

# **INSTRUMENT MAINTENANCE PRACTICES**

**PRESENTED BY**

**PREM BABOO**

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- INSTRUMENTATION BASICS
- MAINTENANCE PRACTICES

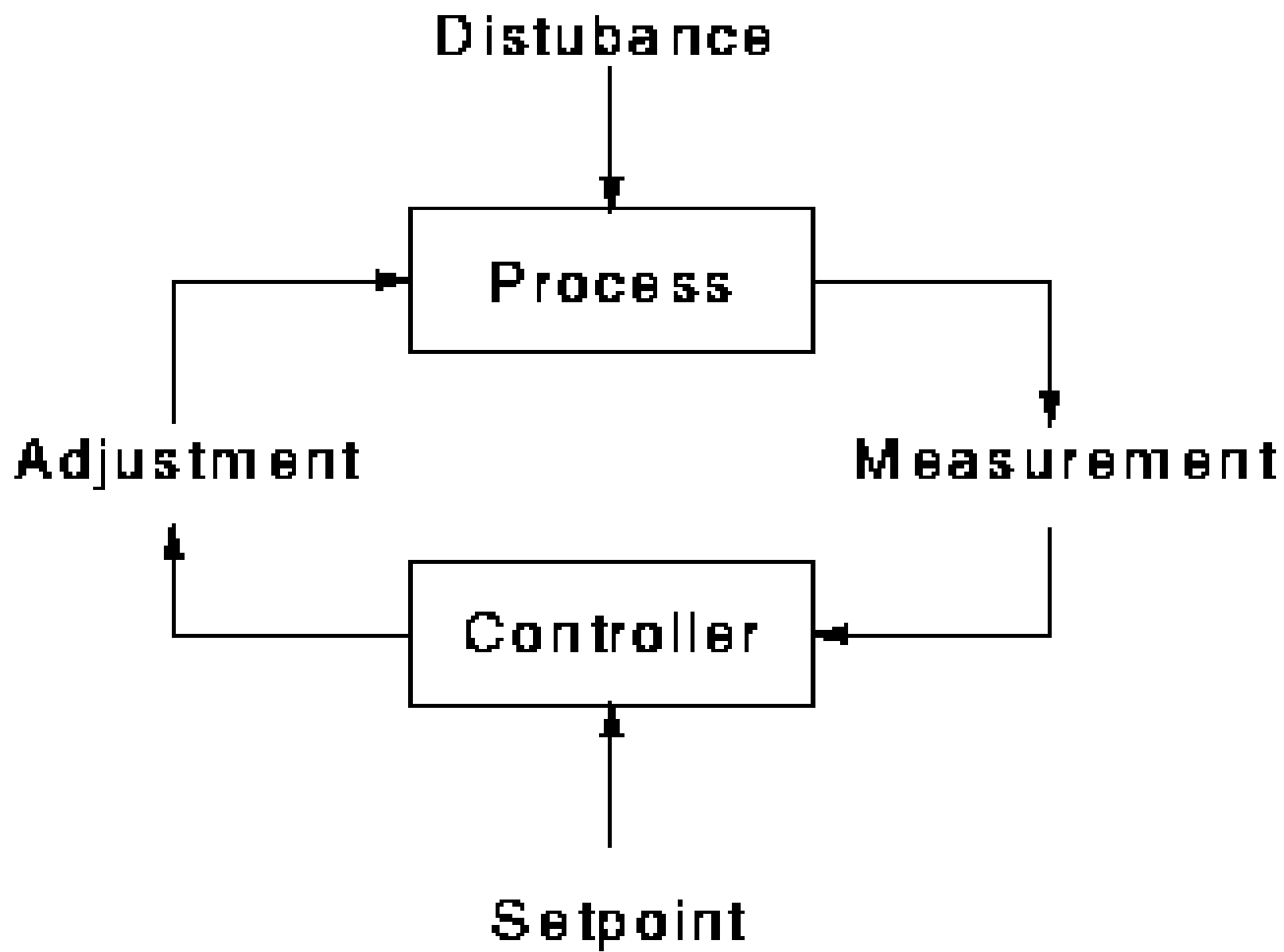
# Introduction

- **National Fertilizers Limited is a chemical process industry. Any process industry is a combination of all Technical and Non-Technical disciplines. All disciplines/ departments functions are interlinked to each other.**
- **Instrumentation in process industry plays a very important role. In the very beginning we need to measure all inputs and outputs at a pre-determined level. For measuring different process parameters, we need particular type of instrumentation. The combination of all type of measurements, its transmission for monitoring, recording and controlling at desired level comes under process Instrumentation.**

**Following are the basic needs to know by every process engineer/operator to start/run any chemical process, plant or section-**

- 1. Process parameters like Pressure, Level, Flow,*
- 2. Temperature, Chemical composition, Vibration etc.*
- 3. Transmission of these parameter to Controlling device in Control Room*
- 4. Control action at pre-determined level*
- 5. Maintaining Safety of Process for the safety of Man, Machine & Material*
- 6. Operation of the all sections at optimized level to achieve maximum capacity utilization within minimum energy investment*

**Let us start with an outline and overview of basic concept of Instrumentation in process industry.**



# Control Loops

**With the basic concept of process control overview, we further derive from it to following control loops-**

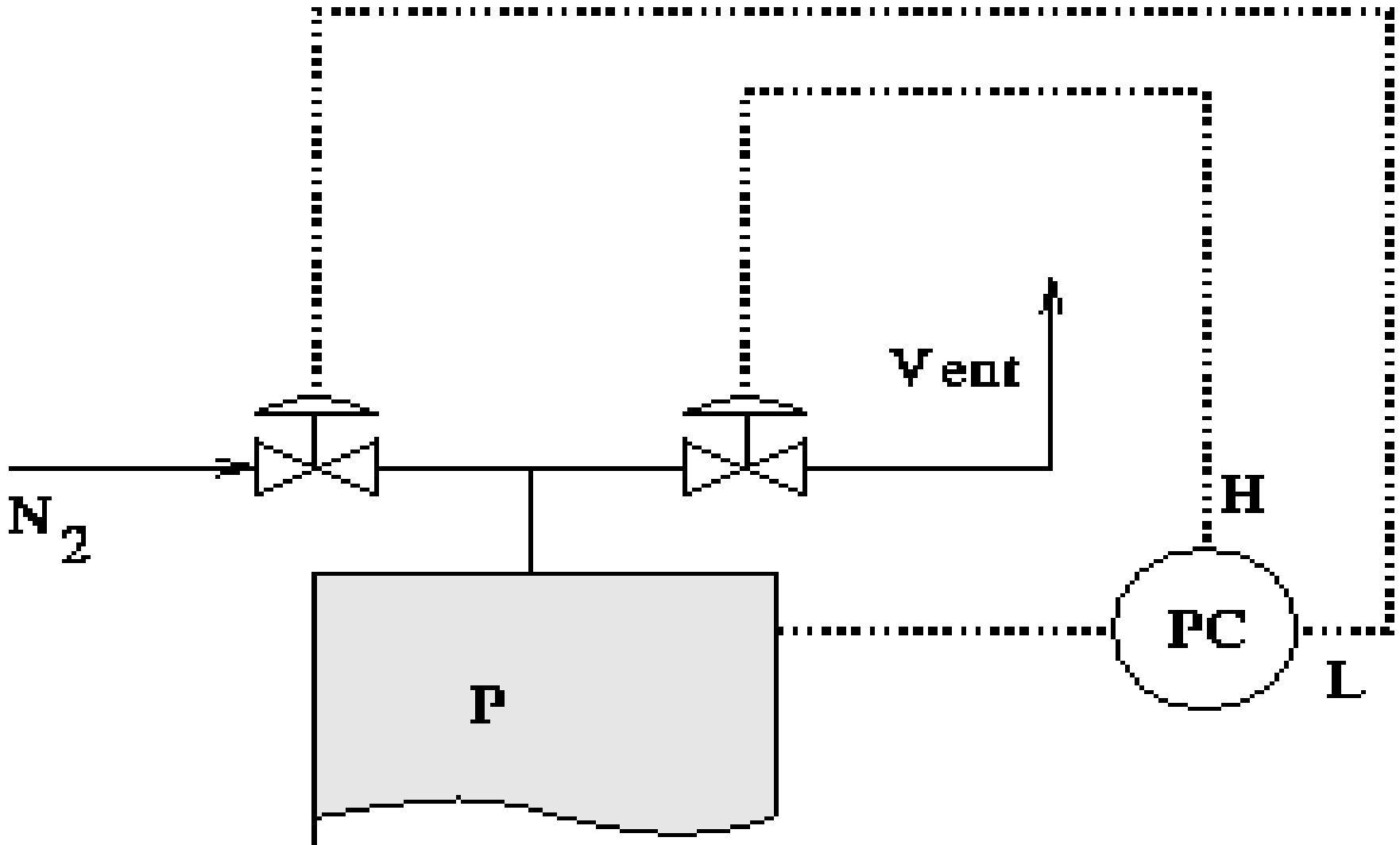
- ❖ Single variable Control Loop***
- ❖ Multi-variable Control Loop***

**These control loops are being given here for your understanding only.**

# *Single Variable Control Loops*

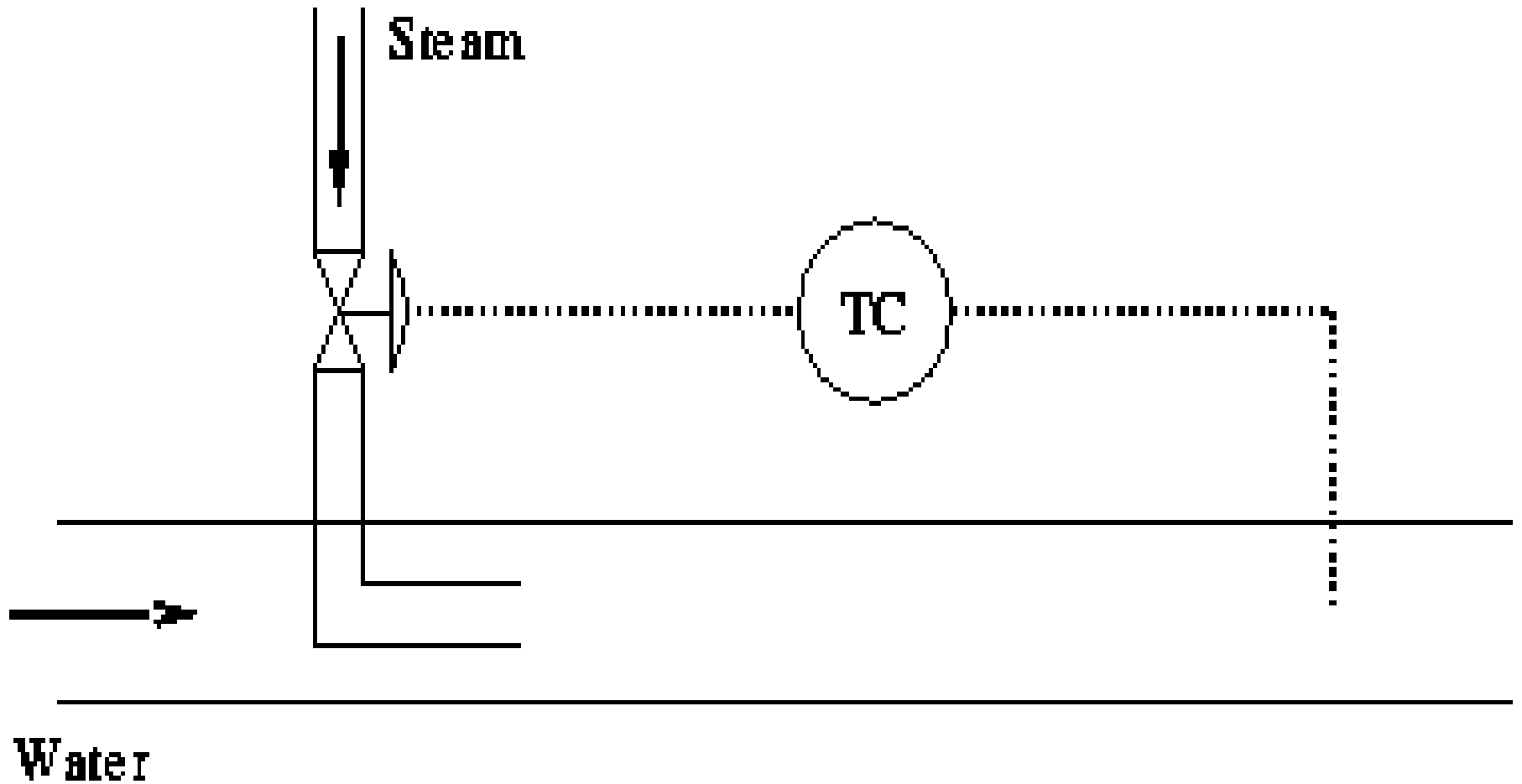
- **Pressure Control**
- **Temperature Control**
- **Level Control**
- **Flow Control**

# Pressure Control

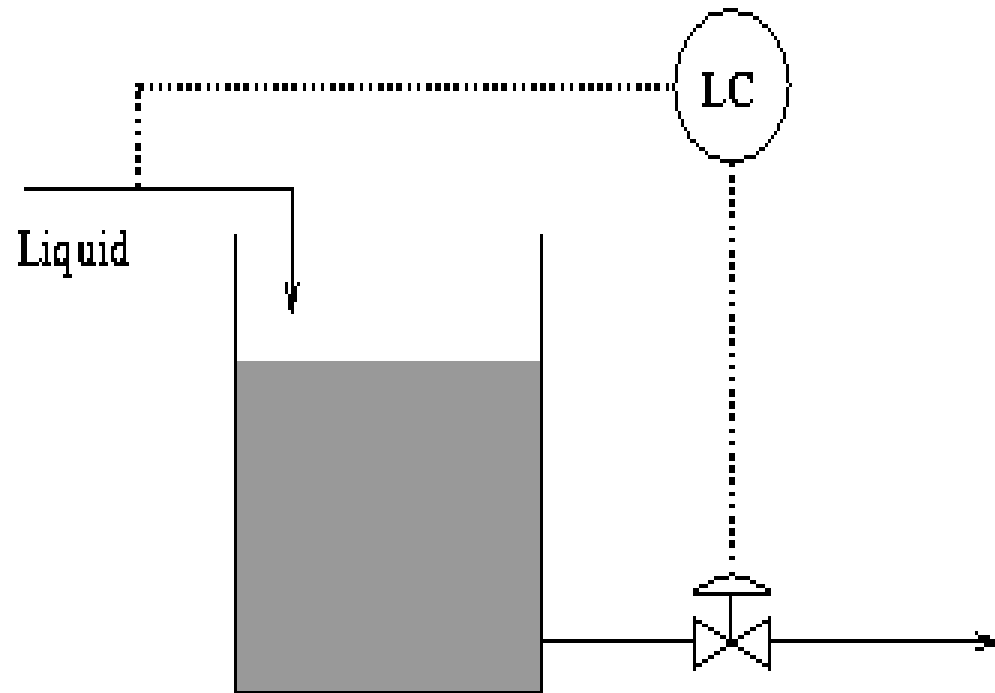




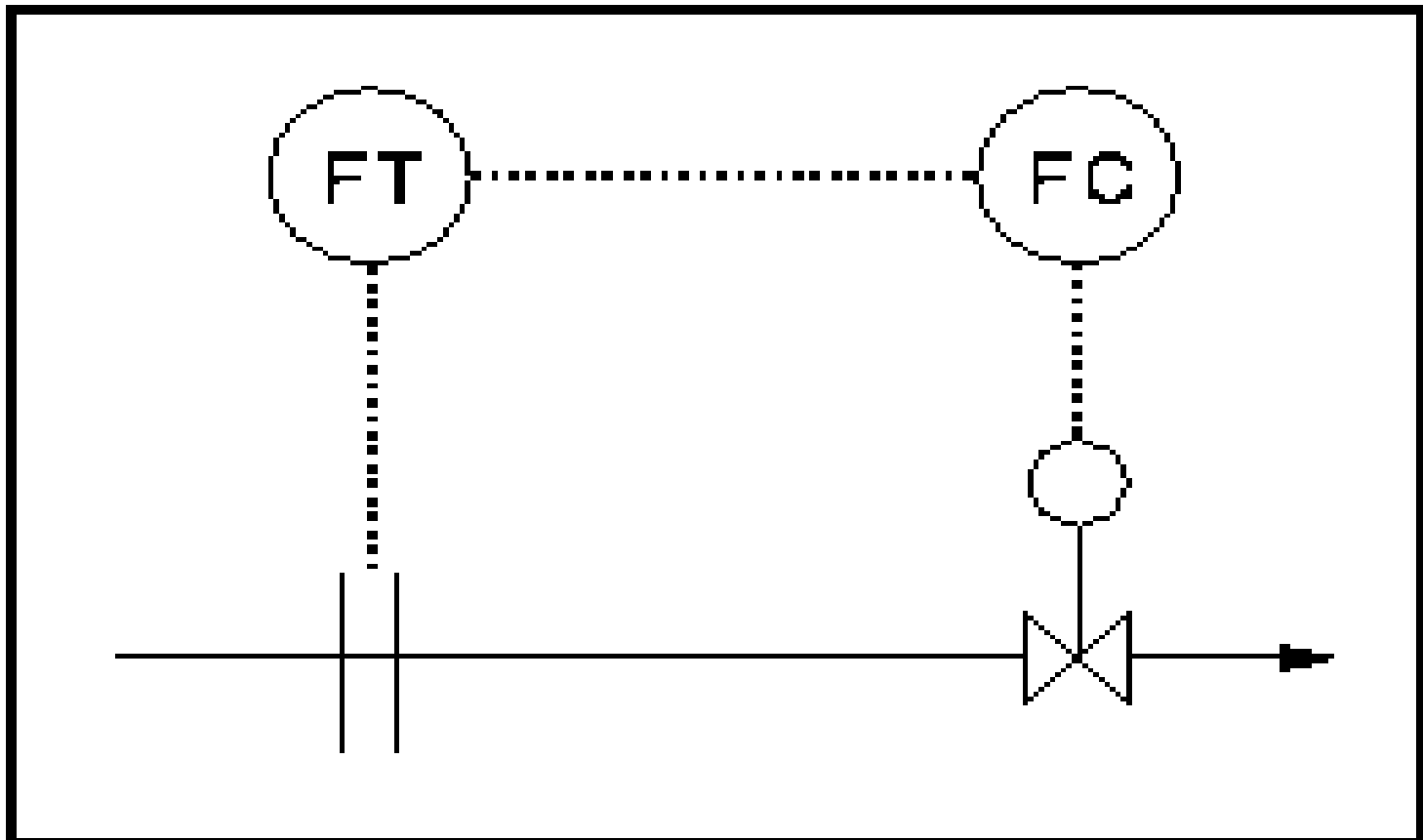
# Temperature Control



# Level Control



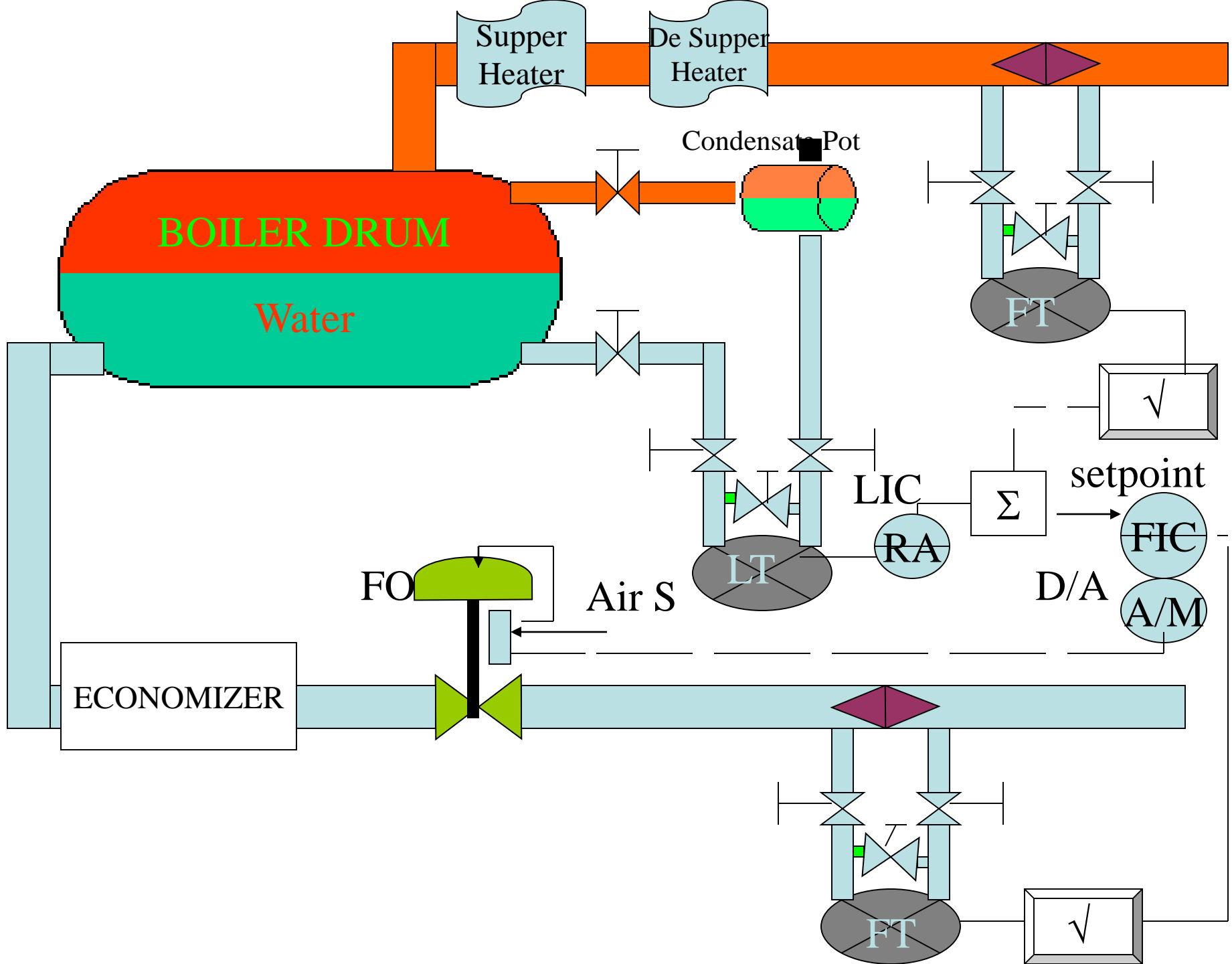
# Flow Control



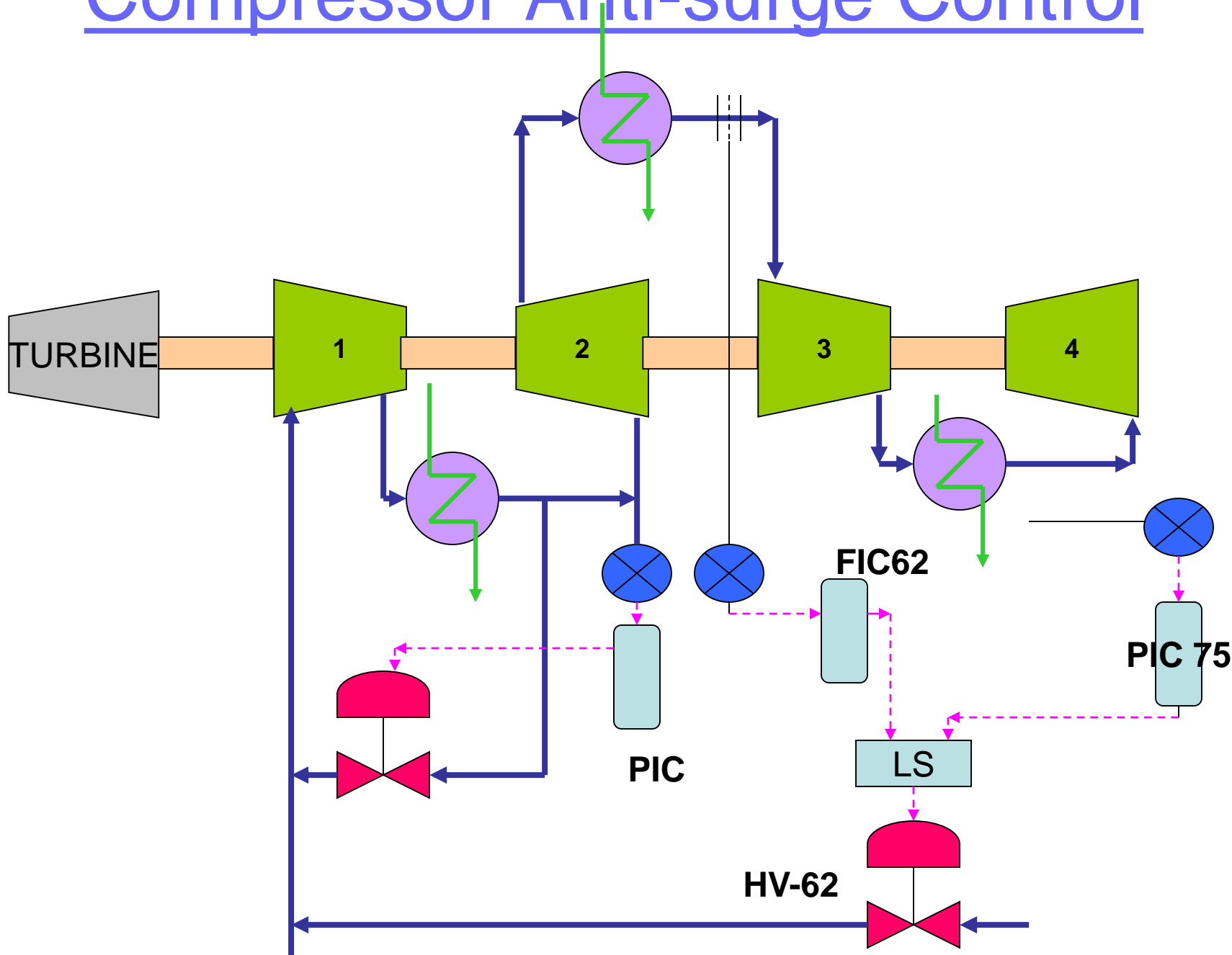
## *Multi-variable Control Loops*

- Boiler Drum Level Control  
(3-Element)
- Compressor Anti-surge Control

# Boiler Drum Level Control



# Compressor Anti-surge Control



# **MAINTENANCE PRACTICES**

- **DAY TO DAY MAINTENANCE**
- **PREVENTIVE MAINTENANCE**
- **SHUTDOWN MAINTENANCE**
- **BREAKDOWN MAINTENANCE**
- **SPARES MANAGEMENT**
- **UP-GRADATION OF SYSTEMS**



# **DAY TO DAY MAINTENANCE**

- **During normal operation of the plant, there may arise some doubts on the performance of some instruments. The same has to be checked, confirmed and rectified.**
- **There are some routine checks which are to be done and consumables are to be provided.**

# Procedures followed

- The normal practice is that the operation group will be raising an MWO for any type of maintenance job which has to be carried out.
- Prepare for the job, refer related documents to ensure safe operation
- Clearance has to be taken and proper isolation / bypassing is required
- Job to be carried out
- Clearance to be given
- Ensuring of results

# **PREVENTIVE MAINTENANCE**

- **Preventive maintenance is the one done to prevent the instruments from reaching a breakdown. Some of them are**
  - **Daily Check Lists**
  - **Weekly Schedules**
  - **Monthly Schedules**
  - **Quarterly Schedules**
  - **Half yearly Schedules**
  - **Yearly Schedules**

# **SHUTDOWN MAINTENANCE**

- **We normally go for annual maintenance shutdown of the plant every year. All the preventive maintenance jobs which cannot be taken up during running of the plant is taken up during shutdown.**

# BREAKDOWN MAINTENANCE

- During running of the plant some times we face serious troubles with the equipments which may require a complete stopping of the system. This is normally termed as break down maintenance

# **SPARES MANAGEMENT**

- **Normally in new projects we keep provision for sufficient spares for maintaining all equipments and Control system for minimum 2-years operation. After this we review the requirement of spares and keep provision for procuring the spares in Revenue budgets. The Revenue budget is being approved in advance so that spares procurement action can be taken to meet any emergency and for repair & maintenance of defective instruments, minimum spares shall be kept always in spares inventory. Procurement action is being initiated as per requirement in due time every year.**

# UP-GRADATION OF SYSTEMS

- In Instrumentation field, a lot of development is being done. The old process instrumentation was pneumatic type and control system was Single loop controller type.
- Interlock systems which is also known as Emergency Shutdown system were based on Electro-mechanical relay type system.
- But now a days there is total change in Instrumentation philosophy. Total instrumentation is based on Electronic systems i.e. right from Transducer/transmission system to DCS, PLC based systems. So to make maximum use of latest instrumentation we always go for Up-gradation.
- To take maximum benefits from these developments, we always go for latest features and diagnostics in our Instrumentation systems.

**- Keeping in view of latest instrumentation we have taken total Electronic control system for our Line-II Expansion plants I.e.the field instrumentation is total electronic smart transmitters, the control system is Distributed type Control system (DCS) and Interlock systems are PLC based failsafe, redundant and available system.**

**- Similarly as best maintenance practices we have gone for up-gradation of Instrumentation system of our Line-I Plants. We have implemented many up-gradation schemes of Instrumentation systems in last 2-years and it is planned to upgrade other obsolete systems.**



# UPGRADATION SCHEMES IMPLEMENTED

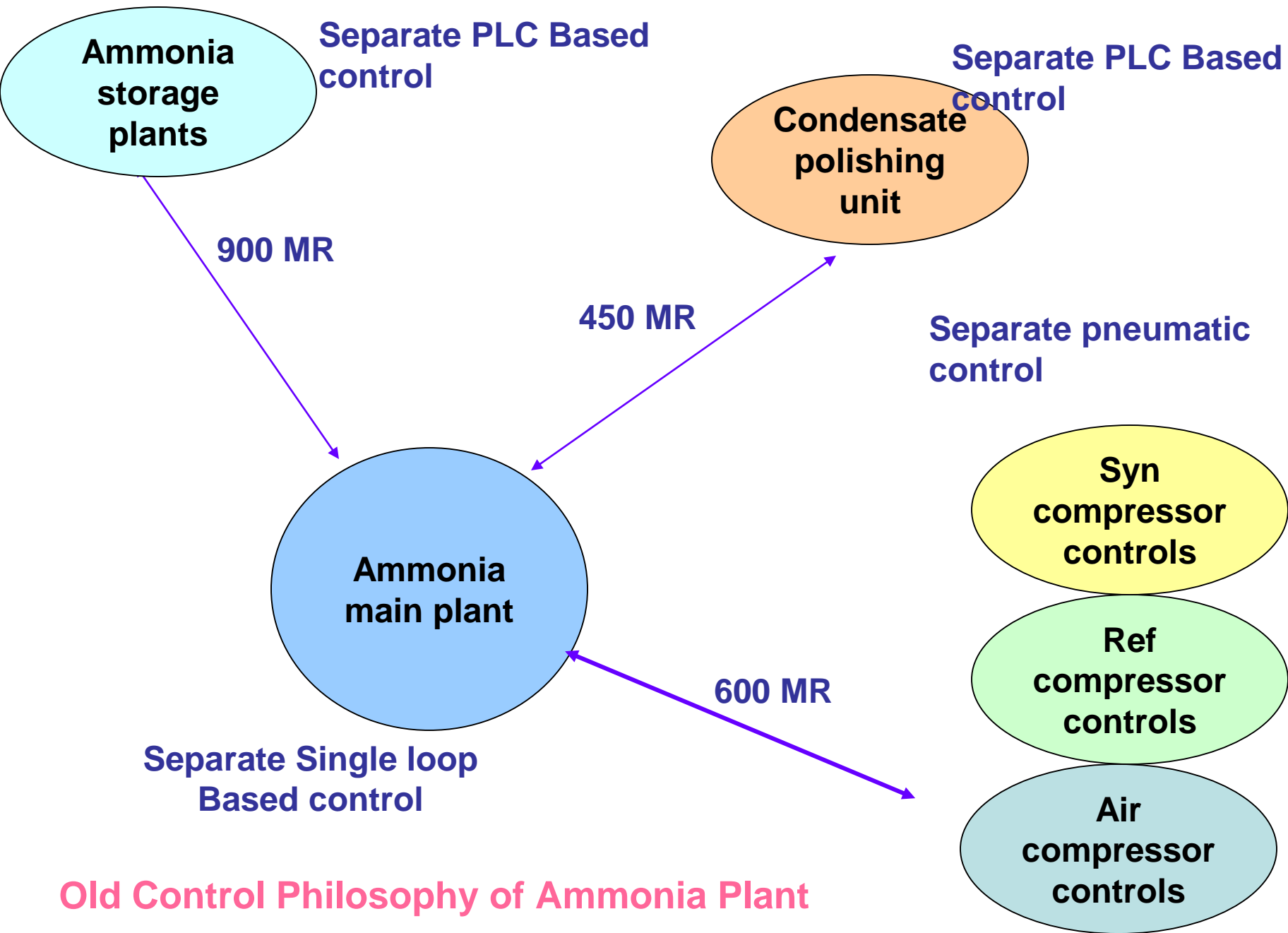
- **‘Yokogawa’ make Centum CS-3000 Distributed Control System in Ammonia & Urea Line-I Plants along with Compressors Instrumentation**
- **‘Bently-Naveda’ make 3500-series with System-1 Diagnostic Vibration, Axial Thrust & Speed Monitoring and protection system for Steam Turbine driven High Speed Centrifugal Compressors**
- **‘GE-Fanuc’ make 90-70 series Programmable Logic Controllers of D.M.Plant-I, Condensate Polishing Unit & Old Ammonia Storage Plant**

**In brief, it is described in next slide that how the scheme of up-gradation is being implemented.**

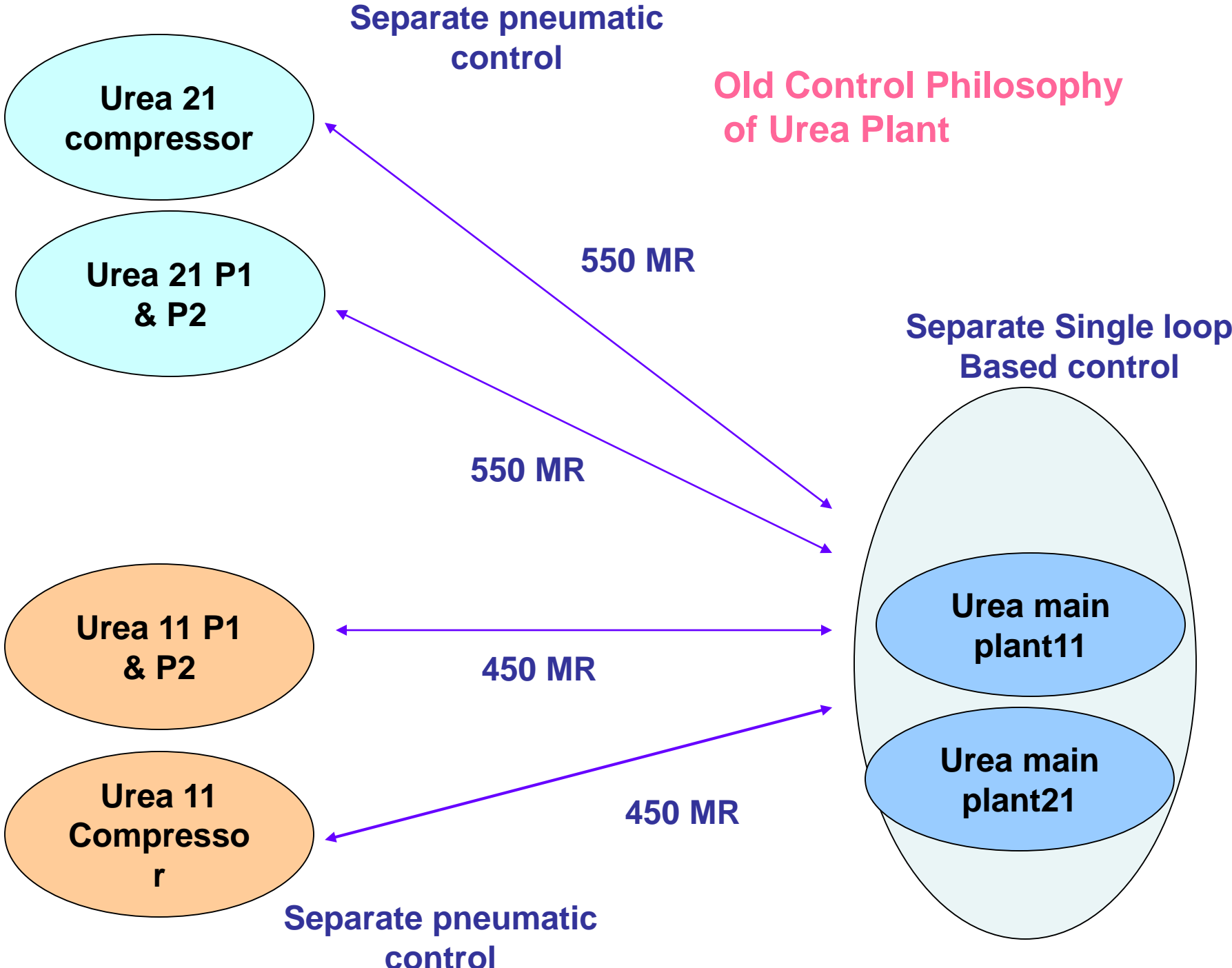
# UPGRADED SYSTEMS

## DISTRIBUTED CONTROL SYSTEM (DCS).

**'Foxboro' make micro processor based Single Loop Programmable Controllers of Ammonia & Urea Plants Line-I with Latest 'Yokogawa' make Centum CS-3000 Distributed Control System along with split and pneumatic control systems of High Speed Centrifugal Steam Turbine Compressors to make it centralize.**



**Old Control Philosophy of Urea Plant**



# LIMITATIONS OF THE OLD CONTROL SYSTEM

- The life expectancy is not ensured due to continuous use for last 18 years.
- Un-predictive failure due to ageing problem.
- Non-Working Data Acquisition System.
- Non Reliable Recording with high maintenance cost.
- Optimization through cascaded loops not possible.

- **Plant disturbance in case of single point failure- non redundant system.**
- **Non Centralized Controls of pilot plants & Compressors.**
- **Compressor pneumatic controllers with slow response time leads to inefficient operation of compressors.**

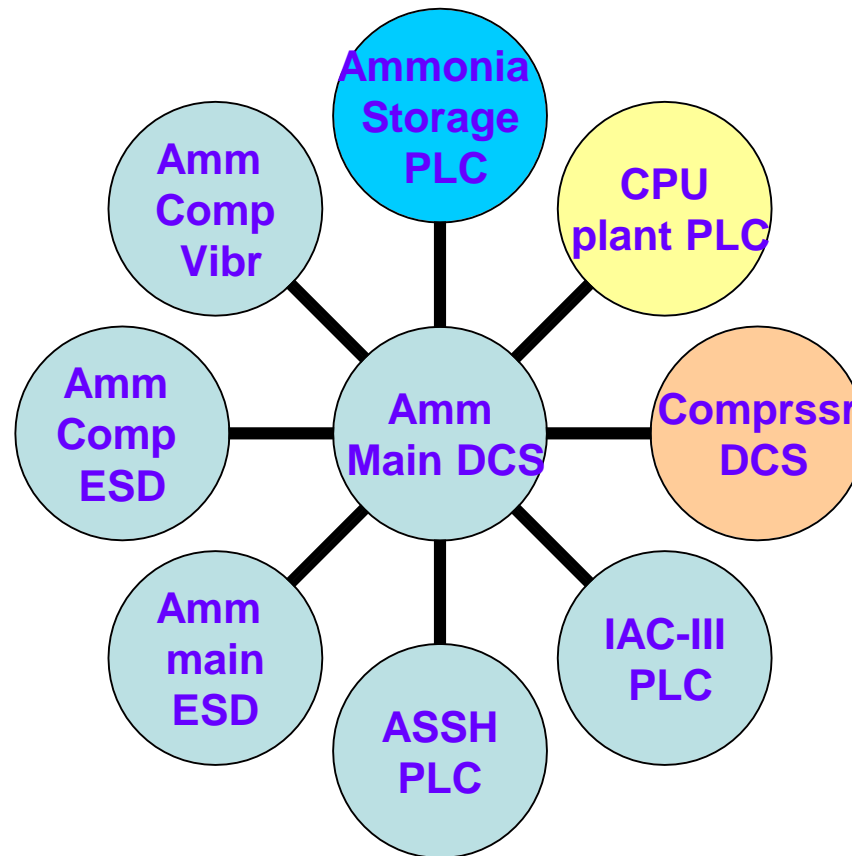
# **SUPERIORITY OF LATEST SYSTEMS**

- **All the limitations listed previously will be wiped out**
- **In addition, the latest control system is**
  - **certified and ensured for reliability**
  - **Availability**
  - **Redundancy**
- **Minimum Down time on account of Control System failure**
- **user friendly**
- **on line modeling for process graphics**
- **The System being offered is certified spare and service support for next 15-Years**

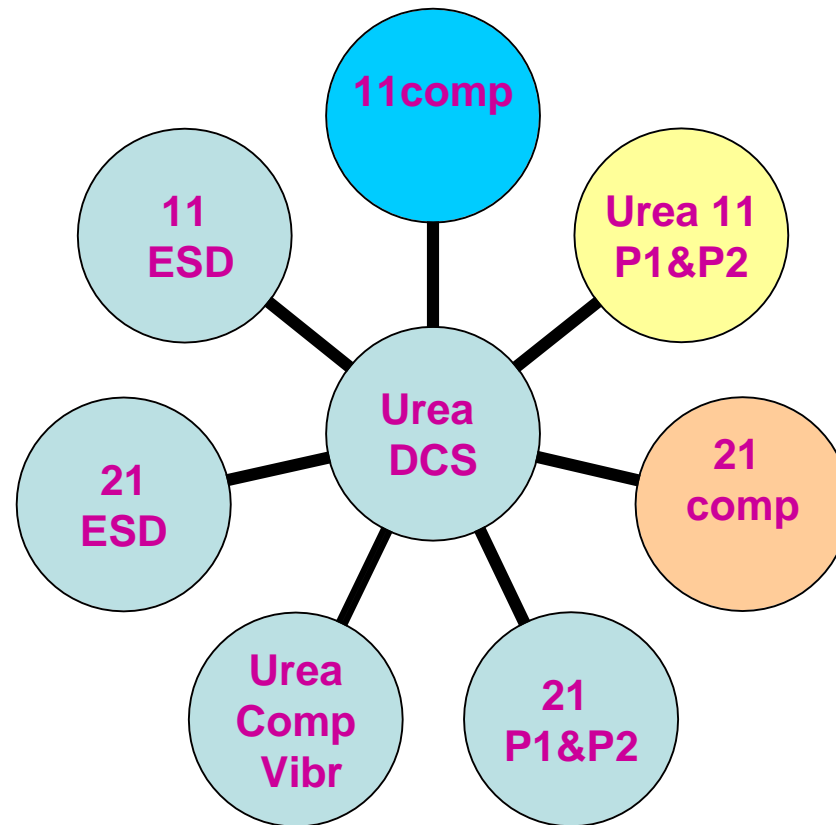
- **historical data.**
- **alarm management.**
- **self diagnosis.**
- **auto tuning.**
- **on line maintenance.**
- **These features are directly resulting to Energy saving with optimum manpower.**
- **Latest control system is having open-end connectivity and platform for other system like advance control system, Mass spectrometer, Management information system etc.**

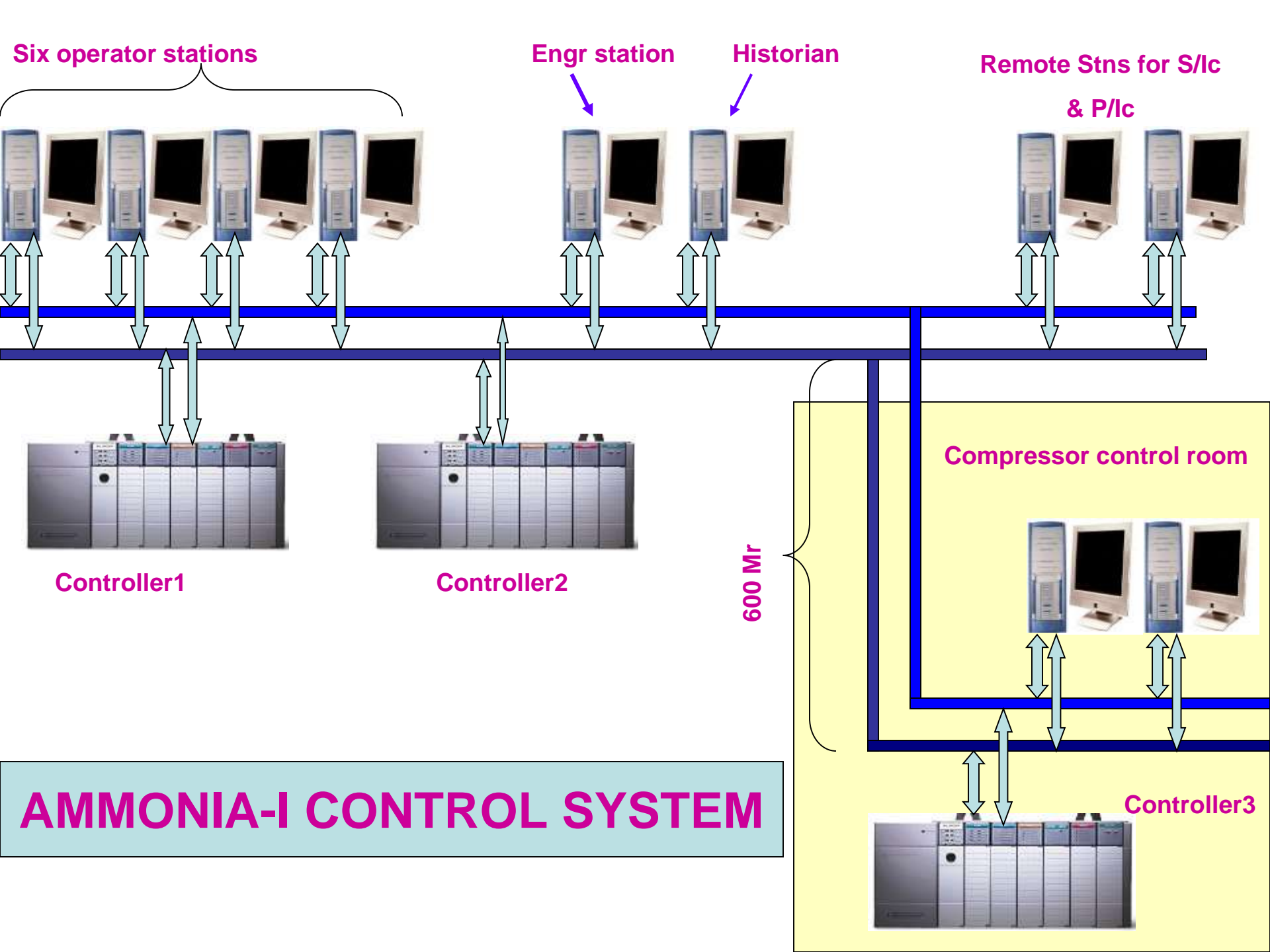


# NEW INTEGRATED CONTROL SYSTEM FOR AMMONIA PLANT



# NEW INTEGRATED CONTROL SYSTEM FOR UREA PLANT





Six operator stations

Engr station

Historian

Remote Stns for S/lc  
& P/lc

Controller1

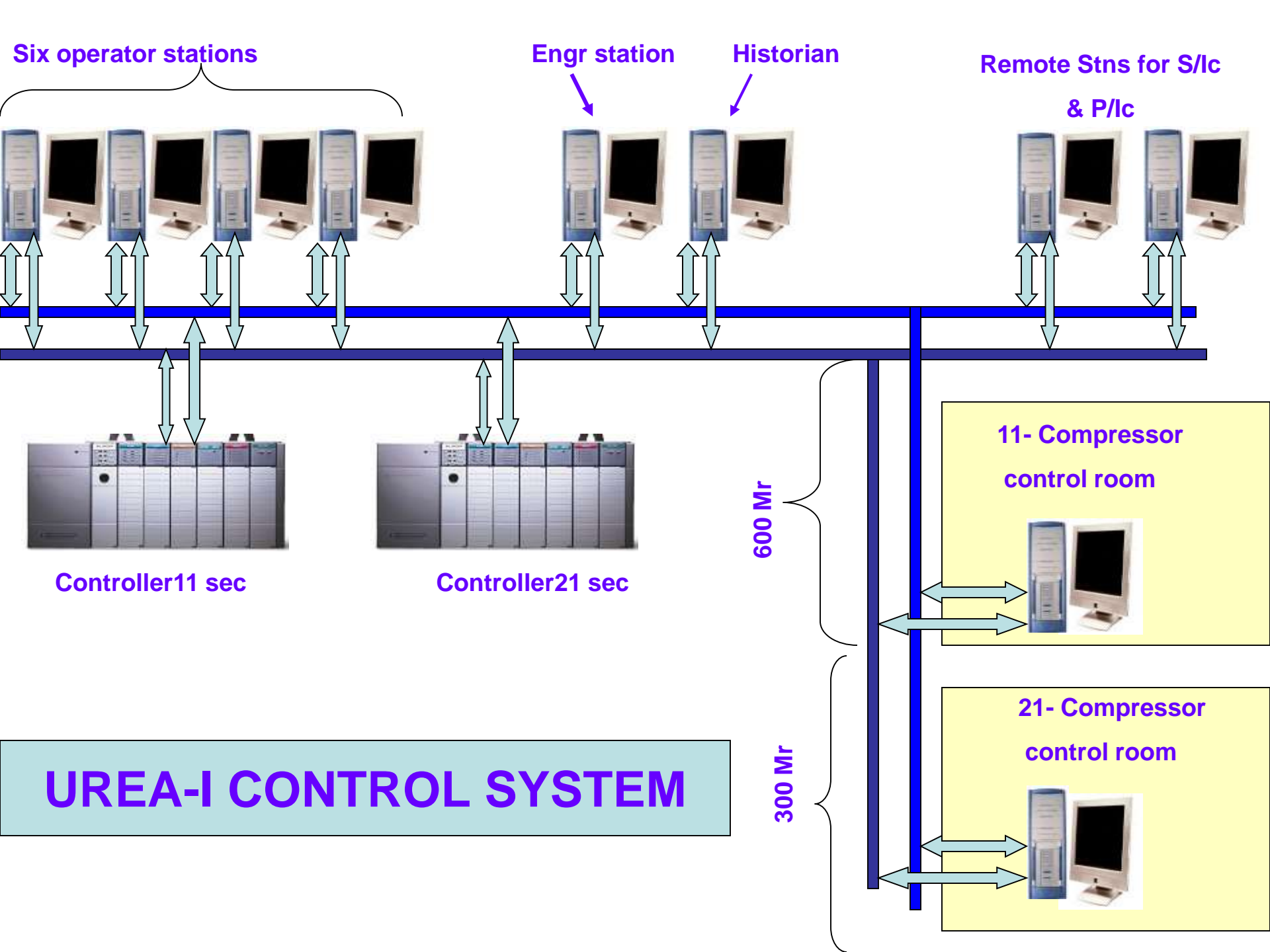
Controller2

Compressor control room

600 Mr

Controller3

AMMONIA-I CONTROL SYSTEM



# **UPGRADATION SCHEMES UNDER IMPLEMENTATION**

- **Up-gradation of Solid state & Electro-mechanical relay based Emergency Shutdown Systems of Ammonia & Urea Line-I Plants to Fail-safe PLC based ESD systems along with Line-I Compressors ESD systems**
- **Up-gradation of Gas Turbine Generator-1/2 Control Systems (GE Mark-IV to GE Mark-VI)**
- **Up-gradation of Control Systems of Heat Recovery Units (HRU-1/2/3) in Captive Power Plant**
- **Up-gradation of Burner Management system of Heat Recovery Units (HRU-1/2/3) in Captive Power Plant**
- **Up-gradation of FIRE ALARM SYSTEM of the Complex**

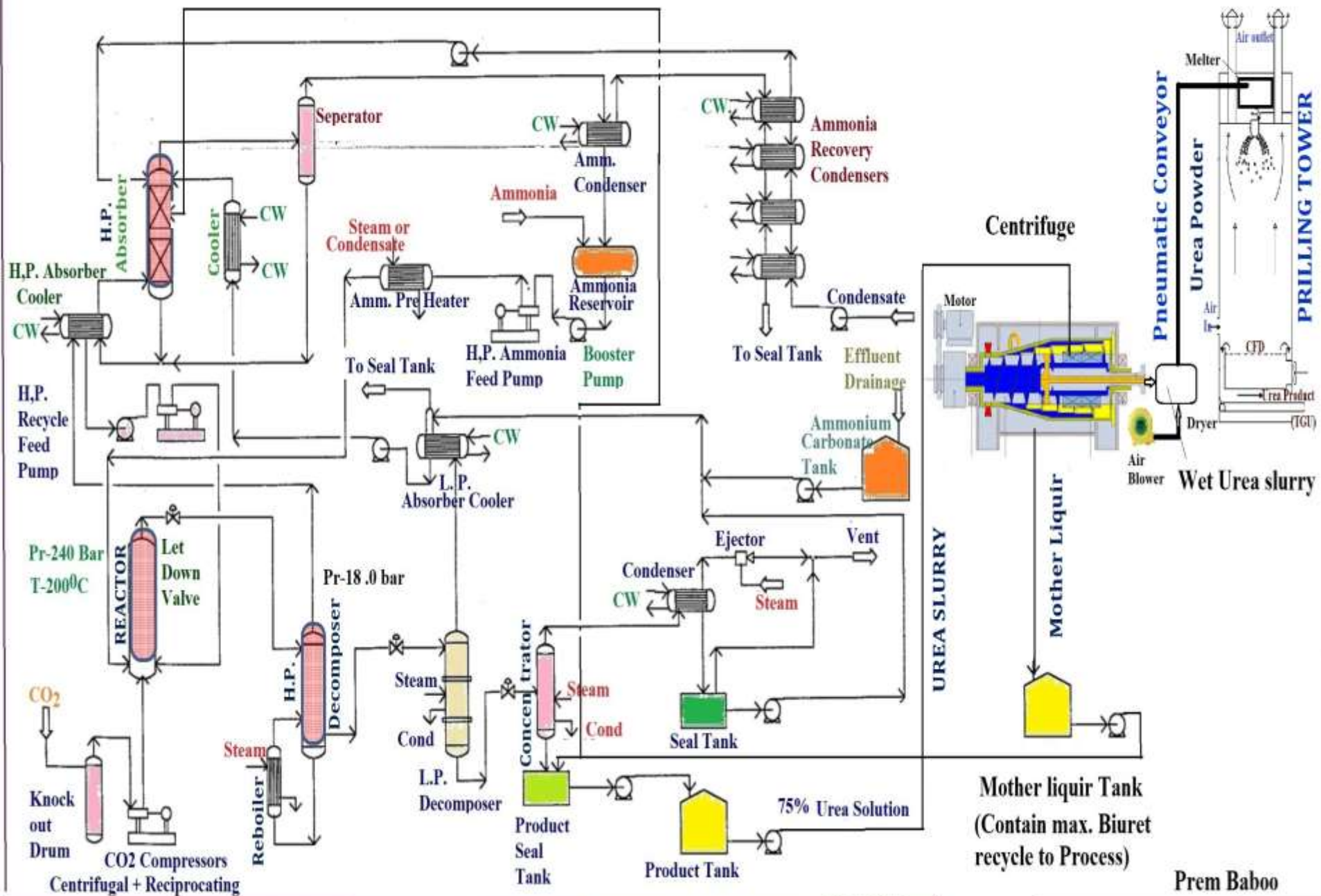
# *PROPOSED UP-GRADATION SCHEMES*

- We are also planning to up-grade the instrumentation of Material Handling and Urea Bagging Plant
- Even the latest instrumentation of Line-II plants i.e.DCS & ESD, Compressors Control system shall be due for up-gradation between year 2010 to 2015

# **Major projects of other units** **under implementation**

- **In our sister units at Bhatinda, Panipat & Nangal we are having Fuel oil based fertilizer plants which are still having old instrumentation. These plants are being switched over to NG/LNG based plant and the all instrumentation shall be up-graded to latest electronic, DCS, PLC based instrumentation. There we shall be having more advanced instrumentation.**

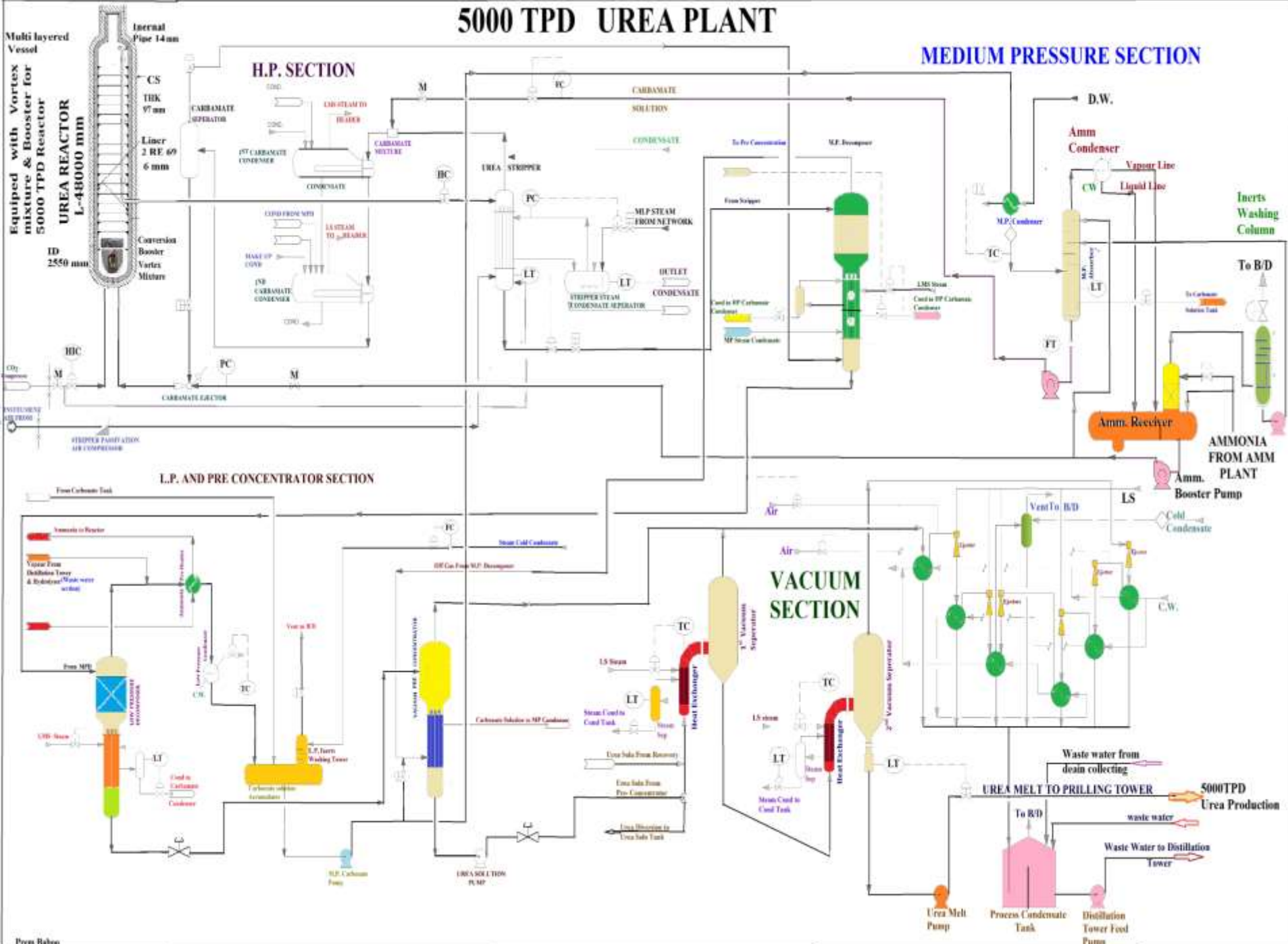
# MTC TOTAL RECYCLE 'C' IMPROVED PROCESS



Prem Baboo



# 5000 TPD UREA PLANT



# **Conclusion**

- **In brief I just conclude here that the NFL corporation as a whole is becoming a Powerful and Giant Fertilizer industry which is having Latest technology in every field and Instrumentation in particular.**
- **We are having the richest culture of the best maintenance practices.**
- **Our Management is also considered to be progressive and liberal to adopt latest energy efficient schemes.**
- **We all shall be having very good opportunities to work in latest technological environment & full utilization of your latest technical skills.**
- **All of you are having very bright future and full satisfaction to work with us.**

**Thanks**

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