PRESENTATION ON

"AUTO CONTROL LOOP SYSTEM"

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cont...

CONTROL SYSTEM

A **Control System** is a set of Electronic devices that regulates the behaviour of other systems.
Control system are used in industrial production for controlling equipment or machines.
Control System is depends upon measuring instrumentation in power plant ,which are based on:-

- Temperature sensing element (SH TEMP CONTROL)
- Pressure Transmitter (FURNACE DRAFT CONTROL)
- Level Transmitter (DRUM LEVEL CONTROL)
- Flow Transmitter (AIR FLOW CONTROL)

cont...

There are two types of control system-

- **OPEN LOOP CONTROL SYSTEM :**

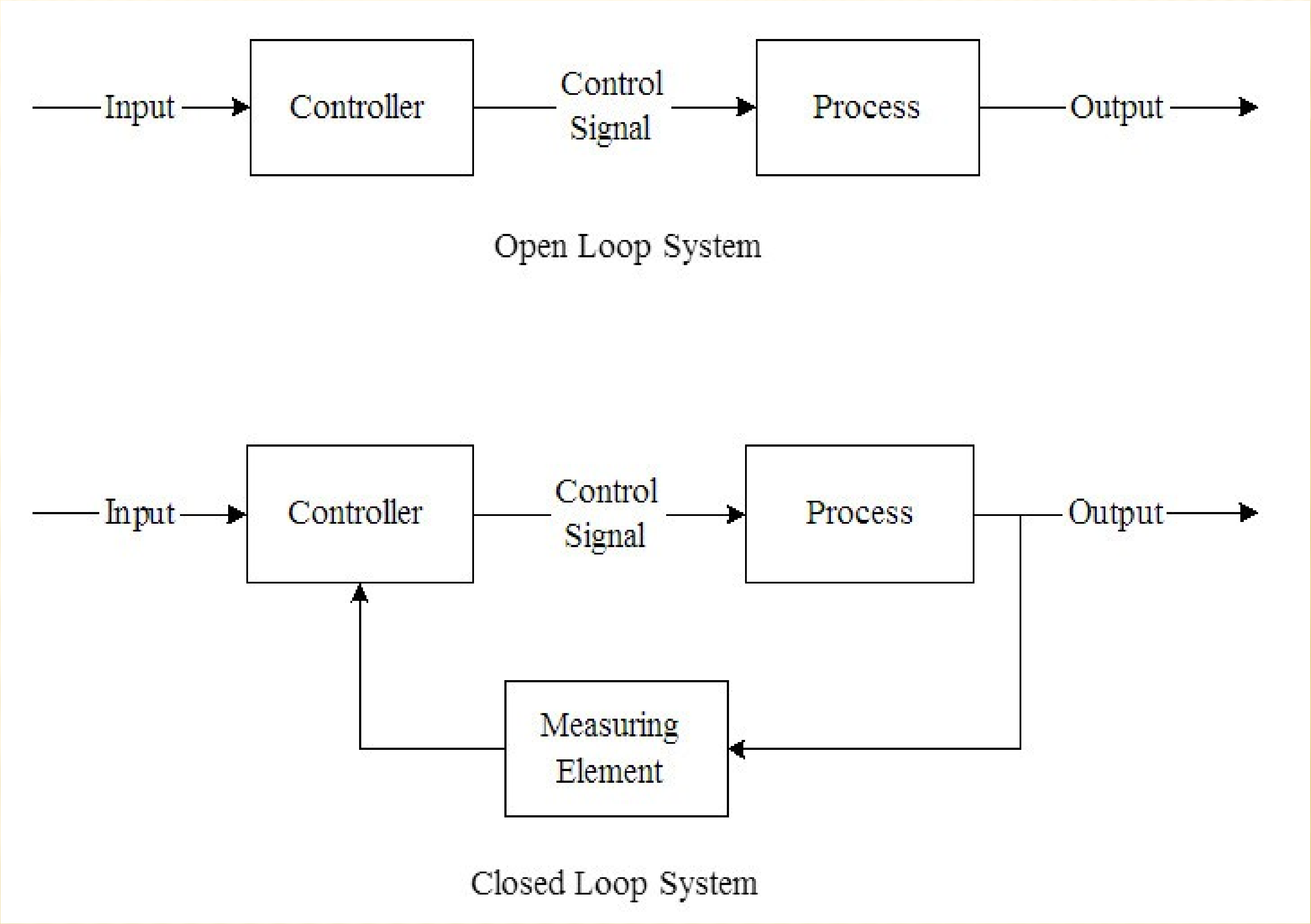
In open loop control system, controller output is generated based on inputs without monitoring feedback.

- **CLOSED LOOP CONTROL SYSTEM:**

In closed loop control system, controller output is taken into consideration and corrections are made based on feedback. A closed loop system is also called a feedback control system.

cont...

BLOCK DIAGRAM OF CONTROL SYSTEM



cont...

AUTO CONTROL LOOP SYSTEM

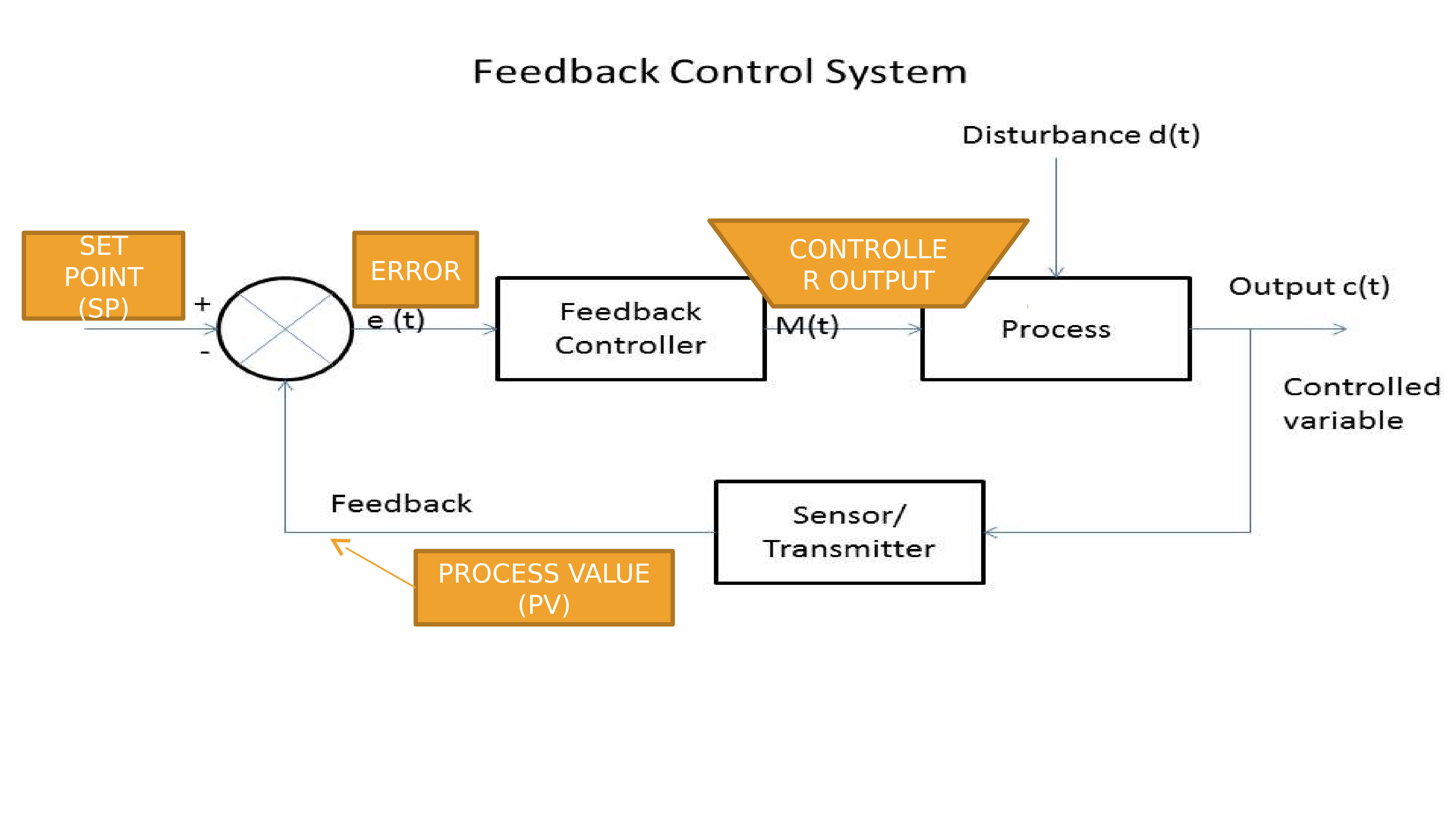
When talking about automatic control theory certain standard terms are used.

BASIC AUTOMATIC CONTROL TERMS:-

- **PROCESS VALUE**
- **DESIRED VALUE(SET POINT)**
- **MEASURED VALUE(FEEDBACK VALUE)**
- **DEVIATION (ERROR)**

  ERROR= SET POINT (SP) - PROCESS VALUE (PV)
- **CONTROLLER**

cont...



Feedback Control System
Disturbance d(t)
SET POINT (SP)
+
-
ERROR
e (t)
Feedback Controller
CONTROLLER OUTPUT
M(t)
Process
Output c(t)
Controlled variable
Feedback
Sensor/ Transmitter
PROCESS VALUE (PV)

cont...

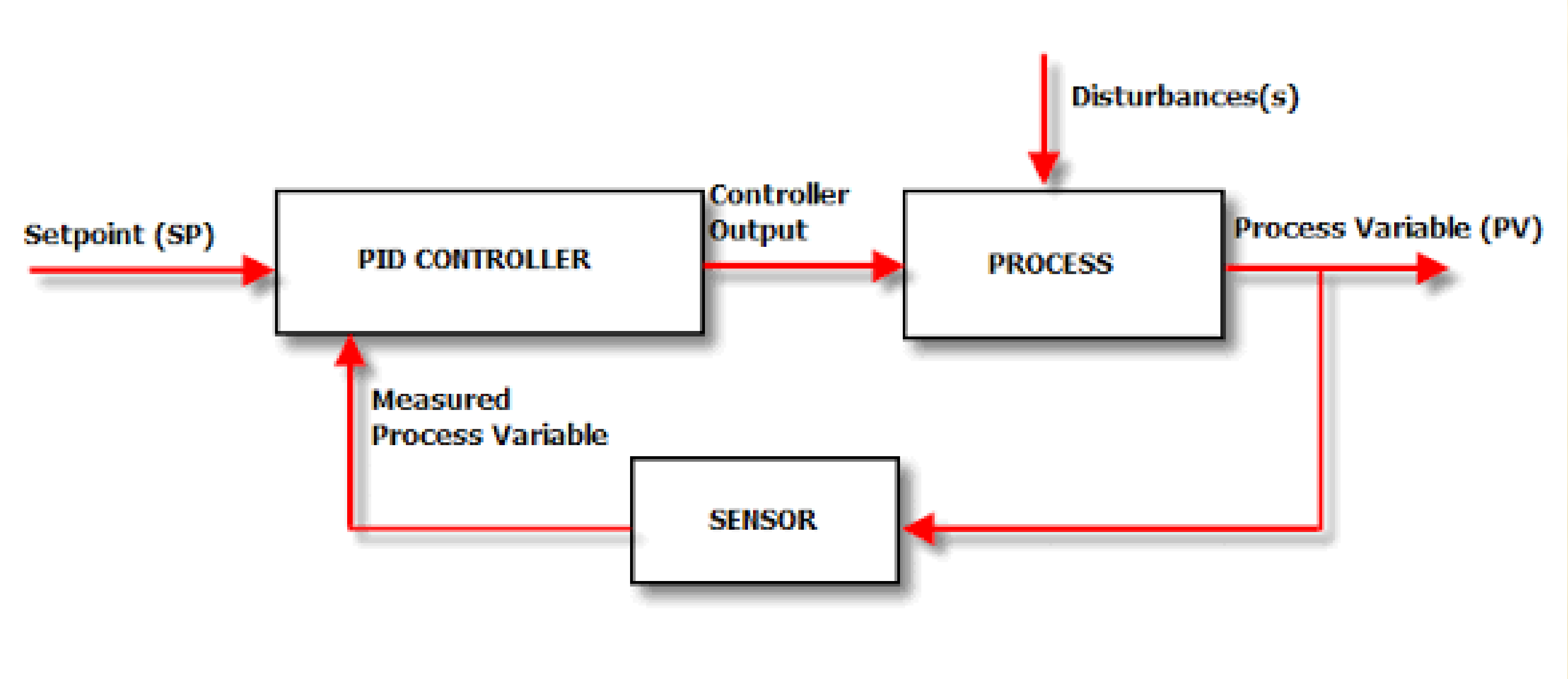
TYPES OF CONTROL ACTION

- **PROPORTIONAL ACTION :**
  The Proportional controller output is directly proportional to the change in the error. If there is no process change, there is no change in output from the controller.
  Controller output= Gain value(P) set from DCS X Error(e)
- **INTEGRAL ACTION (RESET):**
  Integral controller is provided to eliminate the offset that resultant from the proportional controller. Integral action is a function of both time and magnitude of deviation. Reset action continues as long as there is a difference between the set point and process value.
- **DERIVATIVE ACTION (RATE):**
  The Derivative action is directly related to how fast the process changes. Derivative action is the advanced action of the proportional controller. Derivative acts at the start of the process change, when the process change its rate.

We used these above control actions as per process requirement. The combination of all control actions is called a PID Controller.

cont...

PID CONTROLLER



A Proportional–Integral–Derivative controller (PID controller) is a control loop feedback mechanism commonly used in industrial control systems. A PID controller continuously calculates an error value **e(t)** as the difference between a desired set point and a measured process variable.

ERROR= SET POINT-PROCESS VALUE

cont...

FUNCTION OF PID CONTROLLER

- To reduce errors by automatically adjusting the systems input.
- To improve stability of an unstable system.
- To increase or reduce the system’s sensitivity.
- To enhance robustness against external disturbances to the process.
- To produce a reliable performance.

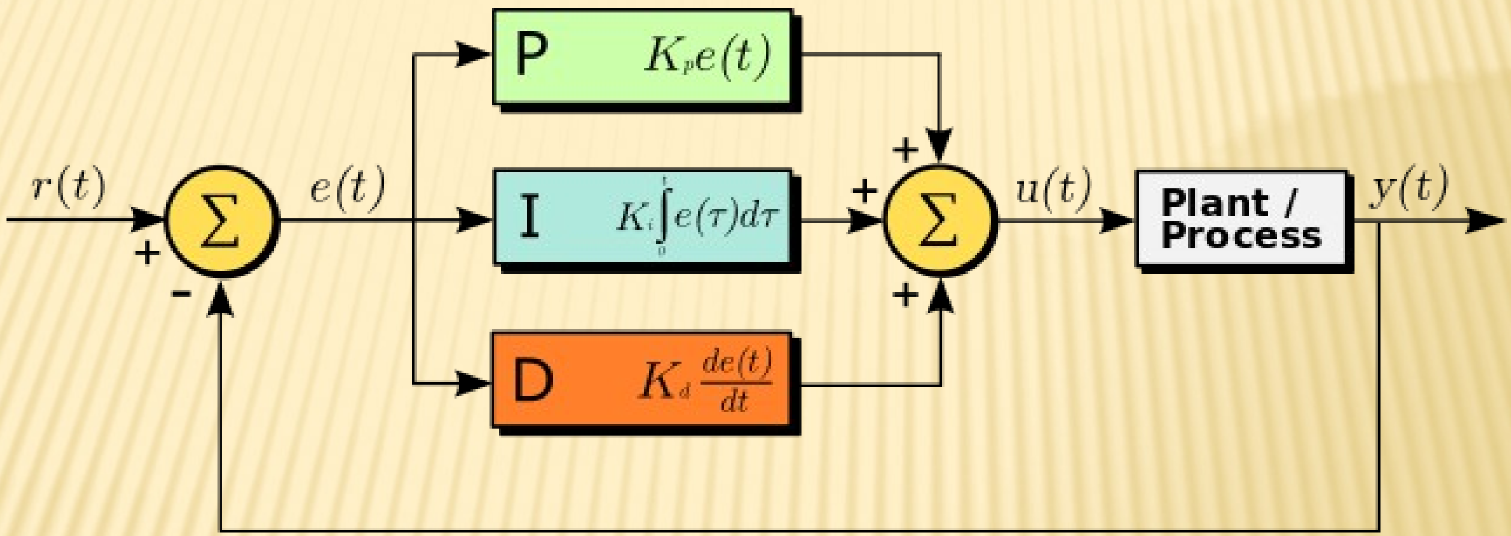
cont...

WHAT IS PID TUNING?

Tuning is adjustment of control parameters to the optimum values for the desired control response. Stability is a basic requirement. However, different systems have different behavior, different applications have different requirements, and requirements may conflict with one another.

cont...

MATHEMATICAL EXPRESSION OF PID CONTROLLER



Where,
Kp - Proportional gain, **Ki** - Integral gain
Kd - Derivative gain, **r(t)** - Set point
e(t) - Error, **u(t)** - Control output
y(t) -Measured value

cont...

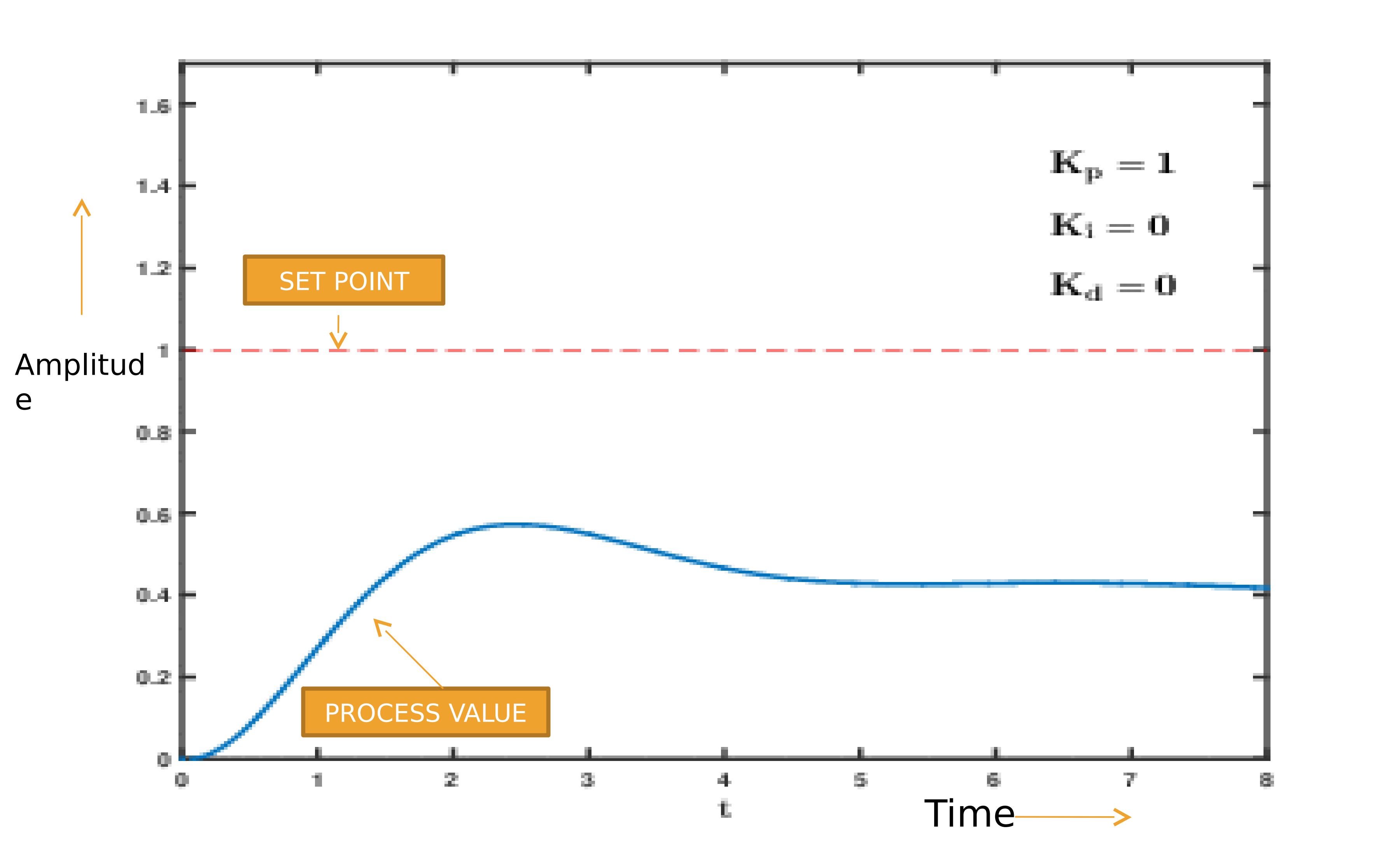
As a PID controller relies only on the measured process variable, not on knowledge of the underlying process. By tuning the three parameters of the model, a PID controller can deal with specific process requirements.

Final controller output is calculated as-

$$u(t) = \underbrace{K_p e(t)}_{\text{Proportional}} + \underbrace{K_i \int_0^t e(\tau)\,d\tau}_{\text{Integral}} + \underbrace{K_d \frac{d}{dt} e(t)}_{\text{Derivative}}$$

cont...

PID TUNING FOR PROCESS



cont...

BOILER AUTO LOOP CONTROL

- FURNACE PRESSURE CONTROL
- PA HEADER PRESSURE CONTROL
- DRUM LEVEL CONTROL
- AIR FLOW CONTROL
- FUEL FLOW CONTROL
- BFP SCOOP CONTROL
- SH TEMPRATURE CONTROL
- RH TEMPRATURE CONTROL
- LDO FLOW CONTROL
- LDO PRESSURE CONTROL
- HFO FLOW CONTROL
- HFO PRESSURE CONTROL
- HFO TEMPRATURE CONTROL
- BURNER TILT CONTROL
- ATOMISING STEAM PRESSURE CONTROL
- MILL AIR FLOW CONTROL
- MILL TEMPRATURE CONTROL
- CBD LEVEL CONTROL

cont...

TURBINE AUTO LOOP CONTROL

- CO-ORDINATED MASTER CONTROL (CMC)
- DEAREATOR LEVEL CONTROL
- DEAREATOR PRESSURE CONTROL
- HOTWELL LEVEL CONTROL
- HPH-5 LEVEL CONTROL
- HPH-6 LEVEL CONTROL
- LPH-2 LEVEL CONTROL
- LPH-3 LEVEL CONTROL
- CEP MINIMUM RECIRULATION CONTROL
- GLAND SEALING PRESSURE CONTROL

cont...

AIR FLOW CONTROL

PURPOSE:

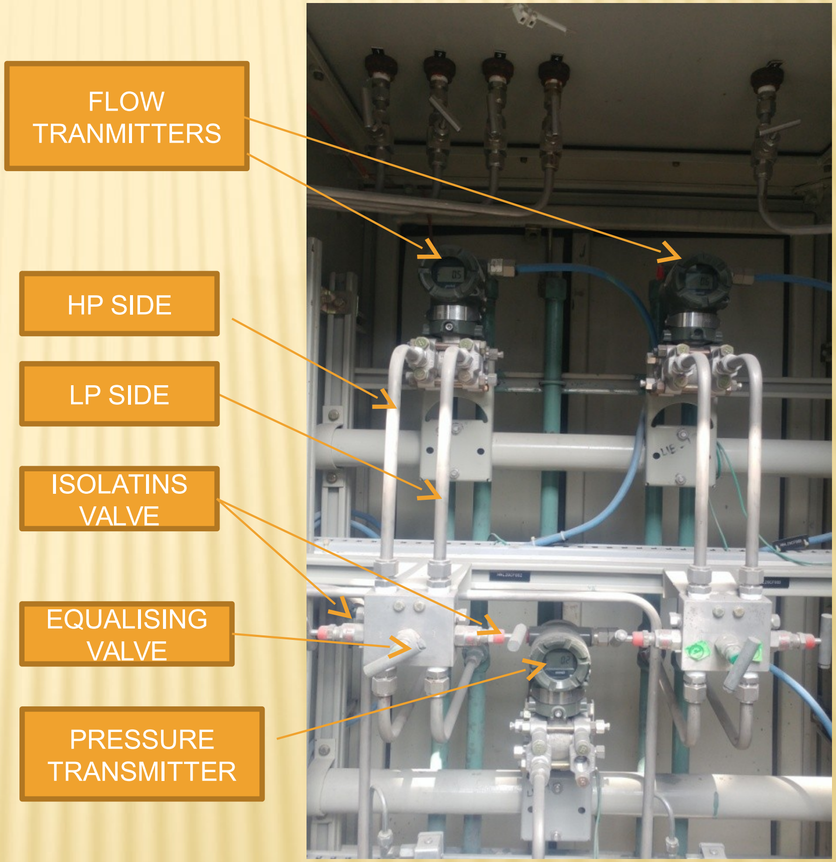
The purpose of this loop is to maintain the airflow required for combustion at the desired value by regulating the blade pitch control of FD fans A & B.

EXECUTION:

The secondary airflow is measured at left (2 nos. of flow transmitter) and right (2 nos. of flow transmitter) side of the secondary air ducts to wind box by means of aerofoils. Each flow will have temperature compensation. The flow is calculated by means of square root of differential pressure across the aerofoil.

cont...

RIGHT SIDE



LEFT SIDE

cont...

DATA SHEET OF SECONDARY AIR FLOW ELEMENT

AIRFOIL FOR SECONDARY AIR

A)	General Data			
1.	Medium		:	Hot Secondary air
2.	Location of airfoil		:	Hot Secondary air duct from AH outlet to wind box.
3.	No. off per boiler		:	Two (One right + one left)
B)	Design Data			
1.	Flow per airfoil	kg/h	:	291779
2.	Medium Pressure	mm wc	:	152
3.	Medium temperature	Deg. C	:	321
4.	Medium velocity in duct	m/s	:	14.5
C)	Duct Data (Internal dimensions)			
1.	Width, W	mm.	:	2500
	Depth, A	mm.	:	4000
	Duct equivalent dia., De	mm.	:	3568
D)	Transmitter			
1.	Transmitter DP		:	76 mmwc at 291779 kg/h.
2.	Pressure drop across flow meter		:	19 mmwc at 291779 kg/h.
E)	Straight Length Requirement		:	
	Upstream - Min. 2 De	mm.	:	7136
	Downstream - Min. 1 De	mm.	:	3568

Remarks

If the above straight length requirement is not possible due to layout restrictions, duct design is to ensure 75% in upstream and 25% in downstream out of the total clear straight length available.

cont...

PRIMARY AIR FLOW

The Primary Air flow for each mill in service is measured by venturi flow element across the PA mixed air duct. Summation of all the primary air flow of individual mill is the total primary air flow to the boiler. We have installed 2 nos. of primary air flow transmitter with the range of 0-110 mmwc , which is converted into 0-90 TPH at DCS-end.

The total air flow required for the combustion in boiler is the summation of total secondary air flow and total primary air flow.

Total Air Flow = Secondary Air Flow + Primary Air Flow

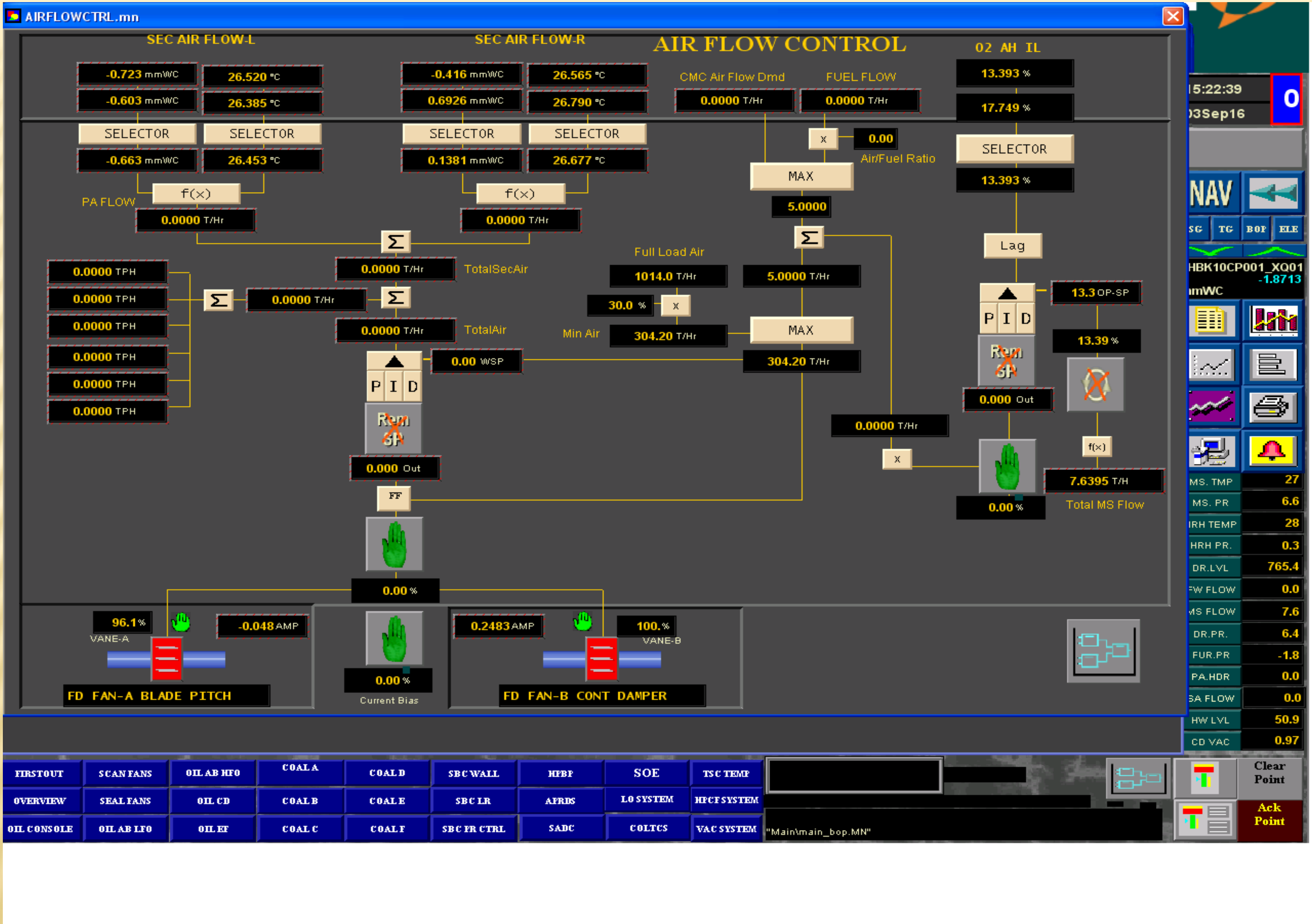
cont...

DATA SHEET OF PRIMARY AIR FLOW ELEMENT

VENTURI FOR MILL AIR

A)	General Data			
1.	Medium		:	Hot Primary air to mill
2.	Location of Venturi		:	Mill inlet duct
3.	No. off per boiler		:	Six (One Per mill)
B)	Design Data			
1.	Flow per Venturi	kg/h	:	74768
2.	Medium Pressure	mm wc	:	731
3.	Medium temperature	Deg. C	:	267
4.	Medium velocity in duct	m/s	:	13.5
C)	Duct Data (Internal dimensions)			
1.	Width, W	mm.	:	1250
	Depth, A	mm.	:	2000
	Duct equivalent dia., De	mm.	:	1784
D)	Transmitter			
1.	Transmitter DP		:	76 mmwc at 74768 kg/h.
2.	Pressure drop across flow meter		:	20 mmwc at 74768 kg/h.
E)	Straight Length Requirement		:	
	Upstream - Min. 2 De	mm.	:	3568
	Downstream - Min. 1 De	mm.	:	1784

cont...


AIRFLOWCTRL.mn
AIR FLOW CONTROL
SEC AIR FLOW-L
SEC AIR FLOW-R
CMC Air Flow Dmd
FUEL FLOW
02 AH IL
SELECTOR
PA FLOW
Air/Fuel Ratio
MAX
Full Load Air
TotalSecAir
TotalAir
Min Air
Lag
OP-SP
Total MS Flow
Current Bias
VANE-A
VANE-B
FD FAN-A BLADE PITCH
FD FAN-B CONT DAMPER
MS. TMP
MS. PR
HRH PR.
DR.LVL
PA.HDR
HW LVL
CD VAC
FIRSTOUT
SCAN FANS
OIL AB HFO
COAL A
COAL D
SBC WALL
HPBP
SOE
TSC TEMP
OVERVIEW
SEAL FANS
OIL CD
COAL B
COAL E
SBC LR
AFRDS
LO SYSTEM
HPCF SYSTEM
OIL CONSOLE
OIL AB LFO
OIL EF
COAL C
COAL F
SBC PR CTRL
SADC
COLTCS
VAC SYSTEM
"Main\main_bop.MN"
Clear Point
Ack Point

cont...

The air flow demand from coordinated control and actual fuel flow whichever is high (lead lag system) is selected to ensure enriched combustion air. The oxygen in the flue gas at the inlet of APH is measured as primary or redundant.

Transfer switch can be selected for either average value or individual value. This signal is compared with excess air set point and any error will have proportional and integral action to have better combustion efficiency.

Under any circumstance the air flow should not be less than 30% MCR flow. This signal is the developed set point and the air flow signal will have proportional and integral action in the air flow controller.

cont...

LIMITATIONS OF PID CONTROL

While PID controllers are applicable to many control problems, and often perform satisfactorily without any improvements. The fundamental difficulty with PID control is that it is a feedback control system, with constant parameters, and no direct knowledge of the process, and thus overall performance is reactive and a compromise.

Now PID controller introduced itself in the two categories:-

- **Feed-forward control**
- **Cascade control**

cont...

FEED-FORWARD CONTROL

The control system performance can be improved by combining the feedback control of a PID controller with feed-forward control. Knowledge about the system can be fed forward and combined with the PID output to improve the overall system performance. Feed forward can be based on the set point and on extra measured disturbances.

We can understand Feed-forward Control system through example of Furnace Draft control.

cont...

PURPOSE:

The main objective of this control is to maintain the furnace pressure constant at the desired set value at all loads. This is achieved by changing the flow of flue gas by modulating the inlet guide vane and varying the speed of the ID fan by VFD system.

cont...

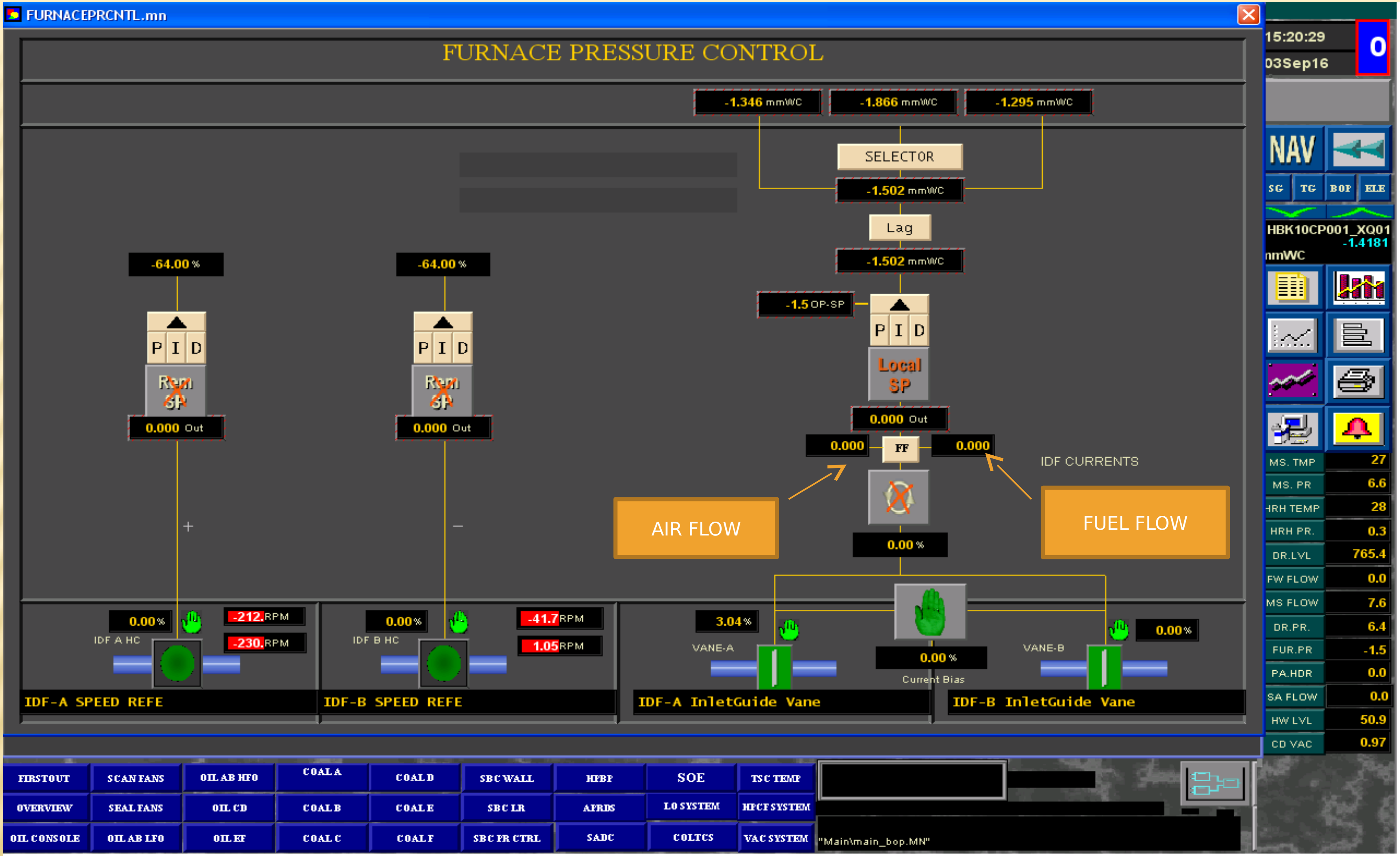
EXECUTION:

Furnace pressure is measured by three transmitters. One signal is selected by mid value auto selection circuit for control. Furnace pressure is compared with set point and actual value. Generated deviation will have proportional and integral action.

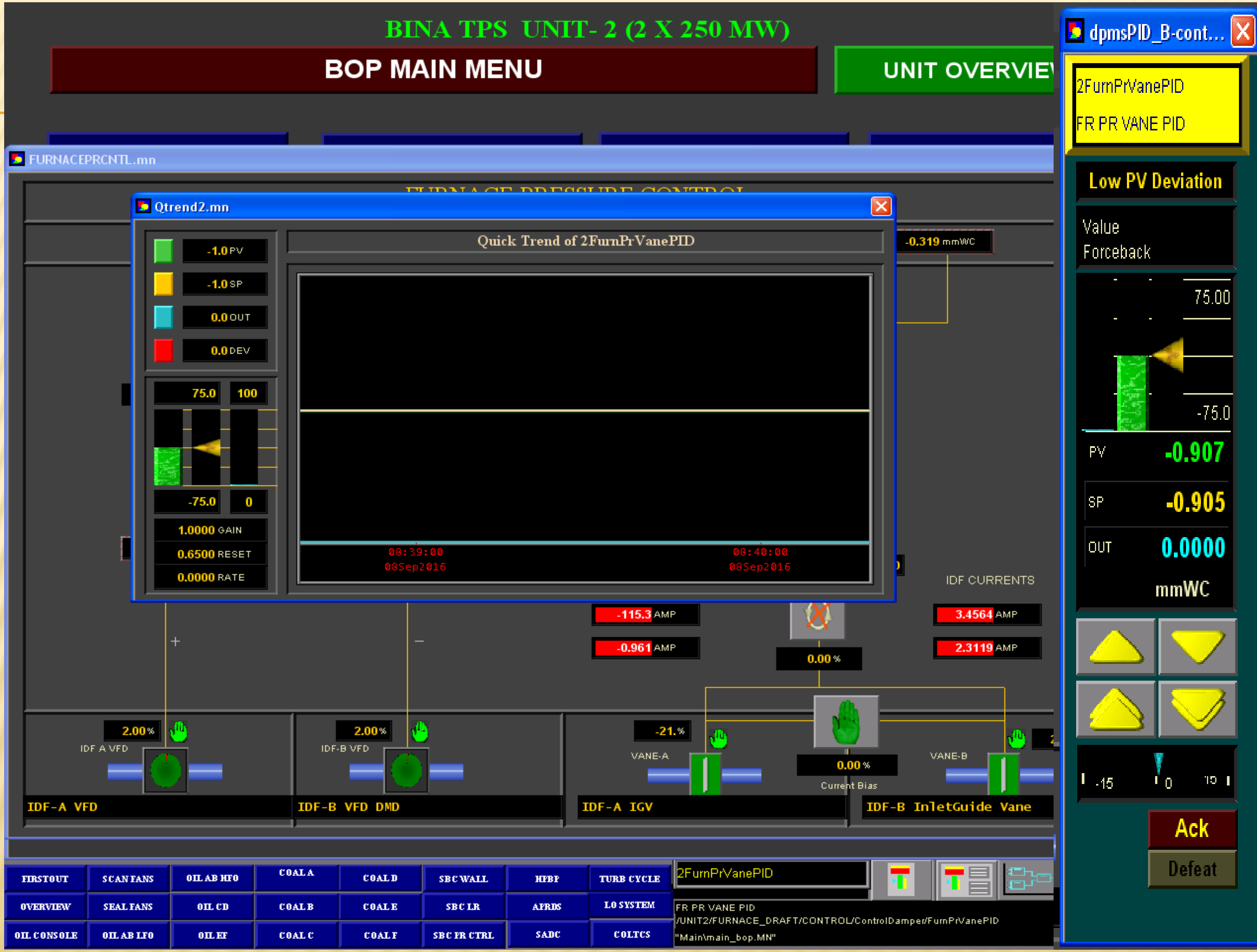
Fuel demand signal is added as a feed forward feature. Feed-Forward feature is provided to minimise negative furnace pressure.

The ID fan inlet damper positions between a maximum and a minimum position limit for optimised control action. If ID fan position goes outside these limits, an error signal goes to a controller, whose output is used to vary fan speed to bring back the inlet damper within the set limits.

cont...


FURNACEPRCNTL.mn
FURNACE PRESSURE CONTROL
-1.346 mmWC
-1.866 mmWC
-1.295 mmWC
SELECTOR
-1.502 mmWC
Lag
-1.502 mmWC
-1.5 OP-SP
PID
Local SP
0.000 Out
0.000
FF
0.000
IDF CURRENTS
AIR FLOW
FUEL FLOW
0.00 %
-64.00 %
-64.00 %
0.000 Out
0.000 Out
IDF A HC
IDF B HC
-212. RPM
-230. RPM
-41.7 RPM
1.05 RPM
3.04 %
VANE-A
VANE-B
Current Bias
IDF-A SPEED REFE
IDF-B SPEED REFE
IDF-A InletGuide Vane
IDF-B InletGuide Vane
15:20:29
03Sep16
NAV
SG
TG
BOP
ELE
HBK10CP001_XQ01
-1.4181
MS. TMP 27
MS. PR 6.6
HRH TEMP 28
HRH PR. 0.3
DR.LVL 765.4
FW FLOW 0.0
MS FLOW 7.6
DR.PR. 6.4
FUR.PR -1.5
PA.HDR 0.0
SA FLOW 0.0
HW LVL 50.9
CD VAC 0.97
FIRSTOUT
SCAN FANS
OIL AB HFO
COAL A
COAL D
SBC WALL
HPBP
SOE
TSC TEMP
OVERVIEW
SEAL FANS
OIL CD
COAL B
COAL E
SBC LR
APRDS
LO SYSTEM
HPCF SYSTEM
OIL CONSOLE
OIL AB LFO
OIL EF
COAL C
COAL F
SBC FR CTRL
SADC
COLTCS
VAC SYSTEM
"Main\main_bop.MN"

cont...


BINA TPS UNIT- 2 (2 X 250 MW)
BOP MAIN MENU
UNIT OVERVIE
FURNACEPRCNTL.mn
Qtrend2.mn
Quick Trend of 2FurnPrVanePID
-1.0 PV
-1.0 SP
0.0 OUT
0.0 DEV
75.0
100
-75.0
0
1.0000 GAIN
0.6500 RESET
0.0000 RATE
08:39:00
08Sep2016
08:40:00
08Sep2016
-0.319 mmWC
IDF CURRENTS
-115.3 AMP
-0.961 AMP
3.4564 AMP
2.3119 AMP
0.00 %
2.00 %
IDF A VFD
2.00 %
IDF-B VFD
-21. %
VANE-A
0.00 %
Current Bias
VANE-B
IDF-A VFD
IDF-B VFD DMD
IDF-A IGV
IDF-B InletGuide Vane
FIRSTOUT
SCAN FANS
OIL AB HFO
COAL A
COAL D
SBC WALL
HFBP
TURB CYCLE
OVERVIEW
SEAL FANS
OIL CD
COAL B
COAL E
SBC LR
AFRDS
LO SYSTEM
OIL CONSOLE
OIL AB LFO
OIL EF
COAL C
COAL F
SBC FR CTRL
SADC
COLTCS
2FurnPrVanePID
FR PR VANE PID
/UNIT2/FURNACE_DRAFT/CONTROL/ControlDamper/FurnPrVanePID
"Main\main_bop.MN"
dpmsPID_B-cont...
2FurnPrVanePID
FR PR VANE PID
Low PV Deviation
Value
Forceback
75.00
-75.0
PV -0.907
SP -0.905
OUT 0.0000
mmWC
-15
0
15
Ack
Defeat

cont...

One additional advantage of PID controllers is that two PID controllers can be used together for better dynamic performance. This is called cascaded PID control. In cascade control there are two PIDs arranged with one PID controlling the set point of another.

Now we discuss the Cascade control loop with the help of Drum Level control.

cont...

DRUM LEVEL CONTROL

PURPOSE:

Boiler drum level is kept constant under all load conditions. For loads more than 30% control system acts on three elements control which utilizing **steam flow**, **feed water flow** and **drum level**. Under low load conditions, **drum level** is maintained by single element.

Execution:

At lower loads (less than 30% BMCR), the start up feed control valve(FD-20) will be used as final control element and at higher loads, full load control valve (FD-14/17) will be used. If the full load control valve is taken for maintenance, stand by feed control valve will be used.

- **SINGLE ELEMENT CONTROL**

•DRUM LEVEL

- **THREE ELEMENT CONTROL**

1.DRUM LEVEL

2.STEAM FLOW

3.FEED WATER FLOW

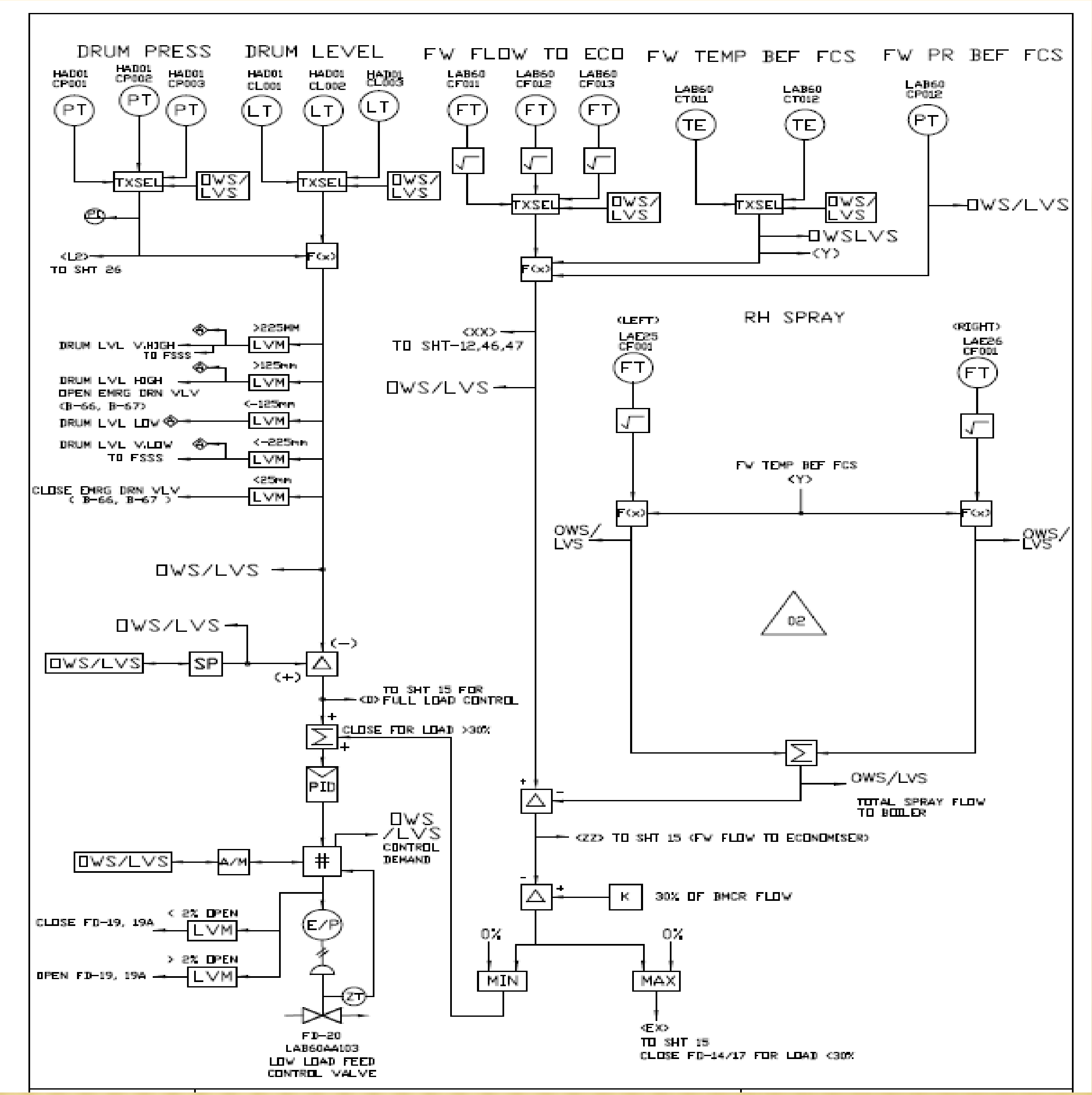
cont...

SINGLE ELEMENT CONTROL

The Drum level measured signal is compared with the drum level set point. The error signal will have a PI Controller.

The PI controller output will be the position demand signal for the 30% control valve to maintain the normal drum level. Auto/manual selection block is provided for operation.

cont...


DRUM PRESS
DRUM LEVEL
FW FLOW TO ECO
FW TEMP BEF FCS
FW PR BEF FCS
HAD01 CP001
HAD01 CP002
HAD01 CP003
HAD01 CL001
HAD01 CL002
HAD01 CL003
LAB60 CF011
LAB60 CF012
LAB60 CF013
LAB60 CT011
LAB60 CT012
LAB60 CP012
PT
LT
FT
TE
TXSEL
OWS/LVS
OWSLVS
<Y>
F(x)
<L2>
TO SHT 26
<XX>
TO SHT-12,46,47
RH SPRAY
(LEFT)
(RIGHT)
LAE25 CF001
LAE26 CF001
>225MM
DRUM LVL V.HIGH
TO FSSS
LVM
>125mm
DRUM LVL HIGH
OPEN EMRG DRN VLV
(B-66, B-67)
<-125mm
DRUM LVL LOW
<-225mm
DRUM LVL V.LOW
TO FSSS
<25mm
CLOSE EMRG DRN VLV
(B-66, B-67)
FW TEMP BEF FCS
<Y>
02
SP
(-)
(+)
TO SHT 15 FOR
<D> FULL LOAD CONTROL
CLOSE FOR LOAD >30%
PID
OWS/LVS
TOTAL SPRAY FLOW
TO BOILER
<ZZ> TO SHT 15 (FW FLOW TO ECONOMISER)
A/M
#
CONTROL
DEMAND
K
30% OF BMCR FLOW
0%
MIN
MAX
E/P
ZT
< 2% OPEN
CLOSE FD-19, 19A
> 2% OPEN
OPEN FD-19, 19A
FD-20
LAB60AA103
LOW LOAD FEED
CONTROL VALVE
<EX>
TO SHT 15
CLOSE FD-14/17 FOR LOAD <30%

cont...

THREE ELEMENT CONTROL

At higher loads the start up control valve shall be closed. The steam flow shall be measured. In order to prevent sudden response due to drum swell and shrink on load change, a time lag unit shall be included in the steam flow signal. The compensated feed water flow signal is computed by subtracting feed water flow at economiser inlet to Re-heater spray water flow.

The error signal produced between drum level measured signal and drum level set point shall have proportional, integral and differential action in the three element drum level controller.

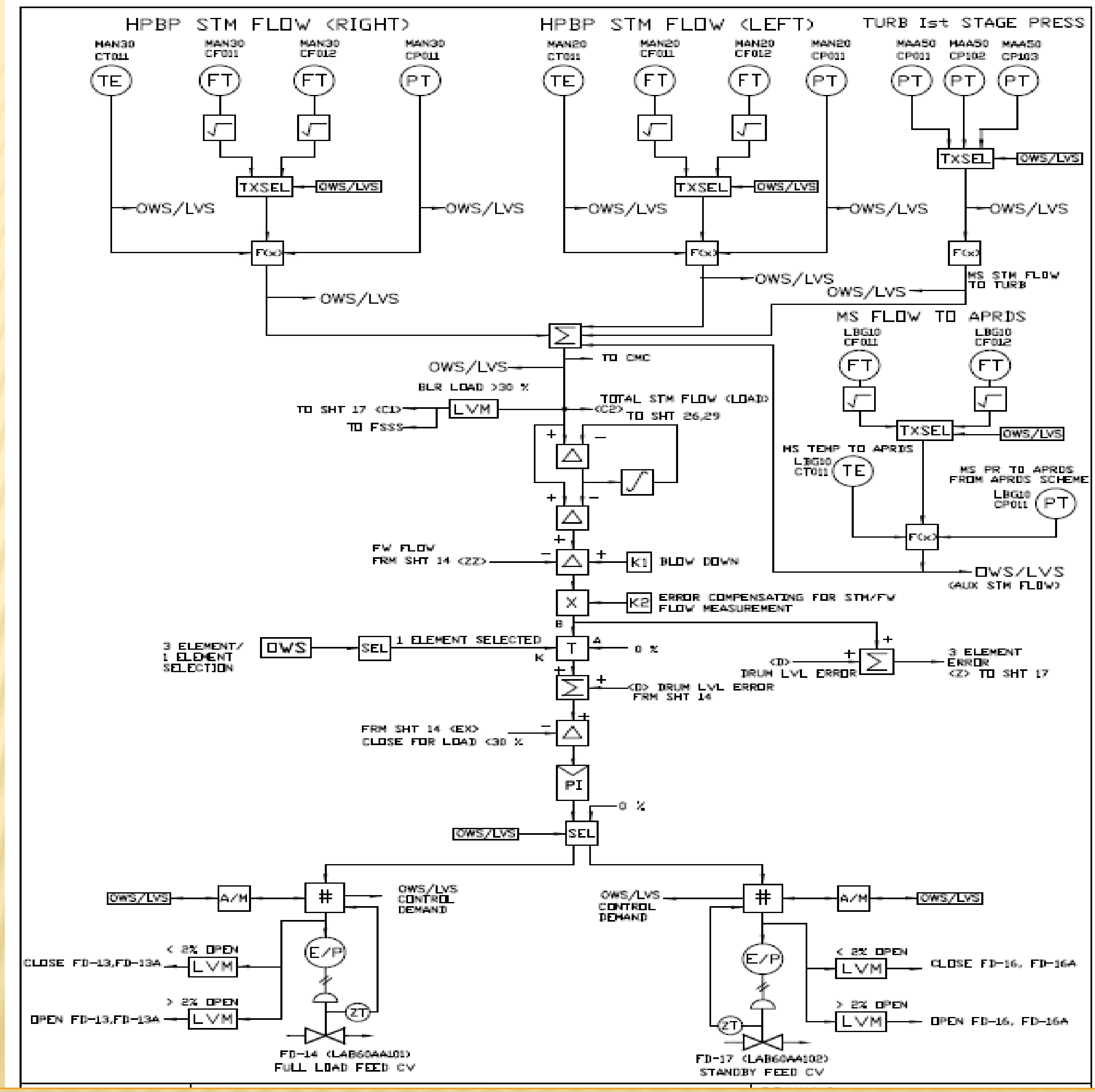
cont...

This will be added with steam flow signal which is the feed water flow demand signal (set point for feed water flow). This will be compared with the feed water flow in the feed water controller. Deviation if any will have a proportional and integral action in the feed water controller.

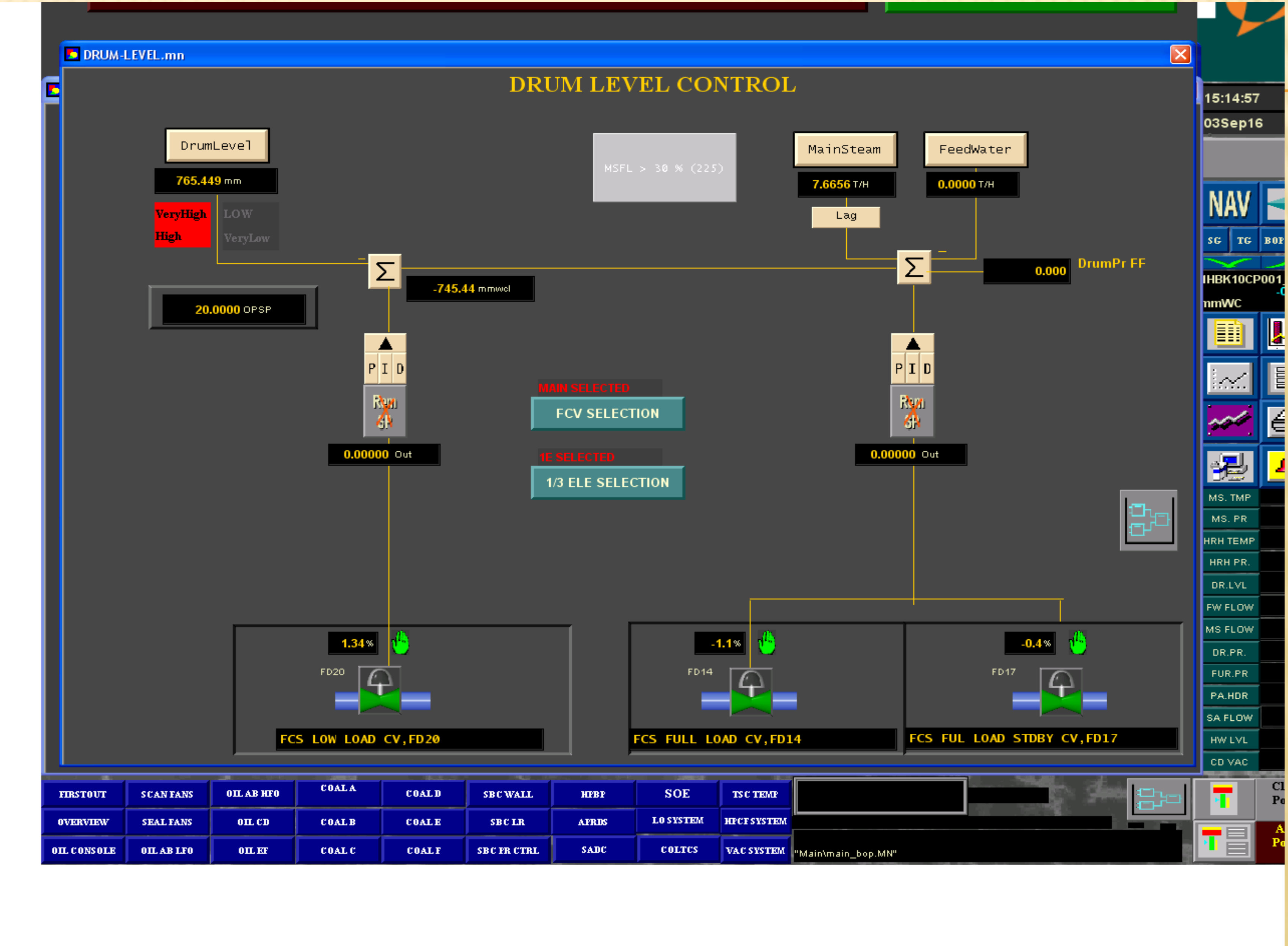
This controller output will be the position demand signal for the full load feed control valve.

Auto/manual selection is provided for operation.

cont...


HPBP STM FLOW (RIGHT)
HPBP STM FLOW (LEFT)
TURB Ist STAGE PRESS
MAN30 CT011
MAN30 CF011
MAN30 CF012
MAN30 CP011
MAN20 CT011
MAN20 CF011
MAN20 CF012
MAN20 CP011
MAA50 CP011
MAA50 CP102
MAA50 CP103
TE
FT
PT
TXSEL
OWS/LVS
F(x)
MS STM FLOW TO TURB
MS FLOW TO APRDS
LBG10 CF011
LBG10 CF012
TO CMC
BLR LOAD >30 %
TO SHT 17 (C1)
TO FSSS
LVM
TOTAL STM FLOW (LOAD)
(C2) TO SHT 26,29
MS TEMP TO APRDS
LBG10 CT011
MS PR TO APRDS
FROM APRDS SCHEME
LBG10 CP011
(AUX STM FLOW)
FW FLOW
FRM SHT 14 (Z2)
K1
BLOW DOWN
K2
ERROR COMPENSATING FOR STM/FW
FLOW MEASUREMENT
3 ELEMENT/
1 ELEMENT
SELECTION
OWS
SEL
1 ELEMENT SELECTED
T
0 %
(D)
DRUM LVL ERROR
3 ELEMENT
ERROR
(Z) TO SHT 17
(D) DRUM LVL ERROR
FRM SHT 14
FRM SHT 14 (EX)
CLOSE FOR LOAD <30 %
PI
A/M
OWS/LVS
CONTROL
DEMAND
E/P
ZT
< 2% OPEN
CLOSE FD-13,FD-13A
> 2% OPEN
OPEN FD-13,FD-13A
FD-14 (LAB60AA101)
FULL LOAD FEED CV
CLOSE FD-16, FD-16A
OPEN FD-16, FD-16A
FD-17 (LAB60AA102)
STANDBY FEED CV

cont...



DRUM-LEVEL.mn
DRUM LEVEL CONTROL
DrumLevel
765.449 mm
VeryHigh
High
LOW
VeryLow
20.0000 OPSP
-745.44 mmwcl
MSFL > 30 % (225)
MainSteam
7.6656 T/H
Lag
FeedWater
0.0000 T/H
0.000
DrumPr FF
P I D
0.00000 Out
MAIN SELECTED
FCV SELECTION
1E SELECTED
1/3 ELE SELECTION
0.00000 Out
1.34 %
FD20
FCS LOW LOAD CV,FD20
-1.1 %
FD14
FCS FULL LOAD CV,FD14
-0.4 %
FD17
FCS FUL LOAD STDBY CV,FD17
15:14:57
03Sep16
NAV
SG
TG
BOP
HBK10CP001
mmWC
MS. TMP
MS. PR
HRH TEMP
HRH PR.
DR.LVL
FW FLOW
MS FLOW
DR.PR.
FUR.PR
PA.HDR
SA FLOW
HW LVL
CD VAC
FIRSTOUT
SCAN FANS
OIL AB HFO
COAL A
COAL D
SBC WALL
HFBP
SOE
TSC TEMP
OVERVIEW
SEAL FANS
OIL CD
COAL B
COAL E
SBC LR
AFRDS
LO SYSTEM
HPCF SYSTEM
OIL CONSOLE
OIL AB LFO
OIL EF
COAL C
COAL F
SBC FR CTRL
SADC
COLTCS
VAC SYSTEM
"Main\main_bop.MN"

cont...

PUT CONTROL LOOP IN AUTO

Desk engineers must follow the following parameters-

1. Deviation between set point and process value is minimum as possible.
2. Put the loop in auto under steady state condition.

cont...

CHANGEOVER OF LOOP FROM AUTO TO MANUAL MODE:

The auto loop shall be trip to manual under the following conditions-

1. in case of two nos. of transmitter fail the auto loop trip to manual.
2. If both transmitter is healthy but deviation is high (±10%).
3. If median is selected two transmitters fail.
4. Operator shall be able to put loop again in auto with 3rd transmitter selection through OWS.
5. In case of three transmitter median is selected and one of the tranmitter fails the average of other two healthy transmitters is given as output to the PID controller.
6. If all the three transmitters fail.
7. Failure of transmitter are alarmed in each of the above cases on OWS.
8. The supervision of final control element shall be provided, in case there is deviation between demand and control element it is alarmed on OWS after the time delay(10 sec).
9. All auto loops, Auto to Manual changeover alarm has provided on LVS.

cont...

TROUBLESHOOTING AND MAINTENANCE

Now we understood, the main parameters of Auto Control System-

- Measure
- Compare
- Compute
- Correct

These four functions are completed by these elements: Controller , Final control element i.e. Control valve and position feedback Transmitters.

In auto control system measuring element and Final control element play a key role to controlling the process with in limit.

cont...

MEASUREMENT DEVICES

S.NO.	PROCESS TYPE	SENSOR
1.	TEMPERATURE	THERMO COUPLE(T/C) & RTDs
2.	PRESSURE	PRESSURE /DIFFERENTIAL PRESSURE (DP)
3.	FLOW	FLOW TRAMSMITTERS
4.	LEVEL	LEVEL TRAMSMITTERS

Final control element i.e. control valve, blade pitch control , IGVs, Hot air dampers , Cold Air dampers etc must be regulate in proper manner.

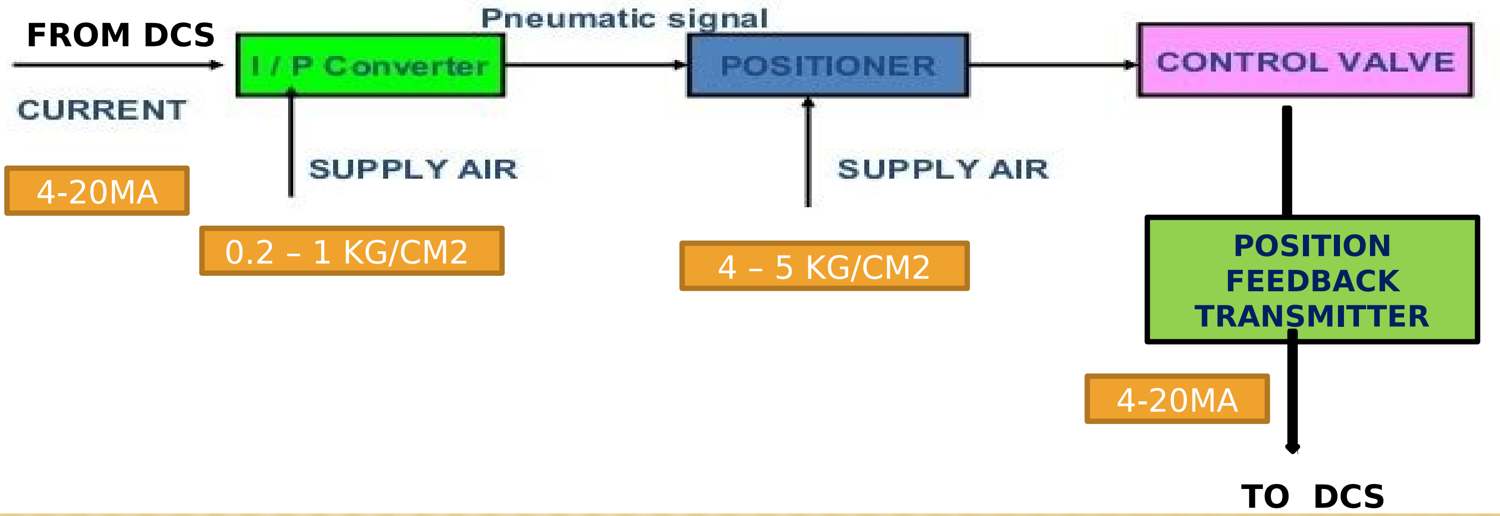
cont...

FINAL CONTROL ELEMENT

The control valve behavior has a major impact on the performance of the Control Loop.

CONTROL VALVES:

They are basically pneumatically operated valves which require around 4 to 5 kg/cm² of air pressure to operate the valve.



cont...

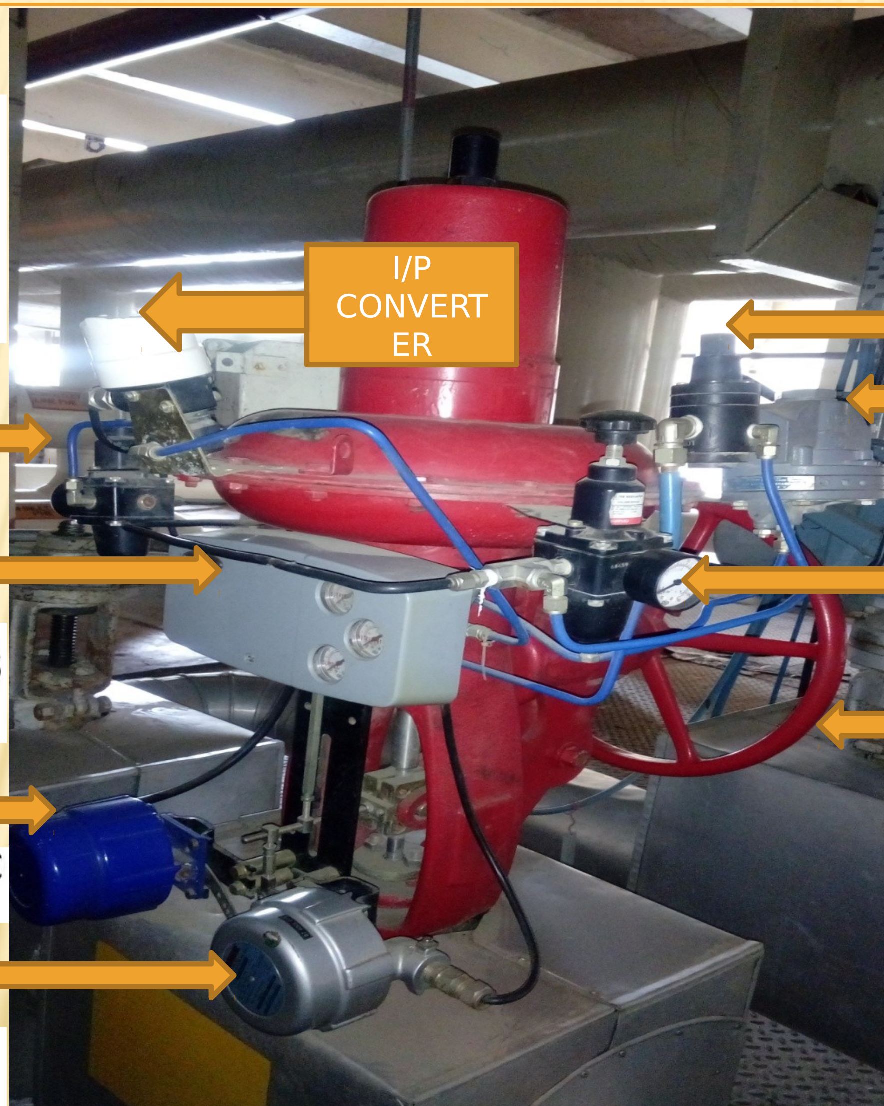
FEED STATION CONTROL VALVE

I/P- A “current to pressure “ transducer (I/P) converts an analog signal i.e. 4-20 ma into pneumatic output i.e. 3-15 psi (0.2-1 kg/cm2)”

I/P CONVERTER

ALR-To lock existing air in case of supply failure.

AIR LOCK RELAY



OPERATING PRESSURE REGULATOR

VOLUME BOOSTER

Volume Boosters – supplies air to actuator when high stroking speed is required.

POSITIONER

SUPPLY PRESSURE REGULATOR

Positioner – receives signal from controller & sends signal to actuator to move the valve.

HAND WHEEL

LIMIT SWITCH BOX

Hand Wheel – used to manually open/close the valve.

Limit Switches – provides **confirmation signal** to PLC or DCS.

POSITION FEEDBACK TRANSMITTER

PFT- convert control valve movement in electrical signal i.e. 4-20 ma.

cont...

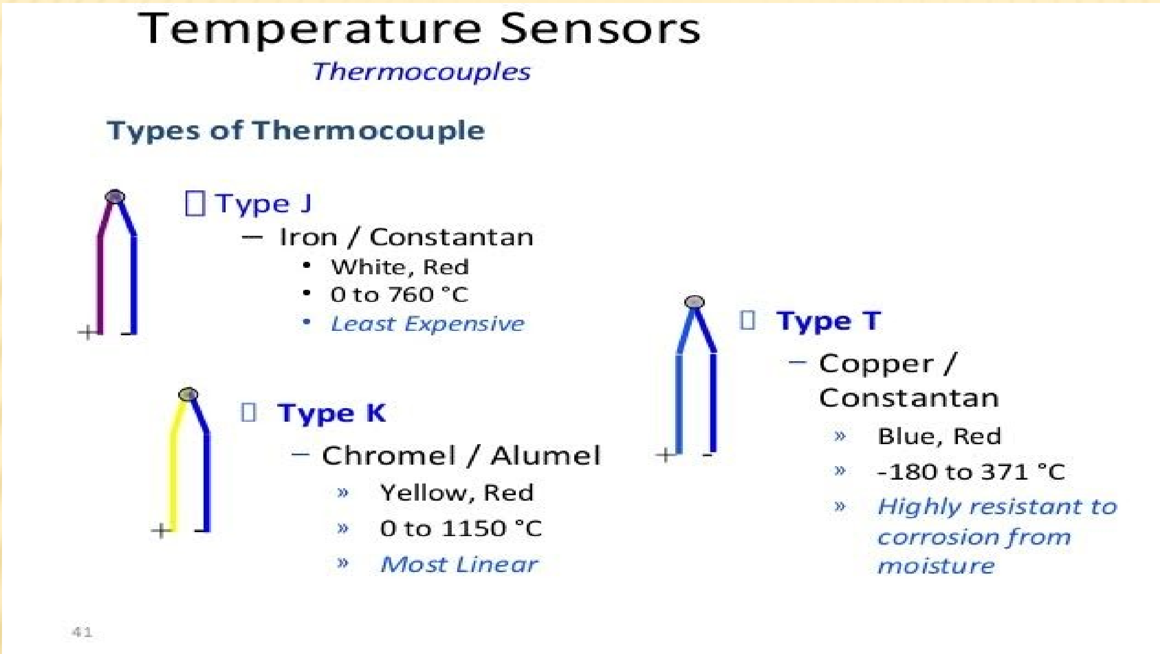
CALIBRATION OF CONTROL VALVE

Functional test Procedure

- The valve, I/P positioner, current source generator, and instrument air supply are set up .
- Instrument air supply P is checked. It is set according to the I/P positioner requirements.
- 4 mA current signal is applied to the I/P positioner. The valve stem shall be in 0% travel. 20 mA current signal is applied to the I/P positioner; the valve stem shall be in 100% travel.
- If the valve stem travel indication didn't show correctly 0% or 100% travel, then travel is calibrated using the HART communicator

cont...

TEMPERATURE MEASUREMENT



TEMPERATURE BATH-

➢To calibrate thermocouple temperature element

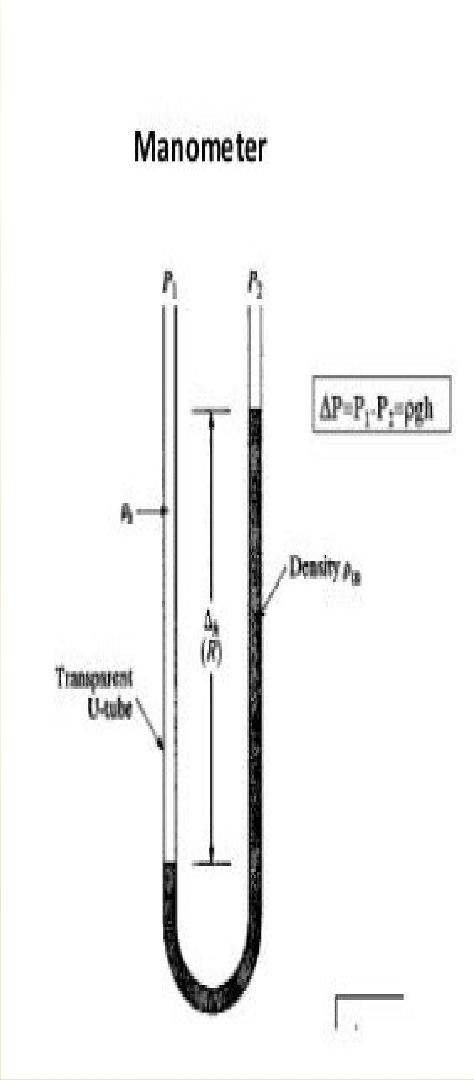
cont...

PRESSURE MEASUREMENT

MANOMETER-

- To calibrate Differential type pressure and flow transmitter.

HART CALIBRATOR



cont...

GOOD INSTRUMENTATION MEANS

QUALITY PRODUCTION, OPTIMISED OPERATION, LONGIVITY AND SAFETY OF THE PLANT .

WE MEAN :

TOTAL ECONOMY OF THE PLANT.

THANKS