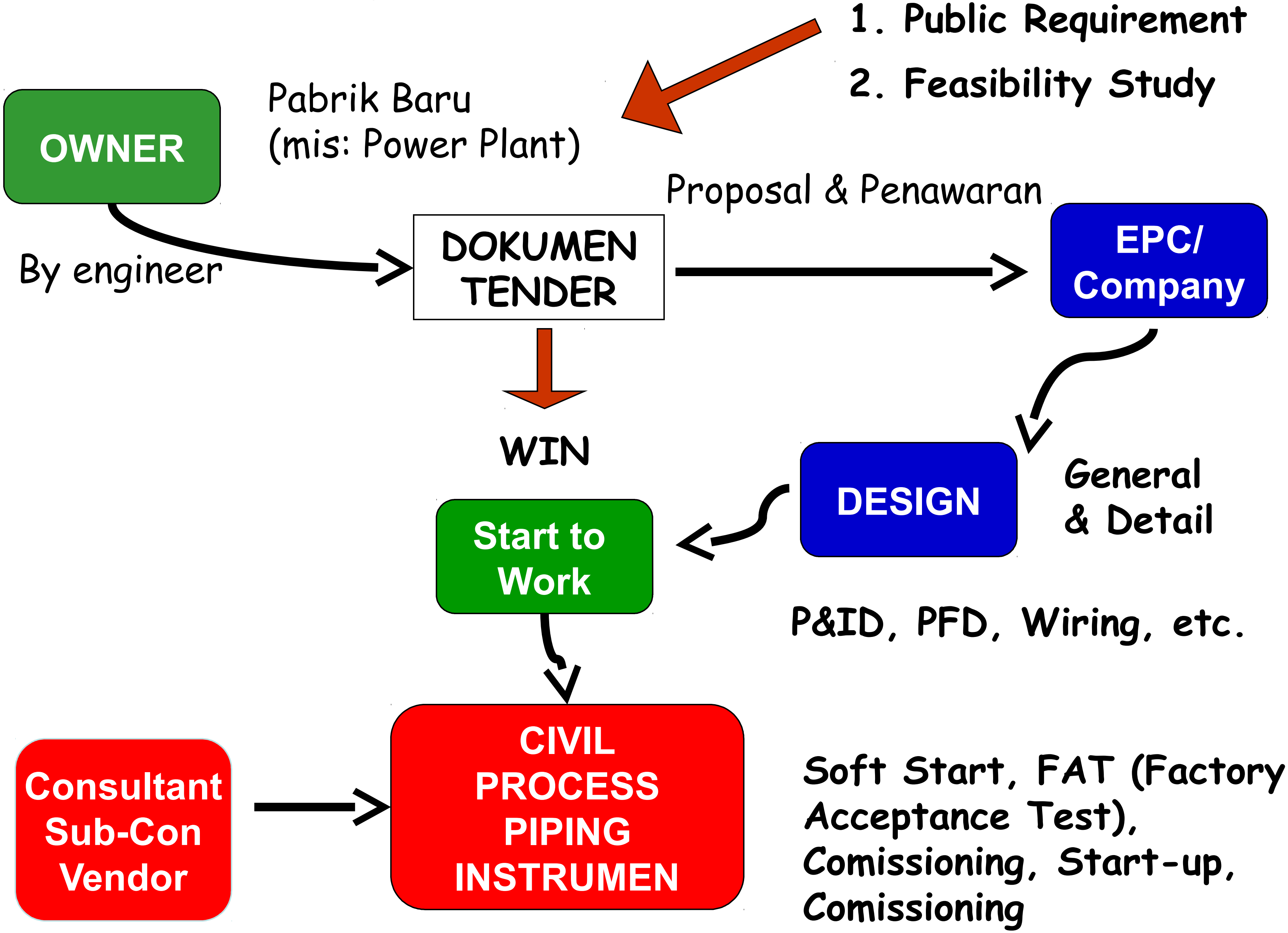
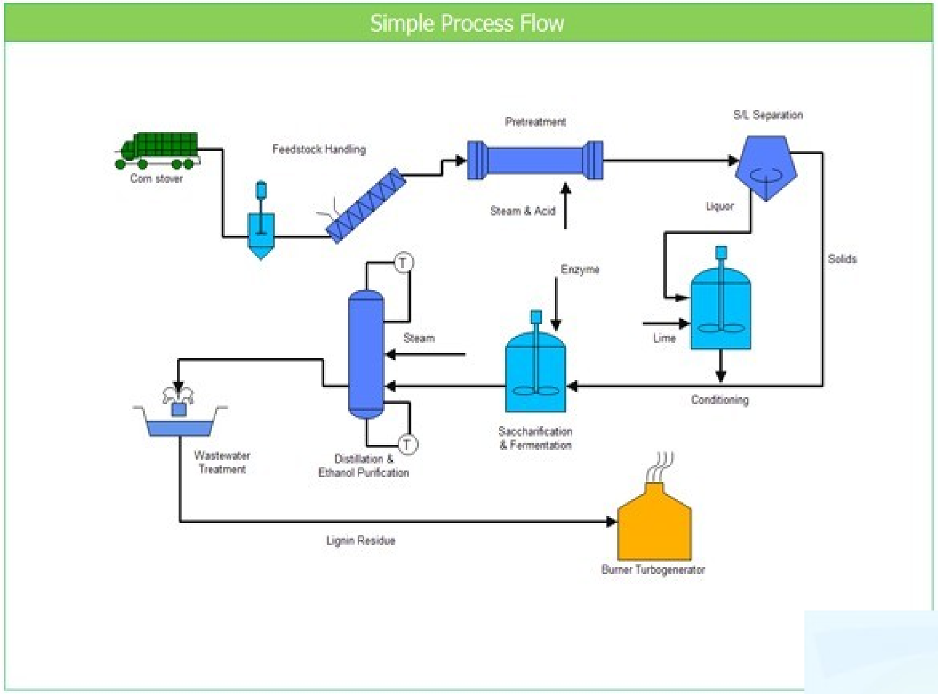
MENGGAMBAR INSTRUMENT

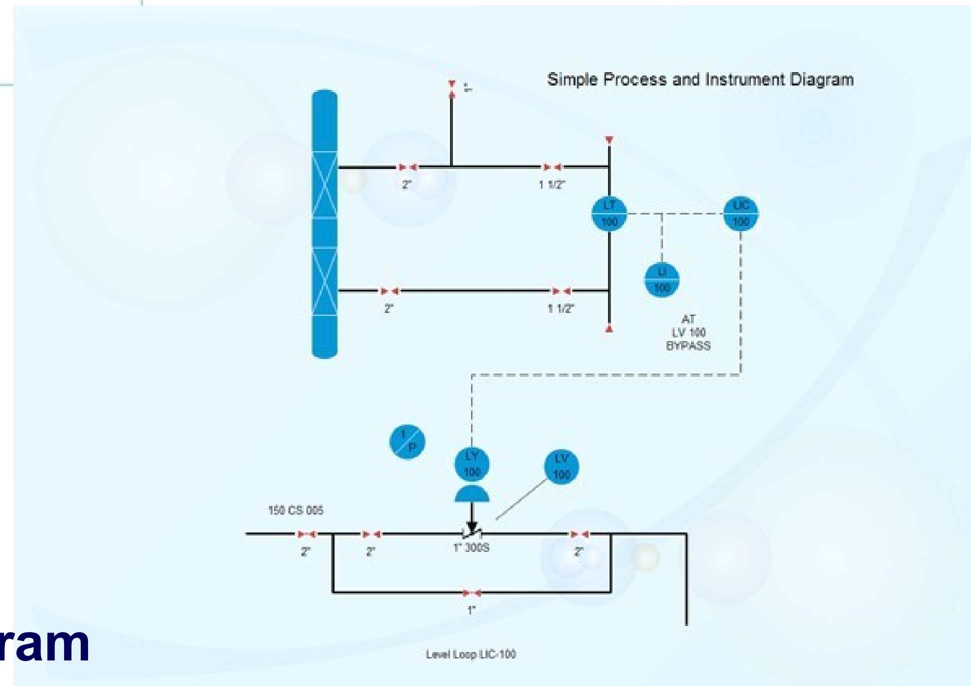
(INSTRUMENTATION DRAWING)

MUNCULNYA PEKERJAAN INSTRUMENTASI





PFD : Process Folw Diagram



P&ID :
Process & Instrumentadion Diagram
Pipeline & Indtrumentation Diagram

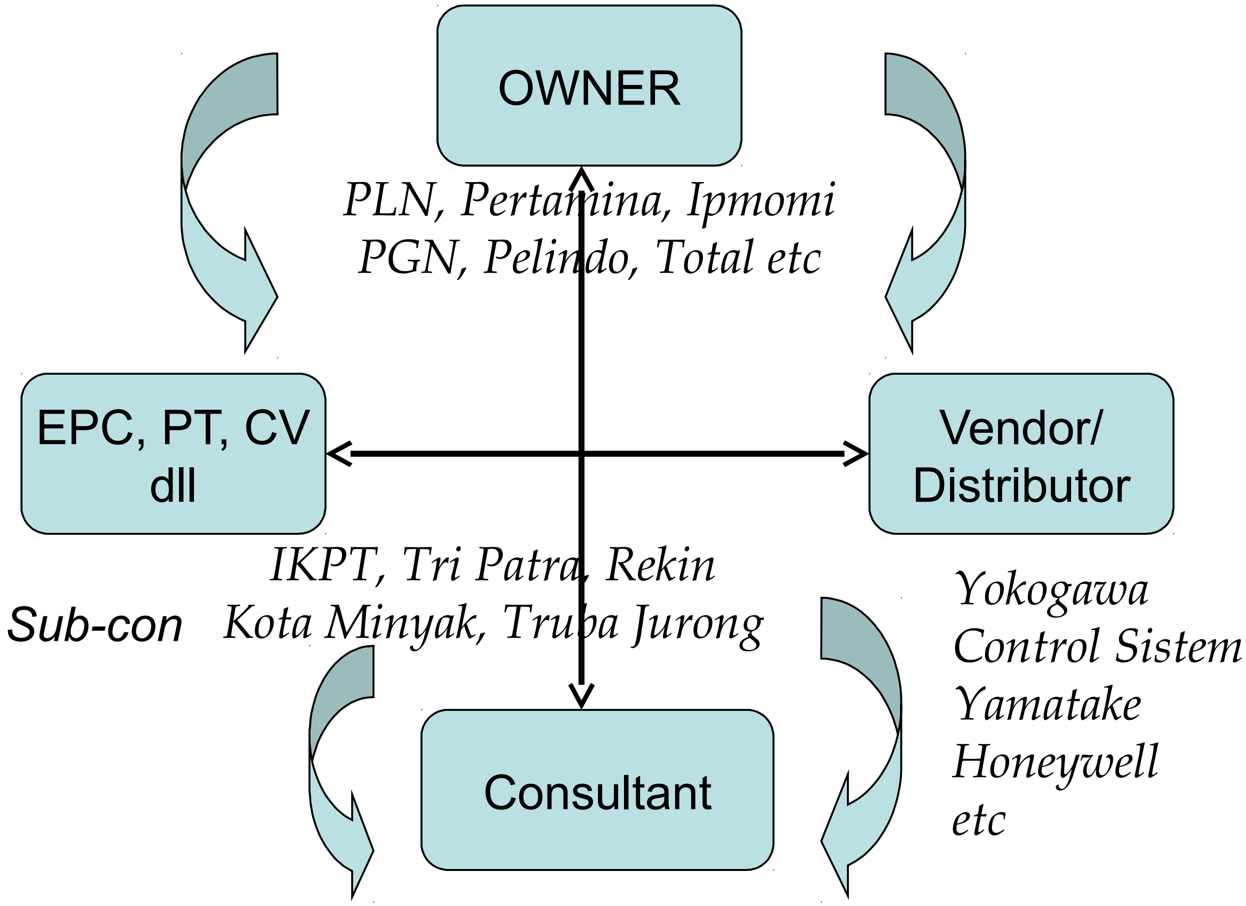
P&ID

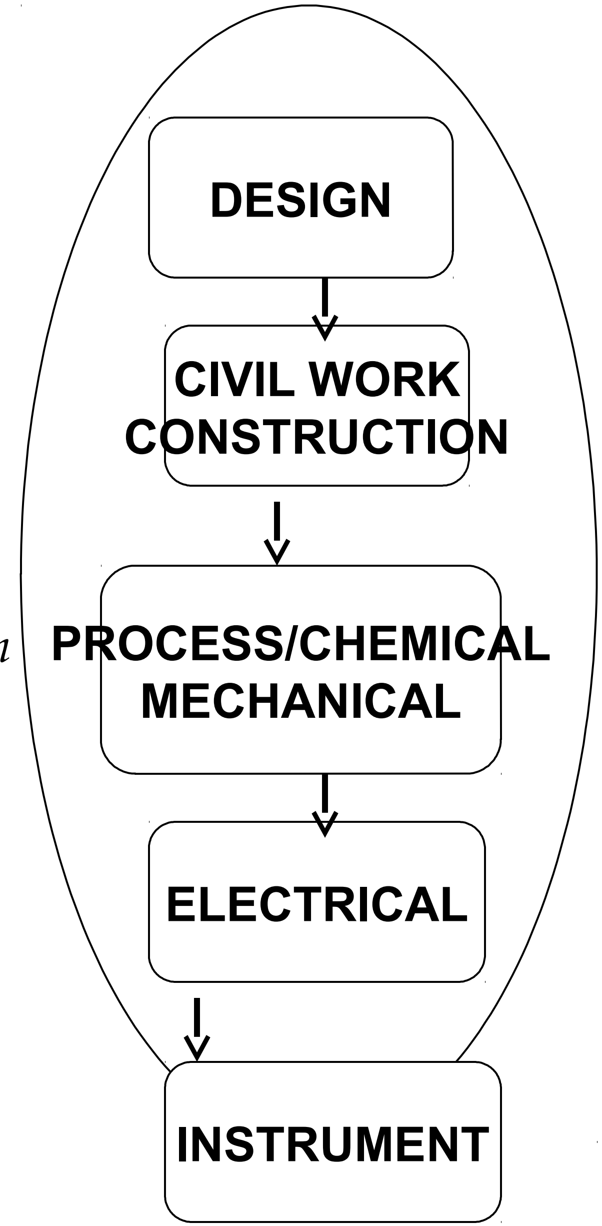
Gambar Instrumentasi dan Perpipaan dari suatu proses (yang terdiri dari perpipaan, proses, pengukuran, pengendalian dan safety/keselamatan)

Bagian tidak terpisahkan dari seluruh gambar untuk pabrik/industri

Bentuk gambar (2D, 3D berikut dengan data base setiap komponen gambar/hubungan antar komponen/pipa)

Guna ➔ KP, TA dan tes awal masuk kerja !!!!





Berdasar wawancara dengan beberapa
Alumni dihampir sub obyek diatas ie dapat
Terlibat sesuai peran dan peruntukan dalam skup instrumen

Proces-Control Requirement and Management

Owner (Government, Company, People…maybe somebody) → rich *Need, Requirement (Increasing Electricity, Energy..etc)*

Penawaran Dokumen Tender (Terbuka, PL, Bebas..etc)

EPC & Company with proper qualification (buy document and make a proposal)

Price, PFD, simple detail P&ID

Win → almost with the lowest total price requirement

Detail Proposal

Discussion & Revision

DP (Termin) → start to build any process manufacture

UNTUK MENGGAMBAR SIMBOL-SIMBOL INSTRUMENTASI MEMPERGUNAKAN STANDARD

“INSTRUMENT SOCIETY OF AMERICA”

ATAU

“ISA STANDARD”

YAITU ANSI/ISA-S5.1-1984 (R 1992) MENGENAI INSTRUMENT SYMBOLS AND IDENTIFICATION.

SIMBOL INSTRUMENTASI TERDIRI DARI :

- LINE INSTRUMENT SYMBOLS.
- INSTRUMENT FUNCTION SYMBOLS.

Menggaambar Instrumen

➔Proses/Equipment/Unit

➔Instrumen (Alat Ukur, Monitoring, Kontrol dan Safety)

➔Pipa (penghubung antar proses)

➔Tubing (penghubung pipa/proses ke instrumen)

➔Wiring/sinyal (Penghubung instrumen ke sistem kontrol PLC/DCS)

➔Logika Kontrol (aksi kontrol yang disesuaikan dengan kondisi proses)
"sering disebut narasi kontrol"

DOCUMENT P&ID

1. Legalisasi dan copyright designer

2. PFD (Process Flow Diagram) menyatakan unit/proses yang terlibat dan hubungannya dimulai dari bahan (raw material) sampai produk. Berisi informasi mass balance (properties yang masuk/keluar)

3. P&ID (Simbol dan sinyal/wiring)

4. Loop Diagram (bagaimana menggambarkan proses aliran sinyal dari field instrumen → sistem kontrol PLC/DCS → kembali ke aktuator kontrol valve

5. Wiring Diagram (logika kontrol yang bekerja)

6. BOM (Bill of material) kebutuhan peralatan disertai harga pembelian

7. Hook Up Drwaing (Gambar 3 Dimensi instrumen dan proses)

“ MOST OF THEM ARE BASED FROM ISA STANDART”

Open the PLTGU

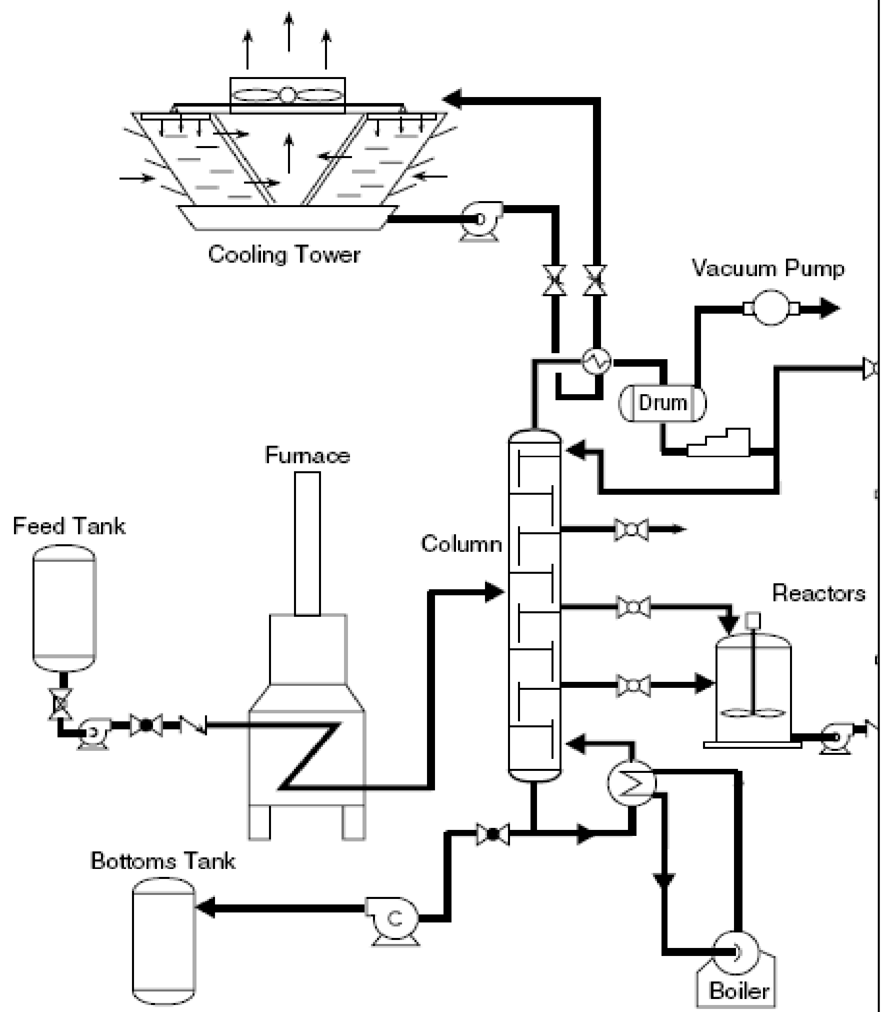


Figure 12.2 *Process Flow Diagram (PFD)*

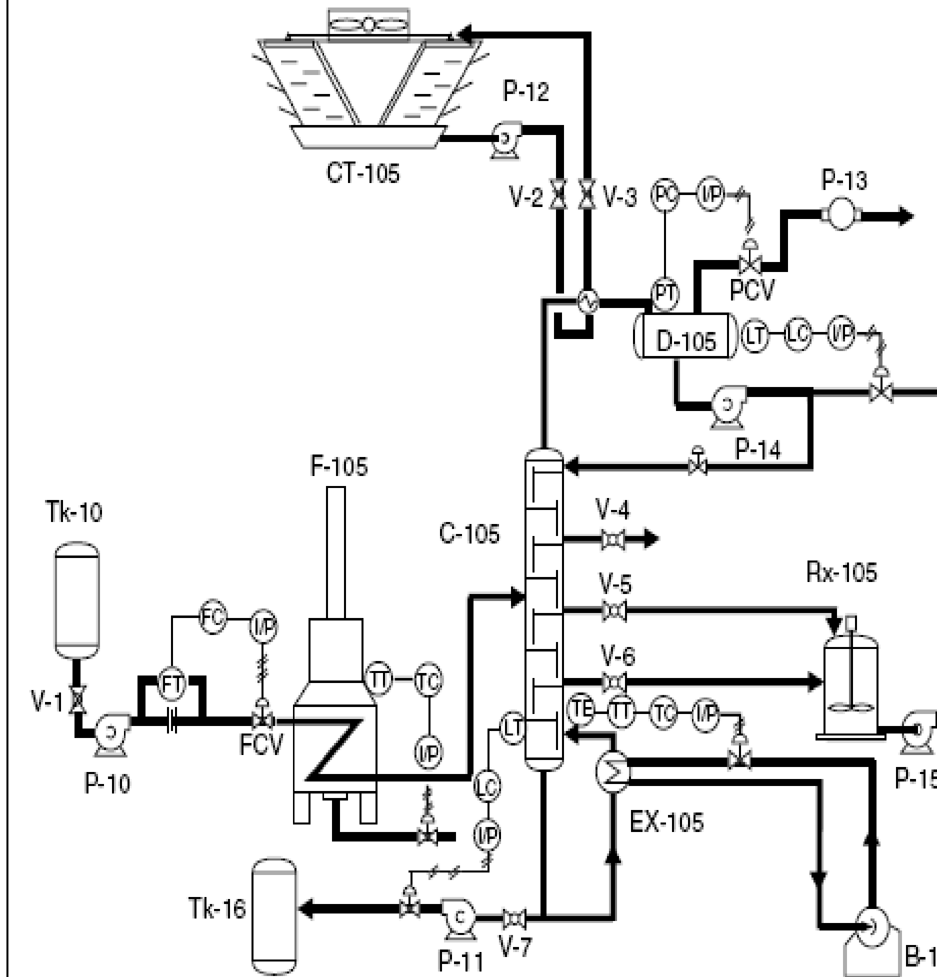
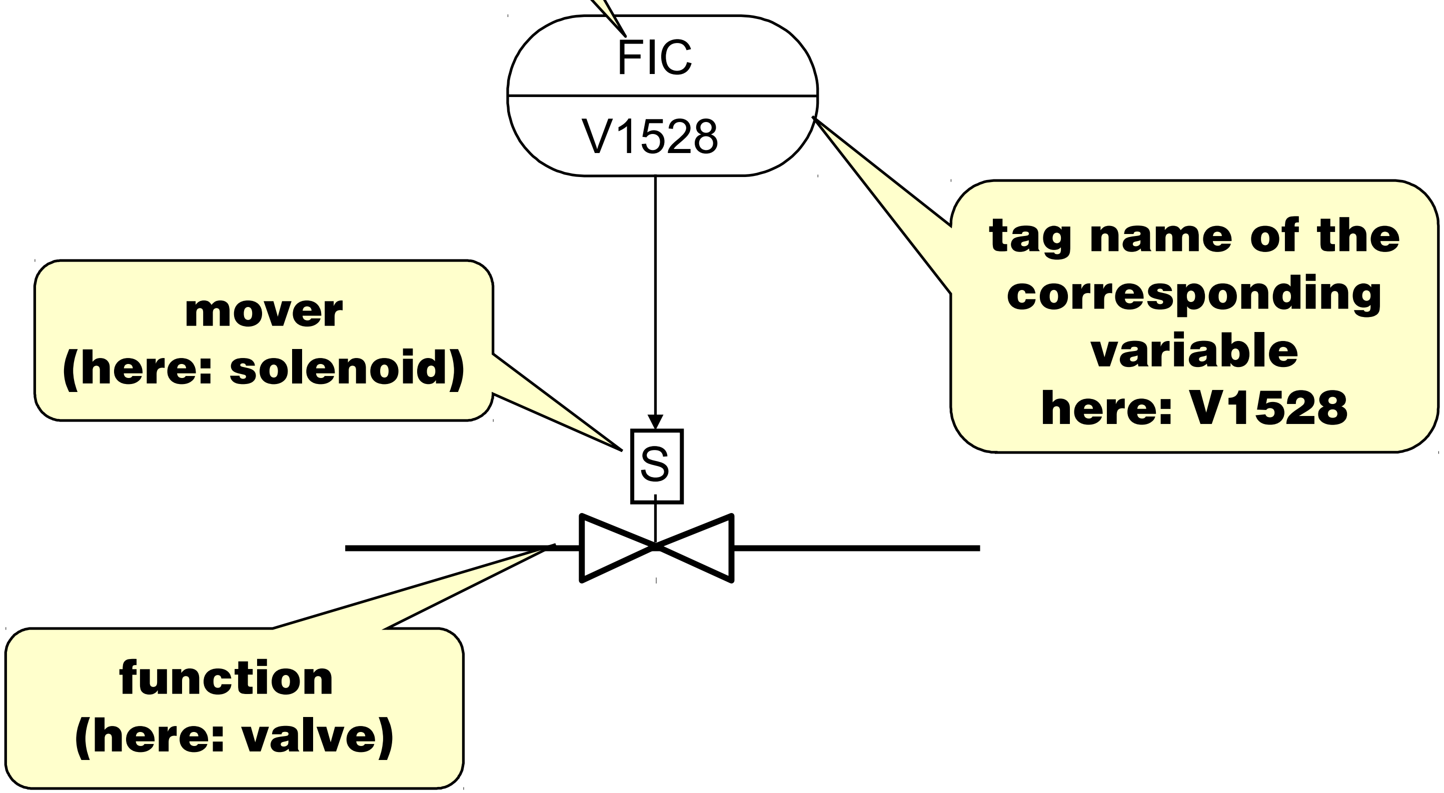
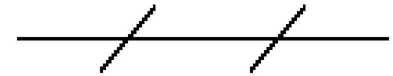
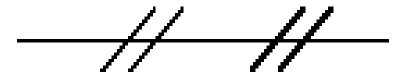
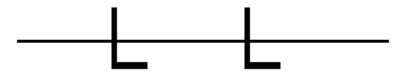
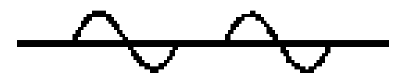
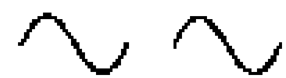


Figure 12.3 *Process and Instrument Diagram (P&ID)*

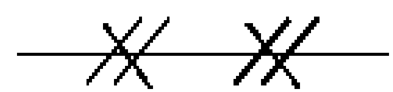
Instrumentation identification

The first letter defines the measured or initiating variables such as Analysis (A), Flow (F), Temperature (T), etc. with succeeding letters defining readout, passive, or output functions such as Indicator (I), Record (R), Transmit (T), see next slides, here: flow indicator digital



(1)	INSTRUMENT SUPPLY * OR CONNECTION TO PROCESS	
(2)	UNDEFINED SIGNAL	
(3)	PNEUMATIC SIGNAL **	
(4)	ELECTRIC SIGNAL	
(5)	HYDRAULIC SIGNAL	
(6)	CAPILLARY TUBE	
(7)	ELECTROMAGNETIC OR SONIC SIGNAL *** (GUIDED)	
(8)	ELECTROMAGNETIC OR SONIC SIGNAL *** (NOT GUIDED)	
(9)	INTERNAL SYSTEM LINK (SOFTWARE OR DATA LINK)	
(10)	MECHANICAL LINK	

OPTIONAL BINARY (ON-OFF) SYMBOLS

(11)	PNEUMATIC BINARY SIGNAL	
(12)	ELECTRIC BINARY SIGNAL	

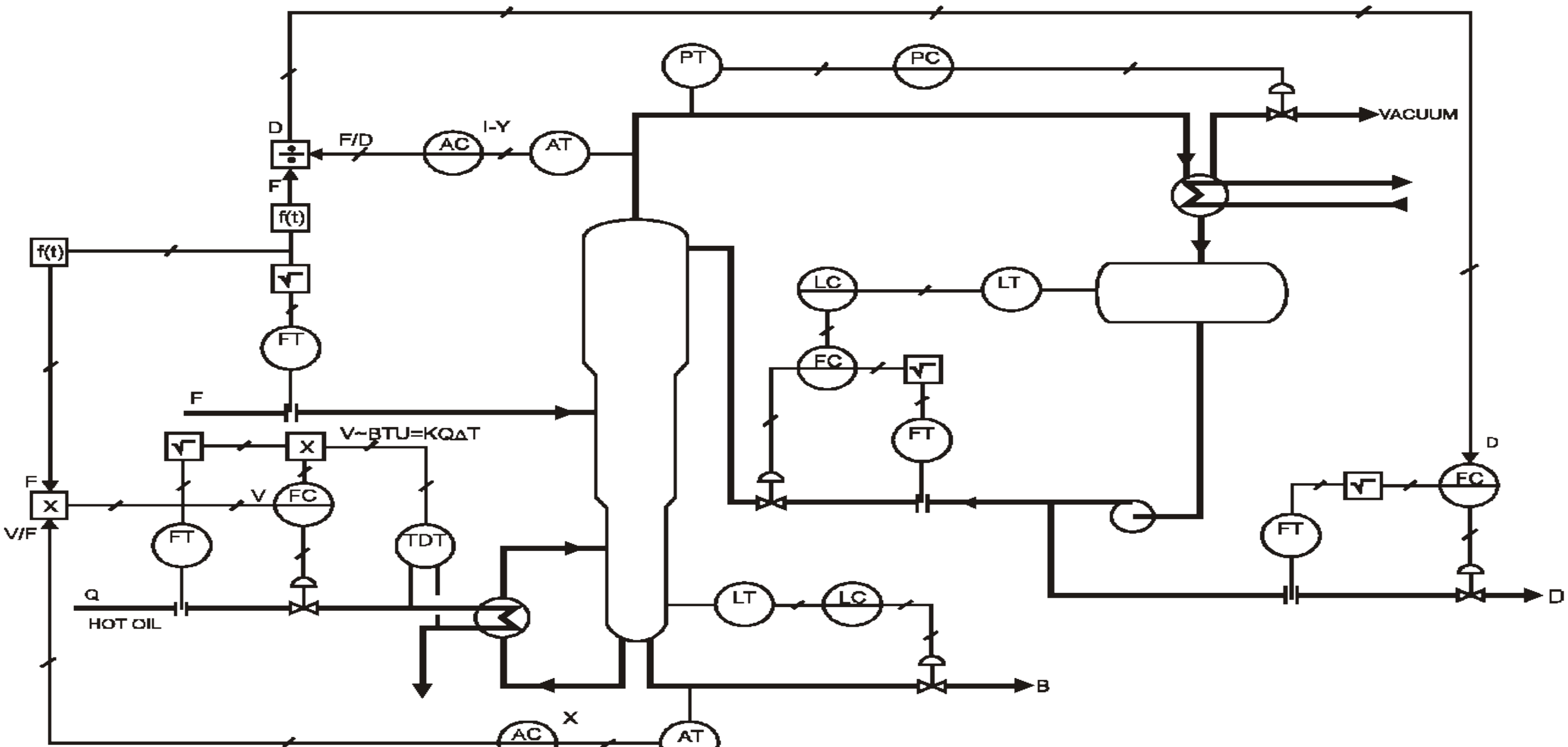
PIPING AND INSTRUMENTATION DIAGRAM (P&ID)

P&ID BIASA JUGA DISEBUT DENGAN MECHANICAL FLOW DIAGRAM (MFD).
PROCESS FLOW DIAGRAM (PFD)

ADALAH

MERUPAKAN DIAGRAM YANG MENGGAMBARKAN ALIRAN PROSES SECARA DETAIL,
TERDIRI DARI PERALATAN POSES YANG BERUPA PIPA BESERTA UKURANNYA, FITTING, VALVE, INSTRUMENT DAN CONTROL VALVE.

2 TYPICAL SYMBOLISM FOR CONCEPTUAL DIAGRAMS



Functionally oriented symbolism and abbreviated identification used to develop control concepts without concern for specific hardware.

* SEE SECTION 4.4 FOR DISCUSSION

LOOP DIAGRAM

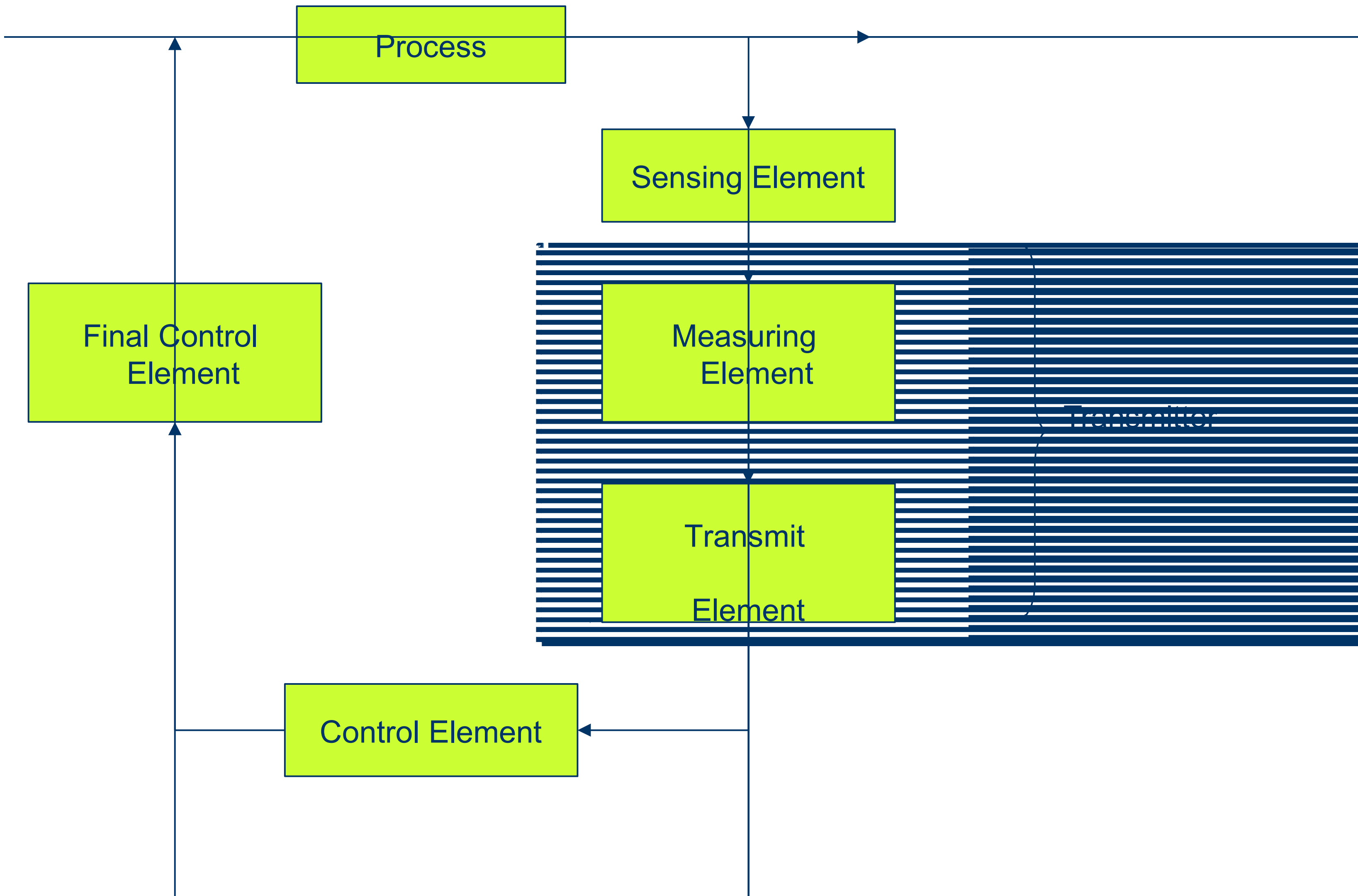
LOOP DIAGRAM MENGGAMBARKAN DIAGRAM PENSINYALAN INSTRUMENTASI YANG DIMULAI DARI PROSES LAPANGAN SAMPAI DI CONTROL PANEL.

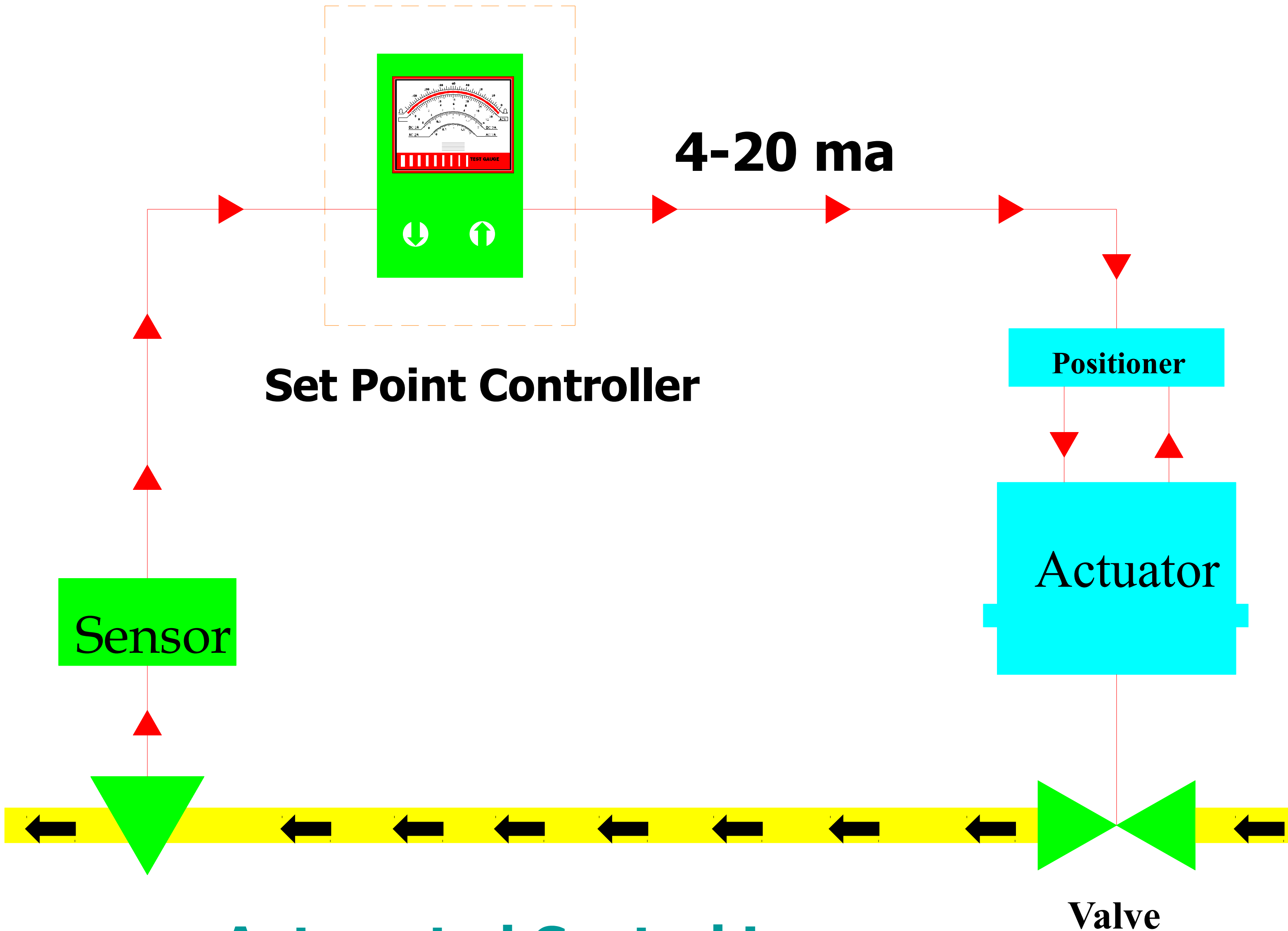
BERDASARKAN ANSI/ISA-S5.4-1991, LOOP DIAGRAM DIBAGI MENJADI BEBERAPA BAGIAN BERDASARKAN DARI INSTRUMENT YANG DIPASANG,
ANTARA LAIN :

- **FIELD PROCESS AREA**
- **SPREADING ROOM**
- **CABINET**
- **CONTROL PANEL**
- **CONSOLE**

The Piping & Instrumentation Diagram (P&ID)

Basic Loop

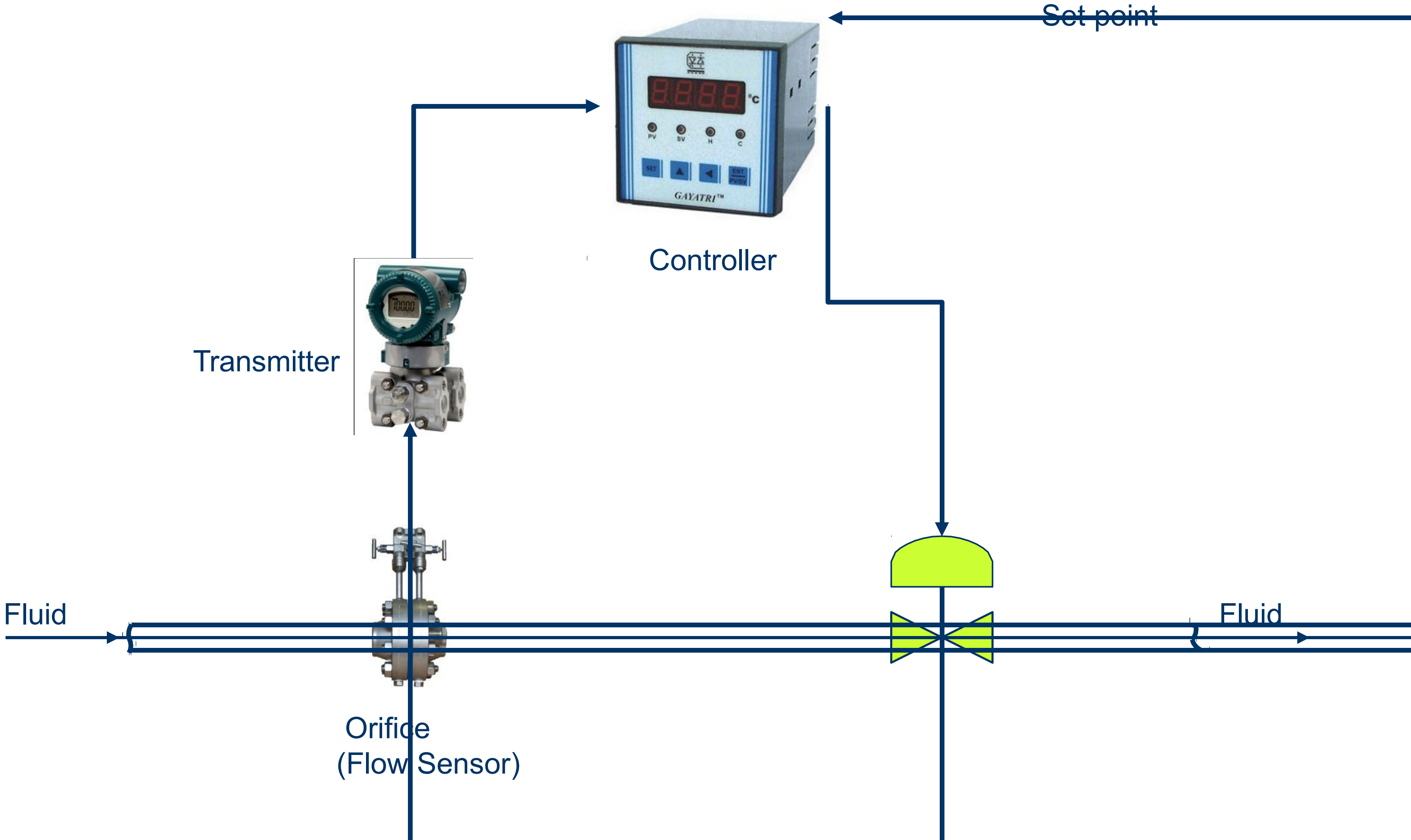




Automated Control Loop

The Piping & Instrumentation Diagram (P&ID)

Basic Loop



SENSORS (Sensing Element)

A device, such as a photoelectric cell, that receives and responds to a signal or stimulus.

A device, usually electronic, which detects a variable quantity and measures and converts the measurement into a signal to be recorded elsewhere.

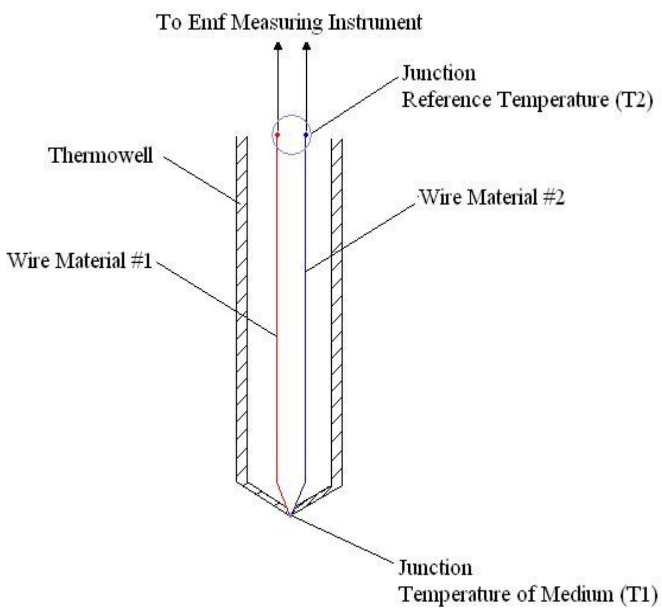
A sensor is a device that measures a physical quantity and converts it into a signal which can be read by an observer or by an instrument.

For example, a mercury thermometer converts the measured temperature into expansion and contraction of a liquid which can be read on a calibrated glass tube. A thermocouple converts temperature to an output voltage which can be read by a voltmeter.

Temperature Sensor

1. Thermocouple

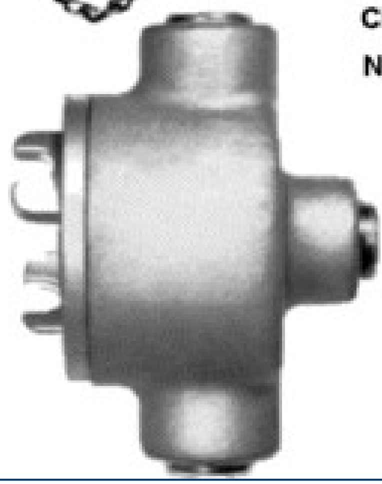
A **thermocouple** is a junction between two different metals that produces a voltage related to a temperature difference. Thermocouples are a widely used type of temperature sensor and can also be used to convert heat into electric power.



CONNECTION HEADS

CA - Die Cast Aluminum
with gray enamel
coating.

CI - Cast Iron



CE - Explosion Proof

NEC: Class I Groups C,D
Class II Groups E,F,G
Class III

UL Standard: 886

THERMOCOUPLE INSERTS

T-14

T-0050867 & T-00829

T-0096

T-0057

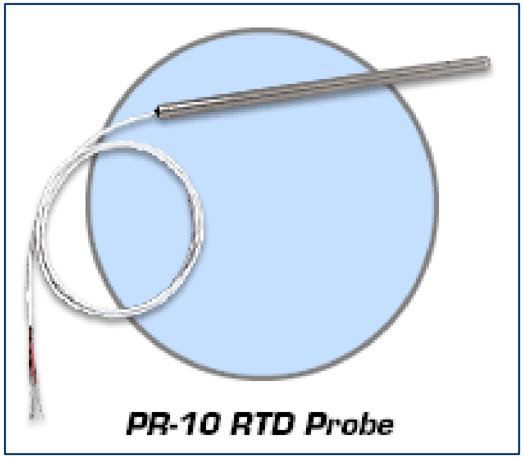
Temperature Sensor

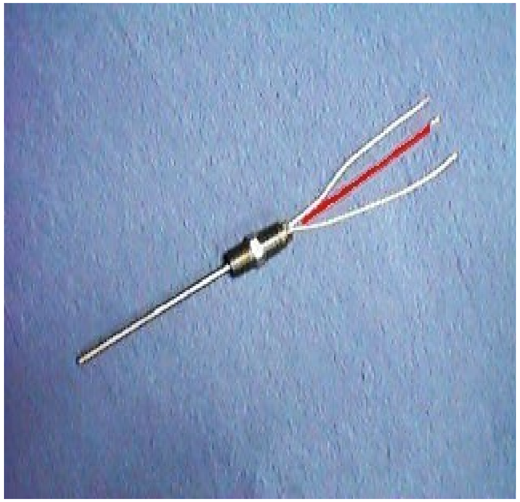
2. Resistance Temperature Detector (RTD)

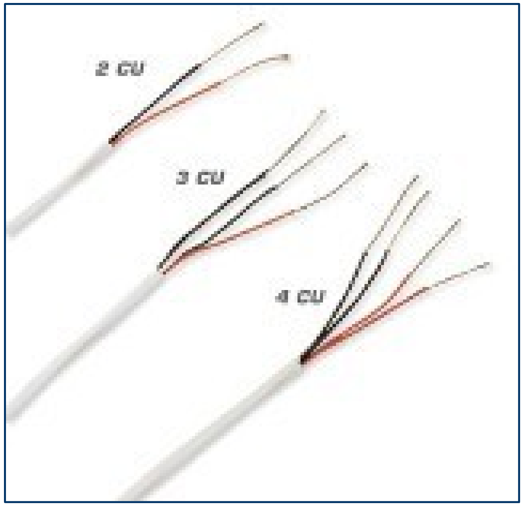
Resistance Temperature Detectors (RTD), as the name implies, are sensors used to measure temperature by correlating the resistance of the RTD element with temperature.

Most RTD elements consist of a length of fine coiled wire wrapped around a ceramic or glass core. The element is usually quite fragile, so it is often placed inside a sheathed probe to protect it.

The RTD element is made from a pure material whose resistance at various temperatures has been documented. The material has a predictable change in resistance as the temperature changes; it is this predictable change that is used to determine temperature.



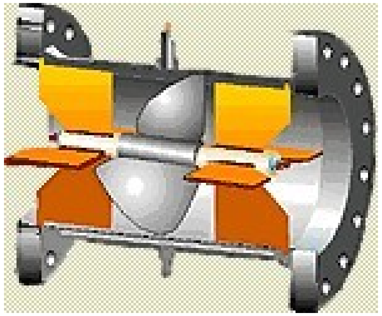




Accuracy for Standard OMEGA RTDs

Temperature °C	Ohms	°C
-200	±056	±1.3
-100	±0.32	±0.8
0	±0.12	±0.3
100	±0.30	±0.8
200	±0.48	±1.3
300	±0.64	±1.8
400	±0.79	±2.3
500	±0.93	±2.8
600	±1.06	±3.3
650	±1.13	±3.6

Flow Sensor



1. Turbine Meter

In a turbine, the basic concept is that a meter is manufactured with a known cross sectional area. A rotor is then istalled inside the meter with its blades axial to the product flow. When the product passes the rotor blades, they impart an angular velocity to the blades and therefore to the rotor. This angular velocity is directly proportional to the total volumetric flow rate.

Turbine meters are best suited to large, sustained flows as they are susceptible to start/stop errors as well as errors caused by unsteady flow states.

Flow Sensor

2. Magnetic Flow Meter

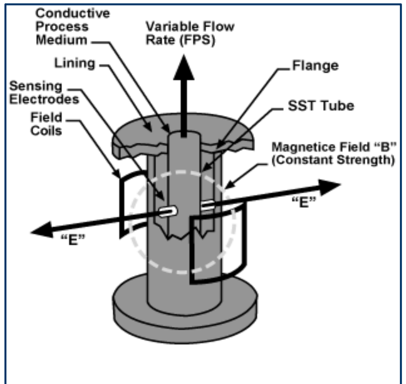
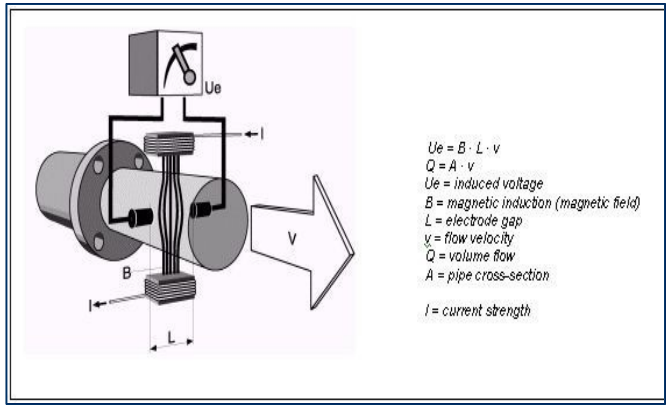


Figure 2.21 - The Magnetic Head Flow Meter



Measurement of slurries and of corrosive or abrasive or other difficult fluids is easily made. There is no obstruction to fluid flow and pressure drop is minimal.

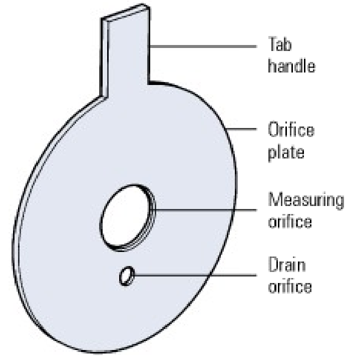
The meters are unaffected by viscosity, density, temperature, pressure and fluid turbulence.

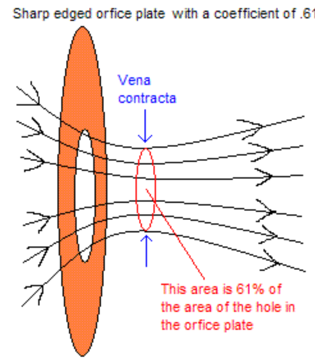
Magnetic flow meters utilize the principle of Faraday's Law of Induction; similar principle of an electrical generator.

When an electrical conductor moves at right angle to a magnetic field, a voltage is induced.

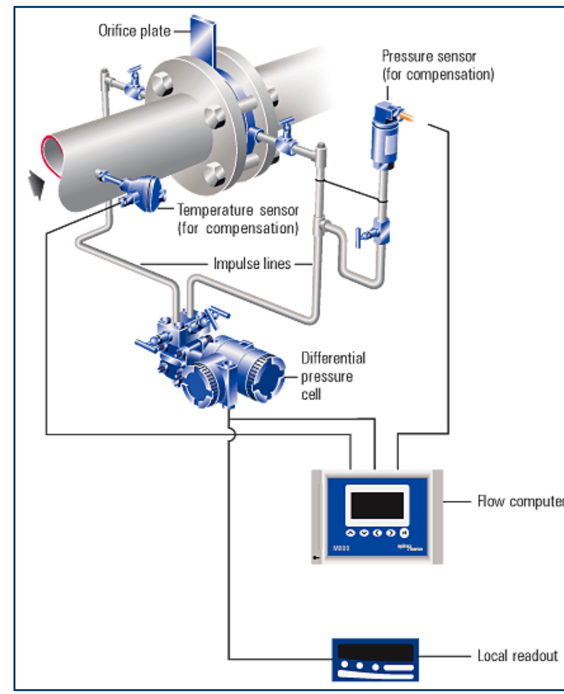
Flow Sensor

3. Orifice Meter





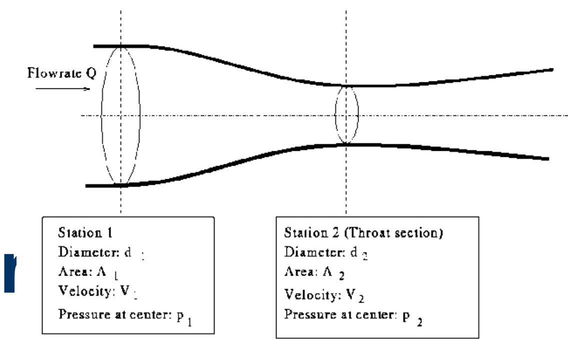
An orifice meter is a conduit and a restriction to create a pressure drop. An hour glass is a form of orifice. A nozzle, venturi or thin sharp edged orifice can be used as the flow restriction. In order to use any of these devices for measurement it is necessary to empirically calibrate them. That is, pass a known volume through the meter and note the reading in order to provide a standard for measuring other quantities. Due to the ease of duplicating and the simple construction, the thin sharp edged orifice has been adopted as a standard and extensive calibration work has been done so that it is widely accepted as a standard means of measuring fluids. Provided the standard mechanics of construction are followed no further calibration is required. An orifice in a pipeline is shown in figure 1 with a manometer for measuring the drop in pressure (differential) as the fluid passes thru the orifice. The minimum cross sectional area of the jet is known as the "vena contracta."



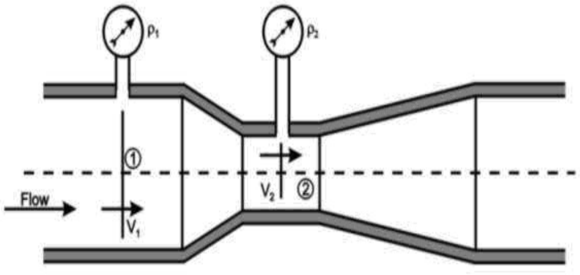
Flow Sensor

4. Venturi Meter

The venturi meter



A device for measuring flow of a fluid in terms of the drop in pressure when the fluid flows into the constriction of a Venturi tube.



A meter, developed by Clemens Herschel, for measuring flow of water or other fluids through closed conduits or pipes. It consists of a venturi tube and one of several forms of flow registering devices.

TRANSMITTER

Transmitter is a transducer* that responds to a measurement variable and converts that input into a standardized transmission signal.

***Transducer is a device that receives output signal from sensors.**

Pressure Level Transmitter

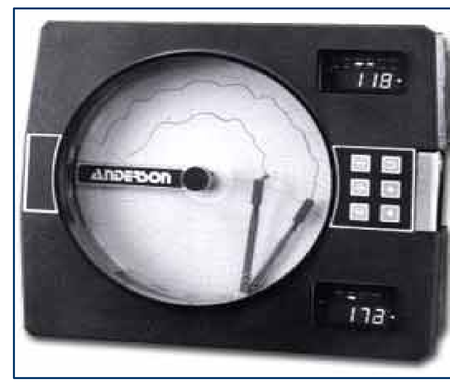
Differential Pressure Transmitter

Pressure Transmitter

CONTROLLER

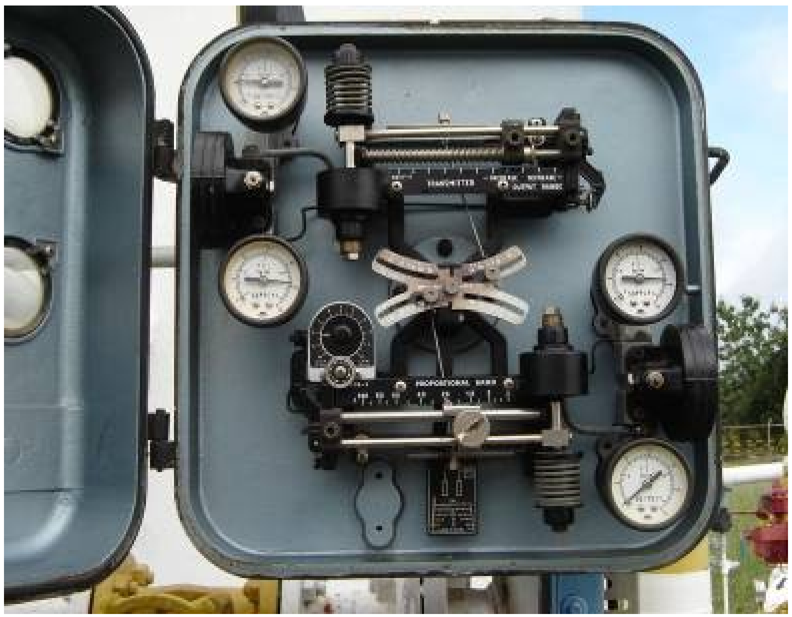
Controller is a device which monitors and affects the operational conditions of a given dynamical system. The operational conditions are typically referred to as output variables of the system which can be affected by adjusting certain input variables

Indicating Controller



Recording Controller

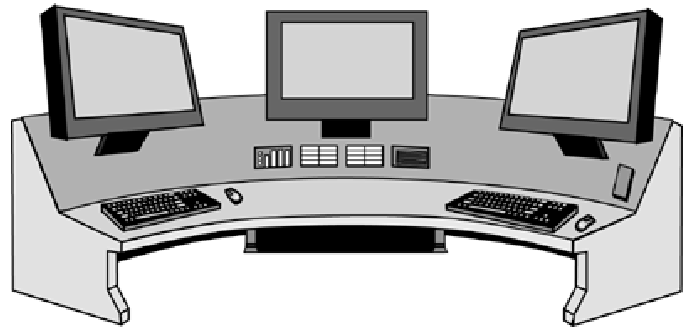
BENTUK INSTRUMEN DI LAPANGAN

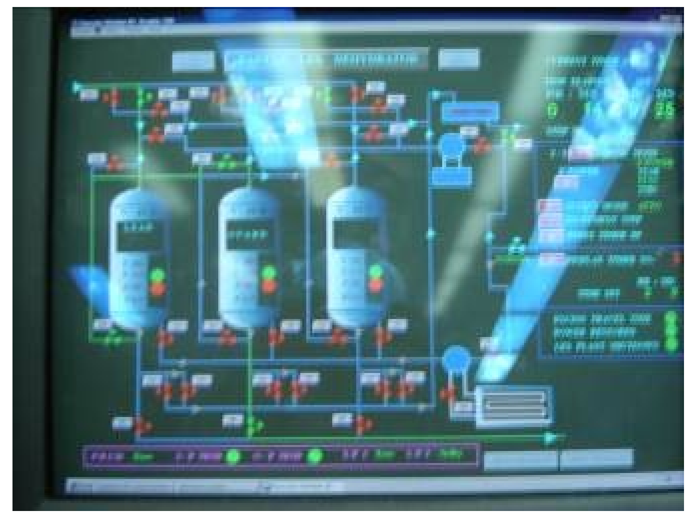


PENGENDALI PNUMATIK DI LAPANGAN

PENGENDALI DI PANEL

Pengendali digital di dalam panel (FCU)





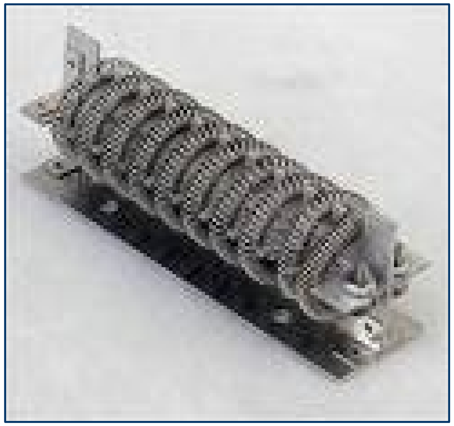
Panel pengendali digital

FINAL CONTROL ELEMENT

Final Control Element is a device that directly controls the value of manipulated variable of control loop. Final control element may be control valves, pumps, heaters, etc.

Pump

Control Valve



Heater

KATUP KENDALI ATO

KATUP KENDALI
ATC