



Dynalectric

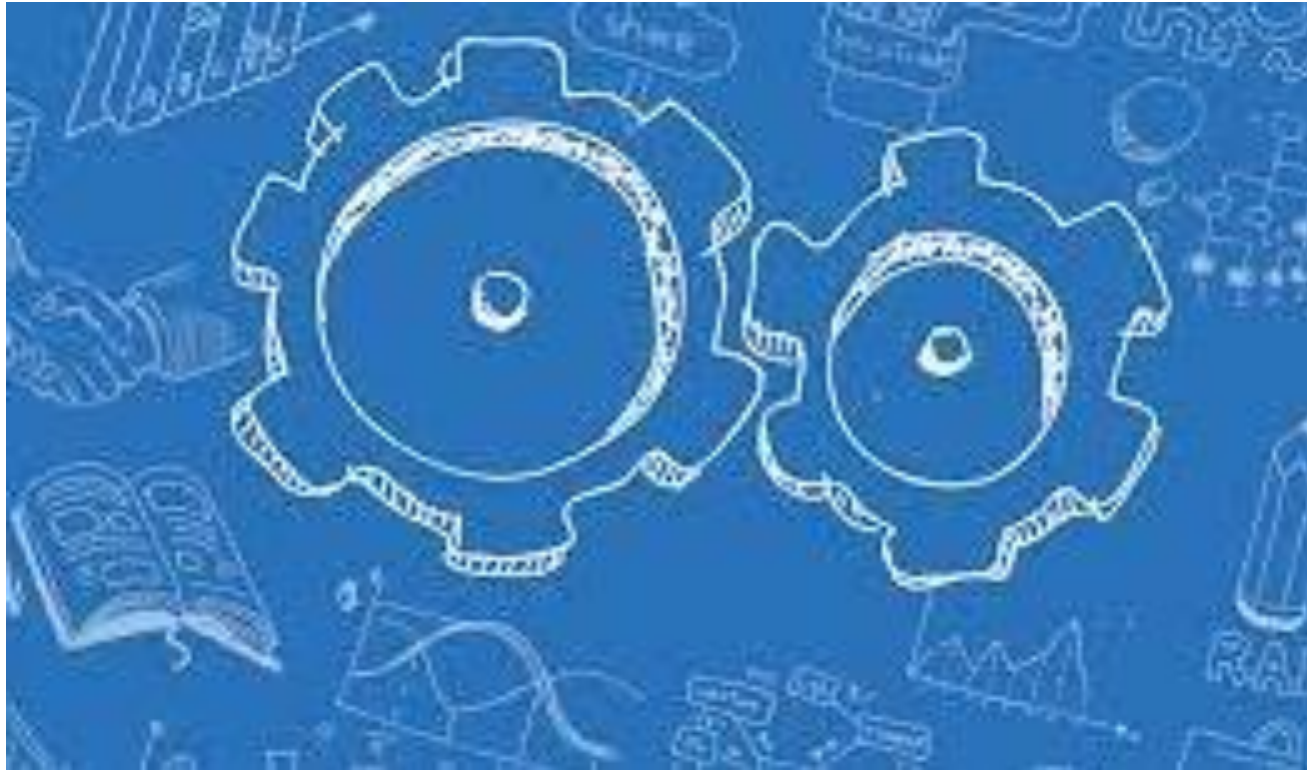
San Diego

An EMCOR Company

Internship Presentation

By: Preston Gomersall

Learning the Engineering Language

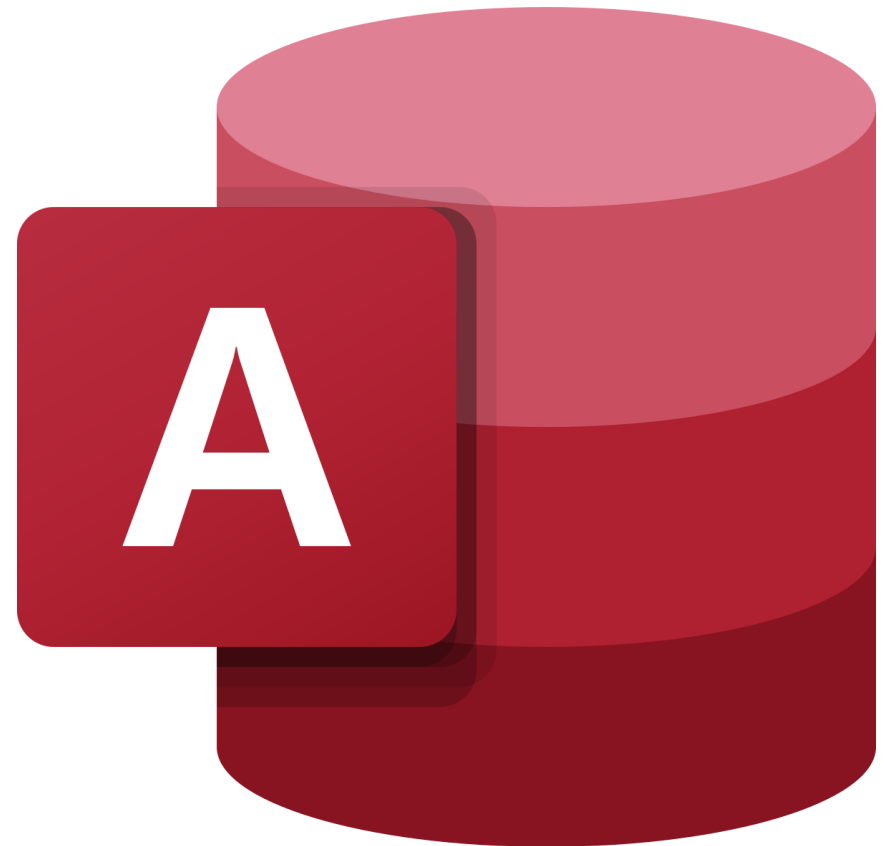


Acronyms and abbreviations.
Ex: SOP, SOV, RIO, CIP, P&ID,
VFD, etc.

Learning Software



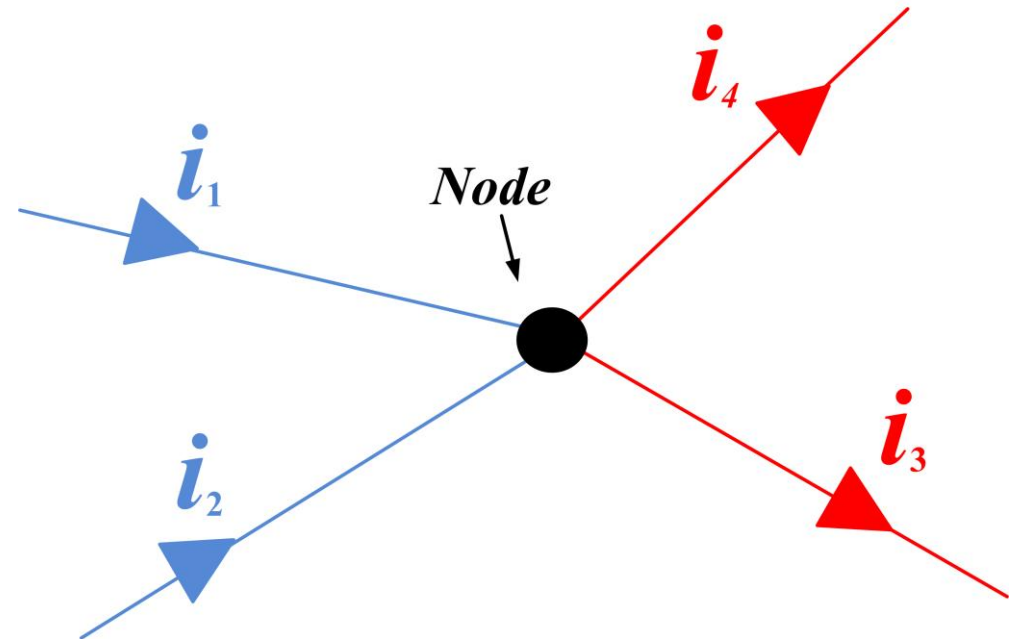
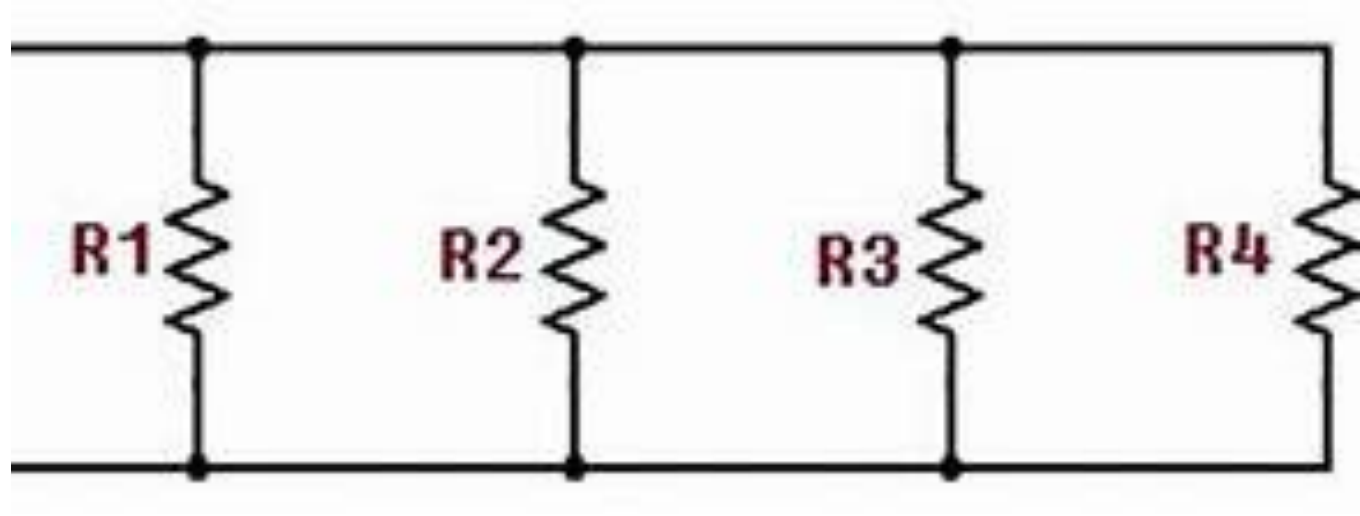
AUTOCAD



Understanding Control Panel and Instruments



Wiring diagram



PLC's



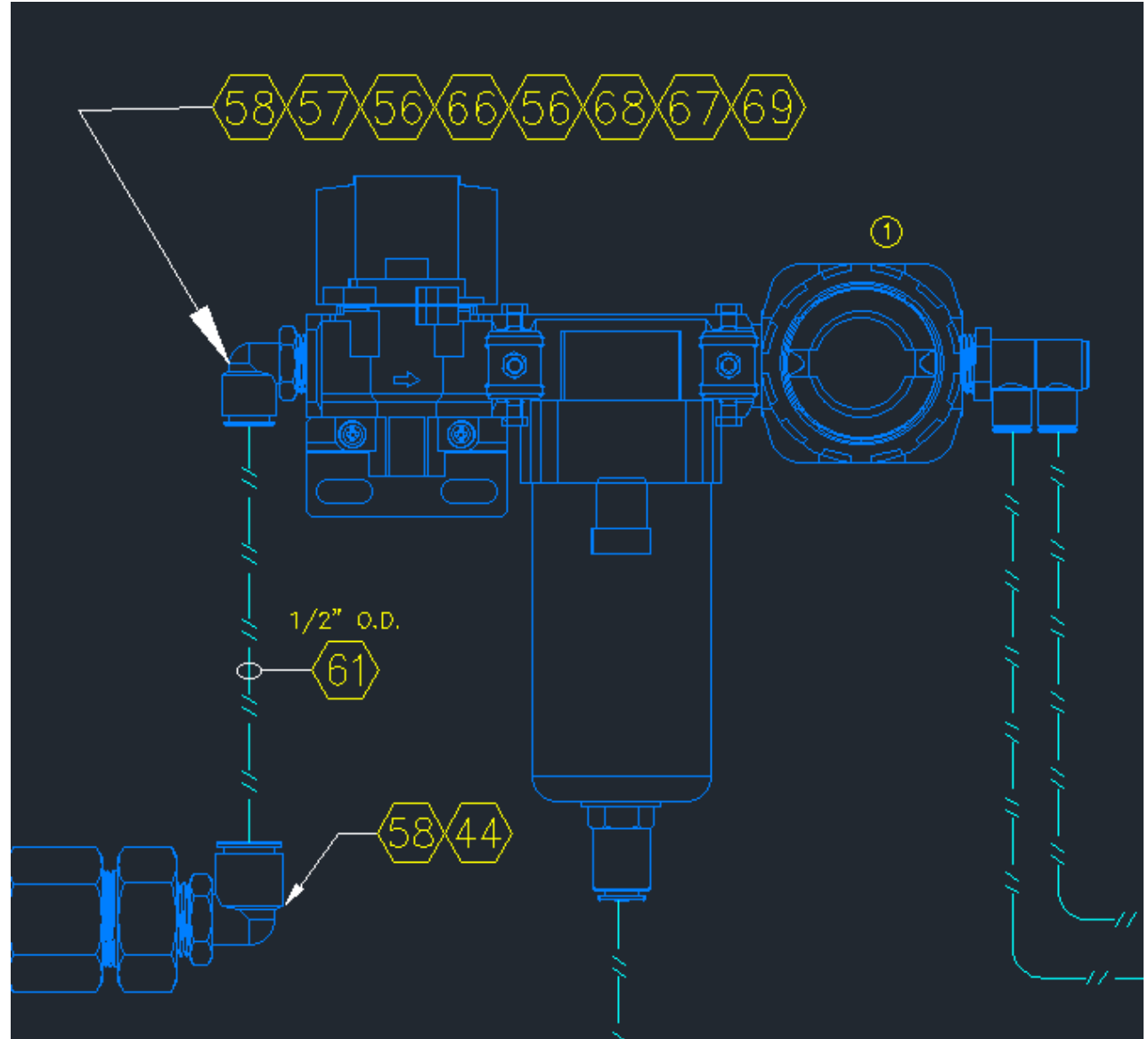
REO Temp Visit



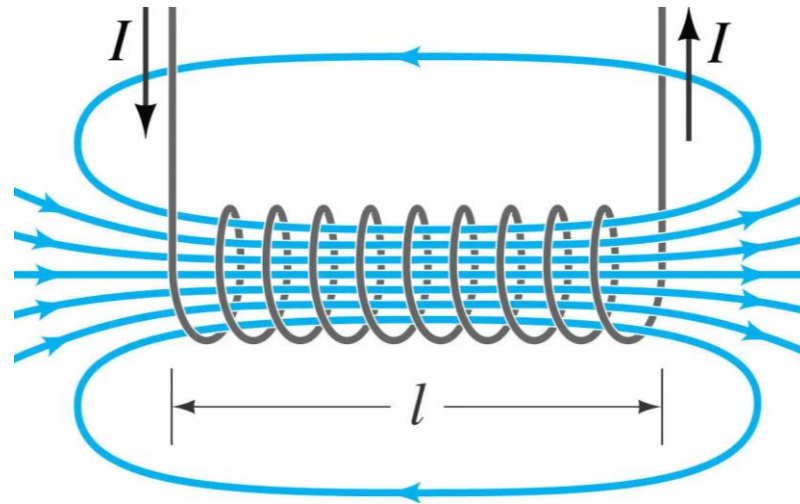
$$R = \frac{PL}{A}$$

$$P = \text{Resistivity} = P_0(1 + \alpha * \Delta T)$$

My Pressure Regulator



Solenoid Valve



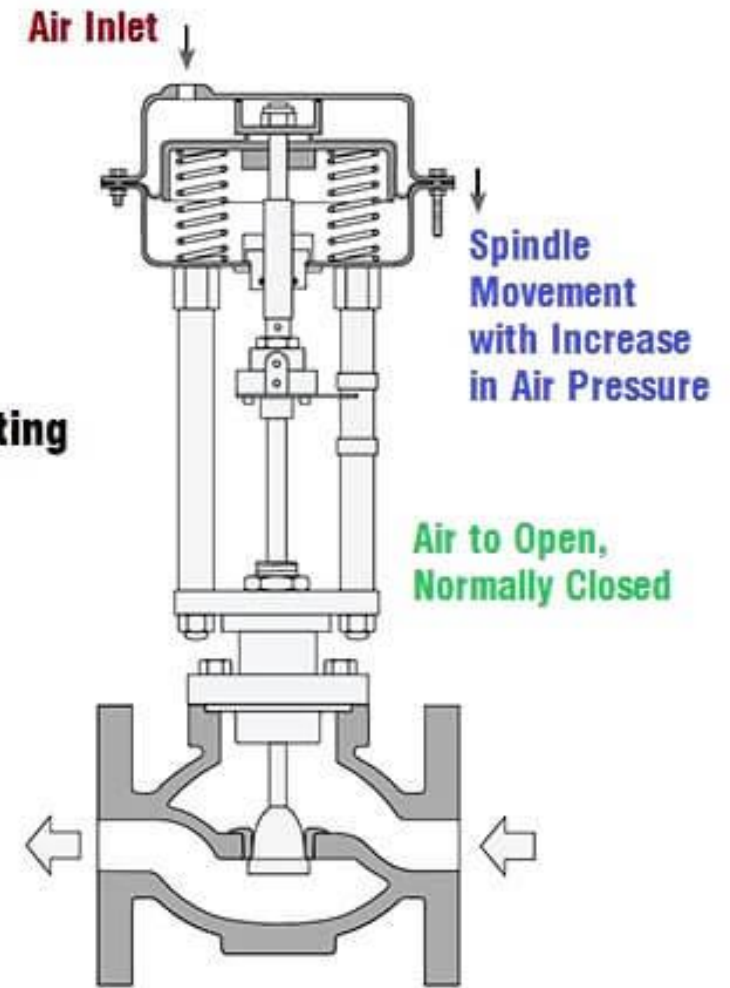
Biot-Savart Law

$$d\mathbf{B} = \frac{\mu_0}{4\pi} \frac{I d\mathbf{s} \times \hat{\mathbf{r}}}{r^2}$$

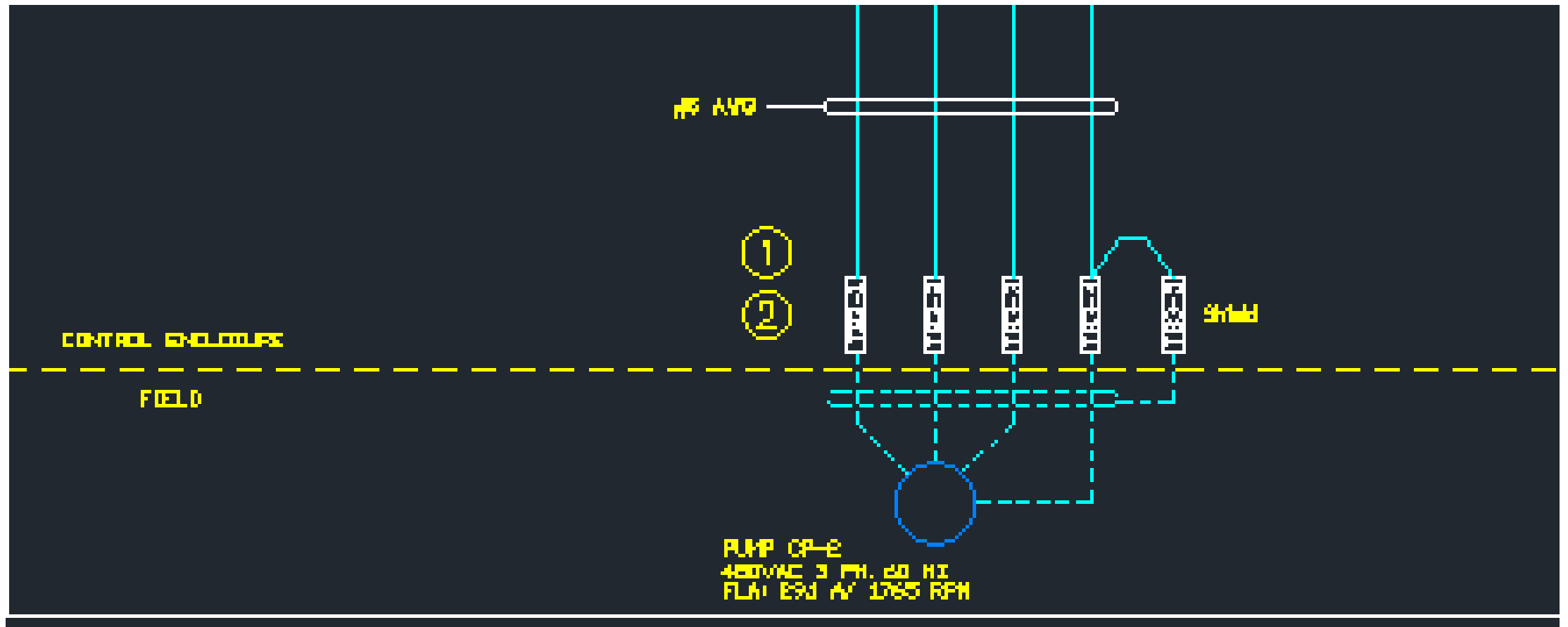
Ampere's Law: $\oint \mathbf{B} \cdot d\mathbf{S} = \mu_0 \cdot I_{\text{inside}}$

Pneumatic Valve Actuator

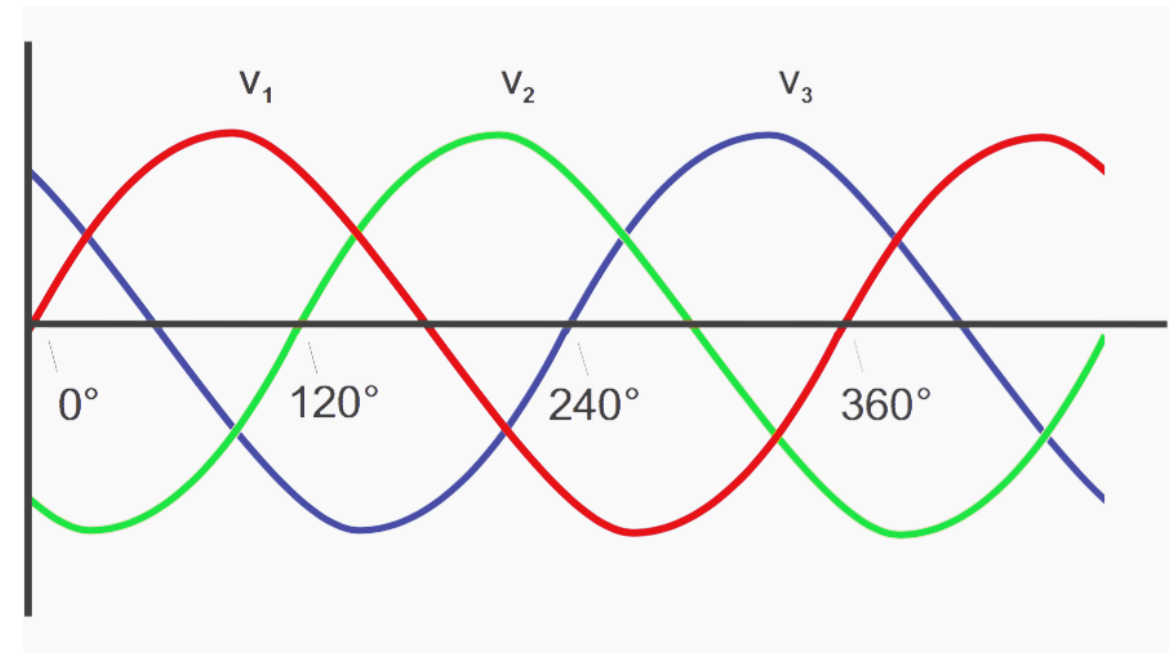
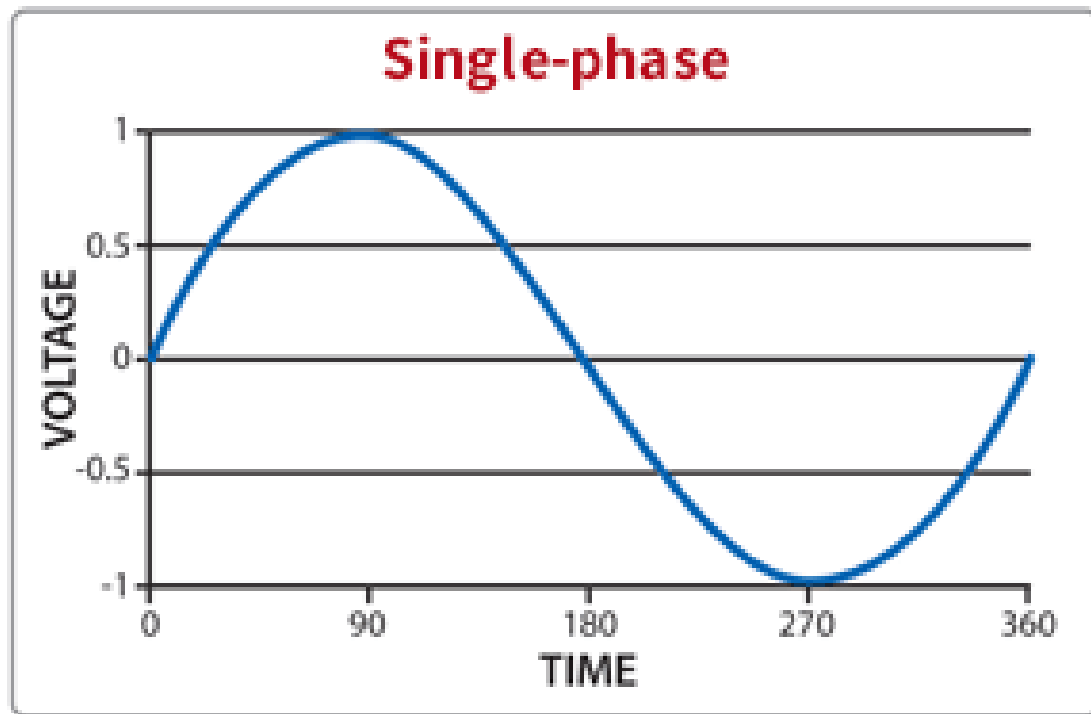
**Direct Acting & Reverse Acting
Control Valve**



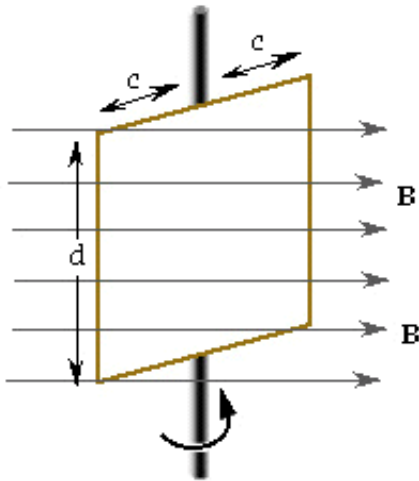
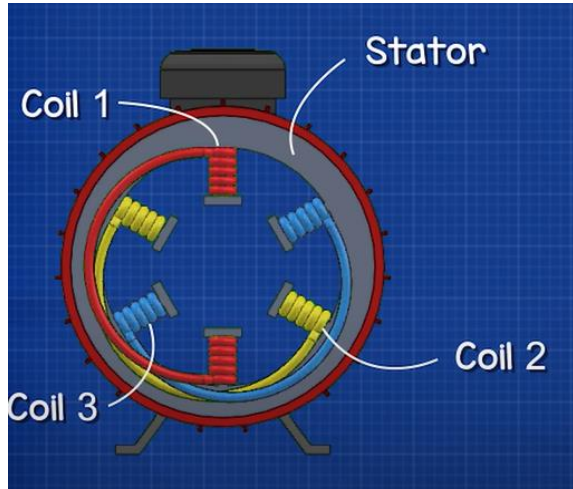
VFD Controlling Pump



Three phase wiring

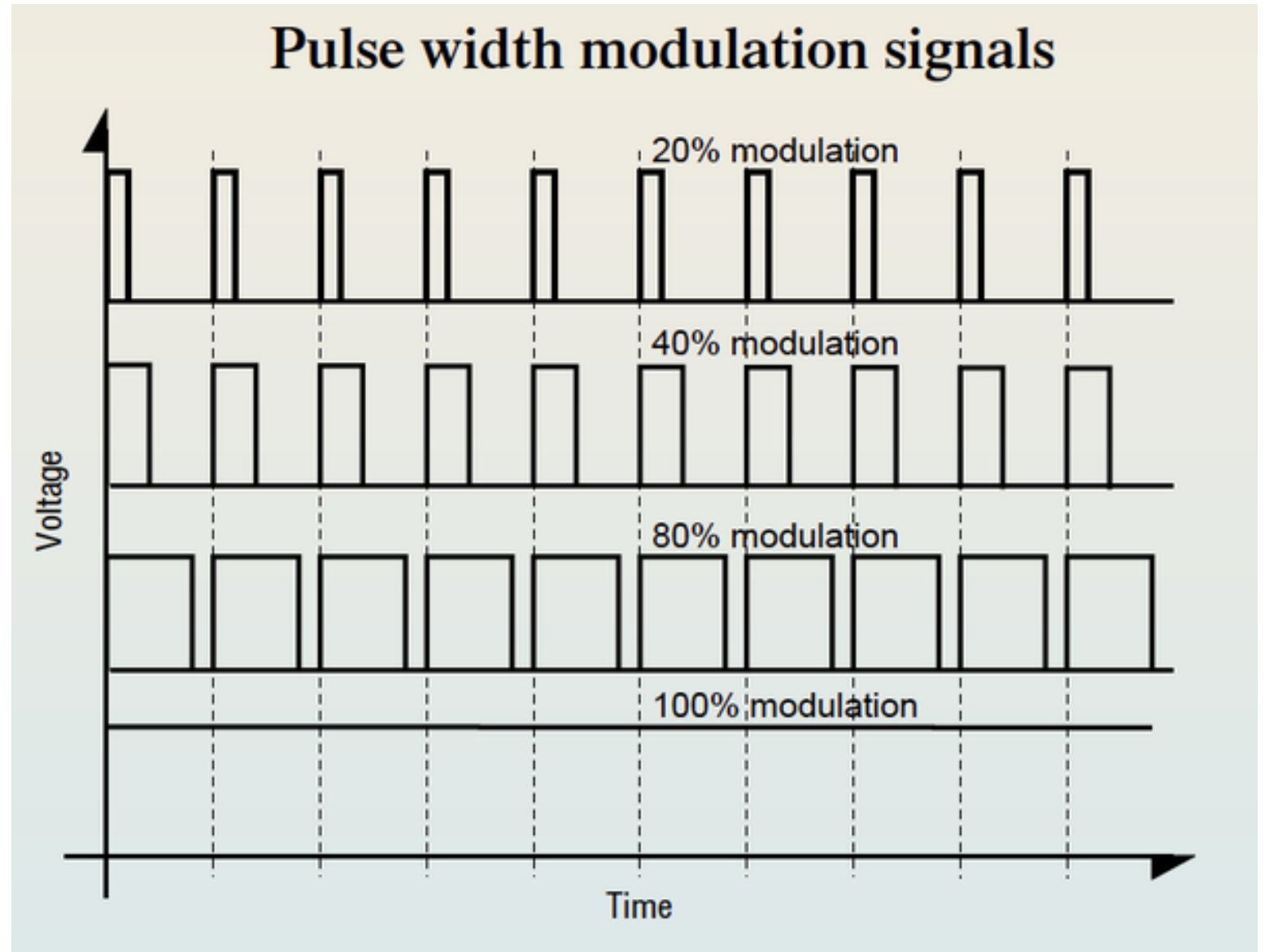


Basic Motor diagram

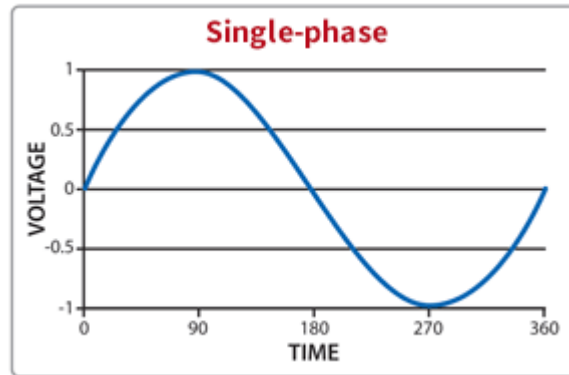


$$\mathcal{E} = -N \frac{\Delta \Phi}{\Delta t}$$

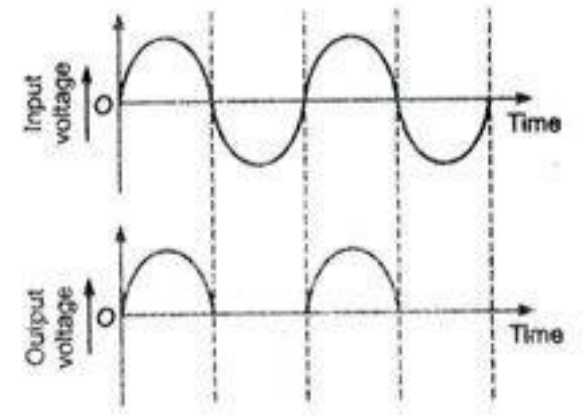
Pulse Width modulation



Rectifiers (AC to DC)

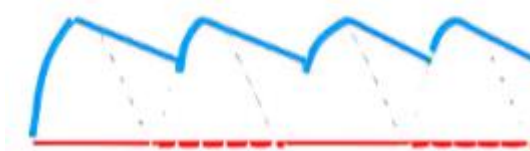


Diode

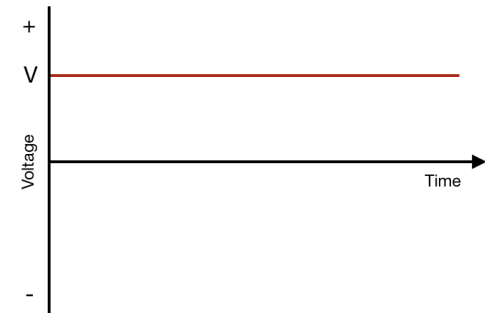


Capacitor

DC output



Voltage
Regulator

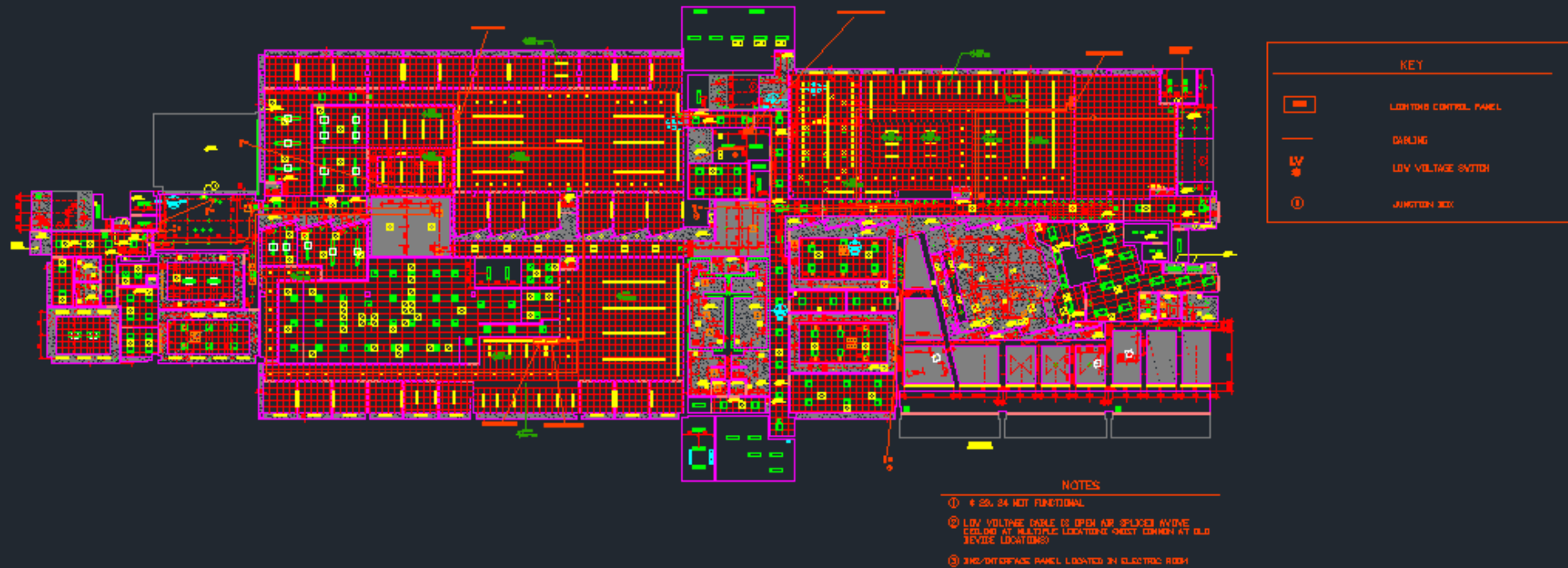


VFD for B Braun

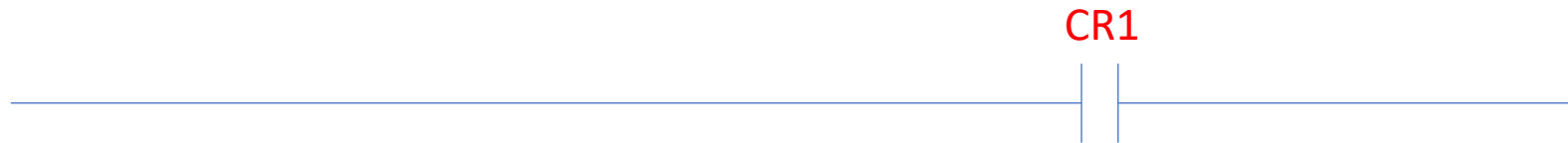
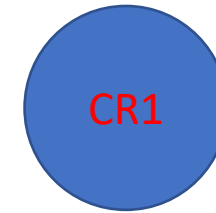
GENERAL NOTES

- NAMEPLATES SHALL BE ENGRAVED LAMINATED PLASTIC OF NOTED SIZE AND COLOR AFFRONT WITH ADHESIVE
- LABELS SHALL BE PRINTED, GENERALLY BLACK ON WHITE, AFFRONT WITH ADHESIVE AND LOCATED AS REQUIRED BY UL 508A
- EACHING OF ALL PANEL CONDUCTORS HAVE A MACHINE PRINTED, SELF-LAMINATING CABLE MARKER IDENTIFYING THE TERMINALS ON WHICH BOTH ENDS OF THE CONDUCTOR LINES
- EACHING OF ALL PANEL PNEUMATIC TUBING SHALL HAVE A MACHINE PRINTED, SELF-LAMINATING TUBING MARKER IDENTIFYING THE PROCESS VALVE TAG NUMBER THE PORT #
- WATER TIGHT TERMINATES
- PANEL CONDUCTORS SHALL BE SIZED FOR CAPACITY PER UL 508A:
 - 41A TO 55A: 6AWG
 - 56A TO 65A: 4AWG
 - 66A TO 75A: 3AWG
 - 76A TO 85A: 2AWG
 - 86A TO 95A: 1AWG
 - 96A TO 105A: 1/2 AWG
 - 106A TO 115A: 1/4 AWG
 - 116A TO 125A: 1/8 AWG
 - 126A TO 135A: 1/16 AWG
 - 136A TO 145A: 1/32 AWG
 - 146A TO 155A: 1/64 AWG
 - 156A TO 165A: 1/128 AWG
 - 166A TO 175A: 1/256 AWG
 - 176A TO 185A: 1/512 AWG
 - 186A TO 195A: 1/1024 AWG
 - 196A TO 205A: 1/2048 AWG
 - 206A TO 215A: 1/4096 AWG
 - 216A TO 225A: 1/8192 AWG
 - 226A TO 235A: 1/16384 AWG
 - 236A TO 245A: 1/32768 AWG
 - 246A TO 255A: 1/65536 AWG
 - 256A TO 265A: 1/131072 AWG
 - 266A TO 275A: 1/262144 AWG
 - 276A TO 285A: 1/524288 AWG
 - 286A TO 295A: 1/1048576 AWG
 - 296A TO 305A: 1/2097152 AWG
 - 306A TO 315A: 1/4194304 AWG
 - 316A TO 325A: 1/8388608 AWG
 - 326A TO 335A: 1/16777216 AWG
 - 336A TO 345A: 1/33554432 AWG
 - 346A TO 355A: 1/67108864 AWG
 - 356A TO 365A: 1/134217728 AWG
 - 366A TO 375A: 1/268435456 AWG
 - 376A TO 385A: 1/536870912 AWG
 - 386A TO 395A: 1/1073741824 AWG
 - 396A TO 405A: 1/2147483648 AWG
 - 406A TO 415A: 1/4294967296 AWG
 - 416A TO 425A: 1/8589934592 AWG
 - 426A TO 435A: 1/17179869184 AWG
 - 436A TO 445A: 1/34359738368 AWG
 - 446A TO 455A: 1/68719476736 AWG
 - 456A TO 465A: 1/137438953472 AWG
 - 466A TO 475A: 1/274877906944 AWG
 - 476A TO 485A: 1/549755813888 AWG
 - 486A TO 495A: 1/1099511627776 AWG
 - 496A TO 505A: 1/2199023255552 AWG
 - 506A TO 515A: 1/4398046511104 AWG
 - 516A TO 525A: 1/8796093022208 AWG
 - 526A TO 535A: 1/17592186044416 AWG
 - 536A TO 545A: 1/35184372088832 AWG
 - 546A TO 555A: 1/70368744177664 AWG
 - 556A TO 565A: 1/140737488355328 AWG
 - 566A TO 575A: 1/281474976710656 AWG
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 - 586A TO 595A: 1/1125899906842624 AWG
 - 596A TO 605A: 1/2251799813685248 AWG
 - 606A TO 615A: 1/4503599627370496 AWG
 - 616A TO 625A: 1/9007199254740992 AWG
 - 626A TO 635A: 1/18014398509481984 AWG
 - 636A TO 645A: 1/36028797018963968 AWG
 - 646A TO 655A: 1/72057594037927936 AWG
 - 656A TO 665A: 1/144115188075855872 AWG
 - 666A TO 675A: 1/288230376151711744 AWG
 - 676A TO 685A: 1/576460752303423488 AWG
 - 686A TO 695A: 1/1152921504606846976 AWG
 - 696A TO 705A: 1/2305843009213693952 AWG
 - 706A TO 715A: 1/4611686018427387904 AWG
 - 716A TO 725A: 1/9223372036854775808 AWG
 - 726A TO 735A: 1/18446744073709551616 AWG
 - 736A TO 745A: 1/36893488147419103232 AWG
 - 746A TO 755A: 1/73786976294838206464 AWG
 - 756A TO 765A: 1/147573952589676412928 AWG
 - 766A TO 775A: 1/295147905179352825856 AWG
 - 776A TO 785A: 1/590295810358705651712 AWG
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 - 806A TO 815A: 1/4722366482869645213696 AWG
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 - 876A TO 885A: 1/604462909807314587353088 AWG
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 - 896A TO 905A: 1/2417851639229258349412352 AWG
 - 906A TO 915A: 1/4835703278458516698824704 AWG
 - 916A TO 925A: 1/9671406556917033397649408 AWG
 - 926A TO 935A: 1/19342813113834066795298816 AWG
 - 936A TO 945A: 1/38685626227668133590597632 AWG
 - 946A TO 955A: 1/77371252455336267181195264 AWG
 - 956A TO 965A: 1/154742504910672534362390528 AWG
 - 966A TO 975A: 1/309485009821345068724781056 AWG
 - 976A TO 985A: 1/618970019642690137449562112 AWG
 - 986A TO 995A: 1/1237940039285380274899124224 AWG
 - 996A TO 1005A: 1/2475880078570760549798248448 AWG
 - 1006A TO 1015A: 1/4951760157141521099596496896 AWG
 - 1016A TO 1025A: 1/9903520314283042199192993792 AWG
 - 1026A TO 1035A: 1/19807040628566084398385987584 AWG
 - 1036A TO 1045A: 1/39614081257132168796771975168 AWG
 - 1046A TO 1055A: 1/79228162514264337593543950336 AWG
 - 1056A TO 1065A: 1/158456325028528675187087900672 AWG
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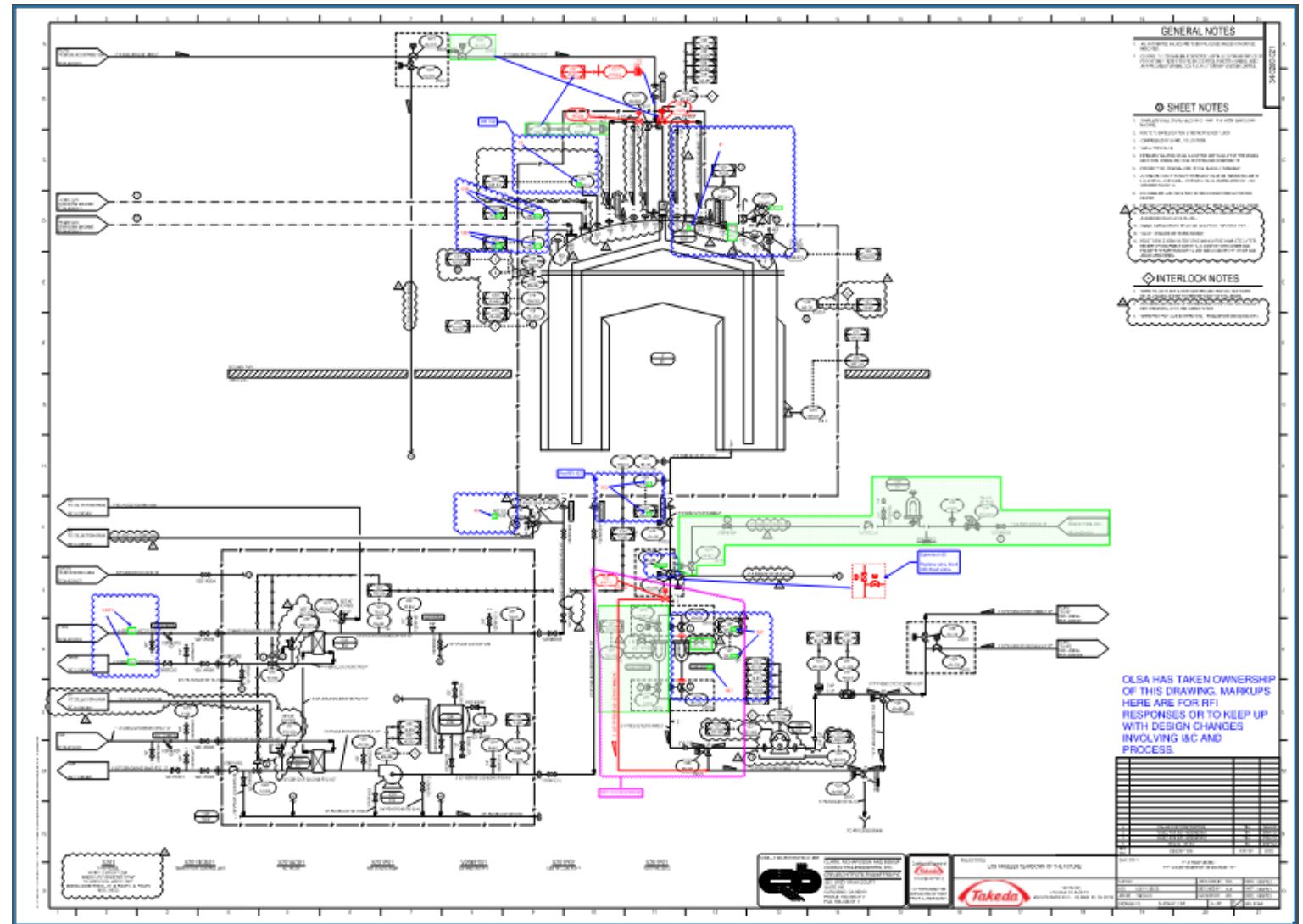
Genentech Lighting Plan



LCP's function



P&ID's for Takeda



Crossover
with MAE
studies at
UCSD





MAE 142 Dynamics and Controls

- This course covers the “Optimal state space control theory for the design of analog and digital controllers (autopilots)”

State Space

Example: Satellite attitude control (second-order system)

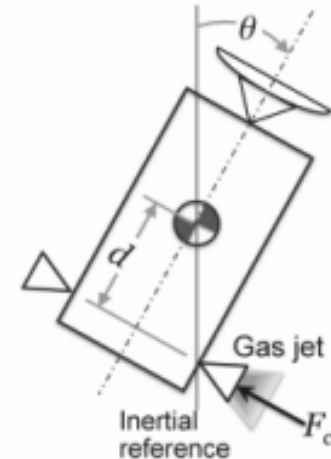
- Satellites require attitude control to ensure that antennas, solar panels, and sensors are correctly oriented. They have thrusters to achieve this.
- Jets produce a moment $F_c d$ about the center of mass ($x(t) = F_c(t)$ is the input force).
- Equation of motion is given by the **second order system**

$$I\ddot{\theta}(t) = F_c(t)d \quad (1)$$

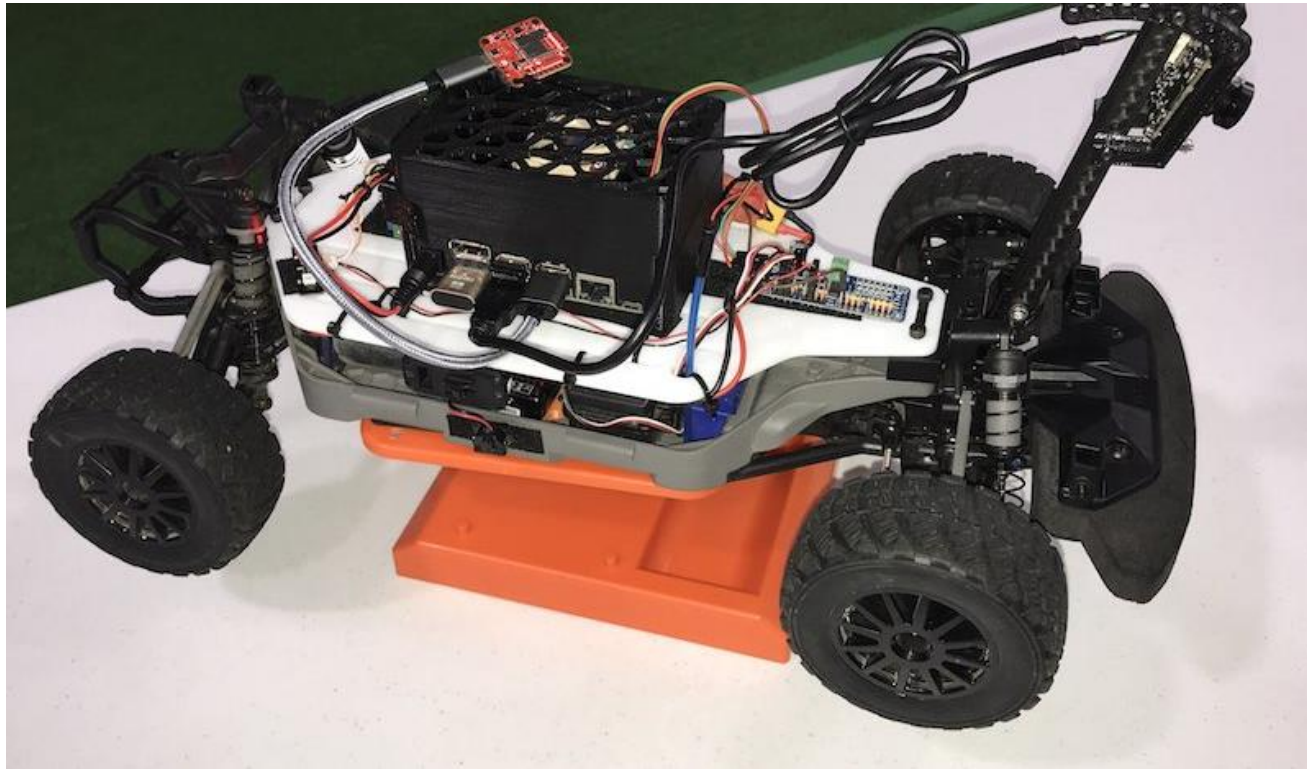
- Define the state $\mathbf{z}(t) = [z_1(t) \ z_2(t)] = [\theta(t) \ \dot{\theta}(t)]$, so $\dot{z}_1(t) = z_2(t)$.
We can write (1) as a **first-order state-space model**

$$\begin{bmatrix} \dot{z}_1 \\ \dot{z}_2 \end{bmatrix} = \underbrace{\begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix}}_A \begin{bmatrix} z_1 \\ z_2 \end{bmatrix} + \underbrace{\begin{bmatrix} 0 \\ d/I \end{bmatrix}}_B F_c(t), \quad y = \underbrace{\begin{bmatrix} 1 & 0 \end{bmatrix}}_C \begin{bmatrix} z_1 \\ z_2 \end{bmatrix}$$

- **Converting second-order systems into first-order systems is a commonly used trick in systems modeling: The theory for first order systems is well developed.**

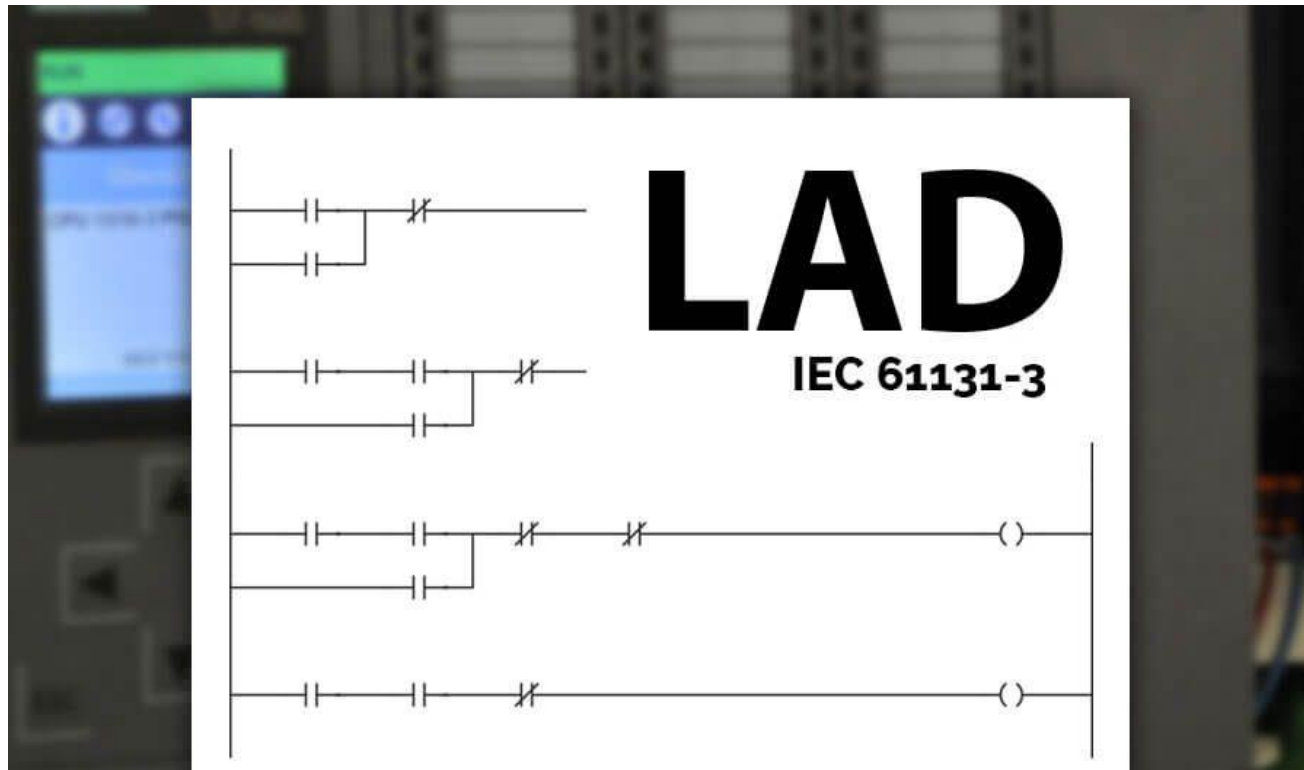


MAE 148 Autonomous Vehicles



- Learn to use motion and position sensors to control a car remotely.
- Algorithms for navigation. Programming the vehicle to follow the proper path.

ECE-40302



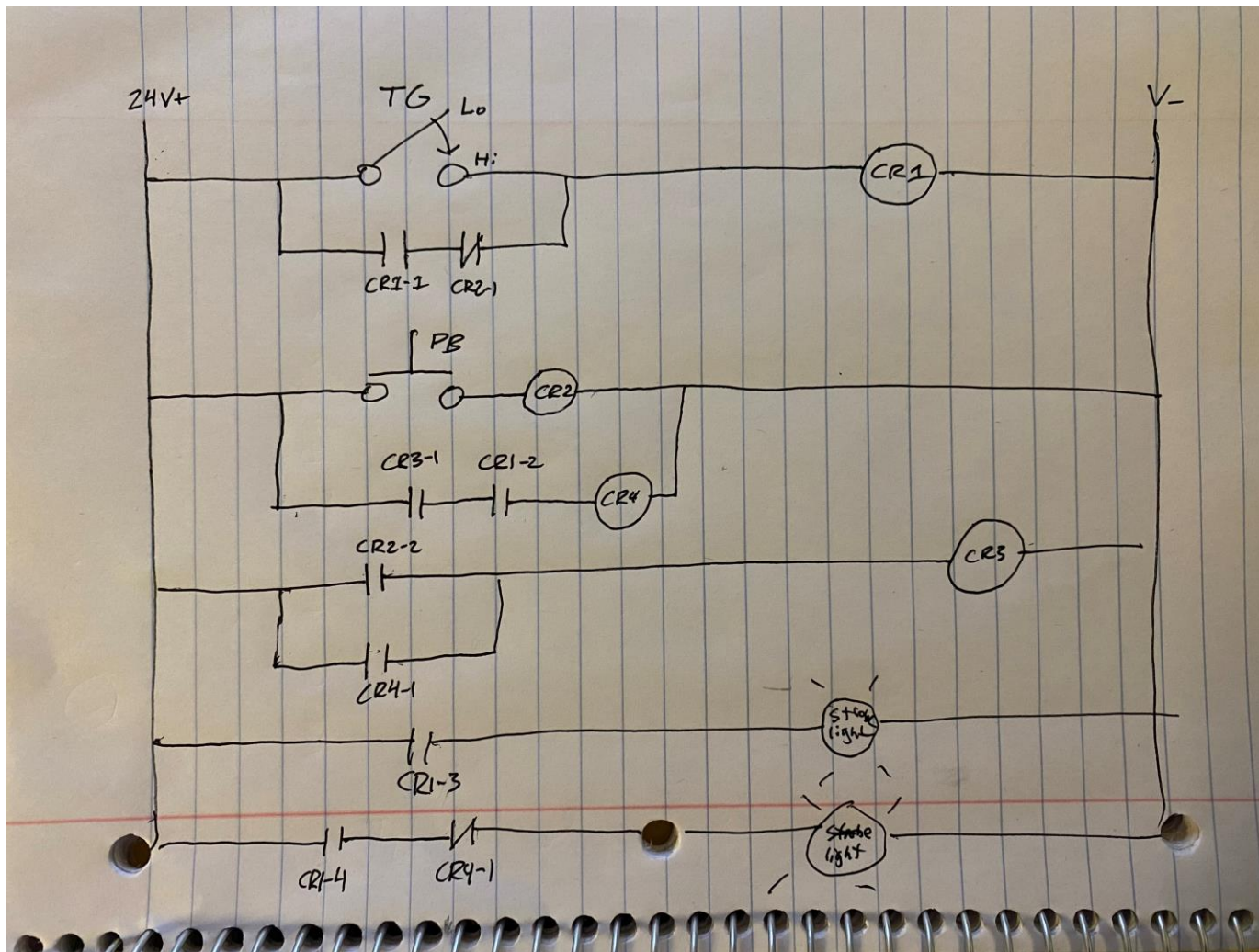
- Ladder Logic programming
- “Programming algorithms used to interact with motors, sensors, switches, networks, valves, relays and hydraulic and pneumatic systems”
- Focus is on Allen Bradley and Rockwell Automation software, although Siemens PLC’s will be explained as well. RSLogix software will be used along with LogixPro for simulation purposes.

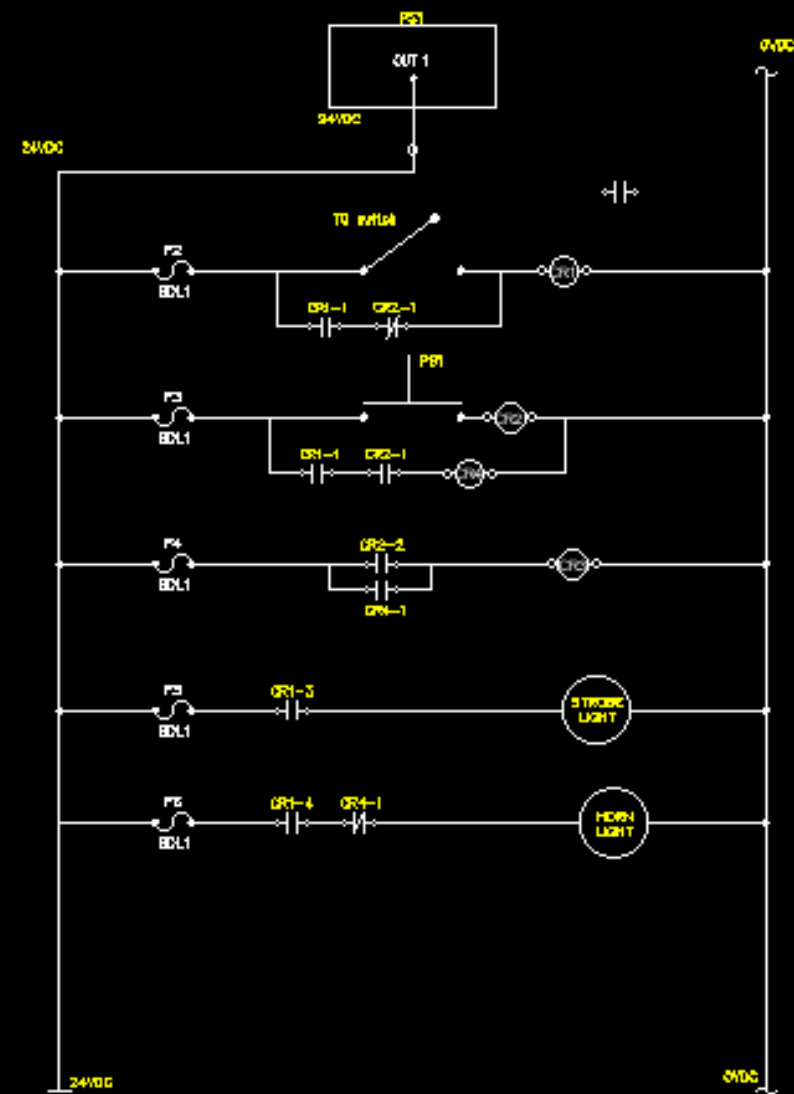
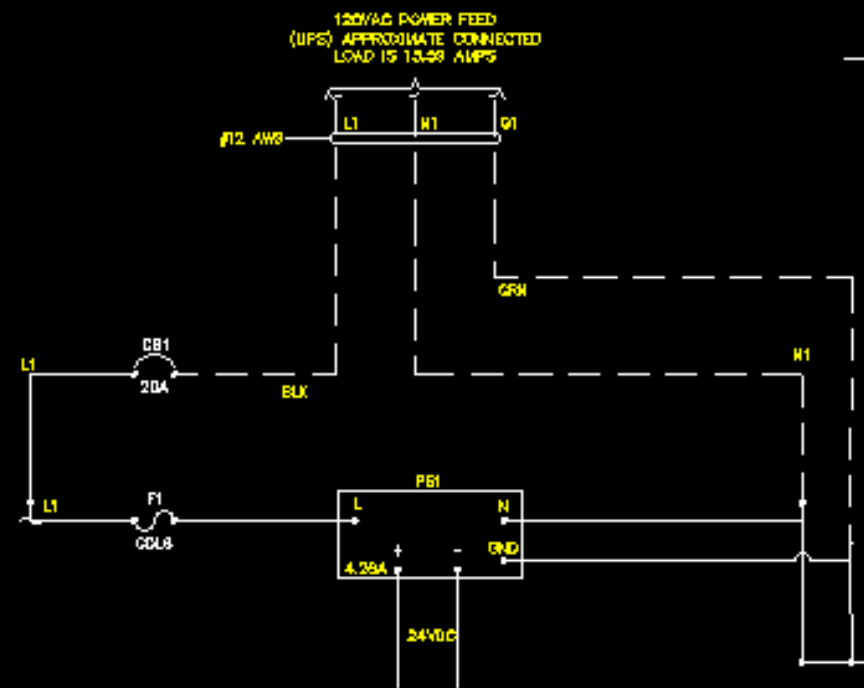
Project Guidelines

Design a NEMA 12 control panel meeting the following minimum requirements. The panel should be listable to UL 508A and is intended for installation in a temperature controlled space.

- The panel must contain power distribution to support the following:
 - 3x 120 VAC Class 1 circuits for internal panel loads.
 - 5x 24 VDC Class 1 circuits for internal panel loads.
- The following operators must be present on the panel door:
 - 1x Two-position maintained knob type – labeled “Lo” and “Hi”.
 - 1x Momentary push button – labeled “Reset/Silence”.
 - 2x LED pilot light indicators – labeled “Horn” and “Strobe”.
- The panel should implement hardware logic to achieve the following:
 - When knob operator is moved from Lo to Hi, Horn and Strobe indicators both energize. Both should stay energized even if knob returns to Lo.
 - When Reset/Silence button is pressed while knob operator is still Hi, Horn indicator should deenergize.
 - When Reset/Silence button is pressed while knob operator is Lo, Horn and Strobe indicators should both deenergize.

Rough draft





Questions?