German University in Cairo

Mechatronics Lab (MCTR704)

Automated Garbage Crushing Bin

Project No. [4]

Name: Ahmed Mohamed Gamal **I.D. #:46-4324** Group: 1

Name: Ahmed Khaled Mady **I.D. #:**46-0798 Group:1

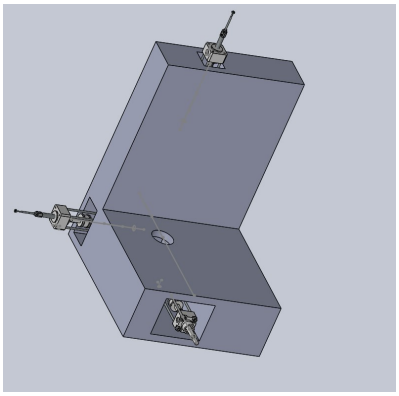
Table of Contents

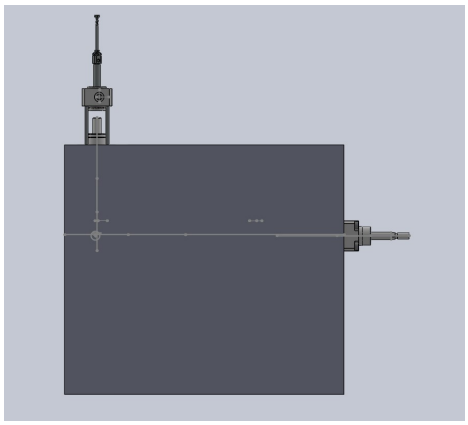
Project Description

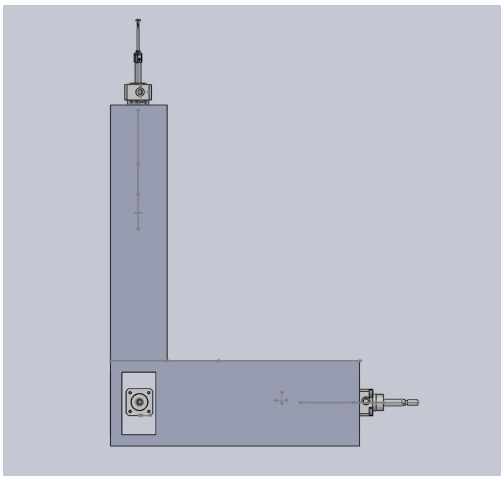
The aim of the project is to compress garbage to reduce space for more storage space and efficiency.
The device has a bin that the garbage is thrown into. The bin which is attached to a piston is then moved to a new position for the compression process. In the compression process, the vertical piston compresses the garbage and then a third piston would expel the compressed garbage outside the device for storage purposes. The project is made of by a base made of aluminum. Movement is made by piston cylinders and controlled by relays as switching devices. An infrared sensor is placed on the bin, when it detects an object in the bin, the first piston pushes the bin to the compressing chamber, compression happens by the second cylinder, and then the third cylinder pushes the garbage out of the box.

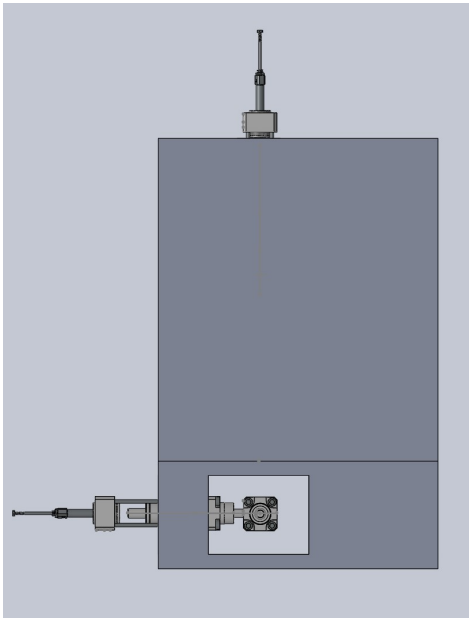
Solid works Design: 3D Schematic Diagram

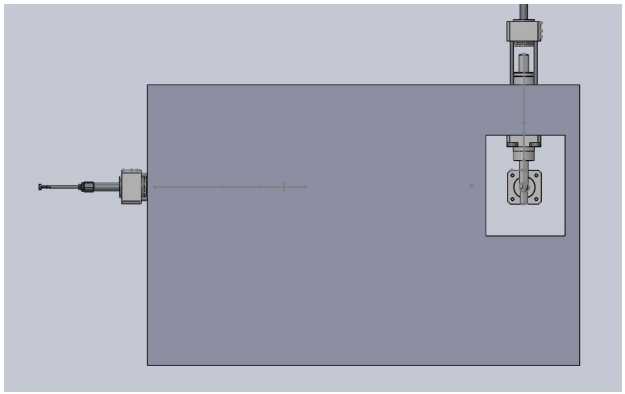
Assembly

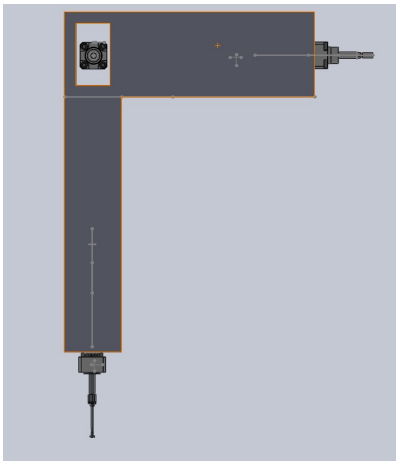


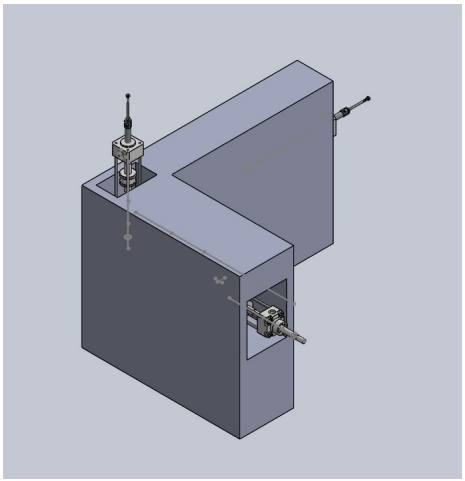


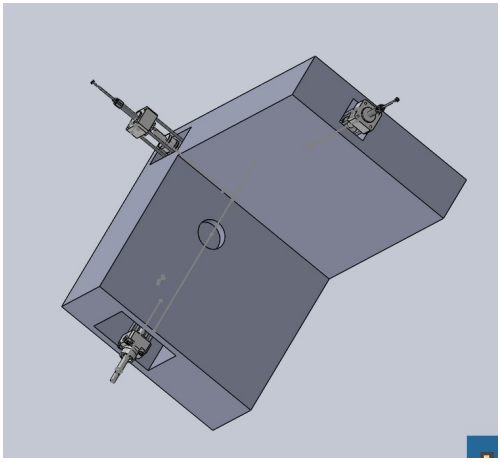


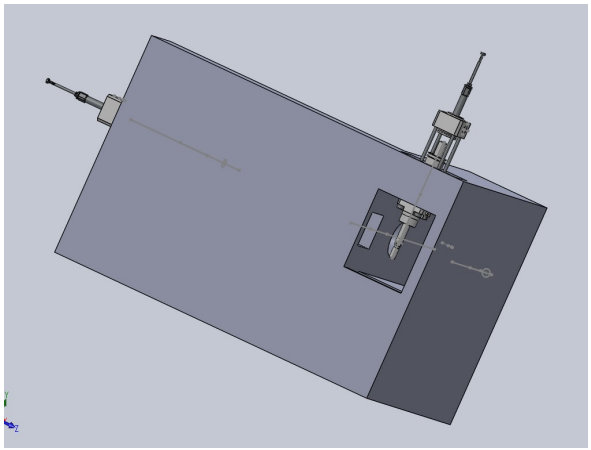


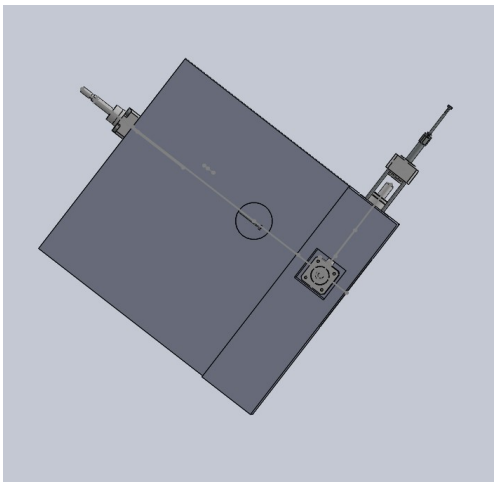




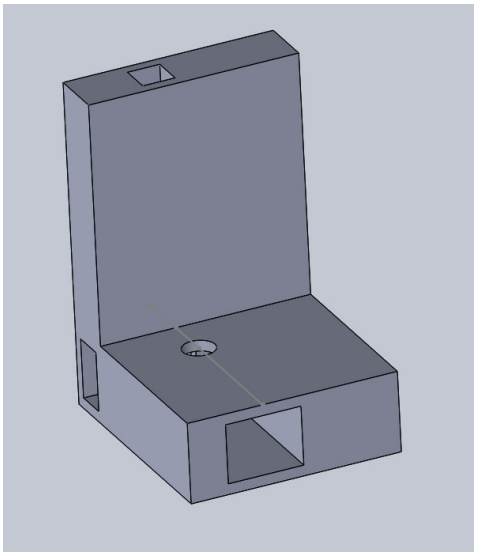


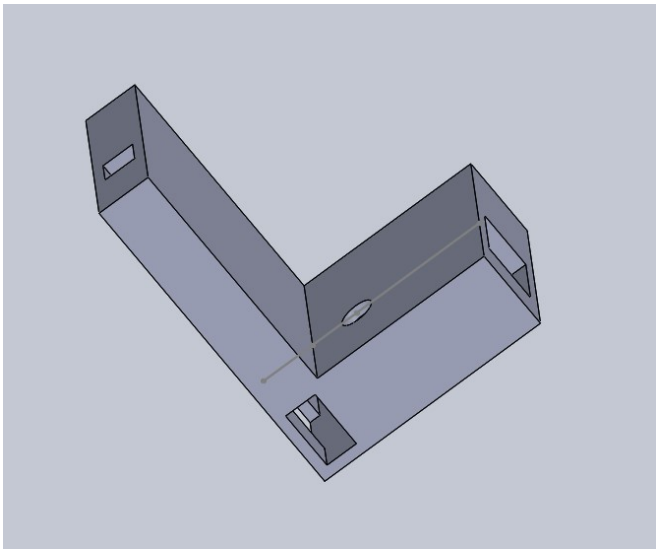


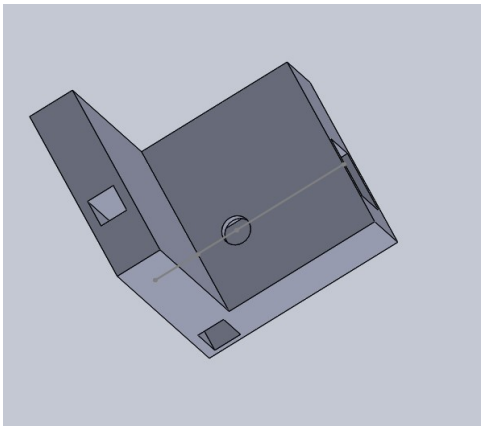


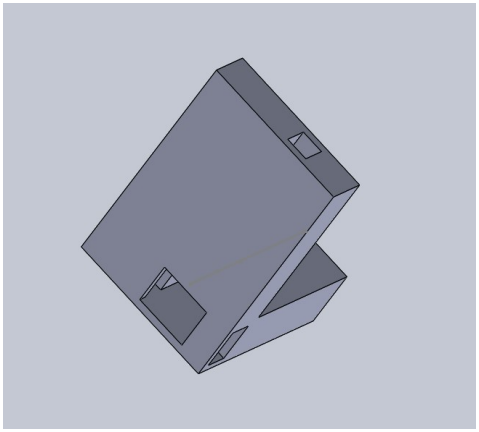


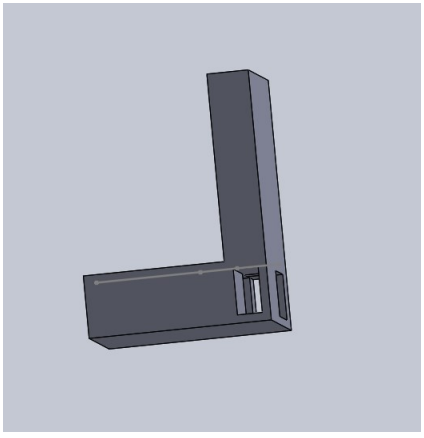
2. Body



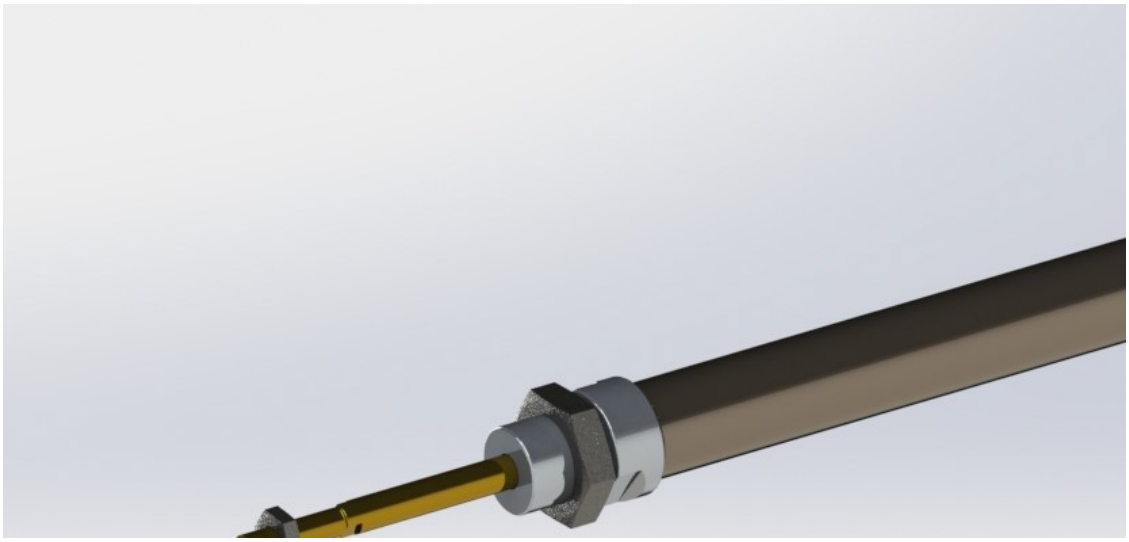


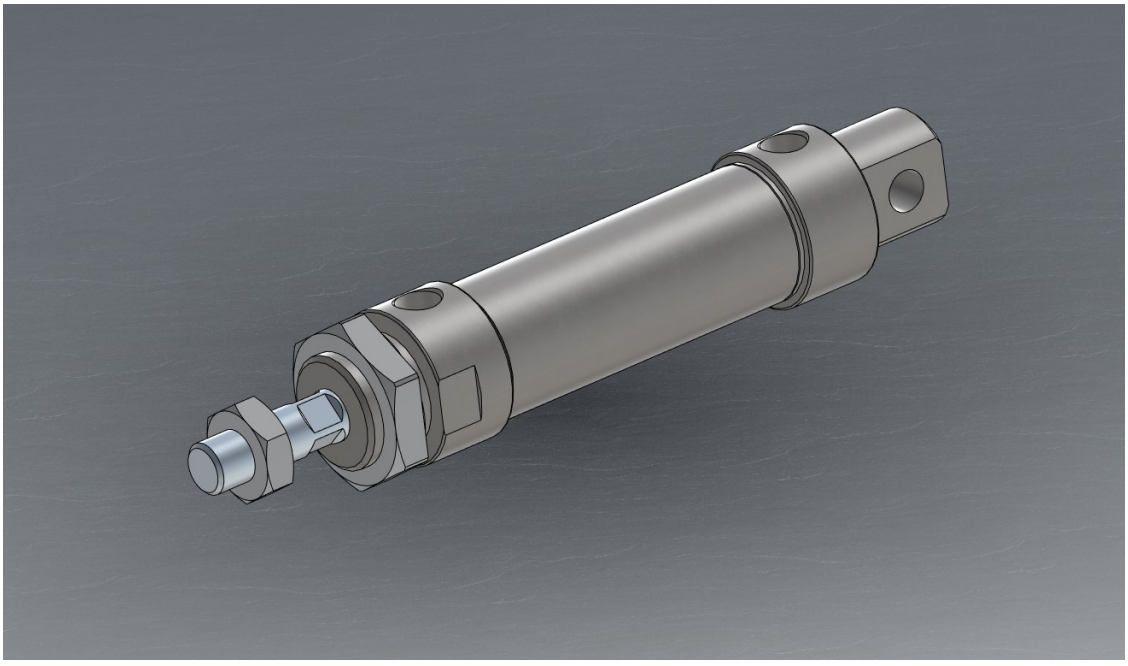






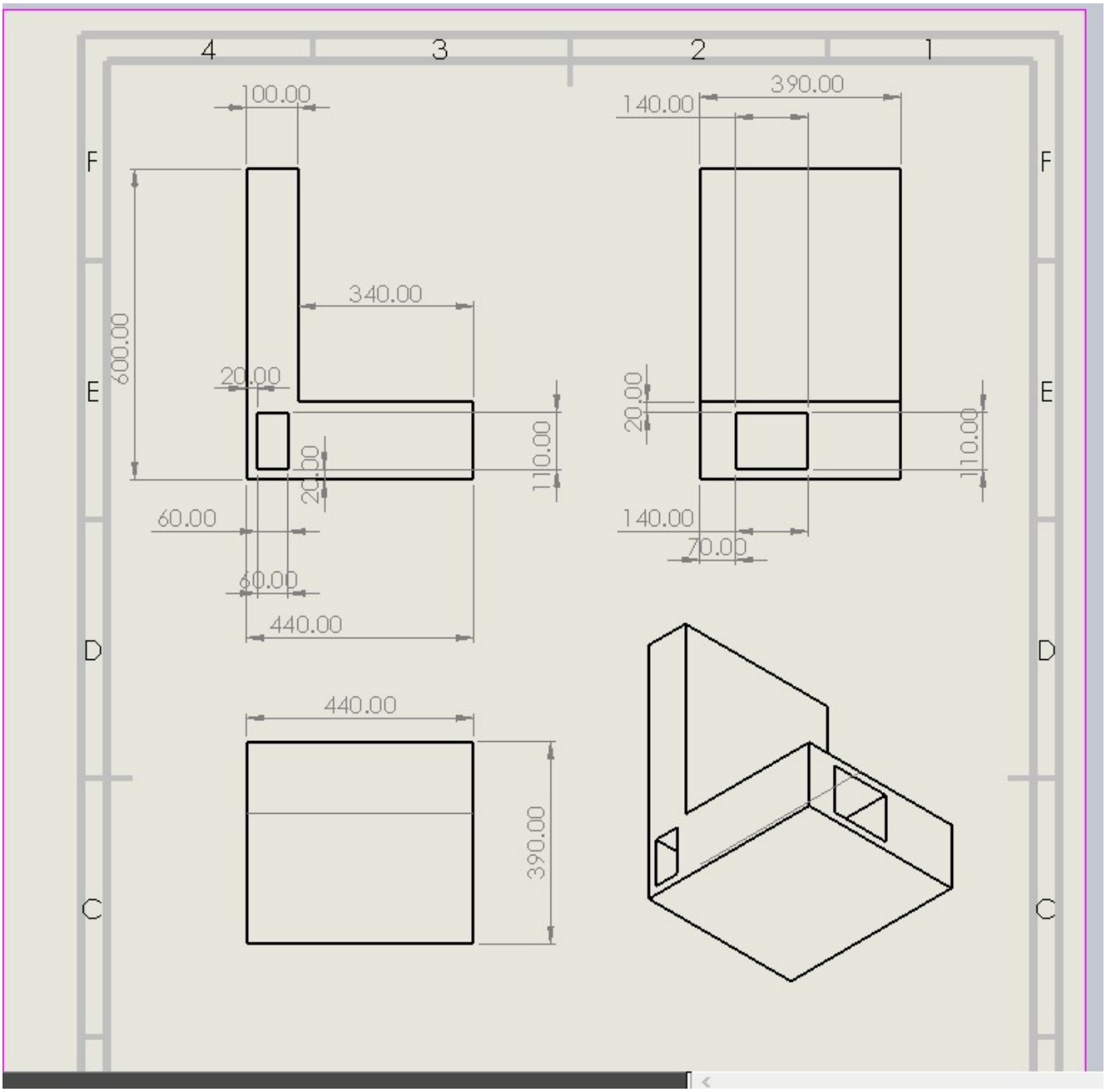
3. Cylinders



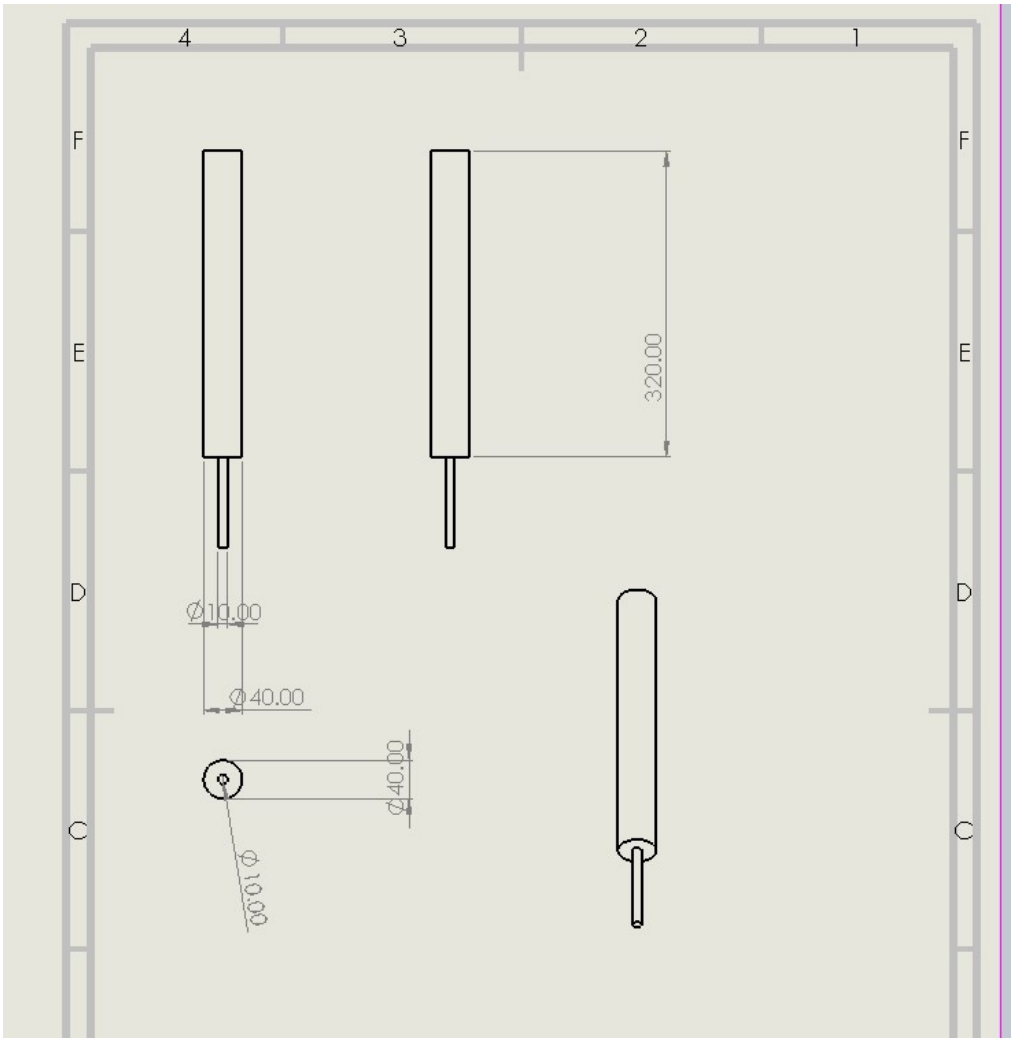


Mechanical Components 2D Projections with Dimensions

1. Body

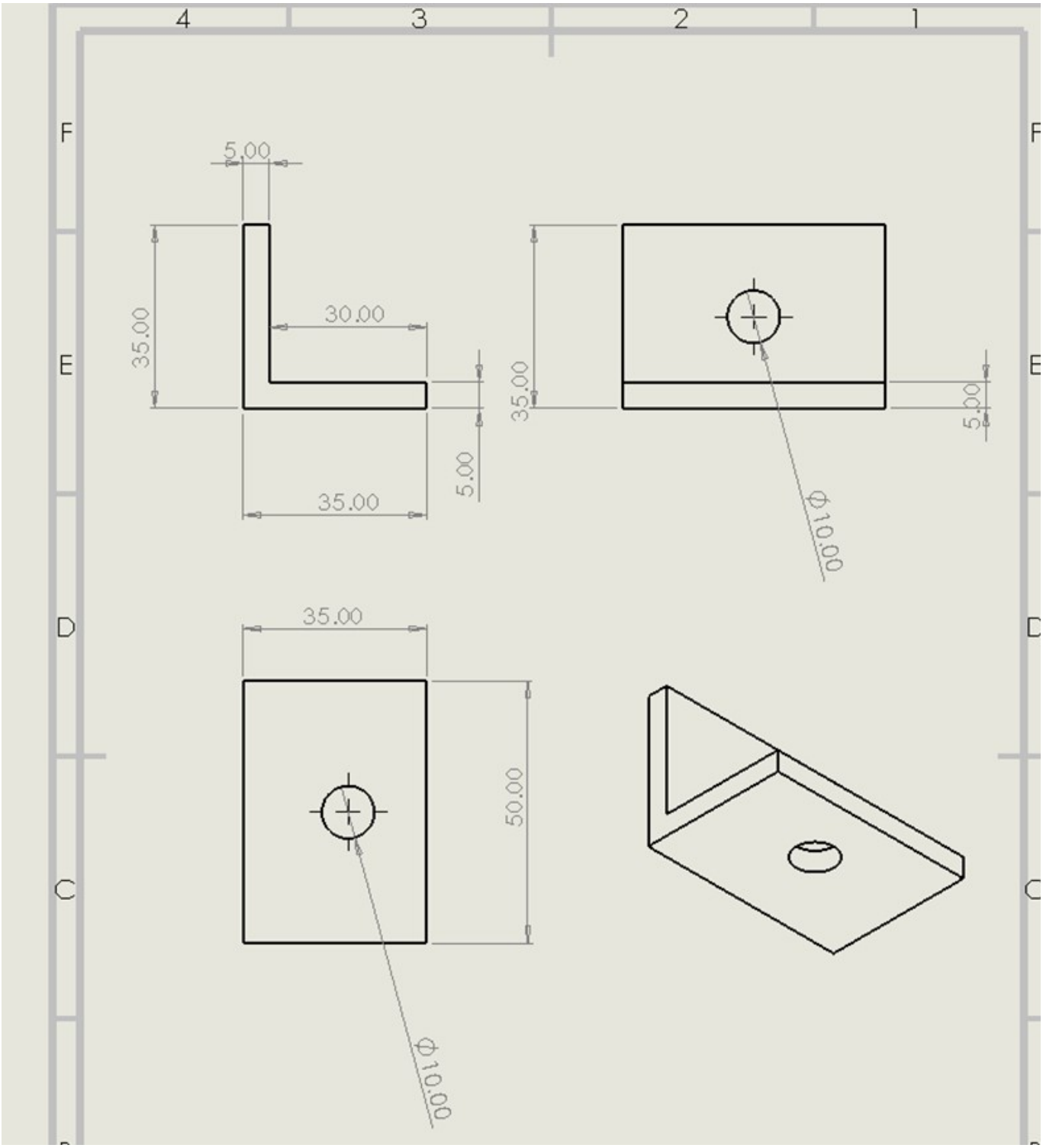


2. Cylinder



S

3. Cylinder Holder



Project Components list and PDF Description

1. G18 3A10PC Optical Sensor

G18-3A10PC

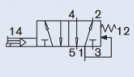
Parameters	Description
Reception:	0 ÷ 10cm
Output configuration:	PNP / NO + NC
Sensor housing:	M18, cylindrical
Optical sensor type:	Reflective
Tightness class:	IP54
Body material:	Plastic
Supply voltage:	10 ÷ 30VDC
Working temperature range:	-25 ° C ~ 55 ° C
Connection:	2m cable
Working Current:	200mA
Sensor Type:	Photoelectric

2. 5/2-way Solenoid Valve

Technical data	
Orifice	DN 6.0
Body material	PA (Polyamide)
Seal material	NBR
Media	Lubricated and non-lubricated dry air; neutral gases (10 µm-filter)
Media temperature	-10 to +50 °C
Ambient temperature	-10 to +55 °C
Manual override	As a standard feature
Port connection	Flange for MP12 (please see illustration)
Pneumatic module	Type MP12 with G1/8, Push-in connection Ø 8 mm
Voltage	24 V DC
Voltage tolerance	±10%
Nominal power	2W, 1W
Duty cycle	Continuous operation (100%)
Electrical connection	Tag connector acc. to DIN EN 175301-803 (previously DIN 43650) Form C Type 2506
Protection class	IP 65 (with cable plug)
Weight	95g
Mounting	with 2 screws M3x30
Installation	Any, preferably solenoid system upright

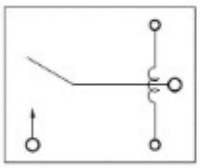
Module	Version	Feature	Item No.
Connection module	right	G 3/8	655 110
		NPT 3/8	655 112
	left	G 3/8	655 109
		NPT 3/8	655 111
Pneumatic basic module 2 valves	push-in connection Ø 8 mm	without check valve	156 617
		with integrated check valve with R-channel	156 635
		with integrated check valve with R and S-channel	156 632
	connection G 1/8	without check valve	156 620
		with integrated check valve with R-channel	156 636
		with integrated check valve with R and S-channel	156 633
	connection NPT 1/8	without check valve	156 631
		with integrated check valve with R-channel	156 637
		with integrated check valve with R and S-channel	156 634
Pneumatic basic module 4 valves	push-in connection Ø 8 mm	without check valve	156 656
		with integrated check valve with R-channel	156 662
		with integrated check valve with R and S-channel	156 659
	connection G 1/8	without check valve	156 657
		with integrated check valve with R-channel	156 663
		with integrated check valve with R and S-channel	156 660
	NPT 1/8	without check valve	156 658
		with integrated check valve with R-channel	156 664
		with integrated check valve with R and S-channel	156 661
Covering plate		for unused valve positions	653 765

5/2-way solenoid valve without cable plug

Circuit function	Orifice [mm]	QNn value air [l/min]	Pressure range [bar]	Power consumption [W]	Response times: Opening [ms]	Response times: Closing [ms][2)]	Item no. 24 V DC
H 5/2-way valve 	6	700	1.0 - 10[1)]	2	20	12	156 828
			1.0 - 10[1)]	2	20	12	163 030[2)]
			2.0 - 10	2	20	12	156 337
			2.0 - 10	2	20	12	158 942[2)]
			2.0 - 8.0	1	20	17	156 827
			2.0 - 8.0	1	20	12	158 943[2)]

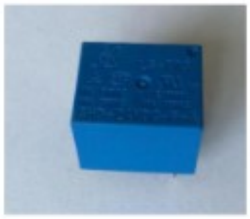
[1)] Version with auxiliary pilot air.

3. Universal Relay 24 VDC 10 A 4 Pins



T73 Schematic H

T73 FOOT DIAGRAM H



Pins	4
Outline Dimension	19 * 15.5 * 15 mm
Contact form	1a
Contact form (resistance)	10A 240 VAC / 125VAC / 28VDC
Coil voltage (DC)	24 V
Coil power (DC)	0.36 W
Close voltage	≤ 75% V
Release voltage	≥ 10% V
Strength between Contacts	1000 VAC/min
Strength Contacts and coils	1500 VAC/min
Contact resistance	≤ 50 mΩ
Insulation resistance	≥ 500 mΩ
Ambient temperature	-40 - 70 Celsius degree
Mechanical life	10.000.000 times/OPC
Electrical life	100.000 times/OPC
Mounting form	PCB
Weight	0.0078 KG
Application	Mete , Range hood
Operation temperature and humidity	- 40 ~ 70 degree Celsius ; 35% ~ 85% RH
Storage temperature and humidity	0 ~ 70 degree Celsius ; 35% ~ 80% RH
Dimension drawing with tolerance	Out dimension ≤ 1 mm, Tolerance: ± 0.2 mm; ≤ 1~5 mm, Tolerance: ± 0.3 mm
	Out dimension > 5 mm, Tolerance: ± 0.4 mm
Tolerance of mounting hole	± 0.1 mm

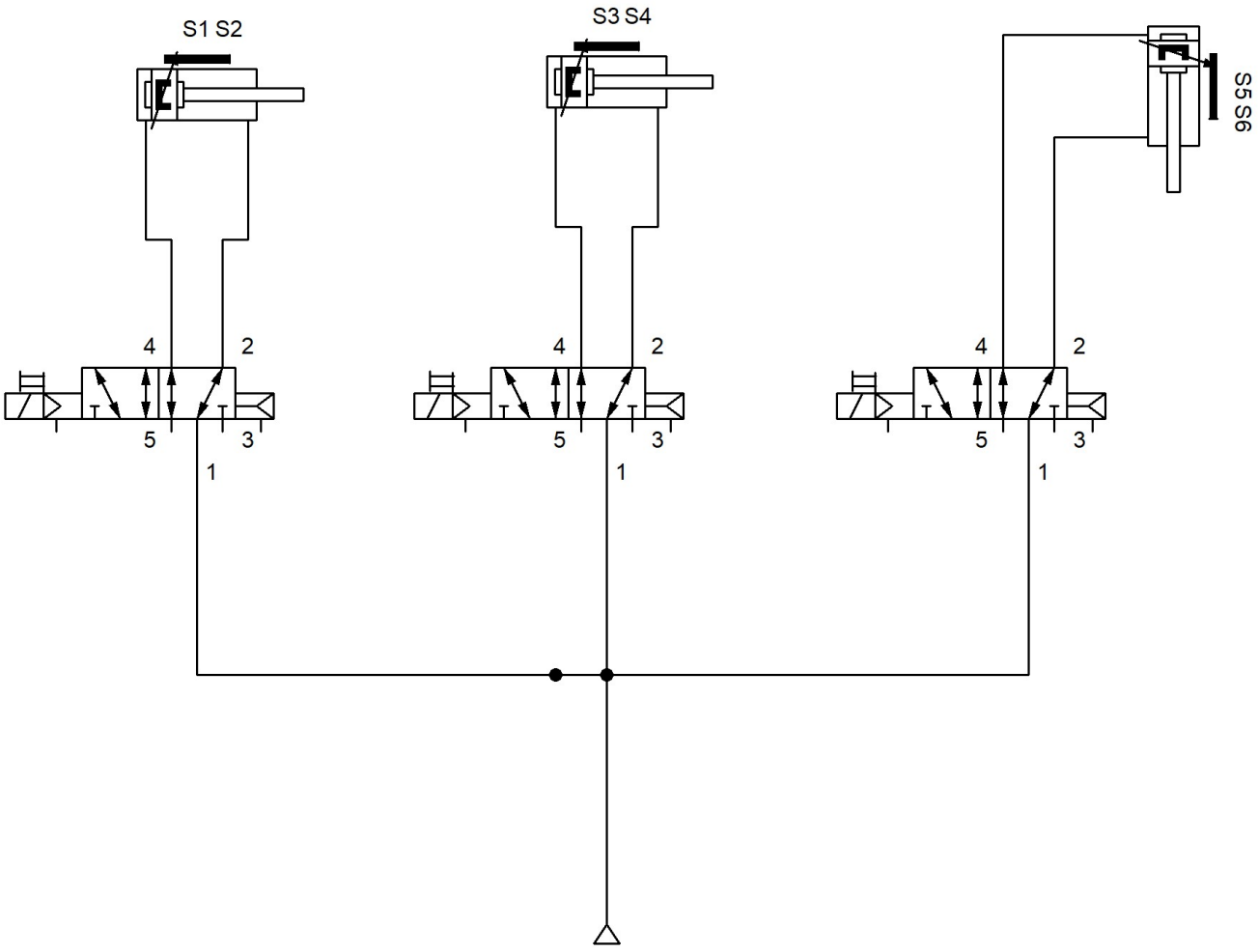
4. 32x175 mm Piston Cylinder

Design and function
Double acting cylinder with adjustable cushions.
Standard stroke lengths in table below, additional lengths on request.

Order number Please complete according to order code.		**XG-160-**...	**XG-200-**...	**XG-250-**...	**XG-320-**...
Piston-Ø (mm)		160	200	250	320
Force at 6 bar in N**	**Extension**	10860 (2441.4 lbf.)	16960 (3812.8 lbf.)	26500 (5957.4 lbf.)	43450 (9767.9 lbf.)
	Retraction	10180 (2288.5 lbf.)	16280 (3659.9 lbf.)	25450 (5721.4 lbf.)	41750 (9385.8 lbf.)
Cushioning length (mm)		50		60	65
Connection		G 3/4		G 1	
Piston rod thread		M 36 x 2		M 42 x 2	M 48 x 2
Operating pressure		1 ... 10 bar (14.5 ... 145 psi)			
Temperature range		– 20 °C ... + 80 °C (– 4 °F ... + 176 °F)			
Medium		filtered/lubricated or filtered/non-lubricated air. If speeds exceed 1 m/s (3.3 ft/s) lubricated air is recommended.			
Standard stroke lengths (mm)*		25, 50, 80, 100, 125, 160, 200, 250, 320, 350, 400, 500, 600, 700, 800, 900, 1000, max. 2500			
Materials		Cylinder tube: Al (anodized) End caps: Al-die-cast (painted) Piston rod: chromium-plated (standard) – stainless steel (see order code) Seals: PU/NBR			

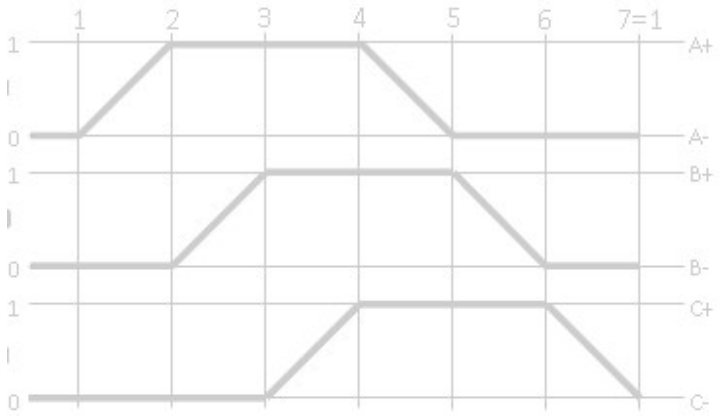
* Refer to "Critical Load Diagram" on page 8.240 to determine critical values on the piston rod.
** The internal friction is considered.

Pneumatic Circuit



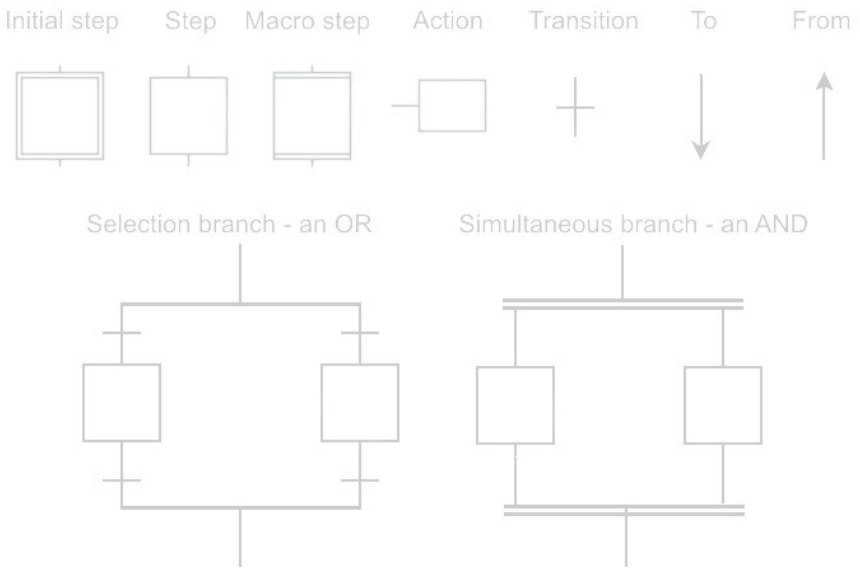
Pneumatic Step Diagram and Description

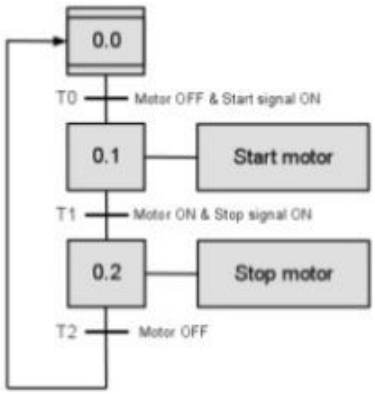
- **Draw the pneumatic step diagram based on your project's operation, as shown in the example below.**
- **Explain your provided pneumatic step diagram; the sequence and the project's operation.**
- **Example for the pneumatic step diagram**



Controller Sequential Chart

Draw your controller sequential chart based on your project's operation, as shown in the example below.

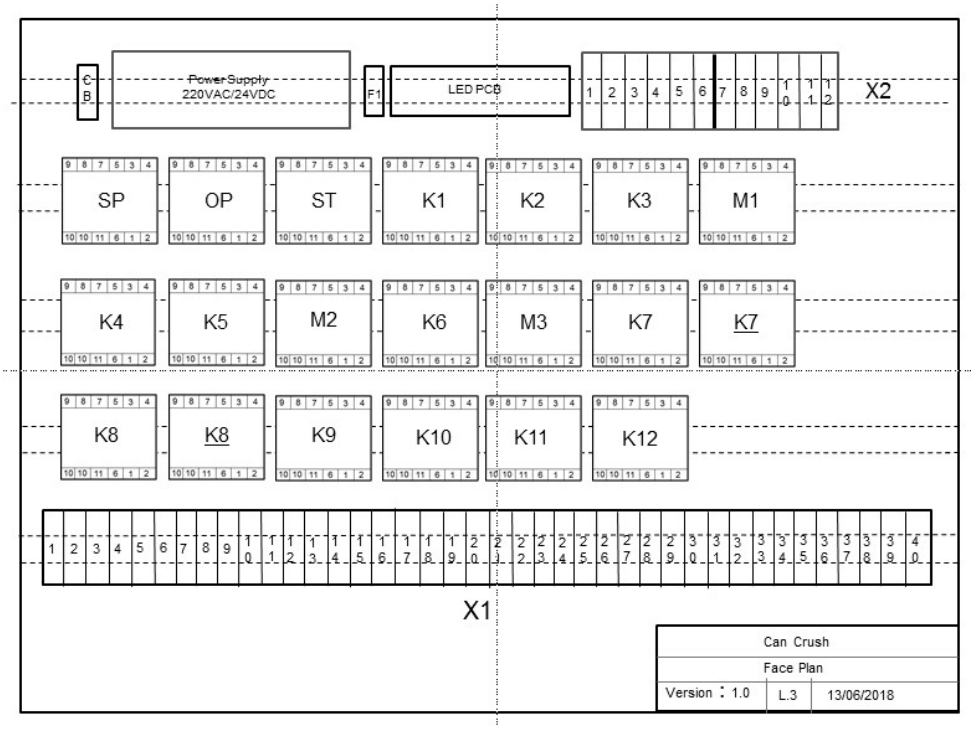




Controller Operating Panel/ Classic Control Implementation

As you already have the information for each component (power supply, solenoids, relays, I/O terminals…), you can configure the size of the panel you need for your project.
Implement the classic control by using the fluidSim software

An example for a panel configuration is shown below:



PLC Control Program

After specifying your project's operation, designing your hardware, and specifying all you inputs and outputs, program your controller using FBD coding. Provide you program networks below: