Continue:

Return switch valves

Return DIN connectors

Return Through beam

Return air cylinder brackets

Return M12 connector (wait) (Also determine color code before reutnring the M12 connectors

Call Bimba for adjusting air cushion

Emitter needs to have a U bracket that wraps around the back. The mounting plate is either above or below the plane of the emitter. Mount it to the two left screws only. We need to print washers. We need to find the distance of the emitter so the angle is okay, it might already be that 8cm but double check.

We need to find exact dimensions of the nose thread. Then we need to use the manual

We need to work in adjustability. For the air cylinder mounting we would want to drill slots instead of holes so that the air cylinder can be rotated if need be.   
Make mounts relatively simple to machine, boxy

**Interfacing:**

The through beams must not open the door when it’s closed, aka, when DIC.M is triggered.

Through beam relay may not be necessary but it does isolate the sensors from a large power draw.

Why are there so many conditions for CLINT? Possibly it should be rewritten?

SSTA might be redundant because it’s included in the open door code? Or should it be in the close door code?  
Maybe INRST should be wired to a button on the console, R17.6 which is the auto door button. If we want to be extra safe we could create another branch with CLINT and then a custom button/bit, but that wouldn’t work because it’s OR logic. We should replace INRST with R17.6 , because we can’t affect any other logic that may have INRST, but we have to make sure INRST did not provide any additional safety. \*We don’t need to do this because KADOP will keep the door open and once CLINT is unlatched, the situation will return to normalcy.

Do we want the secondary solenoid to be wired normally open the door or normally close the door? If the power goes out nothing happens

Write OR condition for the secondary solenoid to be triggered, don’t purely rely on light curtain to trigger it

Think how software will interact with EDM. So the cycle is that the light curtain gets triggered, the safety relay is tripped, but because of the software, the XT1104 relay is held. With the EDM the light curtain may try to return to normal but it can’t because the reset circuit is being held open by the XT1104 relay, indirectly of course. The user hits the button and M53 executed, now the XT1104 input is off, the light curtain that is only held back by the reset circuit is now running again and everything returns to normal.

Be careful about adding DIC.M or DOC.M to reset code because this is what would define if the door could be closed before or after it has triggered DOC.M.

CLINT triggers DOP.R which then triggers KADOP, so once CLINT is off which should return to the normal state.

The operator closes the door by using M53 then the door is triggered. We need to make sure the machine does not start running the M program. It is probably safe to assume that DIC.M is already written and prevents the M program from running, considering they have just left DIC.M normally closed, implying that it would not run the code otherwise.

*Problems:*

ARST connects to INRST, what is ARST?

DOP.R/DOC.R have all the code written for them already. Does it make more sense to write both solenoids to DOP.R/DOC.R and have the switch valves run off the XT1104 input or does it make more sense to just connector DOP.R/DOC.R to the XT1104 input through the software? Let’s connect them through code. Figure out:

How does it reach return state?

Does this inhibit the system overall?

Delay implementing the force guided contacts. They are easy to retrofit and are not crucial quite yet. Plus it’s cheap so it’s easy to convince him later after the sting of the light curtain.

Does SDOC need to exist? By the time the door is ready to be closed, the primary code is now being executed. In fact, maybe it makes sense to not even allow the secondary solenoid to close the door.

ARST and INRST are controlled by the ALARM RESET EMG. RELEASE button

[Grounding Forum](https://diysolarforum.com/threads/why-do-dc-systems-not-make-use-of-grounding-to-the-same-extent-as-with-ac.5152/)

[dc Knowledge](https://electronics.stackexchange.com/questions/417172/why-do-engineers-usually-short-ground-and-negative-ports-on-a-dc-power-supply)

Wire neutral and earth together but only per unit, so we’ll have three separate wire bundles for the solenoid valves.

Is the normal output of the safety relay high? \*Assume it’s high because it has and switches

Ground bolt is 7.5mm [Looks like #10](https://www.google.com/search?rlz=1C1CHBD_enUS936US936&q=ring+terminal+stud+size+chart&tsm=3&tbm=isch&source=lnms&sa=X&sqi=2&ved=2ahUKEwjduuCSg62AAxWoGzQIHcqAAhoQ0pQJegQIDRAB&biw=1536&bih=722&dpr=1.25#imgrc=hss6Gm33W4-LqM)

Code walkthrough:  
 1 Door closing, door not opening, light curtain triggered aka goes low, door not closed, ?

2 CLINT is latched because of ARST

3 DOP.R is latched by CLINT

4 \*CLINT is opened by light curtain not triggered but DOP.R still on because KADOP/secondary system disabled because SDOP controlled completely by CLINT

5 \*M53 is executed which turns off DOC.R on the open code and on close code and triggers DOC.R to close the door

**Mounting:**

Main solenoid: 27cm

Air cylinder: 66.35cm

Screw arrangement: 34cmx25cm

U brackets: 8/32in

5W2P brackets: M3

Diverting valve brackets: Probably SAE of M5

**Installation Problems:**

Switch valve does not function as intended

This depends on the switch valve, double check DIN connector fits and then order another

Return switch valves

Relay has slow return time (might not matter)

Second conveyor sensor did not come in d

One more relay for secondary solenoid (might not matter)

Adjust cushions

**Potential Revisions:**

Order equipment from a source other than McMaster, (likeG&G Hydraulics) to save cost. These companies have longer shipping time and less customer service but lower prices in lieu.  
Likely the intake flow control valve and exhaust flow control valve are redundant. The exhaust flow control valve is more expensive so if metering is possible with only the intake flow control valve, likely $107 could be saved. If exhaust flow control valve is indeed skipped remember to buy mufflers for the main solenoids’ exhaust ports, 4 mufflers for 4 exhaust ports.

SMC’s sine air cylinder will naturally slow the cylinder the last couple inches or so due to its built in design. It’s as much as the [6258K154](https://www.mcmaster.com/6258K154/) but has a 6-8 week lead time. Should be installed similarly to the 6258K154 but that has not been confirmed.

An air cylinder that has only cushions but not a magnet inside the cylinder for sensors to detect, (called sensor ready), is half the price; for example, [6475K216](https://www.mcmaster.com/6475K216/) (double check specs before ordering). Mount a magnet on the extending end of the piston, (so the proximity sensor would be mounted at the position where the piston is fully extended).

If multiple machines will be fed from the same supply line then buy one regulator and supply line solenoid valve. Assuming the machines would be operable on the same pressure which should be reasonable unless one of the machine’s strokes is far longer than 24in.

**Facts:**

M52 open door

M53 close door

Supply pressure: 120psi

Outlet voltage:

232 data interface

0iD or 32iA

Door travel: 21 2/16 inch (53.657cm)

[

101533-00738

101533-00739

101533-01005

]

Door Height: APPROXIMATELY 44.5 inches

When one side is being pressurized, the other side will be evacuated

Serial Number: ML0022-006463

M02 is end of program code that might unlock the interlock

[User Who Offered Help](https://www.practicalmachinist.com/forum/threads/robotics-automation-engineer.404319/)

[Tips](https://automationforum.co/thumb-rules-and-tips-for-control-valves-selection-and-sizing/#:~:text=In%20general%2C%20the%20rule%20of,at%20a%20maximum%20flow%20rate.)

Adapters are 9/16

Exhausts are 11/16

**Considerations:**

We could use the code already in place or use external commands (M9-).

The door needs to be openable if the power goes out

For the manual air control valve it must depressurize more than the main control valve does.

<https://www.machinetoolproducts.com/versabuilt-robotics-versadoor-pneumatic-cnc-door-opener-for-automation>

\*The door appears to not lock at all

\*If the door is open, nothing else will happen because of that lock sensor

Might consider waiting to buy the safety beam until we see the door speed(a0)

The sensor only knows when the door is not closed. The operator will push the button to start the code.

M53 may already hop to next line of code. It may not know to wait because manually operated, it never needed to know

This auto door will clearly interface with the CNC, maybe it’s faster to just building the auto door and plug it in; don’t mount it and just watch the logic happen in real time. This rides on the assumption that we can easily make the adjustments. Maybe one exception would be depending if the safety relay will hold logic.

Does every piece have female or male threads?

For the 24inch stroke cylinder we could install more bump stops

**References:**

Midaco:

800 994 0146 Darrell

DN Solutions (Previously Doosan and Daewood):

888 dns 0010

973 618 2500

Fanuc US:

888 fanuc-us

**Airflow Calculations:**

At 60PSI the airflow is 8SCFM [which](https://www.coastpneumatics.com/scfm-conversion/) is 1.62CFM at T=72 P=74.4PSIA PB=14.7PSI H=.85. The Cv is calculated to be [.4](https://www.swagelok.com/en/toolbox/cv-calculator).

**General Parts:**

Tubing

Piston Mounting Brackets Stationary

Piston

Piston Mounting Brackets Kinetic

Pressure Regulator

Solenoid

Control Valves Open (maybe needle valve?)

Control Valves Close (maybe needle valve?)

Piston lubricant

Release Value for safety stop

Main Solenoid:

4 to 2 solenoid

4xt33, 4ka92

How does it respond to logic?

Are the exhaust vents threaded? Yes because they say female outlets

Would cylinder speed depend on both pressure and depressure rate? This may be fixed if we have valves already, the valves needed to block the exhaust ports.

Consider flow rate: is 9 CFM enough?

<https://www.grainger.com/product/ARO-Solenoid-Air-Control-Valve-2G621>

Make sure it can operate at the PSI we are actually using

The supply will never be feeding both the solenoids at once so we only need to consider CFM for one solenoid.

Can we complete cut off solenoids if they’re only 4 way? \*Because they get completely isolated thai shouldn’t be a problem. \*So we shouldn’t need switch valves for the exhaust ports.

If 9CFM is too high, consider a lower CFM solenoid if cheaper?

<https://www.amazon.com/ARO-Ingersoll-M212SS-024-D-G-2-Position-Solenoid/dp/B06XFMM7LT/ref=sr_1_7?crid=RL2B4XBWGTFB&keywords=aro+4+way+2+position+solenoid&qid=1688070130&sprefix=aro+4+way+2+position+solenoid%2Caps%2C125&sr=8-7&ufe=app_do%3Aamzn1.fos.006c50ae-5d4c-4777-9bc0-4513d670b6bc>

\*200mA

[Cheaper model with 50 min](https://www.zoro.com/aro-solenoid-air-control-valve-14-in-24vdc-a212sd-024-d/i/G2774816/?utm_source=google&utm_medium=surfaces&utm_campaign=shopping%20feed&utm_content=free%20google%20shopping%20clicks&gclid=CjwKCAjw-vmkBhBMEiwAlrMeF529T4GDaorvVeWBd8XoZ97sF0pEp_nirPxkwne2epVMymSIuAeLiBoCwscQAvD_BwE&gclsrc=aw.ds)

*7/6 Addendum:*

Since the cushioning does not behave the expected way and we need to use exhaust ports we will likely need to control the speeds independently with 5/2 solenoid valve.

<https://www.mcmaster.com/6425K14-6425K143/> This requires four less DIN(-$42), 4 exhaust control valves with muffler (+$24.16)[minus silencers], potentially both flow control valve. Would we want meter in only for flow valves?if we have to valves metering out then we might restrict the depressurize system too much. Difference in threads may need attention later, but because NPT male to NPTF female it may not deform those threads and it should be okay.

Tubing:

Fittings are usually push to connect

Make sure it can operate at the PSI we are actually using. It can, according to website linked right below.

Make sure the CFM is enough

Max SCFM at 60PSI is [3.5](https://www.greenlinehose.com/content/Hose%20Flow%20&%20Sizing.pdf)SCFM

Mounting:

<https://www.modularcomponents.com.au/building-blocks/>

[Angle Mount Information](https://cdn.automationdirect.com/static/specs/nitrad2hd2bore.pdf)

[Angle Brackets for Air Cylinder](https://www.automationdirect.com/adc/shopping/catalog/pneumatic_components/pneumatic_air_cylinders/air_cylinder_accessories/d2am-1)

Pistons:

[**https://www.automationdirect.com/adc/shopping/catalog/pneumatic\_components/pneumatic\_air\_cylinders/iso\_15552/g40m500md-mc**](https://www.automationdirect.com/adc/shopping/catalog/pneumatic_components/pneumatic_air_cylinders/iso_15552/g40m500md-mc)

[**https://www.hydraulicmegastore.com/product/32-550amak/**](https://www.hydraulicmegastore.com/product/32-550amak/)

[**https://www.zoro.com/speedaire-air-cylinder-1-12-in-bore-22-in-stroke-nfpa-double-acting-5teg5/i/G7647272/#specifications**](https://www.zoro.com/speedaire-air-cylinder-1-12-in-bore-22-in-stroke-nfpa-double-acting-5teg5/i/G7647272/#specifications)

[**https://www.mcmaster.com/6258K149/**](https://www.mcmaster.com/6258K149/)

Half of the price can be saved if we create a custom sensor setup or cushion setup. It’s possible to mount a magnet on the end of the piston, (where it mounts to the door), and then just have the proximity sensor at the middle point, (wherever the mount lies when the cylinder is fully retracted).

We have three states but only two inputs, but the normal force must equalize the piston force so you only need two inputs.

[Calculator Cylinder Size](https://www.automationdirect.com/pneumatics/cylinders/cylinder_sizing)

Operation force is 15 pounds, 18.75 with 25% safety which is a minimum. We can assume there won’t be too much loss since the system doesn’t have that many components. MAKE SURE ROD DIAMETER MATCHES TABLE

RETRACTING FORCE WILL BE LESS

**Air Cylinder Factors:**

Bore

Pressure

Action

Damping

Safety

**Airflow Calculations:**

Assume maximum case.

Assume that pressure regulator is very close to the solenoid. Meaning the only piping where CFM becomes necessary is primary solenoid to cylinder.

Assume inner diameter of air housing is the same as the outer diameter.

[Airflow Calculations](https://www.youtube.com/watch?v=Fbw3QlP2hTM)   
Cylinder Dimensions:

Bore Diameter=29.633mm

Rod Diameter=7.874mm

Stroke=558.800mm

Pressure=60psi=.414MPa

Piping Dimensions:

Length=2000mm

Diameter=3.175mm

Airflow=2.435 cfm (23cfm from other calculator)

Sine cylinder has slowing effect naturally.

Seems like the REC cylinders are all legacy, why is that? (RECB25-550)

Is the slowing controlled by PLC or is it just mechanical?

Adjustable slowing?

If we order a cylinder without the reed switch does it still come with a magnetic inside?

Anything special about setting it up compared to other cylinders?

Returns?

Auto switch?

Force chart?

<https://www.smcpneumatics.com/RECL25-550-C80C.html>

Pneumatic Cylinder Sensor:

DOC.M is named “Auto Door Open Check Sensor.” NO sensor, when sensor is triggered then the NC DOC.M is triggered and the machine knows the door is already open.

Regulator:

Consider that the nominal pressure may differ, maybe buy a slightly higher PSI gauge

Make sure the pressure adjustment range has a range to and around 60PSI (Likely we would want to go lower than 60PSI, not necessarily higher so that sacrifice can be made if needed, but try not to)

Make sure CFM is enough

Filter

Bowl for condensation?

Light Curtain:

To back off the cylinder, it’s simple just triggering it backwards using the same system. Except when the power goes out this will not be viable for safety or just to open it. THIS WILL DEPEND ON WHAT SETUP THE AIR CYLINDERS WILL BE LIKE, maybe needle out system?

The door handle is going to trigger the light curtain unless we mount it at least 3.5 inches from the door’s edge.

Normal state is 24V, hazard detected is 0V (open door is 0V)

Does the signal stay low until the person’s hand is removed or is it on a timer?

Edge to handle: 4 inches

Edge to handle with arm: 6 inches

SEE CONSIDERATION(a0)

Door must wait until okay signal is given, (this likely could be the same as the normal close door and continue procedure). Check if there is a timer or if it’ll stay open indefinitely.

Fingers must be able to be unclamped?

How many pounds to open the door? Could an operator open it manually, in the case the power goes out?

Alternative: Have it closed with a button and require that someone is holding the button to close the door. This may eliminate the need for a safety beam

<https://www.pepperl-fuchs.com/usa/en/classid_83.htm?view=productdetails&prodid=67155#datasheetcontent>

If OSSD is used then a safety relay is needed as well. Make sure it is not a pulse signal model?

Consider a IP54 [box](https://www.sick.com/media/docs/1/01/101/Operating_instructions_ReLy_OSSD1_en_IM0076101.PDF)

\*It looks like the safety sensor only holds voltage when the object is obstructing the beams aka pulse.

We could remount the handle. Because it won’t be used much anymore it doesn’t matter if it’s in a weird or inconvenient spot.

<https://www.wolfautomation.com/light-curtain-ultra-thin-thru-beam-160mm-det-1/>

Does the light curtain run on AC or DC? DC  
In safety, if the light curtain is exposed to coolant or water or any other substance inspect before using it again.

[General Informaiton](https://info.bannerengineering.com/cs/groups/public/documents/literature/122452.pdf)

Trip or latch (Maybe buy a light curtain that does both and we can troubleshoot in the moment). Maybe just skip because safety relay may not be compatible.

Does the safety relay have enough power to operate the directional valves? Doesn’t matter if we use trip system.

<https://www.bannerengineering.com/us/en/products/part.805795.html> $642

<https://www.bannerengineering.com/us/en/products/machine-safety/safety-modules/sr-im-series.html?pageNum=1&sort=1#all>

*Through Beam Addendum:*

<https://www.wolfautomation.com/photoelectric-sensor-through-beam-pnp-45595/>

<https://www.balluff.com/en-us/products/BOS02AW>

Throw dust into beam’s path to test if it still works

[Says](https://www.automationdirect.com/adc/shopping/catalog/sensors_-z-_encoders/photoelectric_sensors/general_purpose_photoelectric_sensors/qmrhd-0p-0a) to use 24AWG, 100mA max which my calculations give 2.4W

Visible light may be susceptible to other light

*Back to Light Curtain Addendum:*

Is it possible to have the light curtain wire directly to the Lynx? It would have to compensate for the time difference between outputs to know when it’s a real trip. It would also need to input relays, which is not a bad thing considering there are plenty of spares.

[Page 19 for Table of Terminals](https://media.distributordatasolutions.com/allenbradley/2017q1/74da9d8dcf82595eb507972877c303329b069640.pdf) [Diagram](https://literature.rockwellautomation.com/idc/groups/literature/documents/at/safety-at065_-en-p.pdf)

[EDM Explanation](https://blackcontrols.com/blog/f/external-device-monitoring)

[Page 55 for Force Guided Upgrade](https://info.bannerengineering.com/cs/groups/public/documents/literature/179480.pdf) Possibly just across the safety system

Arc suppressors, see datasheet linked on page 60, [Page 8](https://info.bannerengineering.com/cs/groups/public/documents/literature/141249.pdf) suggests that we do not need arc suppressors because we are operating under 151V.

Prove the IM-T-9A can be used

[Force Guided Relay](https://www.wolfautomation.com/relay-force-guided-3no-3nc-24vdc-led/?gclid=CjwKCAjwtuOlBhBREiwA7agf1iitlwB_0r3kSv1ZDpbndH6FLjVyHZj1JtleLMcWFJo2QbSNWqj_QBoCtgEQAvD_BwE)

With respect to choosing polarity for EDM reset circuit, it must be NC because the contacts are mechanically linked, so you can’t have 5 pin.

EDM protects against returning to normal state from safety state, but what if the contacts are welded in normal state and cannot be triggered to safety state?

1brown 2white 3blue 4black 5green

Directional Control Valve:

Do we need one that exhausts the air? Yes, because that is the third connection

Do we want spring return? Yes, it’s cheaper and should work just fine in this situation.

NC or NO? It appears we can set it up whichever way. The only possible problem is that hooking it up “backwards” must have airflow problems depending on how the solenoid is created.

There is a switch valve with speed control but it only has 1/4inch ports. Will there be enough adjustment to slow the air enough? Physically look at 1/4inch compared to 1/8inch, would the CFM change [that](https://www.greenlinehose.com/content/Hose%20Flow%20&%20Sizing.pdf) [much](https://www.engineeringtoolbox.com/air-discharge-hose-d_1523.html)? Will it actually save cost if we have to order different size hoses and connectors? Also is the speed electrically controlled? Don’t need it

Is 6ms fast enough? If so, no need for fast-switching. Don’t need it

<https://www.automationdirect.com/adc/shopping/catalog/pneumatic_components/directional_control_solenoid_valves/solenoid_valves/avs-3111-24d>

[General Directional Valves](https://www.mcmaster.com/products/pneumatic-switches/single-action-electrically-operated-air-directional-control-valves-11/)

Predicted airflow is 3.36SCFM

\*125mA

*Revision:*

<https://www.emerson.com/en-us/catalog/automation-solutions/fluid-control-pneumatics/general-service-valves/asco-320?fetchFacets=true#facet:&partsFacet:&modelsFacet:&facetLimit:&searchTerm:&partsSearchTerm:&modelsSearchTerm:&productBeginIndex:0&partsBeginIndex:0&modelsBeginIndex:0&orderBy:0&partsOrderBy:&modelsOrderBy:&pageView:list&minPrice:&maxPrice:&pageSize:&facetRange:&>

<https://store.flw.com/products/asco-series-8320-3-way-solenoid-valve-8320g174-24-dc.html?gclid=Cj0KCQjwnrmlBhDHARIsADJ5b_kqwdVUEFaNJaQnmqoJlt_2B31sTvs1uuZbggmu5XfgntsTCUOKmT8aAuY5EALw_wcB>

Shuttle valve is a candidate but it works on pressure differential which mean we would need to have one of the solenoid operating at a higher pressure.

Use a 4 way 2 position valve with the exhaust valve sealed

Two 2 way valves that are wired in opposition

[Different Spool Valves](https://www.sunhydraulics.com/sites/default/files/media_library/tech_resources/TT_US_PODirectional_Aug2015.pdf)

<https://www.electricsolenoidvalves.com/1-4-3-way-24v-dc-electric-solenoid-valve/>

<https://us.misumi-ec.com/vona2/detail/221300030450/?HissuCode=VT307-5G1-02&gclid=CjwKCAjwwb6lBhBJEiwAbuVUSifpm42BddhytJo9jq0fVvXjewy8Ozr6tp4lpG-mtpS7asd8uEM1ARoCKSUQAvD_BwE>

Probably L-Port type valve

For Parker [manual](https://www.parker.com/content/dam/Parker-com/Literature/Fluid-Control-Division/Bulletins/PDFs/Parker-General-Cat-3-Way-Valves.pdf), page 17-B7

Search for “l-port” and “3 way selector”

[Top choice for now](https://www.mcmaster.com/2565N15/)

B30

[Alternative for the future](https://tameson.com/products/tp-db014b040f-024dc-solenoid-valve-3-2-way-1-4-inch-brass-fkm-0-2bar-24vdc)

Air-Exhaust Control Valve:

We might not need this at all, depending exactly on how the two solenoids interact

Supply Solenoid:

Use two relays, normally open in parallel with and logic to control the supply solenoid. The and logic is to have redundancy in the system. (Probably skip this, it doesn’t seem to add any more safety)

Make sure it can operate at the PSI we are actually using

Make sure CFM is good. With a Cv=1.4 the allowed airflow is [27](https://www.swagelok.com/en/toolbox/cv-calculator)SCFM, should be good. But it shouldn’t matter because it’s been fed from the supply and has 1/4inch hosing so its airflow should be the least restrictive of all the components.

Should it be 220V or 24V? 220V limits the options.

Pressure assisted or zero pressure? Zero pressure to be safe  
<https://www.mcmaster.com/products/on%2Foff-valves/valve-type~solenoid/solenoid-on-off-valves-10/valve-starting-position~normally-closed/pipe-size~1-4/voltage~24v-dc/for-use-with~air/thread-type~npt/>

500mA

Flow Control Valves:

Mount as close to the air cylinder as possible for best results, (according to [McMaster](https://www.mcmaster.com/products/flow-control-valves/inline-air-flow-control-valves/for-outlet-tube-od~1-8/))

<https://www.mcmaster.com/62005k35/>

Make sure CFM is good. 4SCFM at 73PSI seems sufficient considering the maximum airflow for hose is 3.5CFM. Should not be very restrictive at 60PSI.

Power Supply:

Does Lynx have power leads?

Must be able to supply:

Supply solenoid

Light curtain

Safety relay

Directional valves

Secondary solenoid

Odds and Ends:

1 to2 -> supply solenoid to primary/secondary solenoid

\*Primary solenoid exhaust flow control valve (2 if 5 way solenoid)

\*Secondary solenoid exhaust flow control valve (2 if 5 way solenoid)

Teflon tape for sealing connections

1/8inch pressure gauge (pressure regulator, also maybe for testing)

Push-to-connect adapters

Anti-rust spray for drilled holes (must not react with coolant)

Fuses, rated for 32V so we should be okay

2 Relays, through beam sensors, 24V, 100mA, 24AWG compatible

A 24V tester to activate relays (could go without but CNC has huge power draw)

[DIN connectors?](https://www.amazon.com/43650-Solenoid-Prong-Connector-Indicator/dp/B09SHKJ7F3/ref=sr_1_1_sspa?crid=3CIF5NG3M4TQM&keywords=din+43650&qid=1688078776&sprefix=din+4365%2Caps%2C152&sr=8-1-spons&sp_csd=d2lkZ2V0TmFtZT1zcF9hdGY&psc=1) \*Only 2 needed for main solenoid

Probably don’t need any ground equipment since we’re wiring everything through the Lynx

Wire sleeves

<https://www.grainger.com/product/SCHNEIDER-ELECTRIC-Slim-Interface-Relay-6-A-Current-6LVJ8>

End of Stroke Control:

Release valve controlled by proximity sensor

Progressive spring

Pulse air valve

Add extension to shorter stroke sine cylinder

Just have return stroke slower

**Basic Ladder:**

They are all push and hold by default

The second relay can be NC, which would be on. But if the relay before it is not on, then it doesn’t have any effect. Even if it is on

Think of toggling buttons as just paying attention to the rising edge

1 The PLC will record all inputs 2 The program will execute 3 the outputs are collected 4

When the tutorial said it was proper to use NO, the physical wiring is normally closed so that when it breaks it’ll open the circuit and turn the output off.

[Scan Examples](https://accautomation.ca/understanding-the-plc-program-scan/)

If CLINT goes high then the door opens no matter what. In order for CLINT to go high:

AD Close Relay = 1

AD Open Relay = 0

Safety Sensor Edge On = 0

The door sensor must be out [DCLOSE is DIC.M is door lock sensor (out =0, in = 1)]

KEDGE = 1

Just delete KEDGE and replace it. Deleting KEDGE from CLINT (probably?) won’t affect anything else. Then you don’t have to worry about overwriting anything.

**Strategy:**

We were looking to buy an auto door option, what would we need to know about setting it up?

1 bill of materials

2 prototyping

3 Clear up details

4 testing

**Routine:**

Part is done and operator opens the door

User presses foot pedal to release clamp

User cleans part

User replaces part and presses pedal again

Closes the door

User presses button to start program

6/16:

**Contact Doosan:**  
Questions;

Is it 0V that opens the door and 24V that closes it? Does it pulse or does it hold the voltage?

Does M52:

Stop the machine from running?

Does M52 know when the door is fully open?

It waits until the the auto door close/open button is pressed?

Is there a wait on input code?

Would Doosan send us the ladder code?

Considerations:

The sensor only knows when the door is not closed. The operator will push the button to start the code.

M53 may already hop to next line of code. It may not know to wait because manually operated, it never needed to know

If M00 or M01 is executed, then nothing will happen until Cycle Start is pressed.

M53 may already hop to next line of code. It may not know to wait because manually operated, it never needed to know

Cycle:

start:

The program ends. The door opens because of the M52 code.

Once the M52 code is triggered, the voltage on the relay changes, (but is it high or low?).

The machine must know somehow when the door is fully open. (it’s possible to just put this on a timer)

Then the door must wait for some signal from the operator, likely use a button on the console to close it.

Then the operator presses the continue button

The program runs

GOTO start

Interfacing the solenoid with the CNC relays:

The solenoid only accepts either 1 or 0, there’s no idle position.

1. We could only use 104.1 (M52) and once that goes high, then the door retracts. But we have no idea how it behaves in the software.

2. (This is all assuming the code runs either or, not pulse). We could place two relays after the internal relay, one NC and one NO. Then both relays would be in agreement and they would behave like one relay. Then connect them to the ignition terminal on the solenoid. \*This would preserve the code’s behavior.

3. We could also use an entirely different single relay that would behave exactly as wanted but we would have to write some code for it, hopefully not much.

If we already have code written for M52 then we could just use M52 in the program.

Solenoid relay hooks into CB104.1 and CB104.2. (Because there are two separate relays that suggests a different logic scheme, one where we would need

Y01.1 is open door (maybe called FRDOP because he said it’s not the direct way). CB104.1 is the I/O name

Y01.2 is close door (maybe called FRDCL because he said it’s not the direct way). CB104.2 is the I/O name

Both M52 and M53 appear to be normally open. But if we fish through the code to see the direct connection we might find differing information

Consider cobot compatibility. But ultimately the cobot could just use a single binary signal as well, essentially the same as the CNC machine.

The hold logic is defined by ladder

Why are there two relays for it? Y1.1, hold until y1.2, unless maintenance and interlock are activated. The interlock requires a set time to elapse before M52 can be executed, which is dictated by ladder code.

Does the kit come with a sensor that tells us when the door is fully open or close?

Phone Call:

Maintanence Mode is M250

Keep relay holds whatever state it was, in case of power off

L000 is “0V”, I think he said it was for AC

Logic high is the M52 command

**Address:**

1325 Ross St # A, Petaluma, CA 94954

**Dump:**

Ladder system:

<https://www.youtube.com/watch?v=OmqC7_2Ugd8>

<http://dermako.com/Fanuc_Web_Manuals/Prog/61863ev2.pdf>

<http://www.cncmanuals.com/fanuc/172/pmc-ladder-language-programming-manual/page/128>

<https://cdn.automationdirect.com/static/eBooks/PLC%20Handbook.pdf>

[Toggle Bit](https://www.youtube.com/watch?v=ig5QXp2Bb1s)

Kmap (keep in mind this kmap does not cover every scenario, it excludes the needed and gate)

| LC | Auto | OpCl | Scenario: (1=door open || 0=door close) |
| --- | --- | --- | --- |
| 0 | 1 | 0 | X |
| 0 | 1 | 1 | X |
| 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 1 |
| 1 | 1 | 0 | 1 |
| 1 | 1 | 1 | 1 |
| 1 | 0 | 0 | 1 |
| 1 | 0 | 1 | 1 |

**Relay Chain:**

Normal function:

Connect internal relay leads to solenoid leads. \*When close door, logic high. \*When open door, logic low.

**Lever:**

3 or 4 position

Two NO, one NC

Maintain

[Logic to Relays](http://www.relaiscomputer.nl/index.php/elements)

[3 Position NC NO](https://cdn.automationdirect.com/static/specs/cents22mmselect.pdf) (<https://www.automationdirect.com/adc/search/search?fctype=adc.falcon.search.SearchFormCtrl&cmd=Search&searchquery=lever&categoryId=0&TxnNumber=-1&searchqty=50#Contact_Type_ms=%22(2)%20N.O./(2)%20N.C.%22&start=0&rows=50>)

Is the safety supplied?

1 Allow the door to operate normally (aka standby)

2 Open the door

3 Close the door

4 Override the primary solenoid

We could have two release valves on when secondary is triggered, which would get rid of any primary influence.

Idle:   
Step 1:

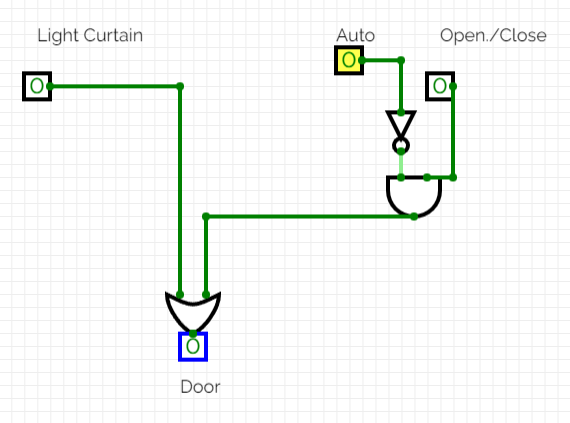
1. Trigger both release valves, making primary solenoid completely ineffective no matter which state it is in
2. Activate control relay for secondary solenoid

Step 2:

**Secondary Control (Safety):**

Return time would be covered because the code will not proceed until the door is fully closed.

Primary is pressurizing left, venting right. Secondary in pressurizing right, venting left. They must have valves because if they’re trying to do opposite actions, then both sides of the cylinder will be vented. The valves should then render one solenoid ineffective.



Caption: If you’re looking at this in the future, I believe the logic is reversed. That is, 0 is open and 1 is close.

4952K721

Do More Designer: [vmlcvrgulkerpkbrim@bbitf.com](mailto:vmlcvrgulkerpkbrim@bbitf.com)

Temporary:

Primary Solenoid Considerations:

Do we need door close relay? DOC.R

Secondary Solenoid Considerations:  
Safety relay is pulse so:

1 Add a few simple lines of code

2 Redo system (This will likely just be Option 1 weirdly)  
  
Let’s go with 1

1 We need code for directional valves

2 We need code for secondary solenoid

So the safety relay goes high temporarily. It will send that pulse to (EDGE.M or KEDGE). The code will run as intended for everything else. Meanwhile:

1 EDGE will trigger Y37.7 which will activate the directional valves. It will need to be toggle code that is turned off likely when DOP.R is.

2 EDGE will trigger Y37.8 which will activate the secondary solenoid. It will need to be toggle code that is turned off likely when DOP.R is.

Because we are able to program toggle bits our system should work.

Software has what we need, even safety and cobot code  
The system we made does not directly work with the code but we can easily adapt it. I will need to add a couple lines of code but they don’t change existing code at all. We will back up the data and I have low risk ways of testing the code.

I know how the code roughly will work but not exactly. It makes more sense to figure that side out when we actually have the door built.  
So now I’m generating the bill of materials.

Choose which air cylinder

Light curtain placement, remounting the handle?

Trip or latch, meaning bypass software or don’t   
Do you want every connection to have push-to-connect?

For less important components would you like to buy them from Amazon or something like that?

Do we want to power the solenoids and light curtain on the Lynx or have a dedicated power supply? Do we know if the Lynx has 24V power source?

Adjustments: 1.5inch air cylinder

Two (or more) safety beams connected in parallel with relays

**Airflow Calculations 1/8inch:**

1/8in pipe has a maximum airflow of 3.5SCFM. The airflow of the cylinder is \_.

Start with finding the airflow of the air cylinder in SCFM and CFM. Use the equation and cross reference it to the table that was given. Once that number is found then it’s a matter of finding pieces that correspond.  
Set up assumptions first  
A=.110SCFM which makes sense because the total volume of air per minute is only .027CF. We are using a small cylinder, with not many cycles so it makes sense it would be a number pretty close to the volume.

The maximum flow of a 1/8inch hose at around 60PSI is 3.5SCFM which is .88CFM (assuming T=72 P=59.7 B=14.7 H=.84). The calculated airflow for the air cylinder is .1104SCFM, using same parameters listed before.

Cv [calculated](https://www.swagelok.com/en/toolbox/cv-calculator) with PI=59.7 P2=54.7 AF=3.5SCFM T=72 SG=1, Cv=.218. All pieces need at least 3.5SCFM or Cv=.218.

Resolution needs to be an inch. Let’s say we have 4in of protection, we need 5 receivers. The receivers normally normally on so that when one faults/power goes out, the door automatically opens. If we connect all 5 in parallel, then it becomes a 5 input and gate. To work with this we could:

1 Wire the sensors in series so that the voltages add up, but that would mean voltage regulation which would be somewhat complicated.

2 Wire the sensors normally off and when one is triggered it gives the 24V for the relay to switch on. This is not particularly safe because if we get an open circuit, (either naturally or from a fuse blowing), the door will continue to operate normally. We could use a relay to reverse the logic. But if one of the sensor fails, (unless short circuit), then the system would have no way of knowing and would continue indifferently.

3 Use 5 different relays all wired correctly. If power cuts out or there is an open circuit, the door automatically opens.

So we make a redundant receiver for each of the “main” receivers, (exception of one), which would cost $300 for the whole setup.

Piston definitely creates too much force to be innocuous

**Returns:**

3 way 2 position valve from Grainger: branch 742 (5760 commerce boulevard, rohnert park ca 94928)

13 and 14 is an unpowered relay. The CNC relays can either be powered or unpowered.