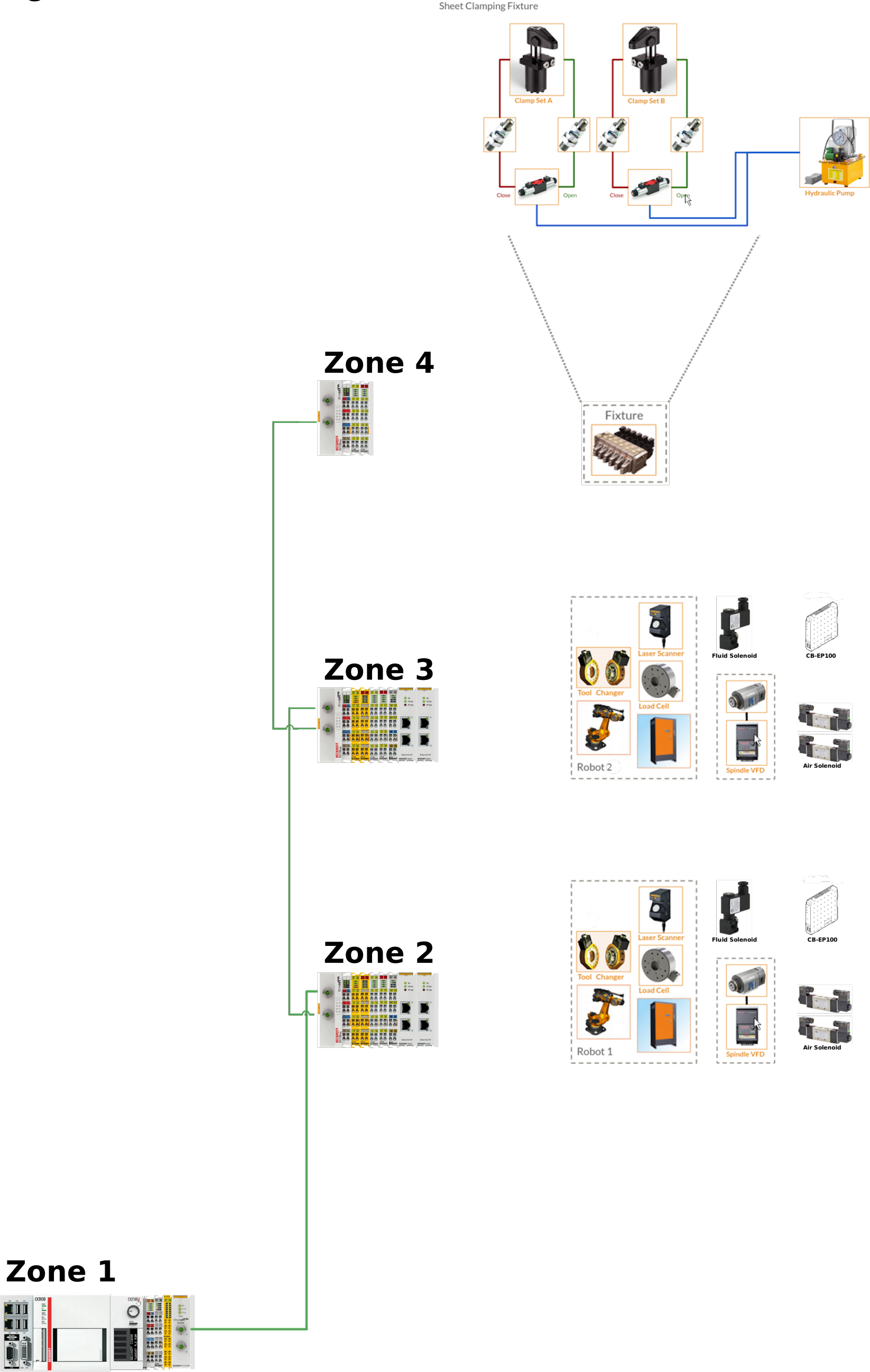


Bill Of Materials

ID	Sensor	Model Number	Qy	Description	Use	Link
	<b>Zone 1</b>					
9	Cell PLC	CX2030	1	Mid level PLC		<a href="#">Beckhoff CX2030</a>
10	Power Supply	CX2100-0014	1	Power supply for CX20xx, 130W		<a href="#">Beckhoff CX2100</a>
11	EtherCat Terminal	EL6070	1	Terminal license key for Twincat 3	licenses will be stored here instead of PLC making it simple to swap PLC	<a href="#">Beckhoff EL6070</a>
12	TwinSAFE Terminal	EL1918	1	8-ch digital input and logic TwinSAFE, TwinSAFE Logic	Safety master executes TwinSAFE logic and spare IO	<a href="#">Beckhoff EL1918</a>
13	EtherCat Junction	EK1122-0008	1	2-port EtherCat Junction M8		<a href="#">Beckhoff EK1122</a>
14	End Cap	EL9011	1	bus terminal end cap		<a href="#">Beckhoff EL9011</a>
15	EtherCat Cable	ZK1090-3232-0xxx	1	M8 cable,AWG 26,female-female	M8 cables are more durable and secure than RJ45 and can easily used with EP blocks	<a href="#">Beckhoff ZK1090-3232-0xxx</a>
	<b>Zone 2</b>					
16	Ethercat Coupler	EK1100-0008	1	EtherCat Coupler with M8 connections		<a href="#">Beckhoff EK1100</a>
17	TwinSAFE Terminal	EL1904	1	4-ch digital input, TwinSAFE	KUKA x11 internal e-stop output	<a href="#">Beckhoff EL1908</a>
18	TwinSAFE Terminal	EL2912-2200	1	4-ch digital output, TwinSAFE	KUKA x11 external e-stop input, pull high voltage contacts (VFD)?	<a href="#">Beckhoff EL2912</a>
19	EtherCat Terminal	EL1008	1	8-ch standard digital input	2 for ATI prox sensor unlock/locked	<a href="#">Beckhoff EL1008</a>
20	EtherCat Terminal	EL2008	1	8-ch standard digital output	4 for pneumatic solenoids, 1 for fluid solenoid	<a href="#">Beckhoff EL2008</a>
21	EtherCat Terminal	EL6021	1	1-channel serial RS422/RS485	1 for Delta VFD-B communication to PLC	<a href="#">Beckhoff EL6021</a>
22	EtherCat Scanner	EL6652	2	2-port EtherNet/IP scanner	1 for keyence comm box, 1 for KUKA robot, 1 for force comm box	<a href="#">Beckhoff EL6652</a>
23	Terminal Cap	EL9011	1	bus terminal end cap	Keep the dust out and cover E-bus contacts	<a href="#">Beckhoff EL9011</a>
24	Communication Unit	CB-EP100	1	EtherNet/IP communication unit	needed to communicate over EtherCat/IP	<a href="#">Keyence CB-EP100</a>
25	Ethernet cable	CA77-005M0-2	2	EtherNet cable CAT7	1 for Keyence CB-EP100 (CAT7 required pg.'1-4'), 1 for Sunrise Instruments Control Box	<a href="#">Digikey Cable</a>
26	Adapter	426-FIT0856	1	DB9 Male to RJ45 Female Adapter	Adapter for Sunrise Instruments Control Box	<a href="#">Mouser DB9-RJ45</a>
27	RS485 Cable	Q8806-1	1	RS-422 low capacitance data cable	Cable for communication VFD<>PLC	<a href="#">AutomationDirect Q8806-1</a>
28	RJ11 Connector	SKU: ST2106CO3165	1	RJ11/14 Connector Male 6P2C	Connector for RS485 connector used for VFD communication (one end only)	<a href="#">SharviElectronics RJ11/14</a>
29	Solenoid Valve Cable	SC11-LS24-3	5	solenoid valve cable, 11mm DIN style molded connector to 3-wire pigtail	4 for 2x NITRA Pneumatic Solenoid Valve, 1 for NITRA Fluid Solenoid Valve	<a href="#">AutomationDirect SC11-LS24-3</a>
30	EtherCat Cable	ZK1090-3232-0xxx	1	M8 cable,AWG 26,female-female	M8 cables are more durable and secure than RJ45 and can easily used with EP blocks	<a href="#">Beckhoff ZK1090-3232-0xxx</a>
	<b>Zone 3</b>					
	Duplicate <b>Zone 2</b>					
	<b>Zone 4</b>					
31	EtherCat Coupler	EK1100-0008	1	EtherCat Coupler with M8 connections		<a href="#">Beckhoff EK1100</a>
32	EtherCat Terminal	EL1088	1	8-ch standard digital input ground switching	4 for Gems Pressure switch output (W - Low Side [Ground Switched])	<a href="#">Beckhoff EL1088</a>
33	EtherCat Terminal	EL2008	1	8-ch standard digital output	4 for hydraulic clamp set A and B relays, 1 for Vevor Hydraulic pump relay	<a href="#">Beckhoff EL2008</a>
34	Terminal Cap	EL9011	1	bus terminal end cap	Keep the dust out and cover E-bus contacts	<a href="#">Beckhoff EL9011</a>
35	Slim Relay	277-10082-ND	5	Relay 24VDC Coil DIN Rail	1 to replace pedal on Vevor Hydraulic pump, 4 for hydraulic clamp set A and B	<a href="#">Digikey 277-10082-ND</a>
36	Connector	5JR664-5A1-US0A	4	48-120V AC/DC 50/60Hz	4 for Hydraulic Valves	<a href="#">OneHydraulics 5JR664-5A1-US0A</a>
37	Connector	557703-05M0	4	M12 Cord Set – 4 Meters	4 for Gems pressure switches	<a href="#">Kempston Ctrlrs 557703-05M0</a>

# Diagram



## Design Explanation

The majority of the components are Beckhoff EtherCat products because of many reasons: exceptional performance, flexible topology, it's simple and robust, and integrated safety to name a few.

The PLC is a mid level performance device with plenty of horse power to power this cell and leave enough room for future upgrades like control kuka's motion (KRC4 and up) for example. The IPC also runs Windows OS so it can handle running software like a traditional office computer, you can run things like SQL databases and/or house all the software required to interface with some of the sensors included in this cell.

An EL6070 keeps all licenses off the IPC which makes it easy to replace or swap without transferring or losing license keys.

Safety is a topic all on its own and without gathering all of the real requirements I had to assume a couple of things, though, I went ahead and included a few safety components. The EL1918 stores the safety logic and why not use a card with inputs instead of opting for a card that only handles logic, you can't every have enough IO so I attempt to leave a little extra wherever possible (some customers even spec a percentage of extra IO). I had a few things in mind for this cell like e-stops, robot safety, and high voltage power but it is not an exhausted list of what is required for a solid safety system.

The EtherCat terminals are made up of input and output channels with a couple of communication terminals that integrate with sensors nicely. Those included are EtherNet/IP for the kuka robot and keyence laser, RS485 for delta VFD, with an extra port for future upgrades. Terminals were chosen with the assumption that din real estate was available in a cabinet, but a nice alternative for terminal type that can handle rough environments EP blocks.

Accessories include items that were required to make communication with PLC an improvement.