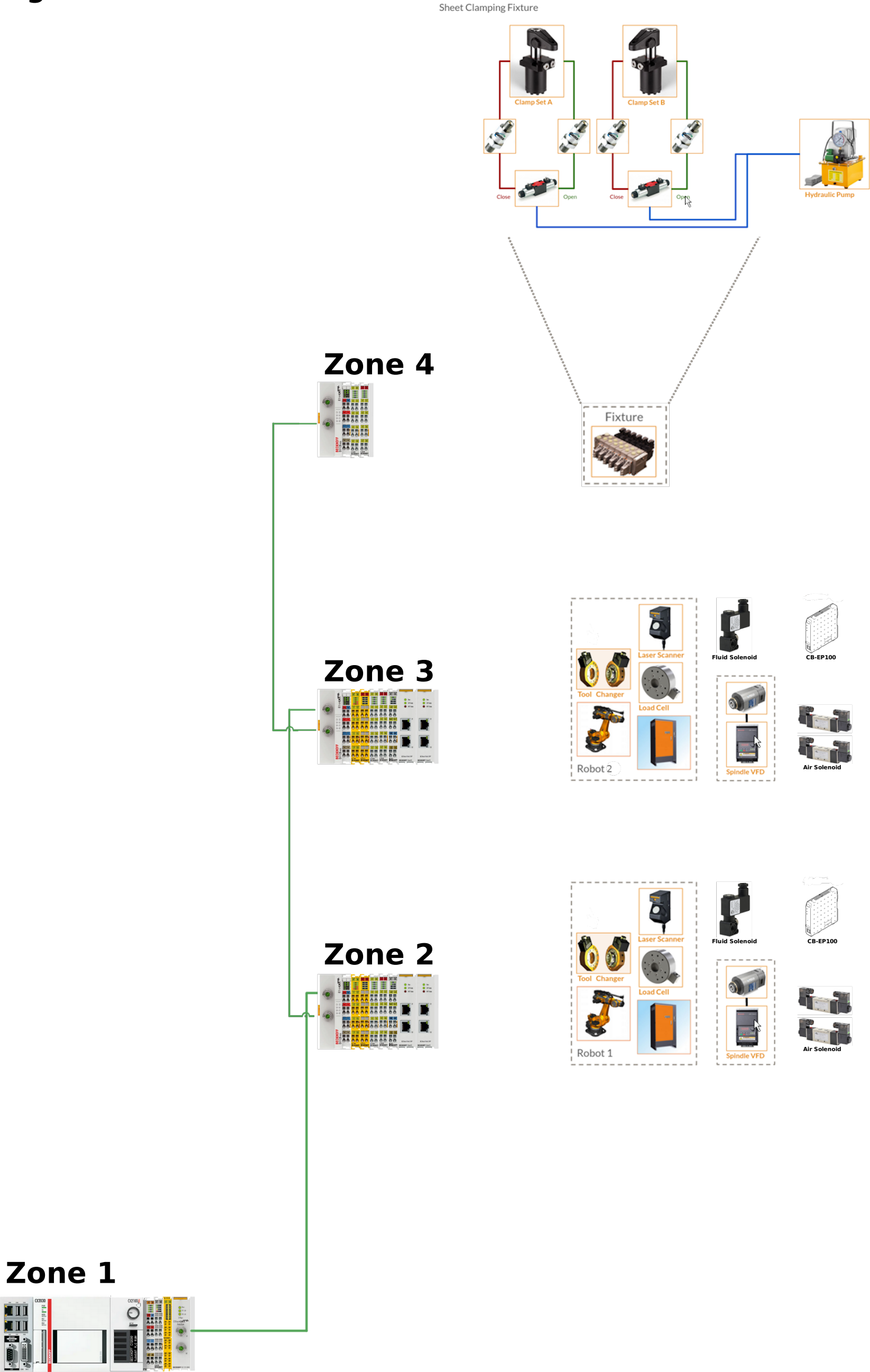


Bill Of Materials

ID	Sensor	Model Number	Qy	Description	Use	Link
	Zone 1					
9	Cell PLC	CX2030	1	Mid level PLC		Beckhoff CX2030
10	Power Supply	CX2100-0014	1	Power supply for CX20xx, 130W		Beckhoff CX2100
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	Beckhoff EL6070
12	TwinSAFE Terminal	EL1918	1	8-ch digital input and logic TwinSAFE, TwinSAFE Logic	Safety master executes TwinSAFE logic and spare IO	Beckhoff EL1918
13	EtherCat Junction	EK1122-0008	1	2-port EtherCat Junction M8		Beckhoff EK1122
14	End Cap	EL9011	1	bus terminal end cap		Beckhoff EL9011
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	Beckhoff ZK1090-3232-0xxx
	Zone 2					
16	Ethercat Coupler	EK1100-0008	1	EtherCat Coupler with M8 connections		Beckhoff EK1100
17	TwinSAFE Terminal	EL1904	1	4-ch digital input, TwinSAFE	KUKA x11 internal e-stop output	Beckhoff EL1908
18	TwinSAFE Terminal	EL2912-2200	1	4-ch digital output, TwinSAFE	KUKA x11 external e-stop input, pull high voltage contacts (VFD)?	Beckhoff EL2912
19	EtherCat Terminal	EL1008	1	8-ch standard digital input	2 for ATI prox sensor unlock/locked	Beckhoff EL1008
20	EtherCat Terminal	EL2008	1	8-ch standard digital output	4 for pneumatic solenoids, 1 for fluid solenoid	Beckhoff EL2008
21	EtherCat Terminal	EL6021	1	1-channel serial RS422/RS485	1 for Delta VFD-B communication to PLC	Beckhoff EL6021
22	EtherCat Scanner	EL6652	2	2-port EtherNet/IP scanner	1 for keyence comm box, 1 for KUKA robot, 1 for force comm box	Beckhoff EL6652
23	Terminal Cap	EL9011	1	bus terminal end cap	Keep the dust out and cover E-bus contacts	Beckhoff EL9011
24	Communication Unit	CB-EP100	1	EtherNet/IP communication unit	needed to communicate over EtherCat/IP	Keyence CB-EP100
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	Digikey Cable
26	Adapter	426-FIT0856	1	DB9 Male to RJ45 Female Adapter	Adapter for Sunrise Instruments Control Box	Mouser DB9-RJ45
27	RS485 Cable	Q8806-1	1	RS-422 low capacitance data cable	Cable for communication VFD<>PLC	AutomationDirect Q8806-1
28	RJ11 Connector	SKU: ST2106CO3165	1	RJ11/14 Connector Male 6P2C	Connector for RS485 connector used for VFD communication (one end only)	SharviElectronics RJ11/14
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	AutomationDirect SC11-LS24-3
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	Beckhoff ZK1090-3232-0xxx
	Zone 3					
	Duplicate Zone 2					
	Zone 4					
31	EtherCat Coupler	EK1100-0008	1	EtherCat Coupler with M8 connections		Beckhoff EK1100
32	EtherCat Terminal	EL1008	1	8-ch standard digital input	4 for Gems Pressure switch output	Beckhoff EL1008
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	Beckhoff EL2008
34	Terminal Cap	EL9011	1	bus terminal end cap	Keep the dust out and cover E-bus contacts	Beckhoff EL9011
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	Digikey 277-10082-ND
36	Connector	5JR664-5A1-US0A	4	48-120V AC/DC 50/60Hz	4 for Hydraulic Valves	OneHydraulics 5JR664-5A1-US0A
37	Connector	557703-05M0	4	M12 Cord Set – 4 Meters	4 for Gems pressure switches	Kempston Ctrlrs 557703-05M0

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.