

### Relays

		Contactor	Pole 1	Pole 2	Pole 3	Pole 4	Model ID	24V DC Coil Power W
K01	E Stop Chain 1	A1-A2	13-14				CA3KN40BD3	1.5
K02	E Stop Chain 2	A1-A2	13-14				CA3KN40BD3	1.5
K03	Axes Limit Switch E-Stop Chain	A1-A2	13-14	23-24	33-34		CA3KN40BD3	1.5
K04	Acess Gate Limit Switches	A1-A2	13-14	23-24	33-34		CA3KN40BD3	1.5
K05	Access Gate Over-ride	A1-A2	13-14	23-24	33-34		CA3KN40BD3	1.5
K06	Enable Axes Drives T20	A1-A2	13-14	23-24	33-34		CA3KN40BD3	1.5
K07	Run Axes Drives T5	A1-A2	13-14	23-24	33-34		CA3KN40BD3	1.5
K08	Axes Retract	A1-A2	13-14	23-24			CA3KN40BD3	1.5
K09	E-Stop Safety Relay Output	A1-A2	13-14	23-24	33-34	43-44	CA3KN40BD3	1.5
K10	X Axis Brake Release	A1-A2	13-14				CA3KN40BD3	1.5
K11	Y Axis Brake Release	A1-A2	13-14				CA3KN40BD3	1.5
K12	Z Axis Brake Release	A1-A2	13-14				CA3KN40BD3	1.5
K13	Gearshift Motor M5 ON/OFF	A1-A2	13-14	21-22			CA3KN22BD3	1.5
K14	Gearshift Motor M6 ON/OFF	A1-A2	13-14	21-22			CA3KN22BD3	1.5
K15	Gearshift Motor M7 ON/OFF	A1-A2	13-14	21-22			CA3KN22BD3	1.5
K16	Gearshift Motor Direction	A1-A2	13-14	21-22	31-32	43-44	CA3KN22BD3	1.5
K17	Vertical ToolHolder Release	A1-A2	13-14				CA3KN40BD3	1.5
K18	Horizontal Toolholder Release	A1-A2	13-14				CA3KN40BD3	1.5
K19	Spindle Lubrication	A1-A2	13-14				CA3KN40BD3	1.5
K22	Central Lubrication Motor Contactor	A1-A2	13-14				CA3KN40BD3	1.5
K20	Hydraulic System Motor VFD Run	A1-A2	13-14	23-24	33-34		CA3KN40BD3	1.5
K21	Tool Change	A1-A2	13-14				CA3KN40BD3	1.5
K23	X axis Drive MPCB Contactor 25A						LC1D25	
K24	Y Axis Drive MPCB Contactor 25A						LC1D25	
K25	Z Axis Drive MPCB Contactor 40A						LC1D40	
K26	Cabinet Fan Thermostat AC							
K27	Cabinet Fan Thermostat DC							
K28	Mist Coolant	A1-A2	13-14				CA3KN40BD3	1.5
K29	Flood Coolant	A1-A2	13-14				CA3KN40BD3	1.5

Q01	Isolation Switch 63A 3P	VCF3	
Q02	MCB 40A 3P D Curve	Acti9 iC60 A9F45340	Incoming Power L1, L2, L3
Q03	MCB 1P 10A D Curve	Acti9 iC60H Disbo A9F45110	X Axis Servo Aux
Q04	MCB 1P 10A D Curve	Acti9 iC60H Disbo A9F45110	Y Axis Servo Aux
Q05	MCB 1P 10A D Curve	Acti9 ic60H Disbo A9F45110	Z Axis Servo Aux
Q06	MCB 1P 32A D Curve	Acti9 iC60H Disbo A9F45132	X Axis Servo Power
Q07	MCB 1P 32A D Curve	Acti9 iC60H Disbo A9F45132	Y Axis Servo Power
Q08	MCB 1P 40A D Curve	Acti9 iC60H Disbo A9F45140	Z Axis Servo Power
Q09	MCB 1P 10A D Curve	Acti9 iC60H Disbo A9F45110	ATV320 VFD - Spindle
Q10	MCB 1P 10A D Curve	Acti9 iC60H Disbo A9F45110	ATV320 VFD - Hydraulic System
Q11	MCB 1P 6A D Curve	Acti9 iC60H Disbo A9F45106	Central Lubrication Pump
Q12	MCB 1P 1A D Curve	Acti9 iC60H Disbo A9F55101	Cabinet Fan
Q13	MCB 1P 4A C Curve	Acti9 iC60H Disbo A9F54104	Siemens 24V PSU 240W
Q14	MCB 1P 4A C Curve	Acti9 iC60H Disbo A9F54104	Siemens 12V PSU 144W
Q15	MCB 1P 2A C Curve	Acti9 iC60H Disbo A9F54101	Omron 5V PSU 30W
Q16	MCB 1P 6A C Curve	Acti9 iC60H Disbo A9F54106	Computer PC PSU
Q17	MCB 1P 6A C Curve	Acti9 iC60H Disbo A9F54106	Computer Monitor

Prefix	Device ID	Label
S 1		X Axis
S 2		Y Axis
S 3		Z Axis
S 4		Handwheel ON
S 5		Jog 0.01 mm
S 6		Pendant Release/Clamp Tool
S 7		E-Stop 1
S 8		E-Stop 2
S 9		Activate
S 10		Home
S 11		Z-Jog
S 12		Y+Jog
S 13		X+Jog
S 14		X-Jog
S 15		Y-Jog
S 16		Z+Jog
S 17		Axes Retract
S 18		Rapid
S 19		Spindle Direction
S 20		Spindle ON
S 21		Tool Change Vertical/Horizontal
S 22		Tool Change
S 23		Lube Cycle
S 24		Cycle Start
S 25		Cycle Stop
S 26		Spindle Nominal RPM
S 27		Spindle % Override
S 28		FeedRate % Override
S 29		
S 30		
S 31		Lube Pressure
S 32		
S 33		Hydraulic System Pressure
S 34		
S 35		
S 36		Gearshift Ratio M5 Slow
S 37		Gearshift Ratio M5 Medium
S 38		Gearshift Ratio M5 Fast
S 39		Gearshift Ratio M6 Slow
S 40		Gearshift Ratio M6 Medium
S 41		Gearshift Ratio M6 Fast
S 42		Countershaft M7 Fast
S 43		Countershaft M7 Slow
S 44		Countershaft M7 Acknowledge
S 45		-X Axis Limit Switch - reducing
S 46		-X Axis Limit Switch - range end
S 47		X Axis Limit Switch - E-Stop
S 48		
S 49		+X Axis Limit Switch - range end
S 50		+X Axis Limit Switch - reducing
S 51		-Y Axis Limit Switch - reducing
S 52		-Y Axis Limit Switch - range end
S 53		Y Axis Limit Switch - E-Stop
S 54		
S 55		+Y Axis Limit Switch - range end
S 56		+Y Axis Limit Switch - reducing
S 57		-Z Axis Limit Switch - reducing
S 58		-Z Axis Limit Switch - range end
S 59		-Z Axis Limit Switch - E-Stop
S 60		+Z Axis Limit Switch - E-Stop
S 61		+Z Axis Limit Switch - range end
S 62		+Z Axis Limit Switch - reducing
S 63		Access Gate Limit Switch 1
S 64		Access Gate Limit Switch 2
S 65		E-Stop 3

## OEM Solenoid Valves

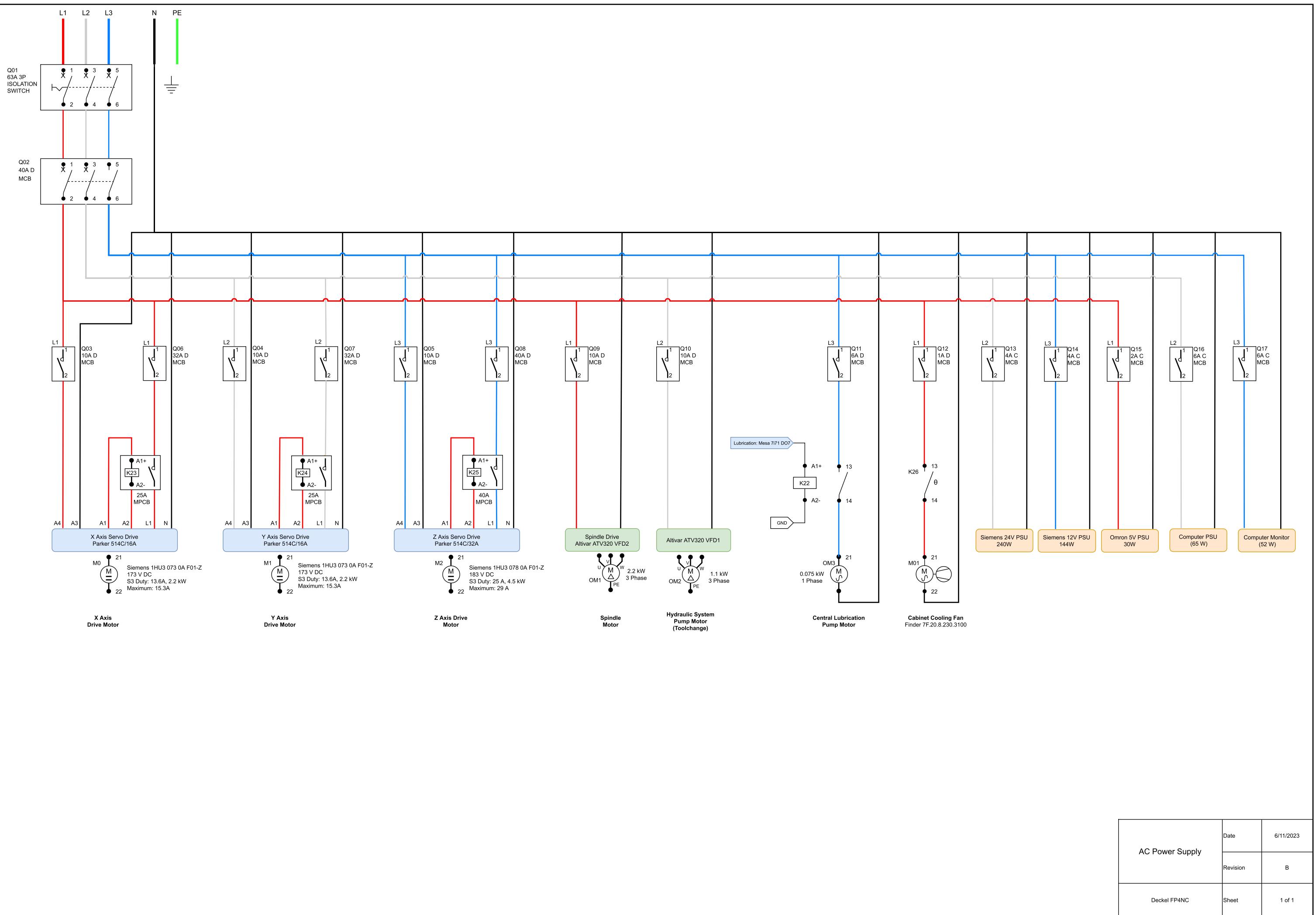
Y01		
Y02	X Axis Brake Release Solenoid	
Y03	Y Axis Brake Release Solenoid	
Y04	Z Axis Brake Release Solenoid	
Y05	Horizontal Drawbar Release Solenoid	
Y06	Vertical Drawbar Release Solenoid	
Y07	Mist Coolant Pneumatic Solenoid	
Y08		
Y09		
Y10	Spindle Lubrication Solenoid Valve	

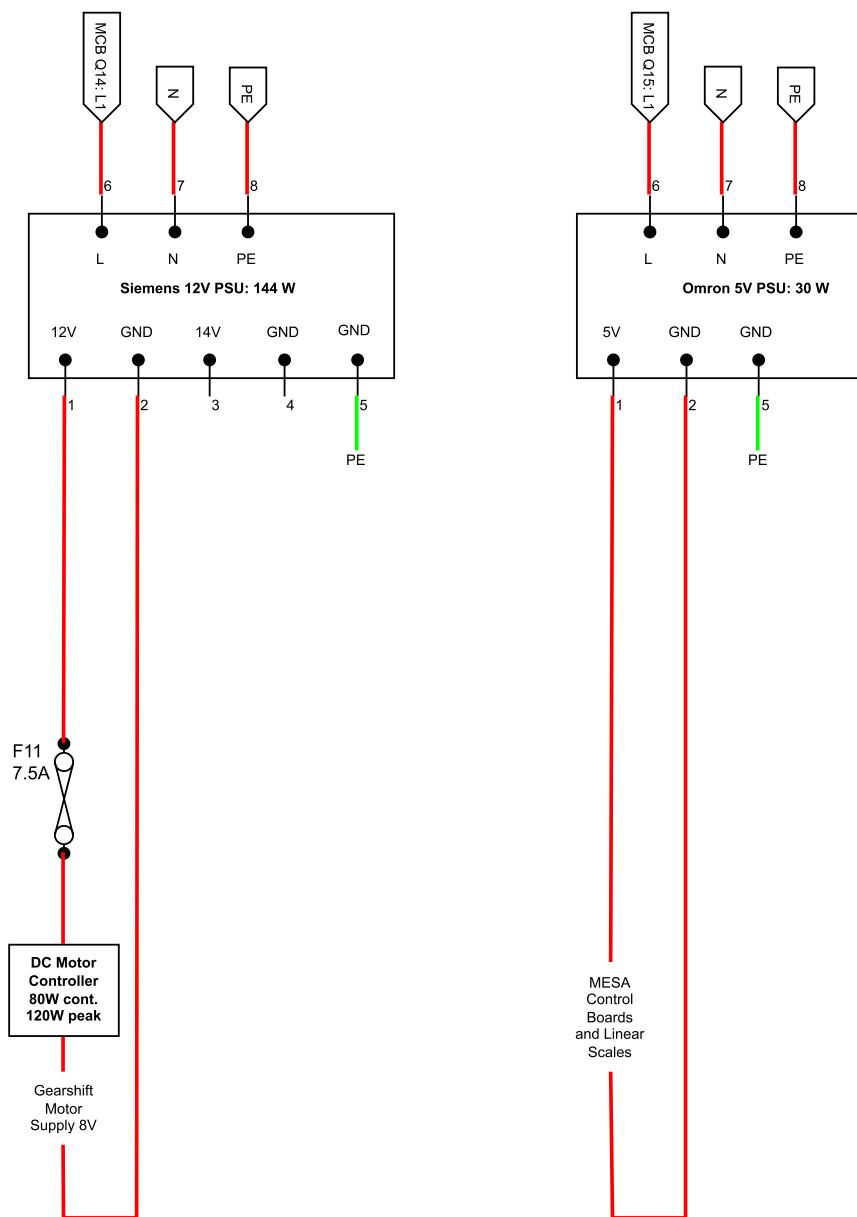
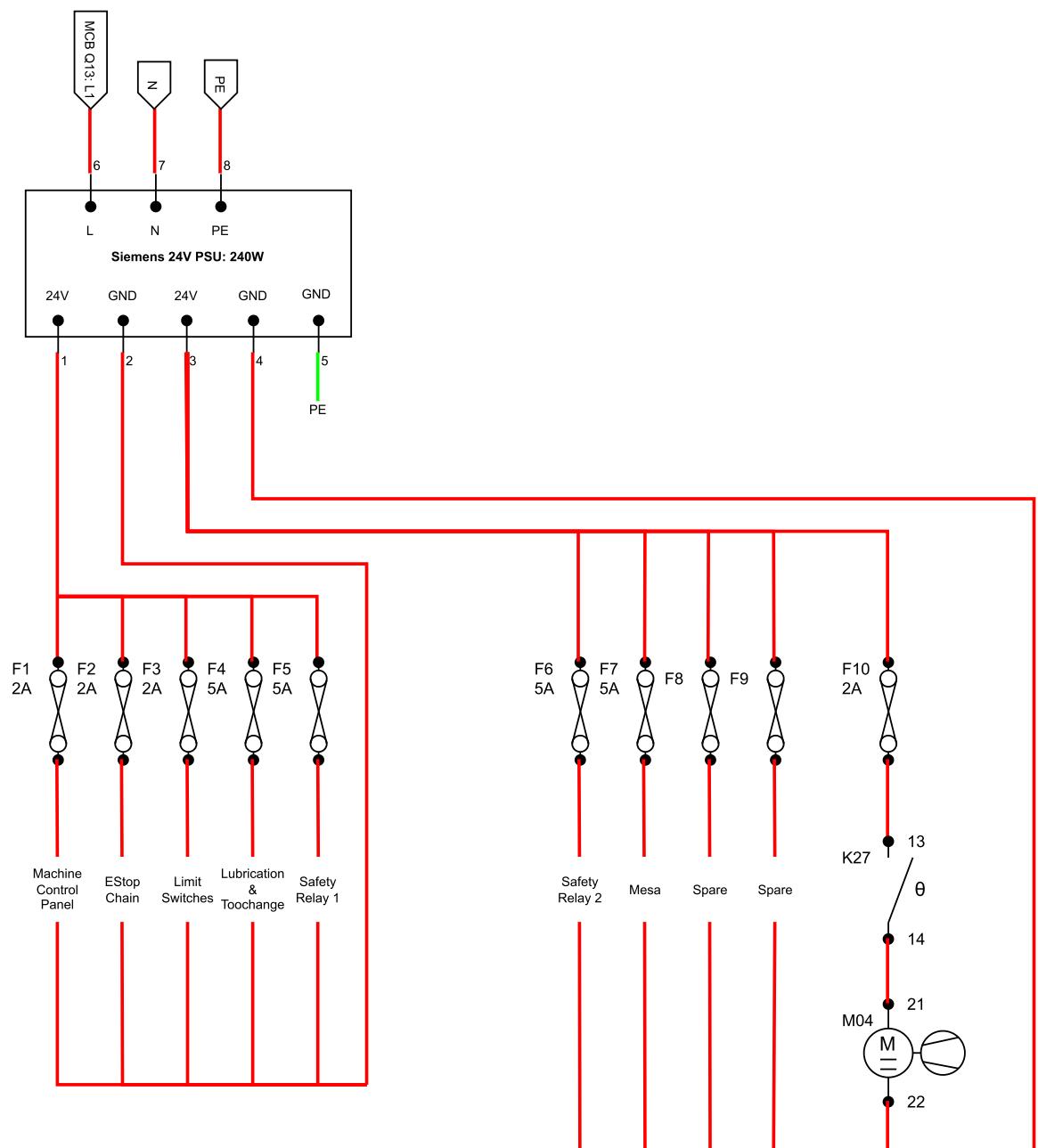
## DC Motors

M1	X Axis Servo Motor
M2	Y Axis Servo Motor
M3	Z Axis Servo Motor
M4	Cabinet Cooling Fan
M5	Gear Shift Block 1
M6	Gear Shift Block 2
M7	Gear Shift Countershaft
M8	
M9	

## AC Motors

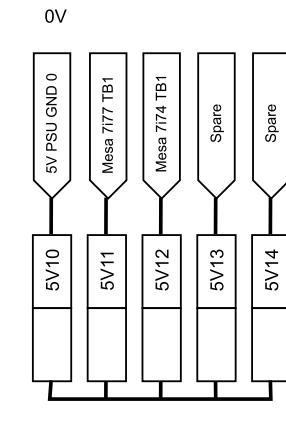
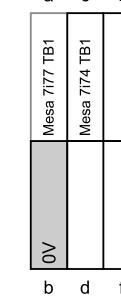
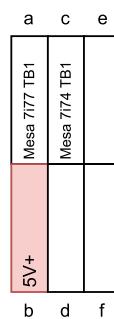
OM1	Spindle Motor	230V 3 Phase	2.2 kW
OM2	Hydraulic System Motor	230V 3 Phase	1.1 kW
OM3	Lubrication Motor	230V Single Phase	0.075 kW
OM4	Cabinet Cooling Fan	230 V Single Phase	0.028 kW
OM5			
OM6			
OM7			
OM8			
OM9			



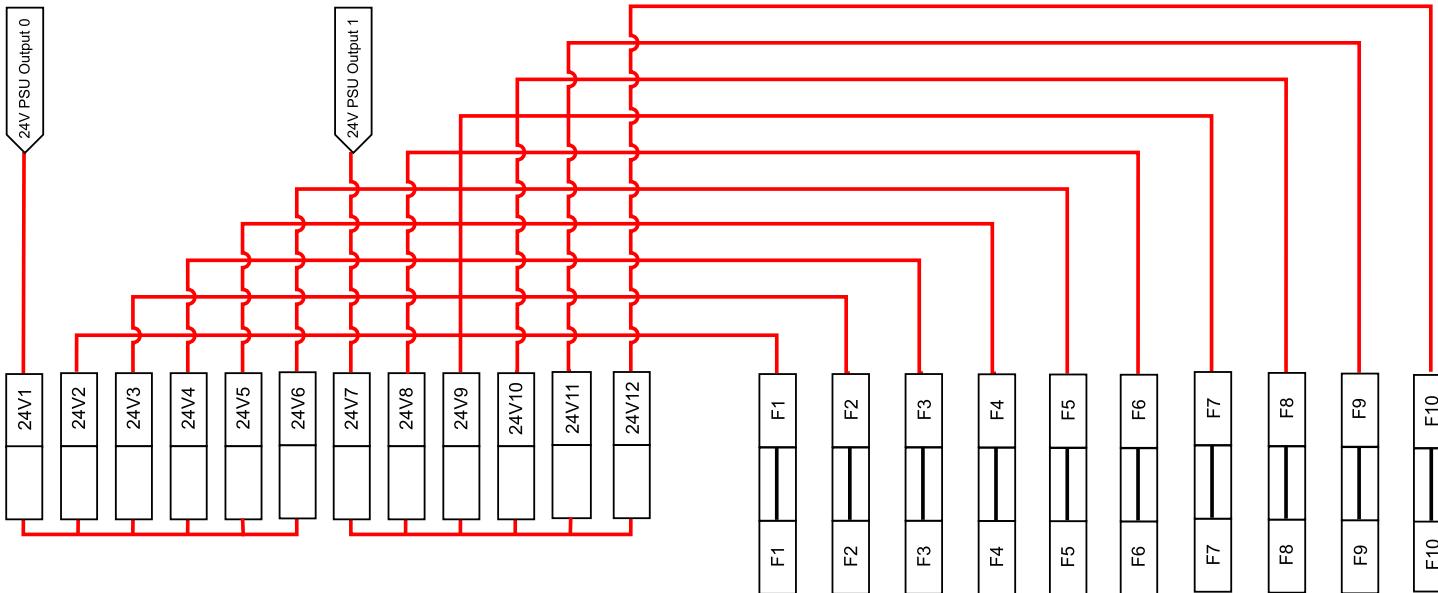


DC Power Supply	Date	6/11/2023
	Revision	B
Deckel FP4NC	Sheet	1 of 3

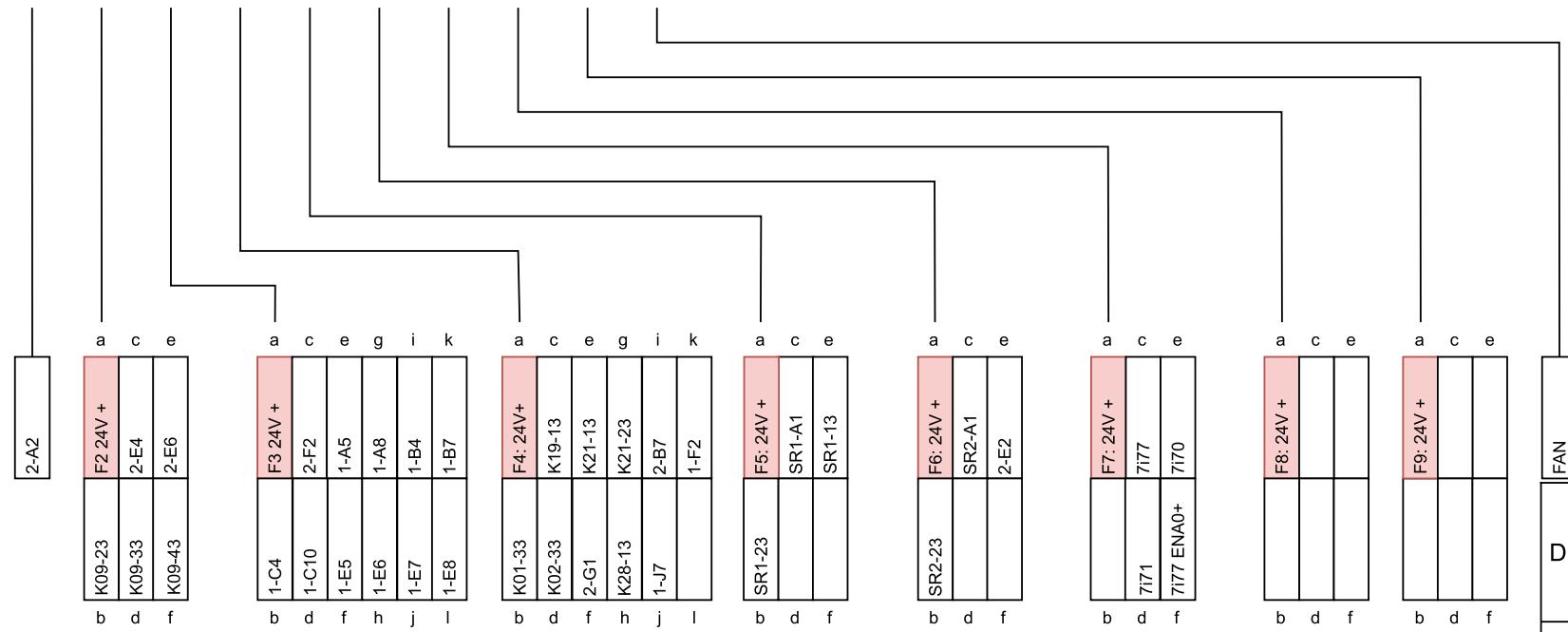
## 5v PSU Power Distribution



## 24V PSU Power Distribution



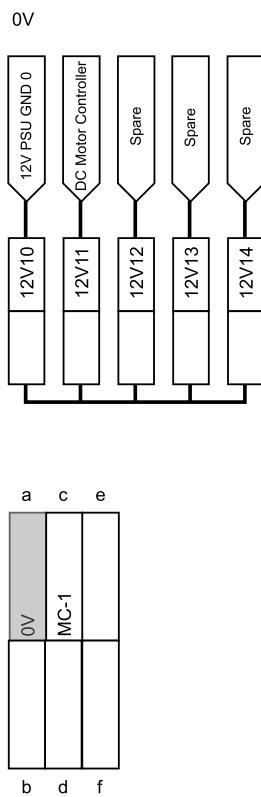
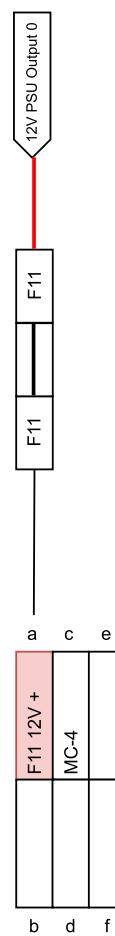
Machine Control Panel, E-Stop Chain, Limit Switches, Lubrication and Safety Relays, Safety Relay 1, Safety Relay 2, Mesa ToolChange, Spare Cabinet Fan



DC Power Supply	Date	6/11/2023
Deckel FP4NC	Revision	B

Sheet	2 of 3
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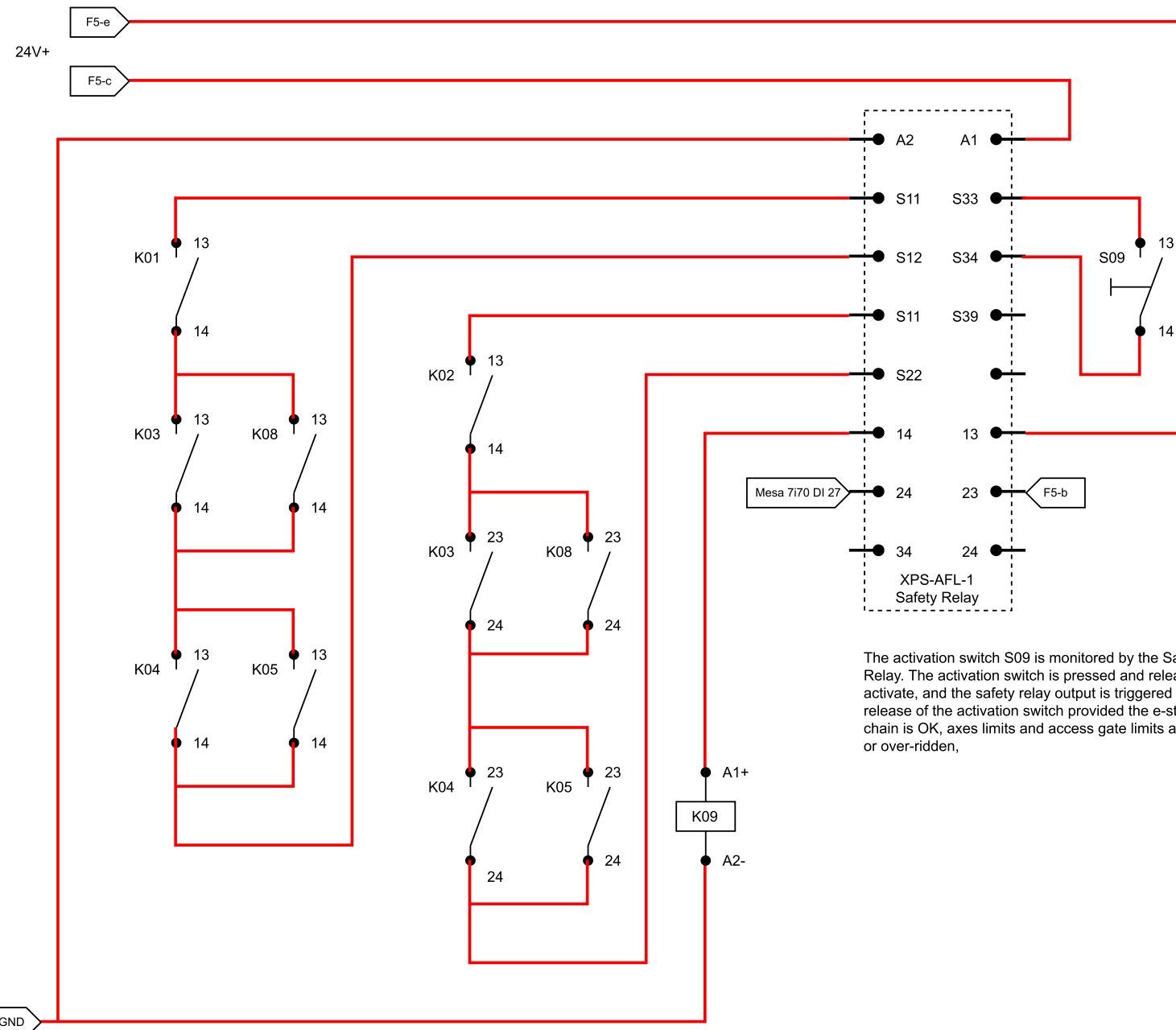
12V PSU Power Distribution



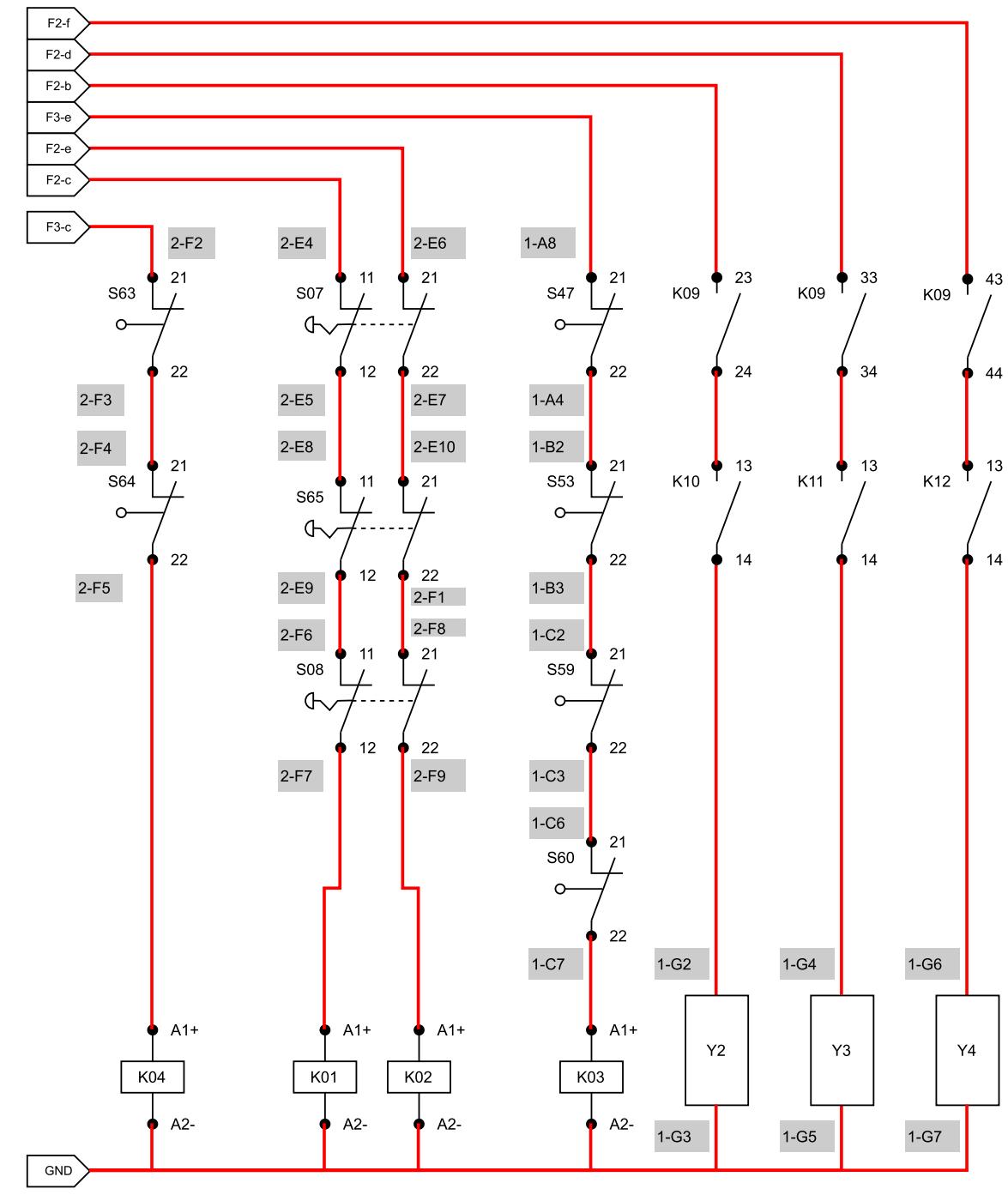
DC Power Supply	Date	6/11/2023
	Revision	B
Deckel FP4NC	Sheet	3 of 3

### Safety Switch Chains and Axis Brakes

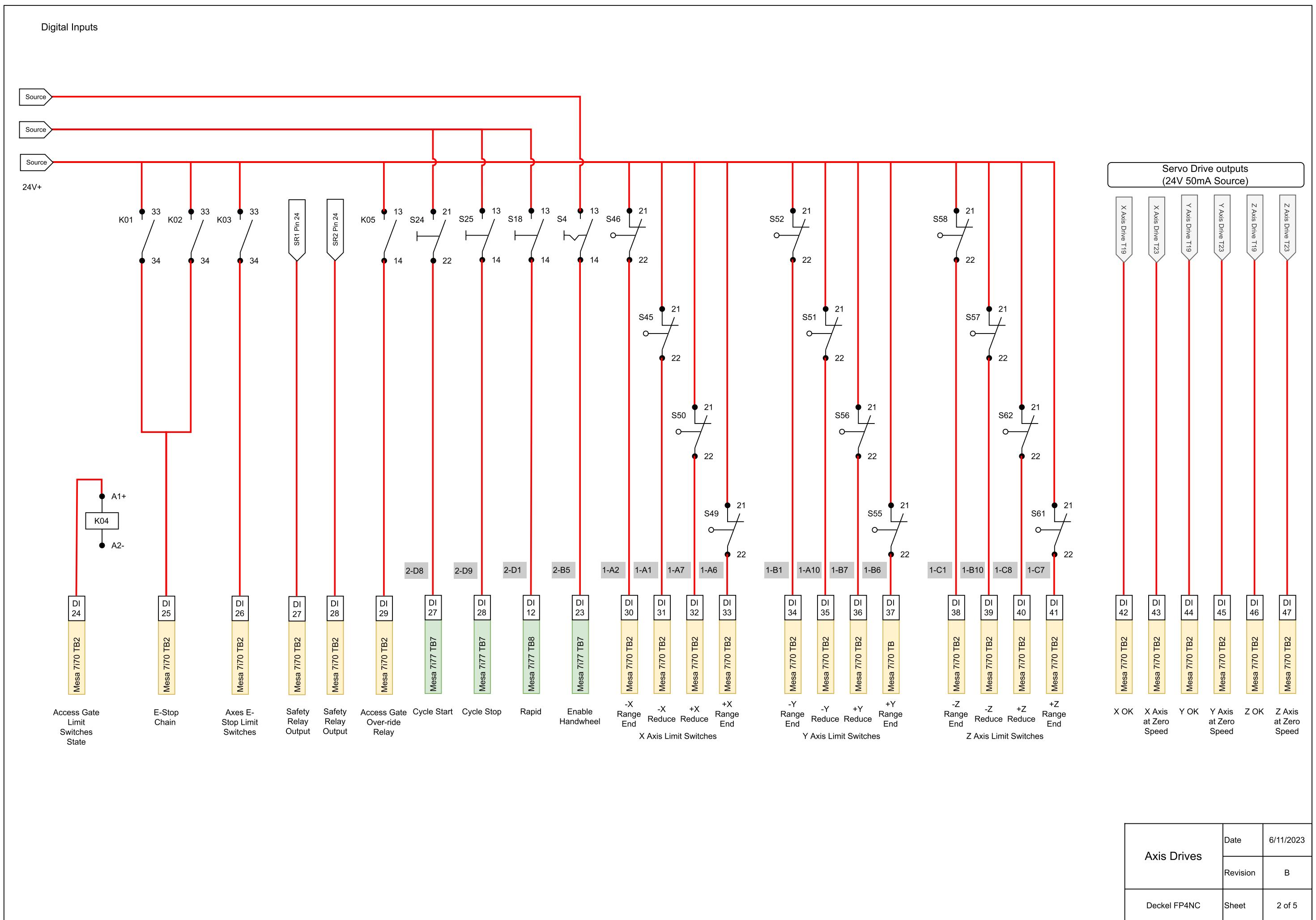
#### Safety Relay



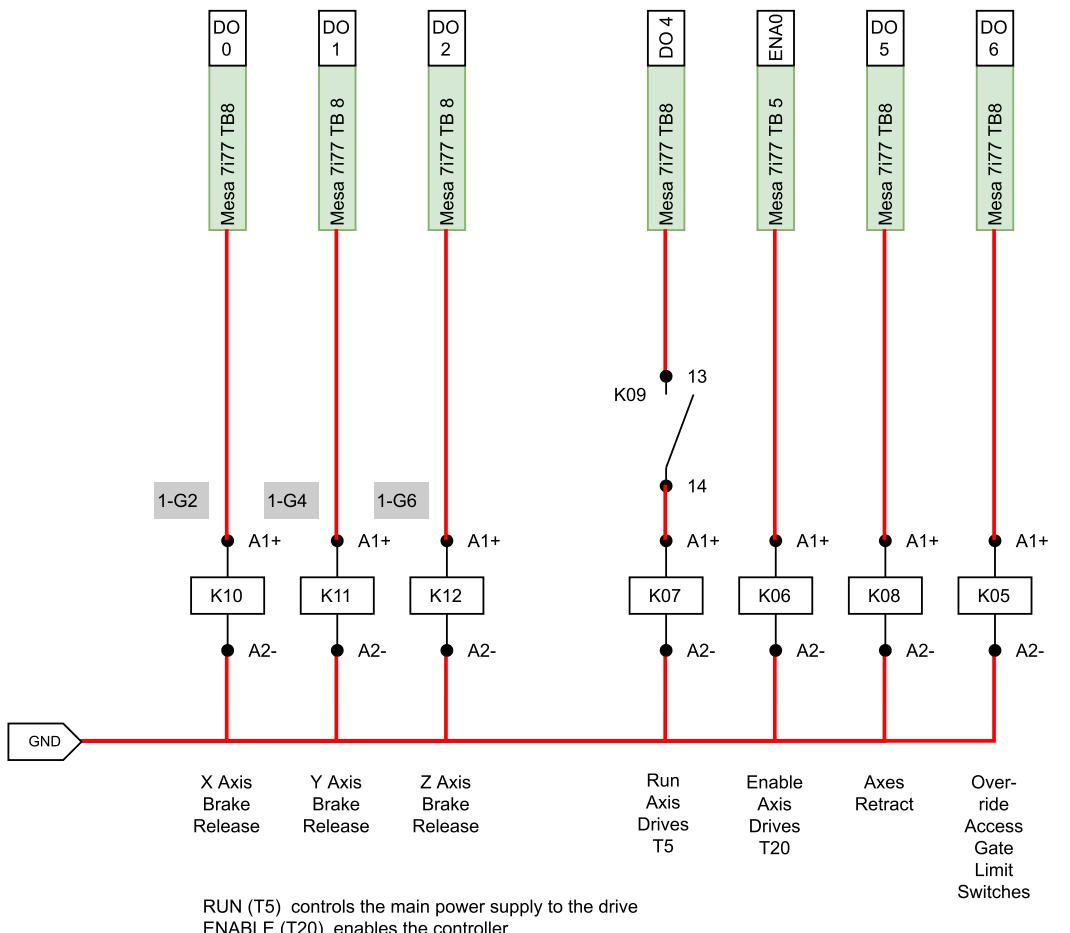
The activation switch S09 is monitored by the Safety Relay. The activation switch is pressed and released to activate, and the safety relay output is triggered by the release of the activation switch provided the e-stop chain is OK, axes limits and access gate limits are OK - or over-ridden,



Axis Drives	Date	6/11/2023
	Revision	B
Deckel FP4NC	Sheet	1 of 5

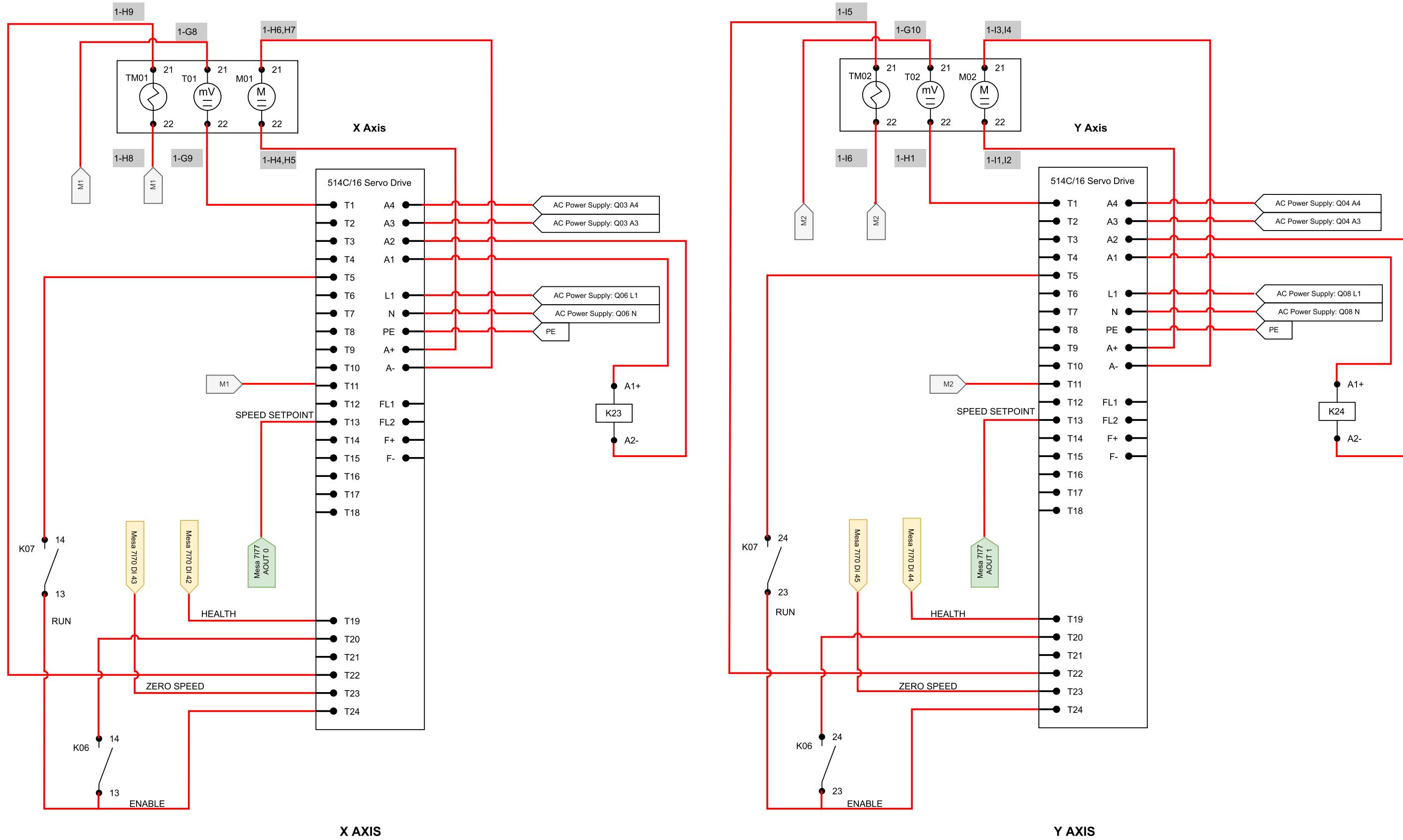


### Digital Outputs

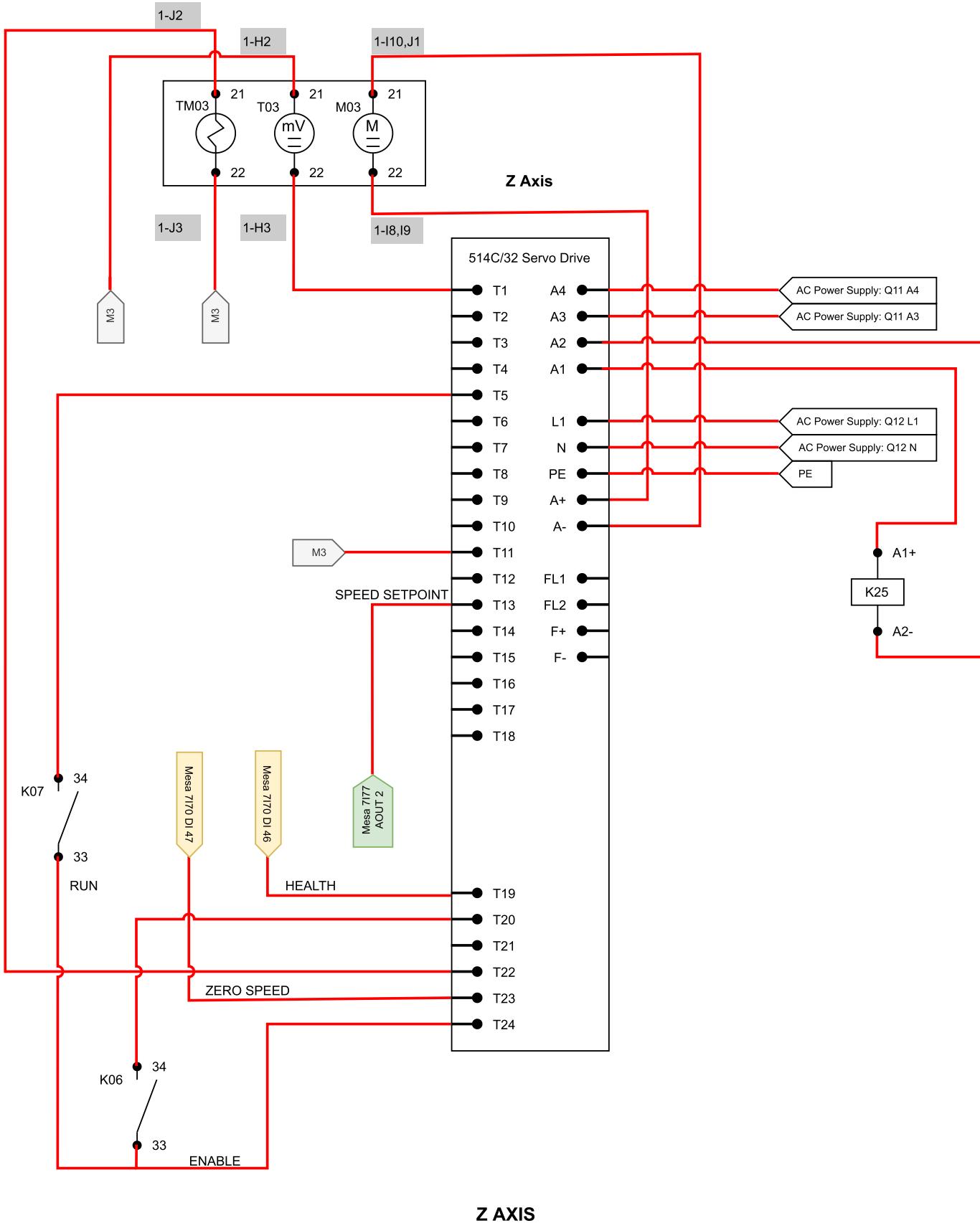


Axis Drives	Date	6/11/2023
	Revision	B
Deckel FP4NC	Sheet	3 of 5

Servo Drives

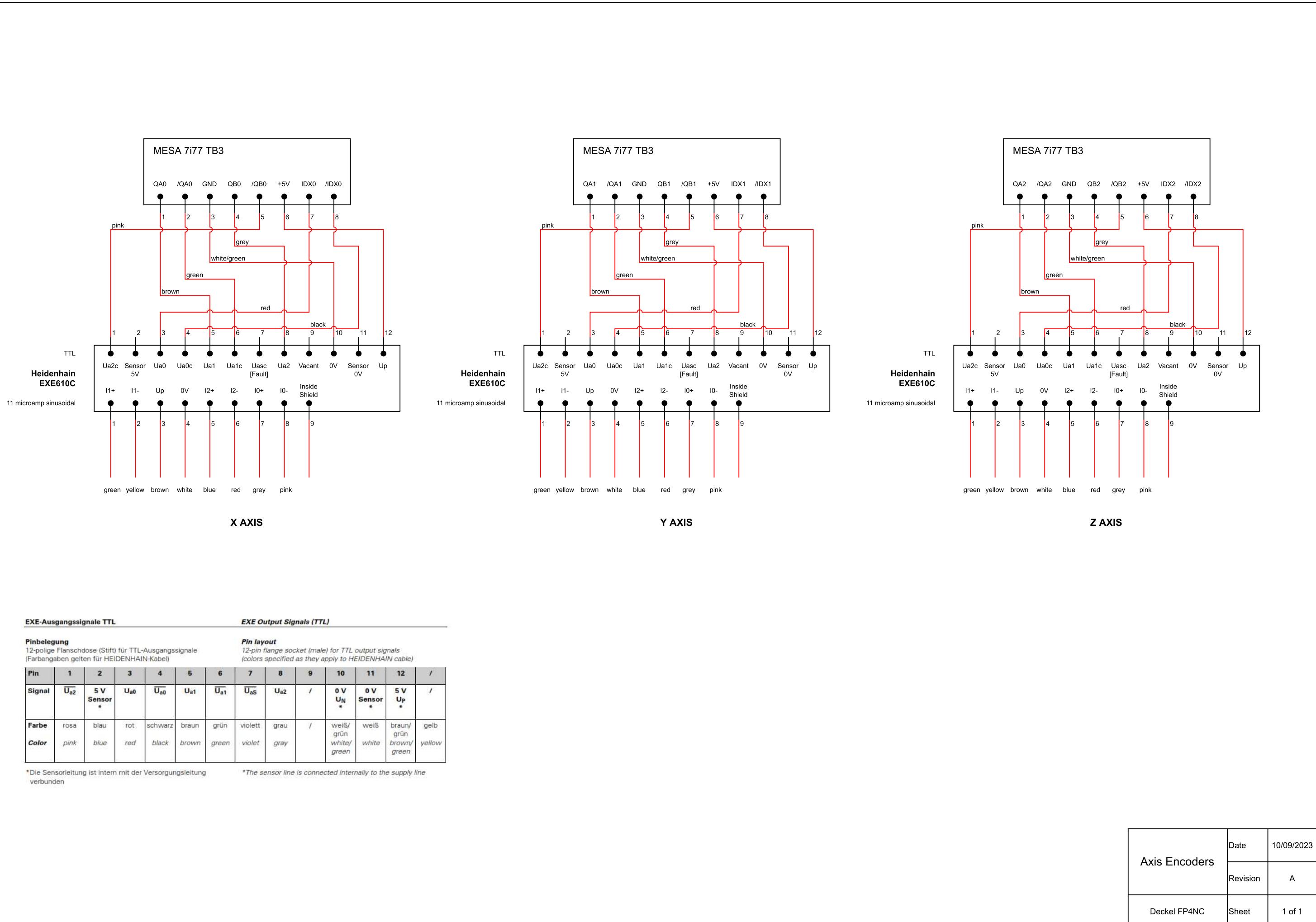


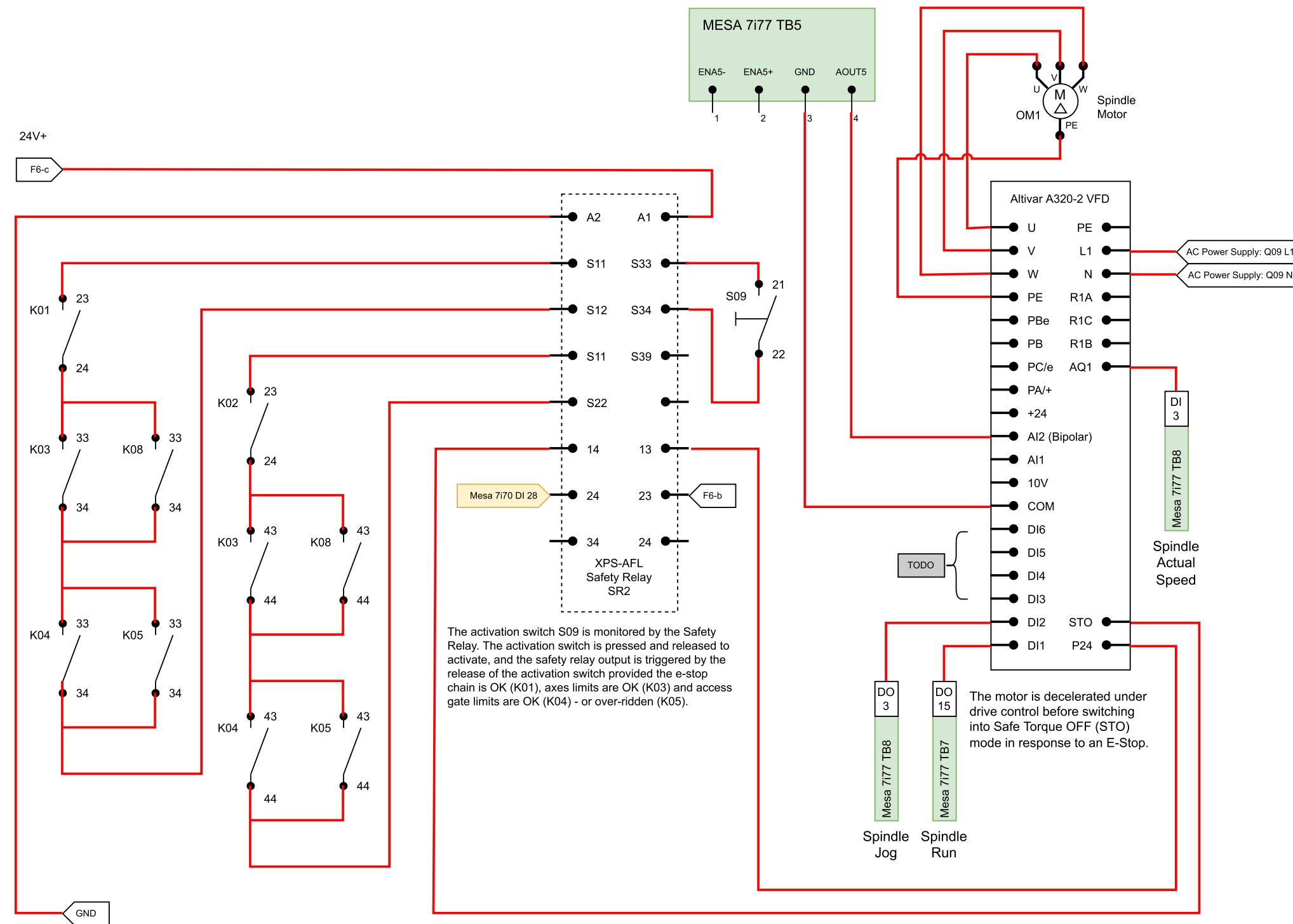
Axis Drives	Date	6/11/2023
	Revision	B
Deckel FP4NC	Sheet	4 of 5



**Z AXIS**

<b>Axis Drives</b>	Date	6/11/2023
	Revision	B
Deckel FP4NC	Sheet	5 of 5

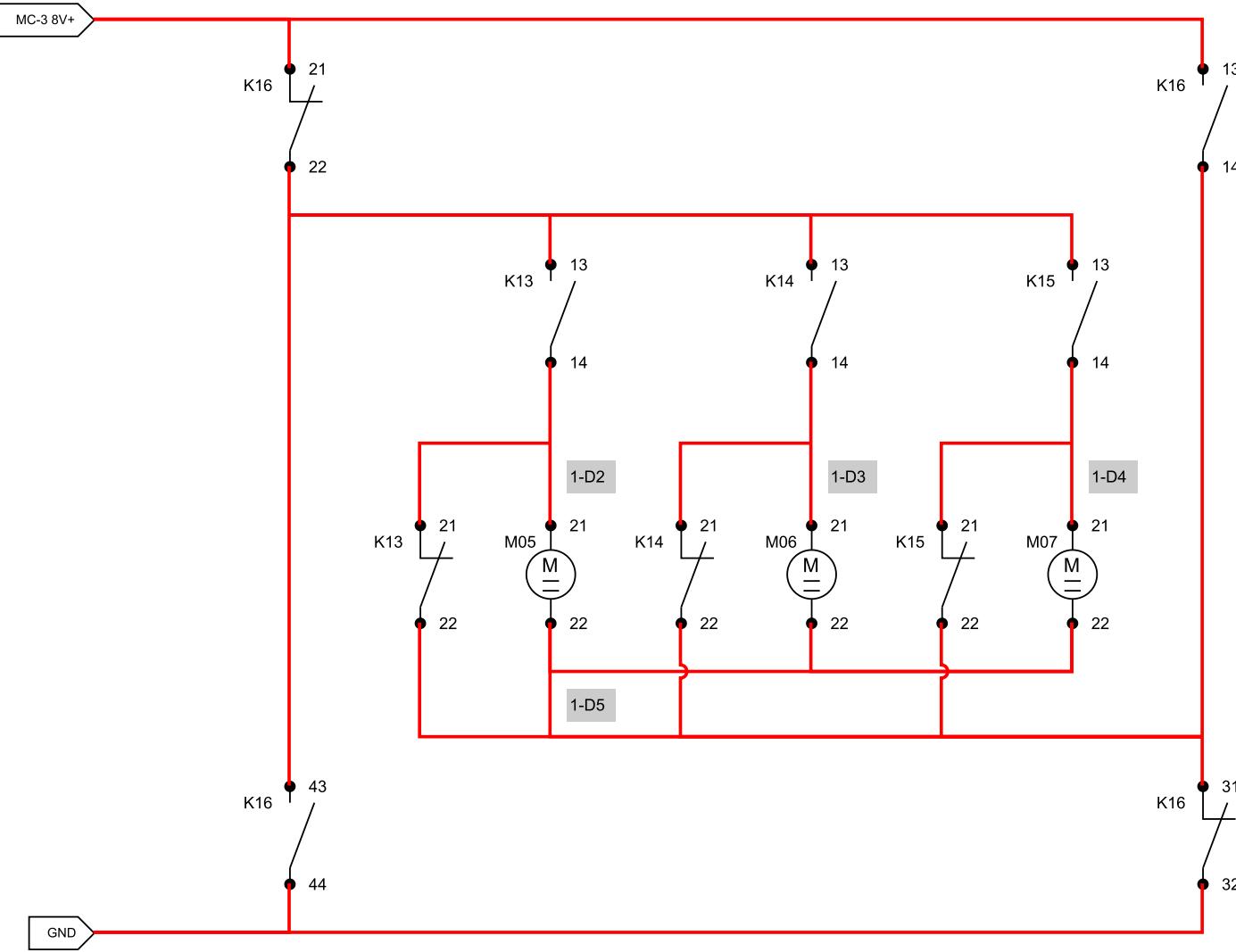




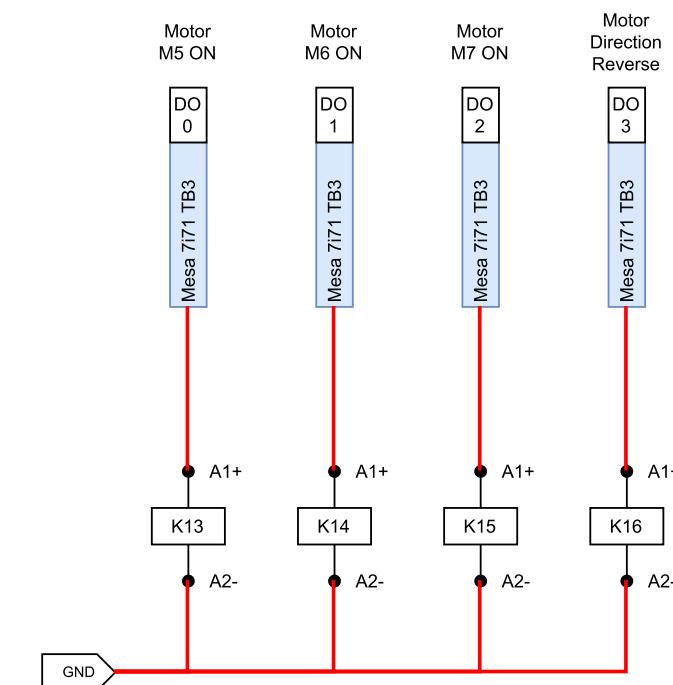
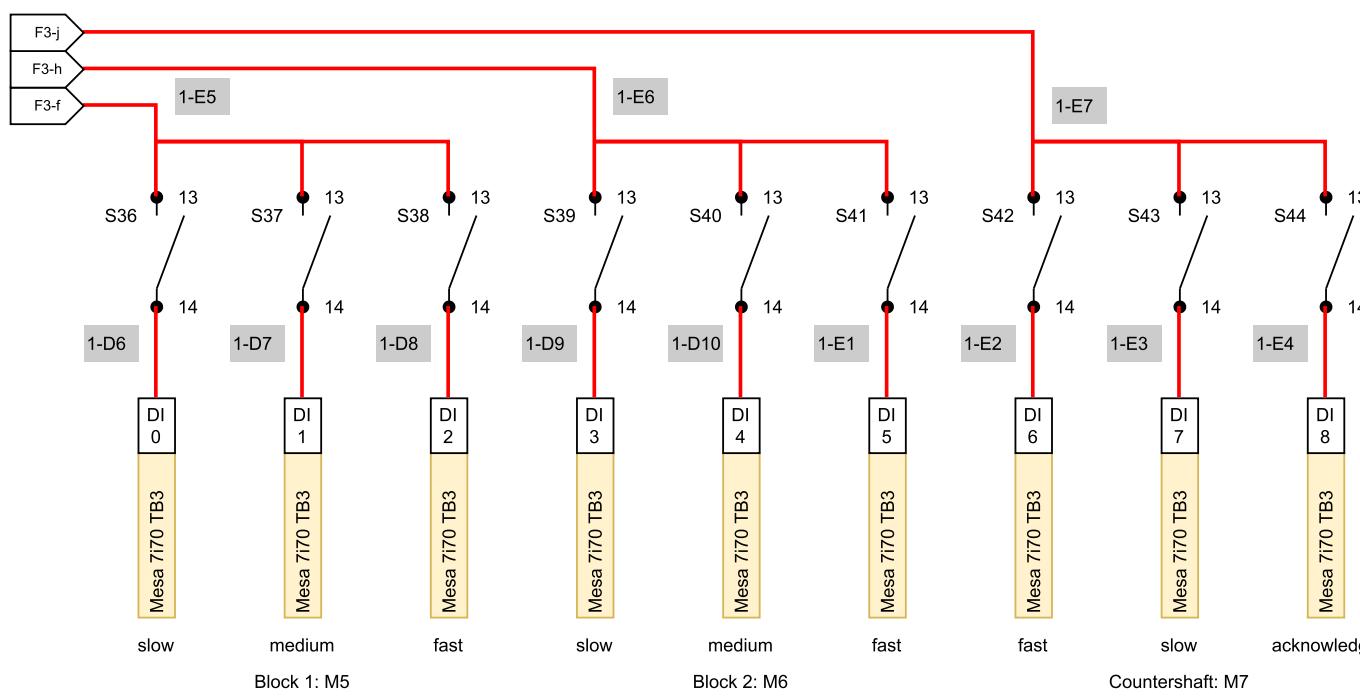
#### Spindle Functions:

- Safe Stop 1 in response to Safety Relay (E-Stop)
- Motor ON/OFF controlled by switch S20 on operator panel
- Motor Speed controlled by +0-10V analogue output (AO5) from Mesa 7i77 control card
- Jog function available (DO3) from Mesa Control Card
- Spindle actual speed [Hz] to Mesa 7i77 DI3.

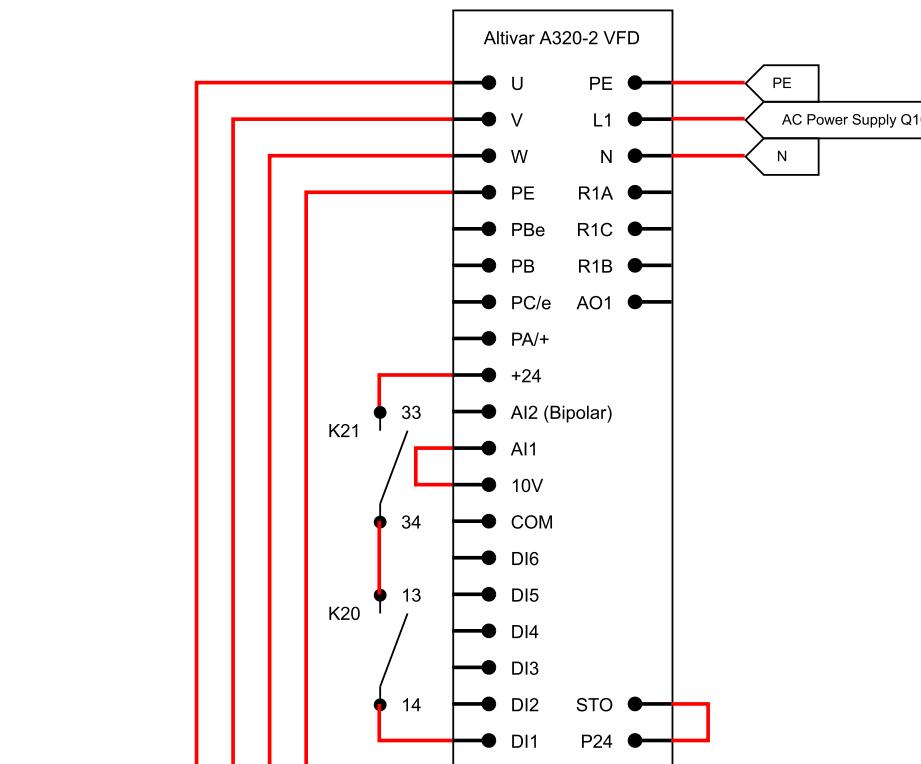
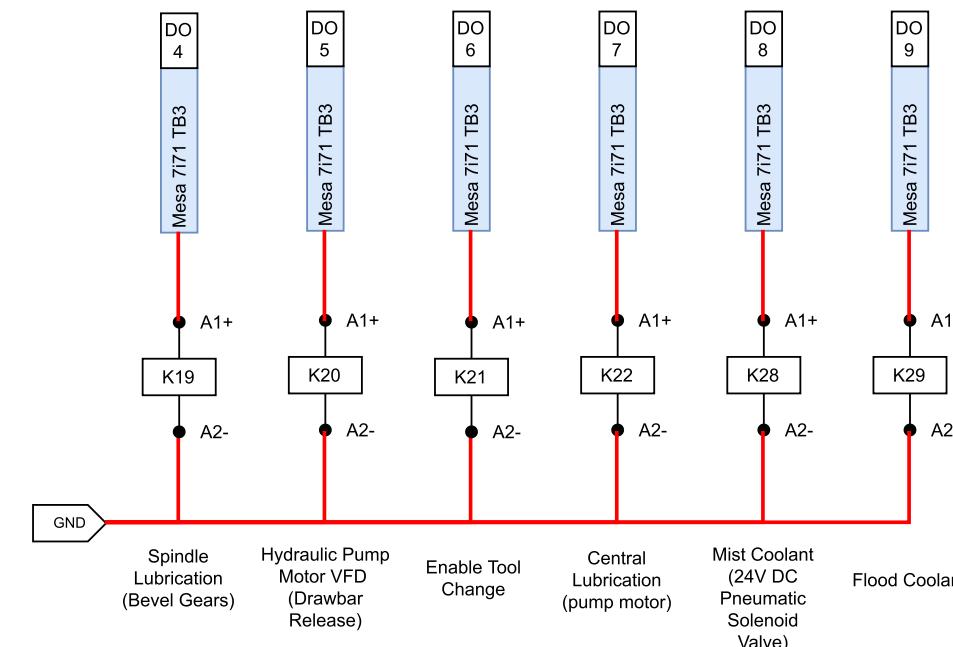
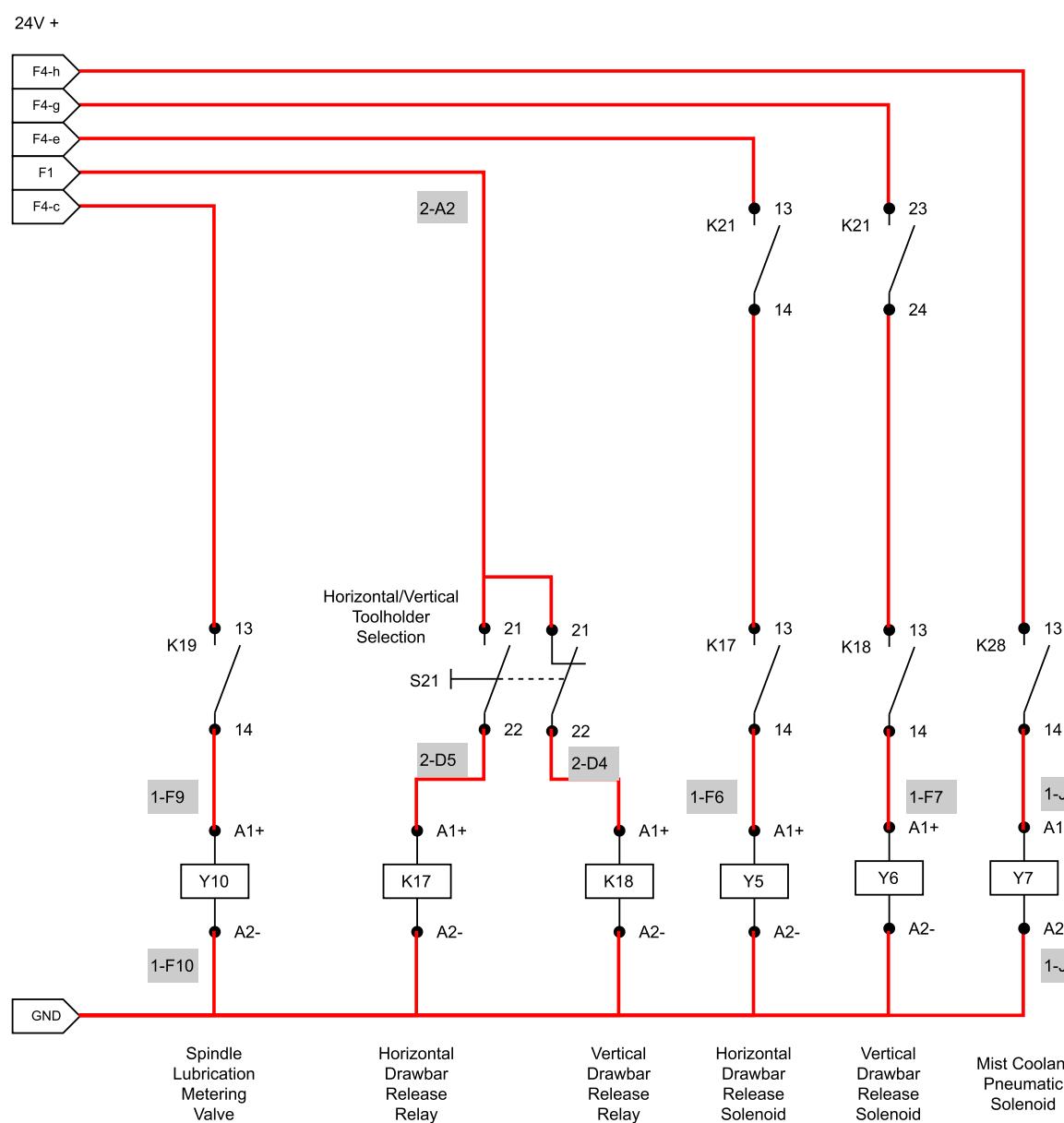
Spindle Control	Date	6/11/2023
	Revision	B
Deckel FP4NC	Sheet	1 of 1



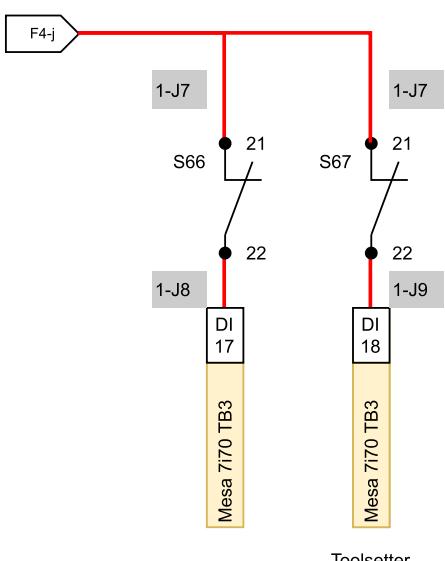
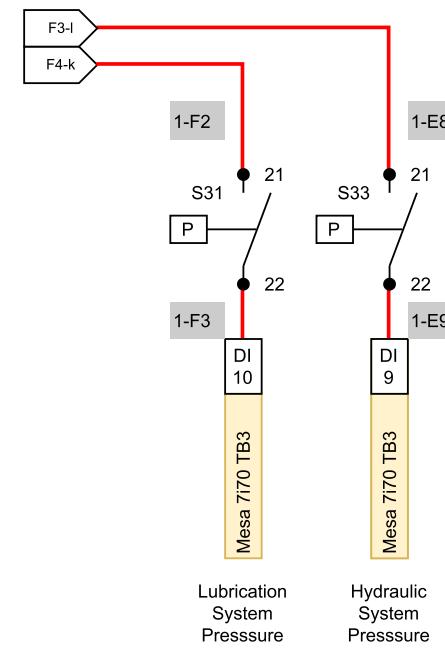
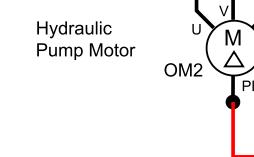
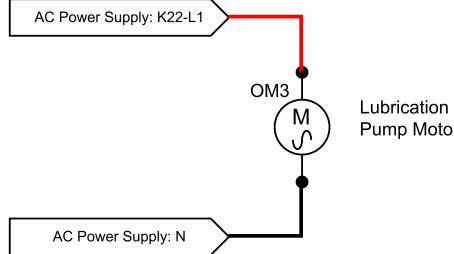
RPM	63	80	100	125	150	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	0
Switch			x		x		x	x	x	x	x	x	x	x	x	x	x	x	
S36																			
S37		x			x			x		x	x	x	x	x	x	x	x	x	
S38	x			x			x		x	x	x	x	x	x	x	x	x	x	
S39								x	x	x									
S40					x	x	x										x	x	x
S41	x	x	x													x	x	x	
S42								x	x	x	x	x	x	x	x	x	x	x	
S43	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
S44																			x



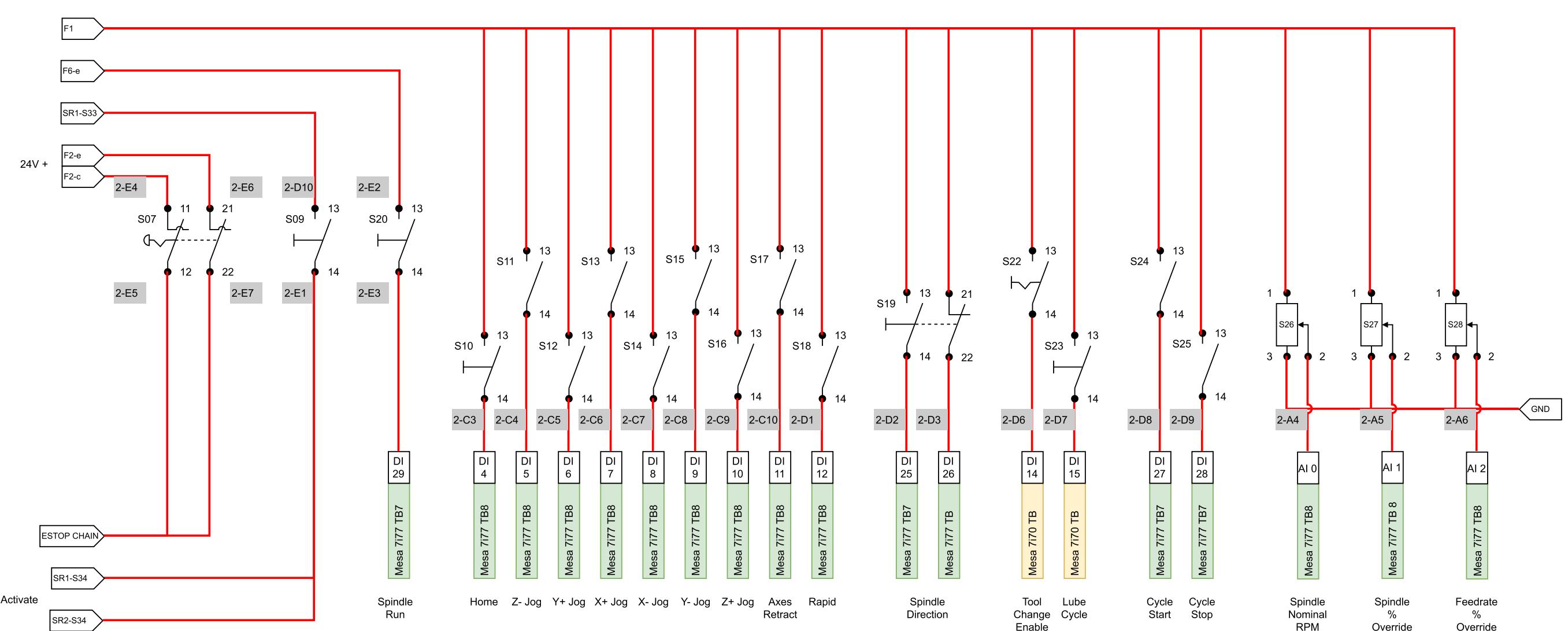
Gearshift	Date	6/11/2023
	Revision	B
Deckel FP4NC	Sheet	1 of 1



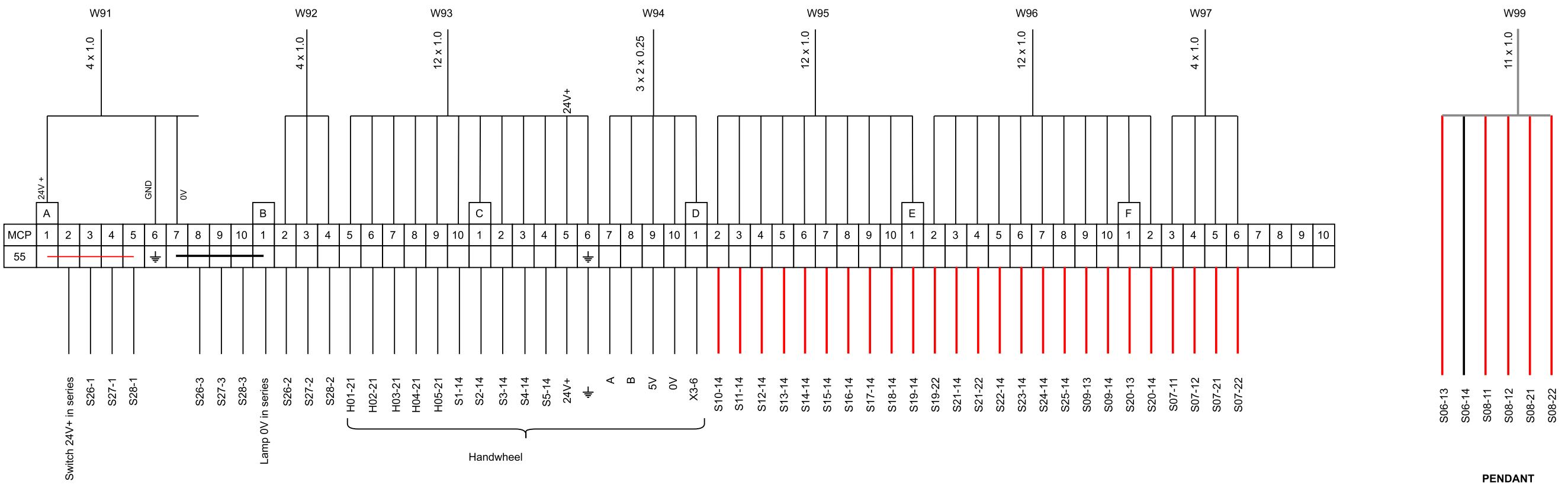
The hydraulic pump motor runs at a constant speed and is switched ON by Relay K20 via pendant tool release switch S6 only when tool change is enabled by MCP switch S22 via K21.



Lubrication and Toolchange	Date	25-01-2025
	Revision	B
Deckel FP4NC	Sheet	1 of 1

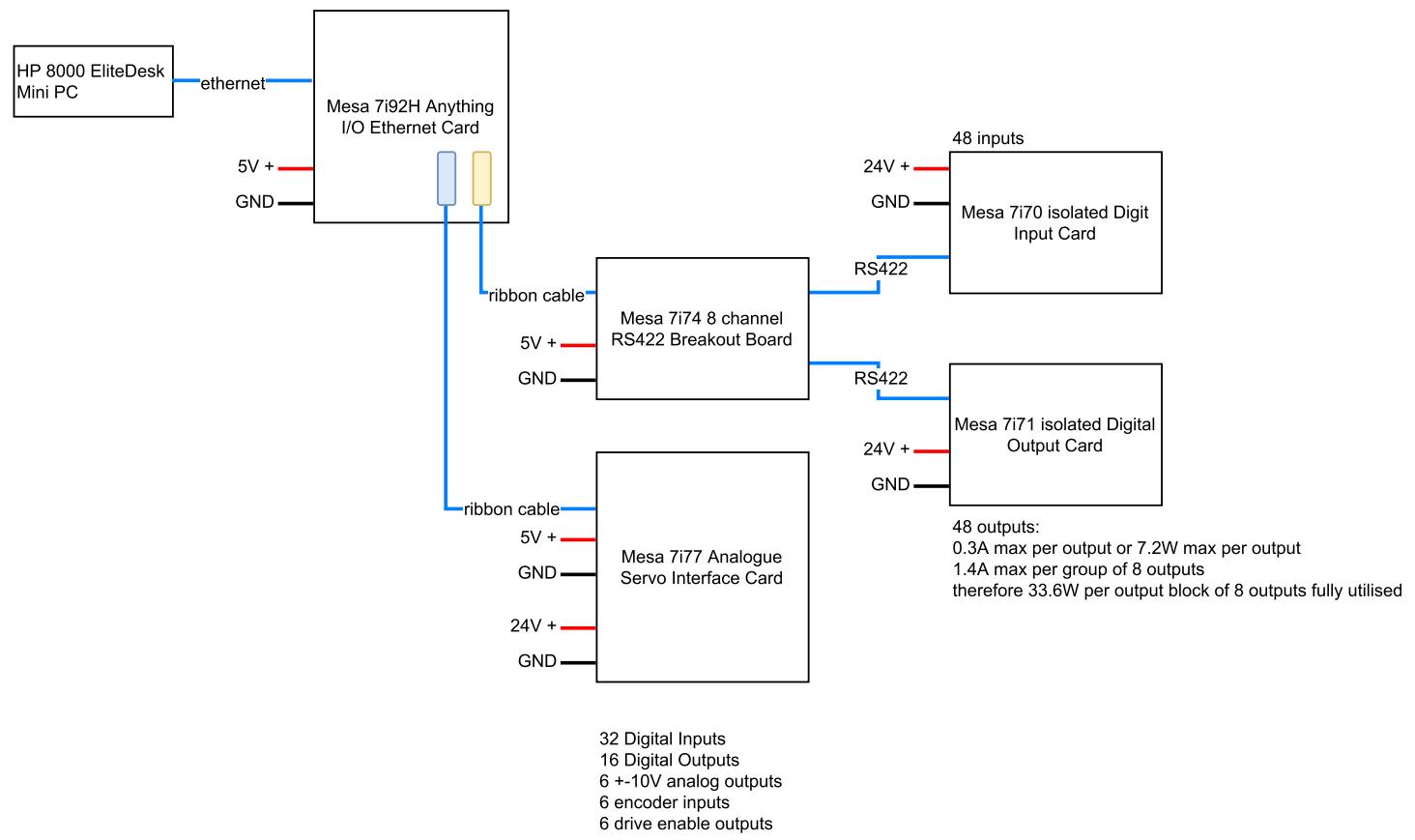


Machine Control Panel	Date	6/11/2023
	Revision	B
Deckel FP4NC	Sheet	1 of 2

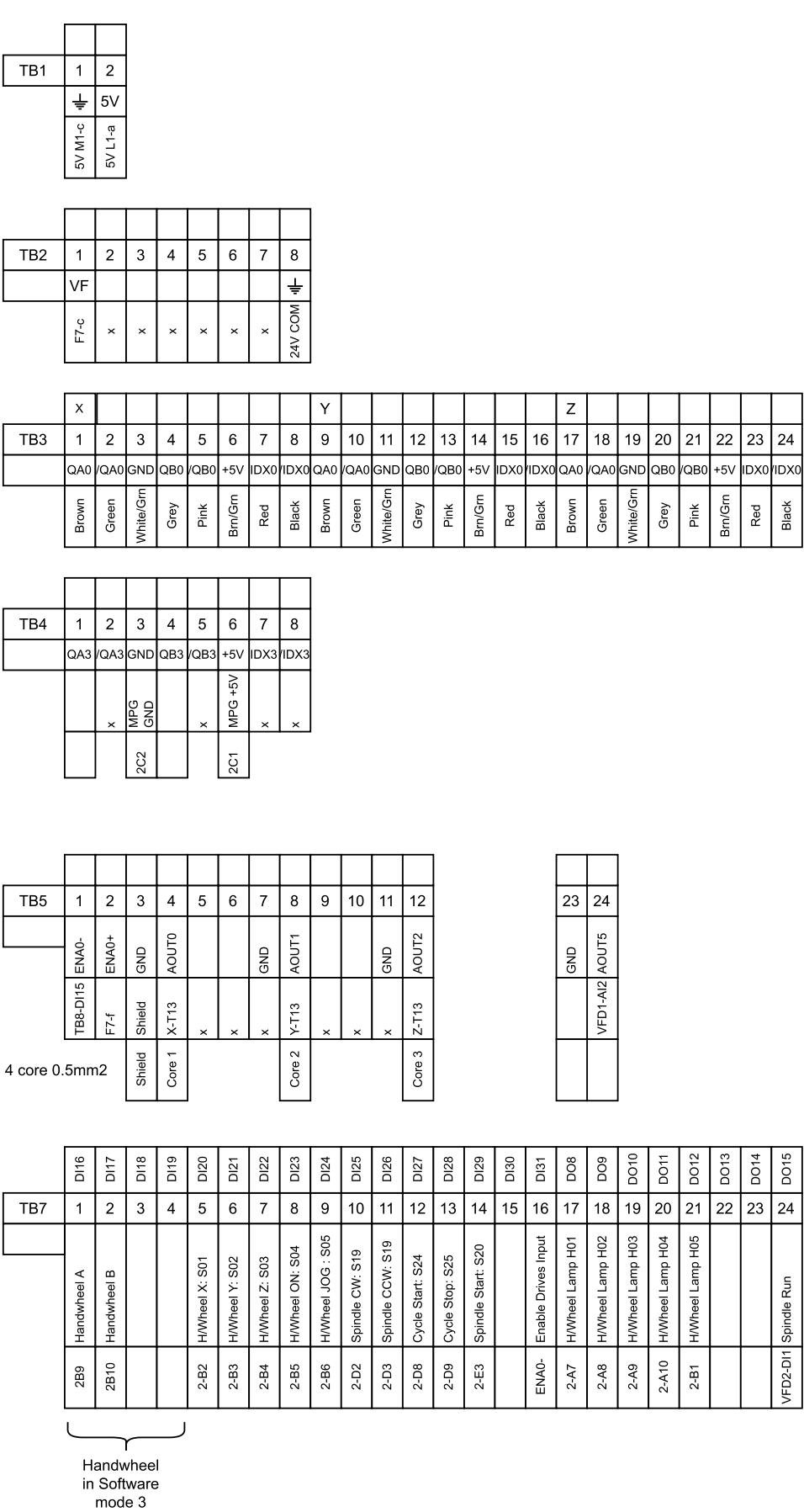


**PENDANT**

Machine Control Panel	Date	6/11/2023
	Revision	B
Deckel FP4NC	Sheet	1 of 2

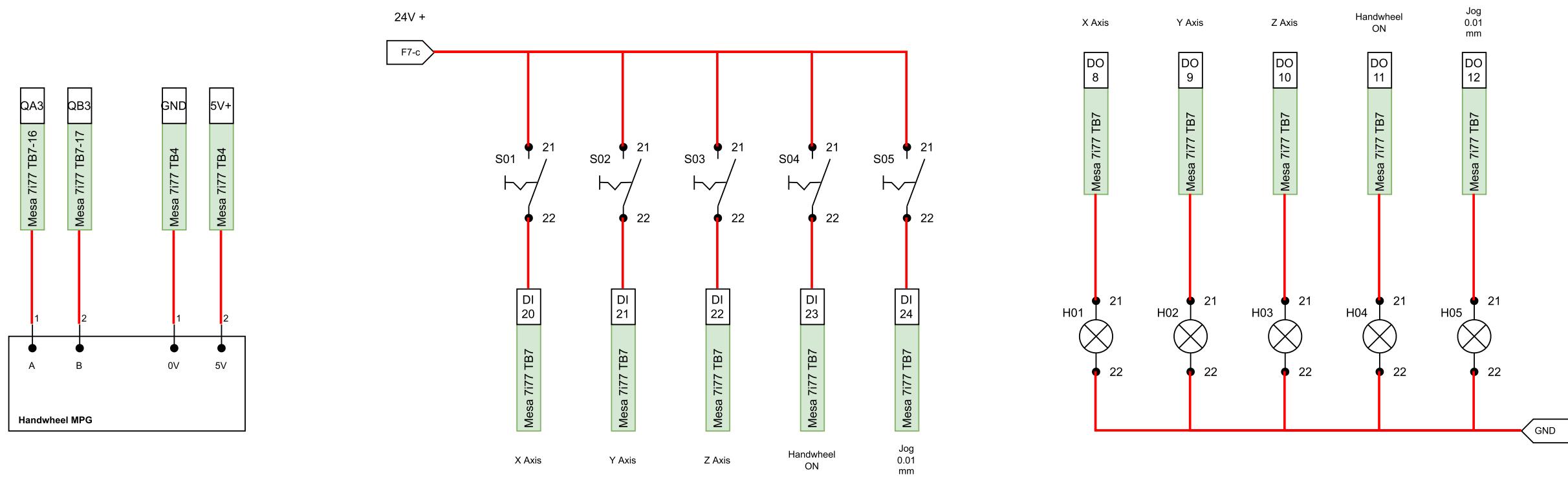


MESA 7i77 Analogue Servo



	TB1		TB2	
				F7-e
		VF		
			1	D124
1-D6	G/Box M/Switch S36	1	D10	K04-A1 Access Gate Limit Switch State
1-D7	G/Box M/Switch S37	2	D11	K01-34 E-Stop Chain State
1-D8	G/Box M/Switch S38	3	D12	K03-34 Axes E-Stop Limit Switch State
1-D9	G/Box M/Switch S39	4	D13	SRI-24 Axes Safety Relay State
1-D10	G/Box M/Switch S40	5	D14	SR2-24 Spindle Safety Relay State
1-E1	G/Box M/Switch S41	6	D15	K05-14 Access Gate Override State
1-E2	G/Box M/Switch S42	7	D16	1-A2 -X Range End
1-E3	G/Box M/Switch S43	8	D17	1-A1 -X Reduce
1-E4	G/Box M/Switch S44	9	D18	1-A7 +X Reduce
1-E9	Hyd Pressure S33	10	D19	1-A6 +X Range End
1-F3	Lube Pressure S31	11	D10	1-B1 -Y Range End
		12	D11	1-A10 -Y Reduce
		13	D12	1-B6 +Y Reduce
		14	D13	1-B5 +Y Range End
2-D6	Tool Change S22	15	D14	1-C1 -Z Range End
2-D7	Lube Cycle S23	16	D15	1-B10 -Z Reduce
2-G1	Drawbar Release	17	D16	1-C9 +Z Reduce
1-J8	Toolsetter S66	18	D17	1-C8 +Z Range End
1-J9	Toolsetter Overtravel	19	D18	X-T19 X Axis Drive OK
S67		20	D19	X-T23 X Axis Drive at Zero Speed
		21	D20	Y-T19 Y Axis Drive OK
		22	D21	Y-T23 Y Axis Drive at Zero Speed
		23	D122	Z-T19 Z Axis Drive OK
		24	D123	Z-T23 Z Axis Drive at Zero Speed
			D147	

	TB3	K13-A1	G/Box Motor M5 ON	DO0
		K14-A1	G/Box Motor M6 ON	DO1
		K15-A1	G/Box Motor M7 ON	DO2
		K16-A1	G/Box Motors Reverse	DO3
		K19-A1	Spindle Lube	DO4
		K20-A1	Hydraulic Pump ON	DO5
		K21-A1	Enable Tool Change	DO6
		K22-A1	Central Lubrication Pump	DO7
		K28-A1	Mist Coolant ON	DO8
		K29-A1	Flood Coolant ON	DO9
				DO10
				DO11
				DO12
				DO13
				DO14
				DO15
				DO16
				DO17
				DO18
				DO19
				DO20
				DO21
				DO22
				DO23
				DO24



Handwheel	Date	6/11/2023
	Revision	B
Deckel FP4NC	Sheet	1 of 1

