



U.S. DEPARTMENT OF
ENERGY



Hall A SoLID Magnet Motor Controller Relay Board (MCRB)

Marc McMullen
Detector Support Group
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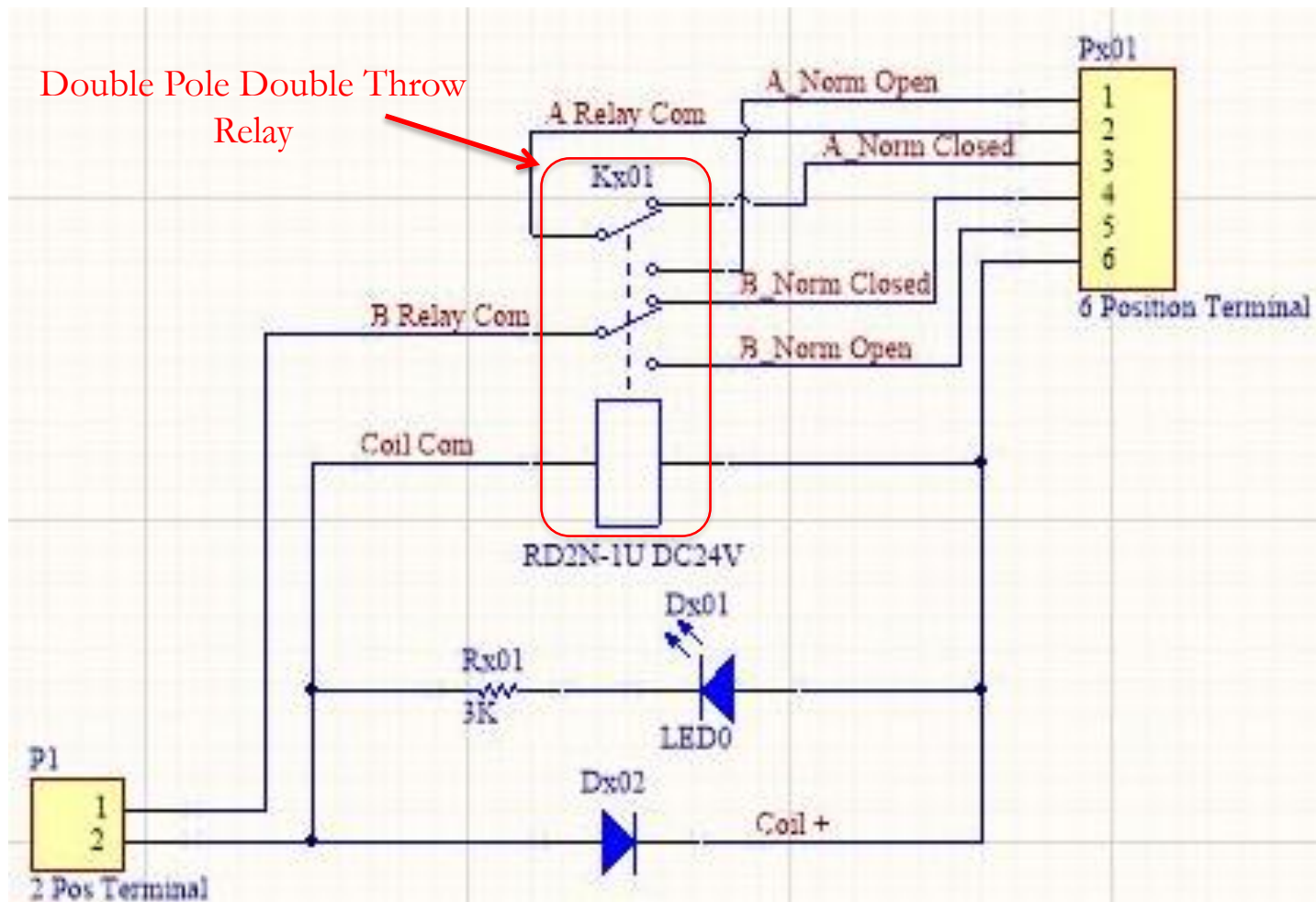
MCRB Circuit Development

- MCRB relay circuit system actuates drive motors to open/close magnet cryogen JTVs
 - JTV motor requires two relays, one to open and one to close
- MCRB can operate up to 12 JTVs

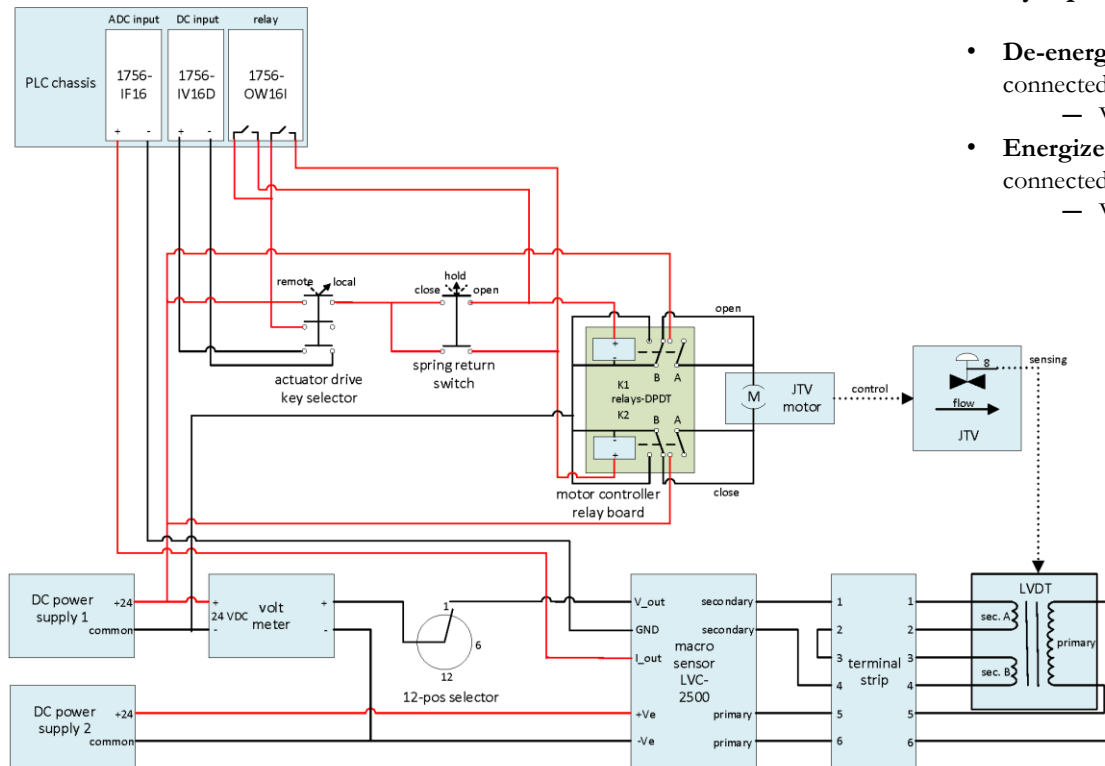
Single Channel Schematic

Two circuits control a single JTV motor

- One to open, the other to close



JTV Control Schematic



Relay Operation

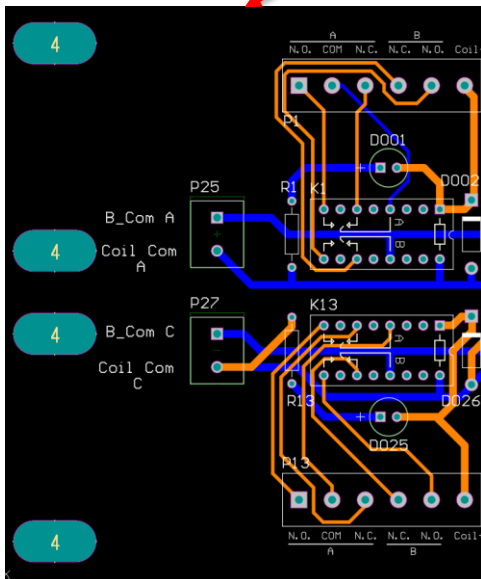
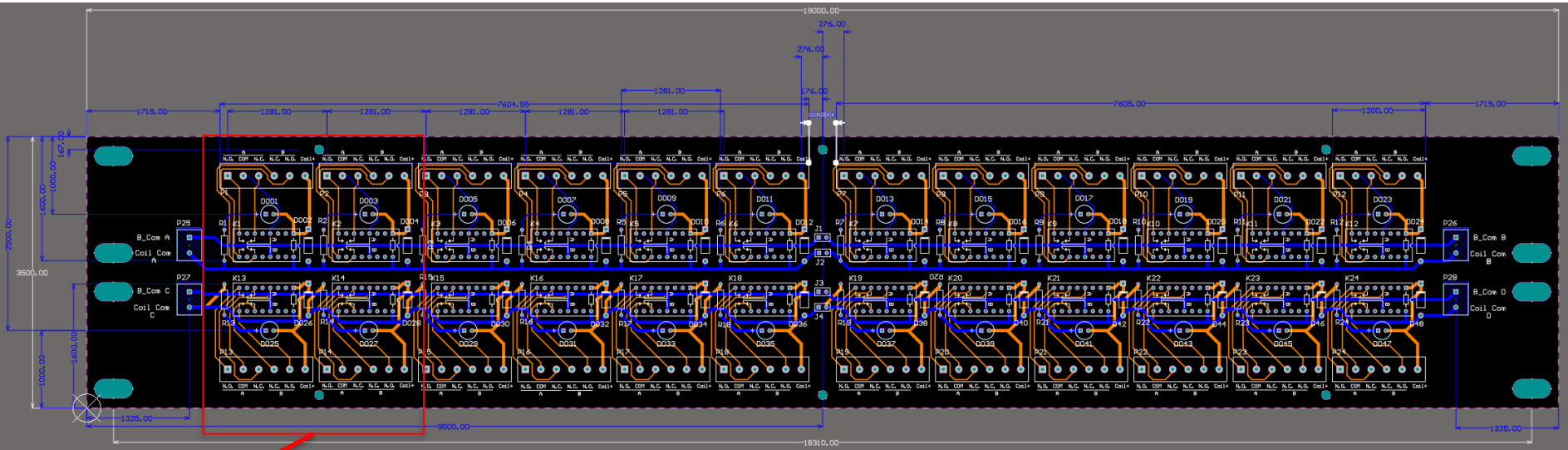
- **De-energized:** K1 and K2 “B” contacts are connected to motor
 - Valve does not move
- **Energized:** K1 (open) or K2 (close) “A” contact is connected to motor
 - Valve opens or closes

Actuator Drive Key (ADK) Position Functionality

- **Local:** Operator controls by toggling spring return switch between open or close
- **Remote:** Control is through PLC by manual operation or PID loop
 - Remote/Local state sense from ADK with IV16D module
 - Valve position is sensed from 0 to 20 mA signal from Macro Sensor LVC-2500 with IF16 module
 - Open and Close position relays are controlled from OW16I

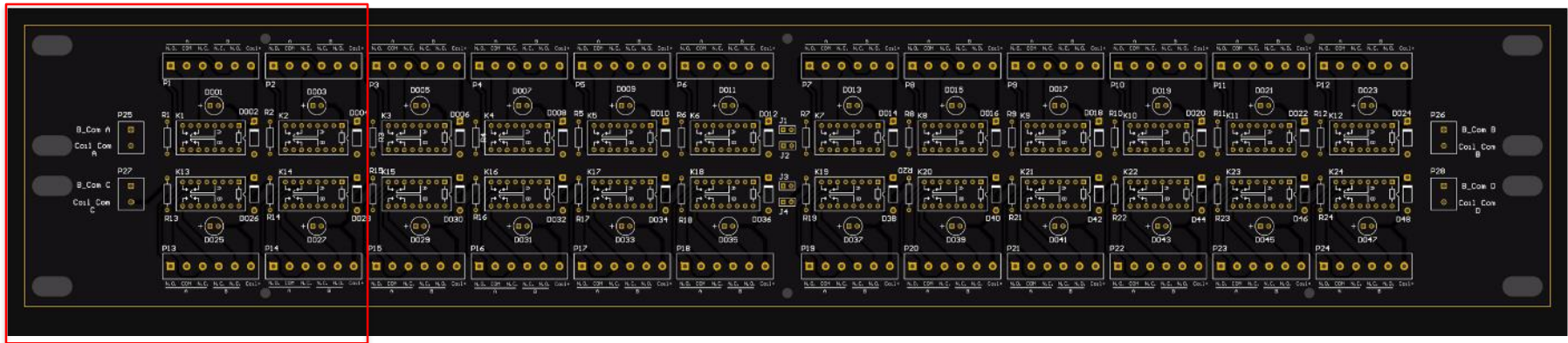
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Routing



- Two-layer board with 24 relay circuits
- Components on top layer
 - All components are through hole
- 25 mil minimum clearance between traces and ground
- 25 mil trace widths
- Coil power/return 50 mil wide traces
- 1 oz. copper thickness

PCB Rendering



Channel LED

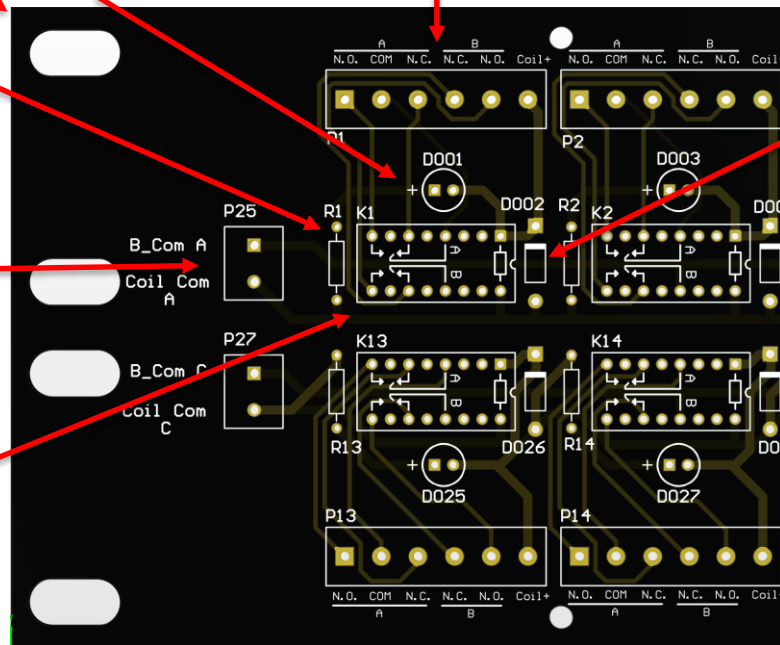
6-Position Terminal (relay and coil + contacts)

3 K Ω Resistor
(LED current limiter)

Diode

2-Position Terminal
(Relay B common contact and
coil common)

DPDT Relay



Cost Per Board

#	Part	Refernce Designator	Manufacturer	Mfg. P/N	Distributor	Dist. P/N	Cost	Parts per board	Parts Cost
1	2 Pos. Term Block	P25 - 28	Phoenix Contact	1729128	Allied	70054405	\$0.95	4	\$3.80
2	6 Pos. Term Block	P1 - 24	Phoenix Contact	1729160	Allied	70054409	\$2.89	24	\$69.36
3	Relay	K1 - 24	Omron	G5V-2-DC24	Allied	70176231	\$3.29	24	\$78.96
4	Relay Socket	K1 - 24	TE	1-2199298-4	Allied	70420185	\$2.67	24	\$64.08
5	2 Pin male header	J1 -4	Molex	87891-4006	Mouser	538-87891	\$2.52	1	\$2.52
6	3 K Resistor	R1 -24		CFR-25JR-52-2K	Mouser	603-CFR-2	\$0.10	24	\$2.40
7	GP Diode	Even D2 -48	NTE	1N4004	Allied	70723010	\$0.05	24	\$1.20
8	Gr LED	Odd D1 - 47	Cree	C503B-GAN-CB0F0791	Mouser	941-C503B	\$0.25	24	\$6.00
9	24 Ch Relay Board		Fusion PCB	24 Ch_Relay			\$22.00	1	\$22.00
	Total								\$250.32

Total cost for a board with components is \$250

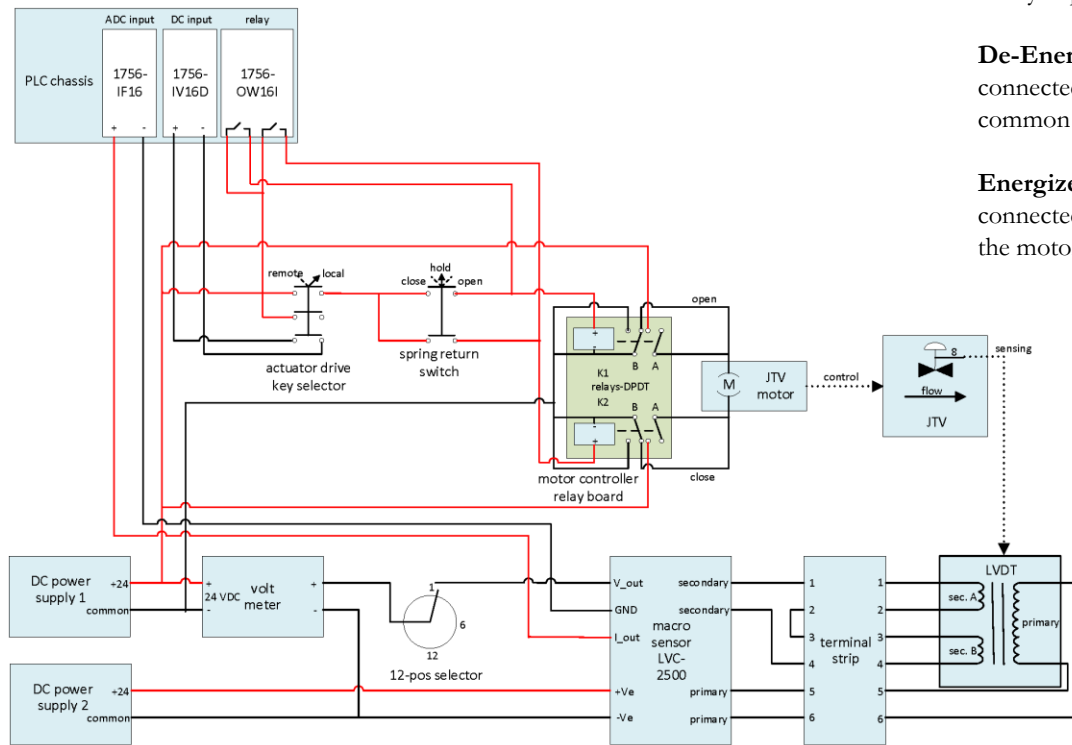
Conclusion

- DSG has designed a 24-Channel MCRB for SoLID magnet
 - Cost per board with components is \$250
- Design under review

End

Thank You

Backup: JT Valve Control Schematic (Detailed)



Relay Operation

De-Energized: K1 and/or K2 “B” contacts are connected to motor drive directions. This connects to common and allows no motor operation.

Energized: Either K1 or K2 “A” contacts are connected to motor drive connections. This connects the motor to turn in that direction.

- The Motor Controller Relay Board will be used to actuate JTVs by controlling the drive and direction of the valve motor. This function is done manually by operating the spring return switch while the actuator drive key selector is in local position.
- When the actuator drive key selector is in remote mode, the PLC senses this state with the IV16D module. In this setting, the system can operate autonomously or manually. The PLC uses the IF16 module to sense a 0 to 20 mA signal from the Macro Sensor LVC-2500 to determine the position of the JTV and correct it by controlling a set of relays on the Motor Controller Relay Board with the OW16I module. This is done in the same manner as a human operator would using the spring return switch .

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Fusion PCB Quote (without shipping)

▼ PCB Cost		USD\$121.32
Base Material	FR-4 TG130	
No. of Layers	2 layers	
PCB Dimensions	88.9mm * 482.6mm	
PCB Quantity	10	
No. of Different Designs	1	
PCB Thickness	1.60mm	
PCB Color	Black	
Surface Finish	ENIG	
Minimum Solder Mask Dam	0.4mm↑	
Copper Weight	1oz.	
Minimum Drill Hole Size	0.3mm	
Trace Width / Spacing	6/6 mil	
Blind or Buried Vias	No	
Plated Half-holes / Castellated Holes	No	
Impedance Control	No	
Sub-Total	USD\$121.32	
Production Time ⓘ	4 ~ 5 Working Days	
Weight	1.37kg	
Shipping	Calculated at Checkout	
<div>Add to Cart</div>		