HALL D
PLC Control System Solenoid Report

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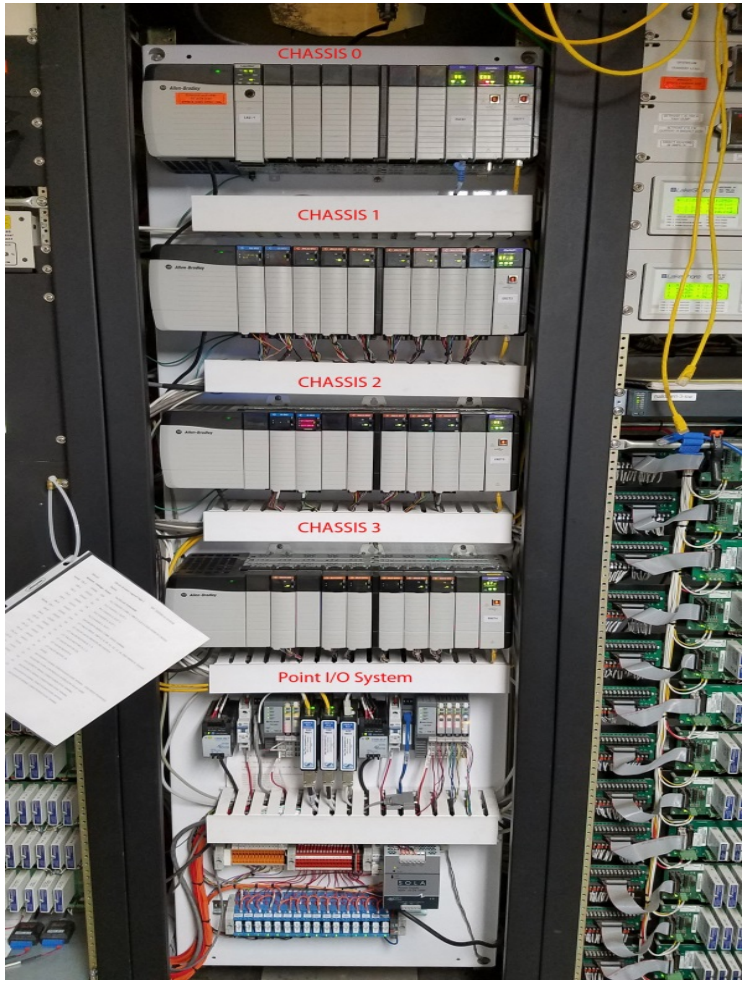
Solenoid Control System

The Solenoid PLC control system is one of the eight PLC systems located in Hall D.

This system is made up of four chassis (0-3) and two Point I/O systems.

Each chassis carries different types of communication modules.

Configuration of the control system in the Solenoid-Location in Hall D



Chassis 0

- Used to set the controller and communication modules for the whole PLC system in the solenoid.

Power Supply/AB Controller control-Logix 1756-L62 5562 /E-WEB, ControlNet and Ethernet modules

Spreadsheet Layout for Chassis 0

Chassis 0		Slot 0	Slot 1	Slot 2	Slot 3	Slot 4	Slot 5	Slot 6	Slot 7	Slot 8	Slot 9
	Power Supply 1756-PA72	Controller 1756-L62							WEB+ 1756-EWEBIA	ControlNet Bridge 1756-CN2/B	EtherNet /IP 1756EN2T
Bit/Channel 00											
Bit/Channel 01											
Bit/Channel 02											
Bit/Channel 03											
Bit/Channel 04											
Bit/Channel 05											
Bit/Channel 06											
Bit/Channel 07											
Bit/Channel 08											
Bit/Channel 09											
Bit/Channel 10											
Bit/Channel 11											
Bit/Channel 12											
Bit/Channel 13											
Bit/Channel 14											
Bit/Channel 15											

Chassis 1

- Sequence-of-events modules used to control hardware status of the entire solenoid system.
- Analog inputs in slots 2, 5, and 8 are reading the voltage taps for the four solenoid coils.
- Analog inputs in slots 3, 4 , 6, and 7 analyze the signal from the temperature and strain gauge sensors in coil 1 and coil 2.

Power Supply /digital SOE modules/ analog inputs and Ethernet/IP communication

Spreadsheet Layout for Chassis 1

Chassis 1		Slot 0	Slot 1	Slot 2	Slot 3	Slot 4	Slot 5	Slot 6	Slot 7	Slot 8	Slot 9
	Power Supply 1756-PA72	Iso. 24 V Sequ. of Events Input 1756-IB16ISOE	Iso. 24 V Sequ. of Events Input 1756-IB16ISOE	Analog Input 1756-IF16	Analog Input 1756-IF16	Analog Input 1756-IF16	Analog Input 1756-IF16	Analog Input 1756-IF16	Analog Input 1756-IF16	Analog Input 1756-IF16	EtherNet /IP 1756EN2T
Bit/Channel 00		Spare	Spare	VTT #1	SC1_TP1	SC1_SG1	VTT #9	SC2_TP1	SC2_SG1	VTT #17	
Bit/Channel 01		MPS Relay 1 Phase Detector	Fast Relay 1 Vacuum SUM	VTT #2	SC1_TP2	SC_1SG2	VTT #10	SC2_TP2	SC2_SG2	VTT #18	
Bit/Channel 02		MPS Relay 2 A/C Overcurrent	Fast Relay 2 LHe Liquid Level	VTT #3	SC1_TP3	SC1_SG3	VTT #11	SC2_TP3	SC2_SG3	VTT #19	
Bit/Channel 03		MPS Relay 3 Water Flow	Fast Relay 3 DS Lead Flow	VTT #4	SC1_TP4	SC1_SG4	VTT #12	SC2_TP4	SC2_SG4	Spare	
Bit/Channel 04		MPS Relay 4 Overtemp String	Fast Relay 4 US Lead Flow	VTT #5	SC1_TP5	SC1_SG5	VTT #13	SC2_TP5	SC2_SG5	Spare	
Bit/Channel 05		MPS Relay 5 Slow Dump SUM	Fast Relay 5 DSCL Temp	VTT #6	SC1_TP6	SC1_SG6	VTT #14	SC2_TP6	SC2_SG6	Spare	
Bit/Channel 06		MPS Relay 6 Ground Fault	Fast Relay 6 DSCLr Temp	VTT #7	SC1_TP7	SC1_SG_T	VTT #15	SC2_TP7	Spare	Spare	
Bit/Channel 07		MPS Relay 7 CEBAF Panel	Fast Relay 7 USCL Temp	VTT #8	SC1_TP8	SC1_SG_B	VTT #16	SC2_TP8	Spare	Spare	
Bit/Channel 08		MPS Relay 8 Fast Dump SUM	Fast Relay 8 USCLr Temp	Spare	SC1_TCR1	Spare	Spare	SC2_TCR1	Spare	Spare	
Bit/Channel 09		MPS Relay 9 E-Stop / Doors	Fast Relay 9 DSCL Voltage	Spare	SC1_TCR2	Spare	Spare	SC2_TCR2	Spare	Spare	
Bit/Channel 10		MPS Relay 10 Main Contactor	Fast Relay 10 USCL Voltage	Spare	SC1_TCR3	Spare	Spare	SC2_TCR3	Spare	Spare	
Bit/Channel 11		Slow Relay 1 VT Cable Intlck	Fast Relay 11 PLC Fast Dump	Spare	SC1_TCR4	Spare	Spare	SC2_TCR4	Spare	Spare	
Bit/Channel 12		Slow Relay 2 Cable Interlocks	Fast Relay 12 Quench Detector	Spare	SC1_TCR5	Spare	Spare	SC2_TCR5	Spare	Spare	
Bit/Channel 13		Slow Relay 3 PLC Watchdog	Refigerator Monitor	Spare	SC1_TCR6	Spare	Spare	SC2_TCR6	Spare	Spare	
Bit/Channel 14		Slow Relay 4 PLC Slow Dump	Spare	Spare	SC1_TCR7	Spare	Spare	SC2_TCR7	Spare	Spare	
Bit/Channel 15		Spare	Spare	Spare	SC1_TCR8	Spare	Spare	SC1_TCR8	Spare	Spare	
		Wiring Schematic Page - 0110	Wiring Schematic Page - 0120	Wiring Schematic Page - 0107	Wiring Schematic Page - 0111	Wiring Schematic Page - 0112	Wiring Schematic Page - 0108	Wiring Schematic Page - 0114	Wiring Schematic Page - 0115	Wiring Schematic Page - 0109	

Chassis 2

- Slots 1 and 2 hold DC inputs used for signals on the quench detector interlocks and magnet power supply.
- The signal in slot 2 is used to diagnose inputs from the UPS.
- The analog input modules in slots 4–7 analyze the signals from the temperature and strain gauge sensors in coils 3 and 4.

Power Supply with digital/analog inputs and Ethernet communication module

Spreadsheet Layout for Chassis 2

Chassis 2		Slot 0	Slot 1	Slot 2	Slot 3	Slot 4	Slot 5	Slot 6	Slot 7	Slot 8	Slot 9
	Power Supply 1756-PA72		10-30 V DC Input 1756-IV16	10-30 V DC Diagnostic Input 1756-IB16D		Analog Input 1756-IF16	Analog Input 1756-IF16	Analog Input 1756-IF16	Analog Input 1756-IF16		EtherNet /IP 1756EN2T
Bit/Channel 00			QD_U1	UPS Setpoint		SC3_TP1	SC3_SG1	SC4_TP1	SC4_SG1		
Bit/Channel 01			QD_L1	UPS Setpoint		SC3_TP2	SC3_SG2	SC4_TP2	SC4_SG2		
Bit/Channel 02			QD_U2	Spare		SC3_TP3	SC3_SG3	SC4_TP3	SC4_SG3		
Bit/Channel 03			QD_L2	Spare		SC3_TP4	SC3_SG4	SC4_TP4	SC4_SG4		
Bit/Channel 04			QD_U3	Spare		SC3_TP5	SC3_SG5	SC4_TP5	SC4_SG5		
Bit/Channel 05			QD_L3	Spare		SC3_TP6	SC3_SG6	SC4_TP6	SC4_SG6		
Bit/Channel 06			QD_U4	Spare		SC3_TP7	Spare	SC4_TP7	Spare		
Bit/Channel 07			QD_L4	Spare		SC3_TP8	Spare	SC4_TP8	Spare		
Bit/Channel 08			QD_SUM	Spare		SC3_TCR1	Spare	SC4_TCR1	Spare		
Bit/Channel 09			Spare	Spare		SC3_TCR2	Spare	SC4_TCR2	Spare		
Bit/Channel 10			Dump Switch Status	Spare		SC3_TCR3	Spare	SC4_TCR3	Spare		
Bit/Channel 11			CEV Key switch Remote Position	Spare		SC3_TCR4	Spare	SC4_TCR4	Spare		
Bit/Channel 12			MPS Control Power	Spare		SC3_TCR5	Spare	SC4_TCR5	Spare		
Bit/Channel 13			MPS Main Power	Spare		SC3_TCR6	Spare	SC4_TCR6	Spare		
Bit/Channel 14			MPS Ready	Spare		SC3_TCR7	Spare	SC4_TCR7	Spare		
Bit/Channel 15			MPS Sum Interlock	Spare		SC1_TCR8	Spare	SC1_TCR8	Spare		
		Wiring Schematic Page - 0	Wiring Schematic Page - 0101	Wiring Schematic Page - 0102	Wiring Schematic Page - 0	Wiring Schematic Page - 0116	Wiring Schematic Page - 0117	Wiring Schematic Page - 0118	Wiring Schematic Page - 0119	Wiring Schematic Page - 0	

Chassis 3

- Most of chassis 3 controls the Cryo-system.
- Slots 1, 6, and 7 are analog inputs that analyze the signals from the temperature, cryogenic levels, pressure, and vacuum coming from the distribution box .
- Slots 3, 4, and 5 contain the relay outputs used to control the opening and closing of the JT valves in the whole Cryo-system.

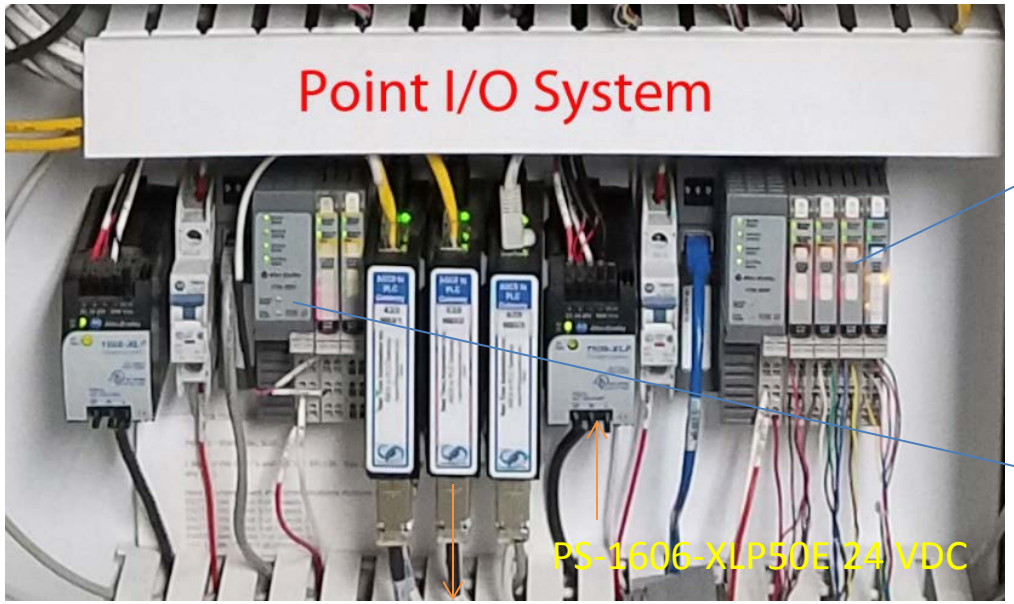
Power Supply with analog inputs/outputs relay and Ethernet communication module

Spreadsheet Layout for Chassis 3

Chassis 3		Slot 0	Slot 1	Slot 2	Slot 3	Slot 4	Slot 5	Slot 6	Slot 7	Slot 8	Slot 9
	Power Supply 1756-PA72		Analog Input 1756-IF16		Isolated Relay 1756-OW16I	Isolated Relay 1756-OW16I	Isolated Relay 1756-OW16I	Analog Input 1756-IF16	Analog Input 1756-IF16		EtherNet /IP 1756EN2T
Bit/Channel 00			Coil 2 Conv Vacuum		LN2 (HX) JTV #8 **CLOSE**	Spare	Spare	LN2 BAYONET TP_NSB PT-100	Coil # 1 He FILL LVDT # 1		
Bit/Channel 01			Coil 1 Conv Vacuum		LN2 (HX) JTV #8 **OPEN**	Spare	Spare	LN2 SUPPLY TP_NS PT-100	Coil # 2 He FILL LVDT # 2		
Bit/Channel 02			Coil 3 Conv Vacuum		LN2 Tank JTV #7 **CLOSE**	He Tank JTV #10 **CLOSE**	Spare	TP_USCLW PT-100	Coil # 3 He FILL LVDT # 3		
Bit/Channel 03			Coil 4 Conv Vacuum		LN2 Tank JTV #7 **OPEN**	He Tank JTV #10 **OPEN**	Spare	TP_DSCLW PT-100	Coil # 4 He FILL LVDT # 4		
Bit/Channel 04			LN2 Liquid Level		He MIX (HX) JTV #9 **CLOSE**	Spare	Spare	Combination Vacuum Gauge _A	LHe RETURN LVDT # 5		
Bit/Channel 05			Temp. Heat Exchanger		He MIX (HX) JTV #9 **OPEN**	Spare	Spare	Combination Vacuum Gauge _B	LN2 TANK FILL LVDT # 7		
Bit/Channel 06			LN2 Differential Pressure Sensor		Coil # 3 He JTV #3 **CLOSE**	Spare	Spare	WH RETURN VP CEV # 6	LN2 Supply (HX) LVDT # 8		
Bit/Channel 07			LHe Differential Pressure Sensor		Coil # 3 He JTV #3 **OPEN**	Spare	PLC FAST Relay	Spare	LHe MIX (HX) LVDT # 9		
Bit/Channel 08			LHe TANK Pressure sensor		Coil # 1 He JTV #1 **CLOSE**	Spare	Keep Alive RESET	System Vacuum SCC_PI_VAC	LHe TANK FILL LVDT # 10		
Bit/Channel 09			LHe SUPPLY Pressure Sensor		Coil # 1 He JTV #1 **OPEN**	Spare	Keep Alive CONTROL	Coil # 1 Vacuum SC1_PI_V V1	Upstream Current Lead		
Bit/Channel 10			LN2 Supply Pressure Sensor		Coil # 2 He JTV #2 **CLOSE**	Spare	Spare	Coil # 2 Vacuum SC2_PI_V V2	Downstream Current Lead		
Bit/Channel 11			LN2 TANK Pressure Sensor		Coil # 2 He JTV #2 **OPEN**	Spare	Spare	Coil # 3 Vacuum SC3_PI_V V3	Solenoid Magnet HALL PROBE		
Bit/Channel 12			Nitrogen (Cryo) Contamination		Coil # 4 He JTV # 4 **CLOSE**	Spare	PLC SLOW Relay	Coil # 4 Vacuum SC4_PI_V V4	Power supply SHUNT Output		
Bit/Channel 13			Helium (Cryo) Contamination		Coil # 4 He JTV # 4 **OPEN**	Spare	PS Control Board RESET	System Vacuum SCC_PI_MAN	Power supply GROUND FAULT		
Bit/Channel 14			Helium MIX Temp. Heat Exchanger		He Return JTV # 5 **CLOSE**	Spare	Dump Diode Fault RESET	DBOX Conv Vacuum	P/S Passbank Voltage		
Bit/Channel 15			LHe Liquid Level		He Return JTV # 5 **OPEN**	Spare	Quench Detector RESET	Manifold Conv Vacuum	Power Supply Voltage		
		Wiring Schematic Page - 0	Wiring Schematic Page - 0121	Wiring Schematic Page - 0	Wiring Schematic Page - 0103	Wiring Schematic Page - 0104	Wiring Schematic Page - 0105	Wiring Schematic Page - 0106	Wiring Schematic Page - 0113	Wiring Schematic Page - 0	

Point I/O Systems

NBX435 ASCII-to-PLC Modules



Spreadsheet HalldAENT3

	IP: 129.57.26.96 HalldAENT3				
Chassis	Slot 0	Slot 1	Slot 2	Slot 3	Slot 4
	Ethernet Adapter 1734-AENT	Analog I Input 1734-IE2V/C	Analog I Input 1734-IE2V/C	Analog I Input 1734-IE2V/C	DC Input 1734-IB8
Bit/Channel 00		[Dbox_PumpSpeed]	[C2_PumpSpeed]	[C3_PumpSpeed]	[Dbox_VacValve]
Bit/Channel 01		Spare	[C1_PumpSpeed]	[C4_PumpSpeed]	[C1_VacValve]
Bit/Channel 02					[C2_VacValve]
Bit/Channel 03					[C3_VacValve]
Bit/Channel 04					[C4_VacValve]
Bit/Channel 05					Spare
Bit/Channel 06					Spare
Bit/Channel 07					Spare

Spreadsheet HalldAENT1

	HalldAENT1		
Chassis	Slot 0	Slot 1	Slot 2
	Ethernet Adapter 1734-AENT	Analog I Output 1734-OE4C	Analog V Output 1734-OE2V
Bit/Channel 00		[JTV6.OVAL]	Spare
Bit/Channel 01		Spare	Spare
Bit/Channel 02		Spare	
Bit/Channel 03		Spare	
Bit/Channel 04			
Bit/Channel 05			
Bit/Channel 06			
Bit/Channel 07			

Communication

Red Ethernet TCP/IP

- PLC ⟷ I/O Analog/Digital Modules
- PLC ⟷ Point I/O System
- PLC ⟷ EPICs and HMI (Monitoring)
- PLC ⟷ PXI System
- PLC ⟷ 435NBX (ASCII to PLC data)(MPS-Lake Shore temperature controller)

Conclusion

- The PLC solenoid control system is documented.
- The control system contains spare modules in the chassis to allow the system to change depending on the requirements of future applications and modifications to the solenoid.