

SPHERIX

TABLE 2. Hardwired and software interlocks

MAGNET HW INTERLOCKS	MAGNET SOFTWARE INTELOCKS	LIQUEFIER
Quench detectors ready	Magnet over current	Turbine 1 speed
Quench detector 1	Magnet strain gage summary	Turbine 2 speed
Quench detector 2	Three magnet temperatures summary	Turbine 1 temperature
+ Current lead voltage	+ Current lead voltage	Turbine 2 temperature
- Current lead voltage	- Current lead voltage	Internal dewar temp.
+ Superconducting bus bar voltage	+ Current lead temperature	
- Superconducting bus bar voltage	- Current lead temperature	
LHe Reservoir Level	LHe Reservoir Level	
Vacuum Level	Vacuum Level	
Panic Button	LHe inlet temperature supply > 6 K	
Magnet ΔT O.K. (future)		

INSTRUMENTATION AND MISCELLANEOUS CONTROLS

TABLE 3 is a list of PLC 1 instrumentation, not including: redundant or unused sensors and standard standalone modules such as Leybold vacuum controllers, water bath heaters and video cameras. Four 150 watt cartridge heaters mounted in the connecting bus bar of each of the two current leads eliminate condensation and icing. Standalone temperature controllers provide 48 VAC power on a time proportional basis via a zero crossover circuit, reducing noise. Dual 330 K Klaxon temperature switches on each bus bar ensure over-temperature protection. Lead temperatures are monitored, but not protected, by the PLC system with alarms at 280 K and 300 K.

TABLE 3. Sensors and instruments for PLC 1

Transducer Type	Manufacturer/Model	#	Location	Input	Comments
Pressure	KPSI / Model 27	25	Liquefier and 1 at magnet	PLC	1 failed
Pressure	Valcom	3	Magnet	PLC	
Platinum RTD	Lakeshore PT-103	24	Liquefier and 1 on magnet shield outlet	PLC	only 7
Strain Gauge	Micro Measurement WK -06-250-BG-350	28	Solenoid support rods	GPIB	7 have failed T. compensated
Silicon Diodes	Lake Shore DT-470/231 transmit.	20	Liquefier, 2 in solenoid reservoir, 1 in 4000 l dewar	PLC	1 failed; at connector
Cryogenic Linear Temp. Sensors	Micro Measurement CLTS -2B	33	Solenoid cylinder, shield, support rods and reservoir	30 GPIB 3 PLC	1 has failed (3 RTD inputs)
LHe level probe	AMI/ Model 135	2	Solenoid and 4000 l dewar	PLC	
LHe ΔP level measurement	Rosemount	2	Liquefier internal dewar and 4000 liter dewar	PLC	
Carbon Glass	Lakeshore/CGR1200	9	Solenoid	GPIB	2 have failed
Zero Flux Current Transducer	Dyna Power ZFCT	2	Solenoid and power supply	PLC	
Thermocouple	Omega Micro Mega 77553 controller	2	Solenoid current leads	PLC	Heater control and thermometer
He Flow Rate Meters	Sierra Instruments Model 600 & Bronkhorst	2	Solenoid shield and liquefier	PLC	Insertion probe type; Rotor type
Axial Positioner	linear potentiometer	6	Solenoid	By hand	1 has failed
Turbine Speed	Jaquet/FT 1400	2	Liquefier	PLC	

Platinum

Silicon RTD

use strain gage
read

Thermo couple

41

4:6
1 Lake Shore

3 Lake Shore

HT06 1/4 MT09

Mega Transmitter
2