3.4 Support System

The support system for the helium vessel comprises of four vertical and four horizontal/axial rods of 304LN grade stainless steel. A diagram of one of the Q2/3 vertical supports is shown in figure 3.4.1. Full details of the Q2/3 and Q1 supports systems may be found in drawings ACQC0117 and ACQC0017 respectively.

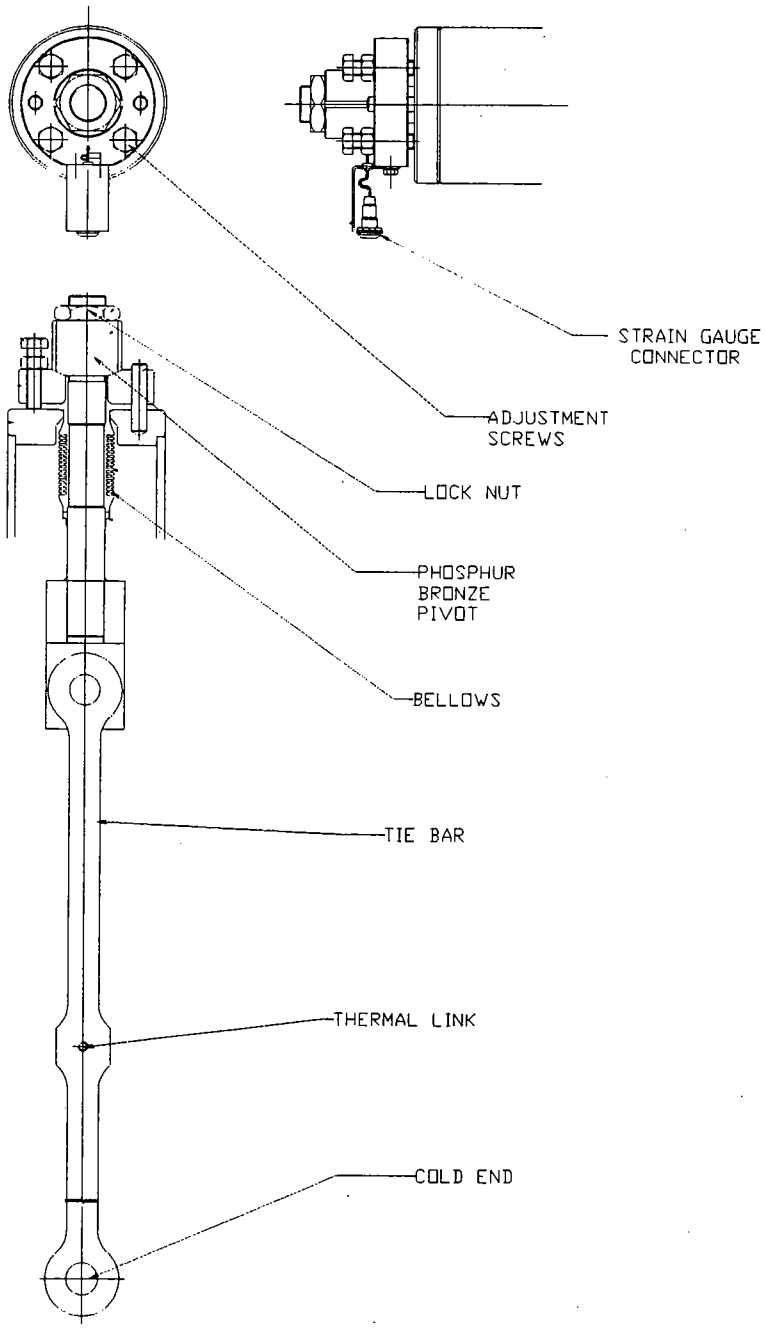


FIGURE 3.4.1 VERTICAL SUPPORT ROD ASSEMBLY Q2/3

3.4.1. Strain Gauges

Each of the supports rods is fitted with two strain gauges in the positions marked in the diagram. The strain gauges are copper nickel alloy type and temperature compensated for steel. The nominal gauge resistance is 120Ω ± 0.5%. The passive gauge is designed to null any changes in lead resistance and is positioned in a low strain region of the support system. The active gauge is positioned on the support in the region of pure tension. The cross sectional area of the rods at the position of the active gauge is shown in table 3.4.1 whilst figure 3.4.2 shows the wiring details (see also drawing CCQC0117).

Table 3.4.1 - Strain Gauge Calibration Factors

Support	CSA at active gauge (mm)	Resistance change (mΩ/kN)	Output voltage (Quarter Bridge) (mV/kN)
Q2/3 Vertical	616	1.86	23
Q2/3 Horizontal	254	4.52	56
Q1 Vertical	254	4.52	56
Q1 Horizontal	254	4.52	56

The strain gauges are connected to the strain gauge amplifier unit in the control rack. The output voltage from each of the gauge bridges may be read in turn by selecting the appropriate knob position on the front panel. Table 3.4.2 provides a cross reference between the amplifier unit and the strain gauge position. The strain gauge positions refer the location as viewed from the service turret end of the cryostat.

Table 3.4.2 - Strain Gauge Amplifier Reference

	Strain Gauge	Amplifier knob position	
	-	0	Amplifier Zero
Vertical Supports	A	1	Turret end left
	B	2	Closed end left
	C	3	Closed end right
	D	4	Turret end right
Horizontal Supports	E	5	Turret end left
	F	6	Closed end left
	G	7	Closed end right
	H	8	Turret end right

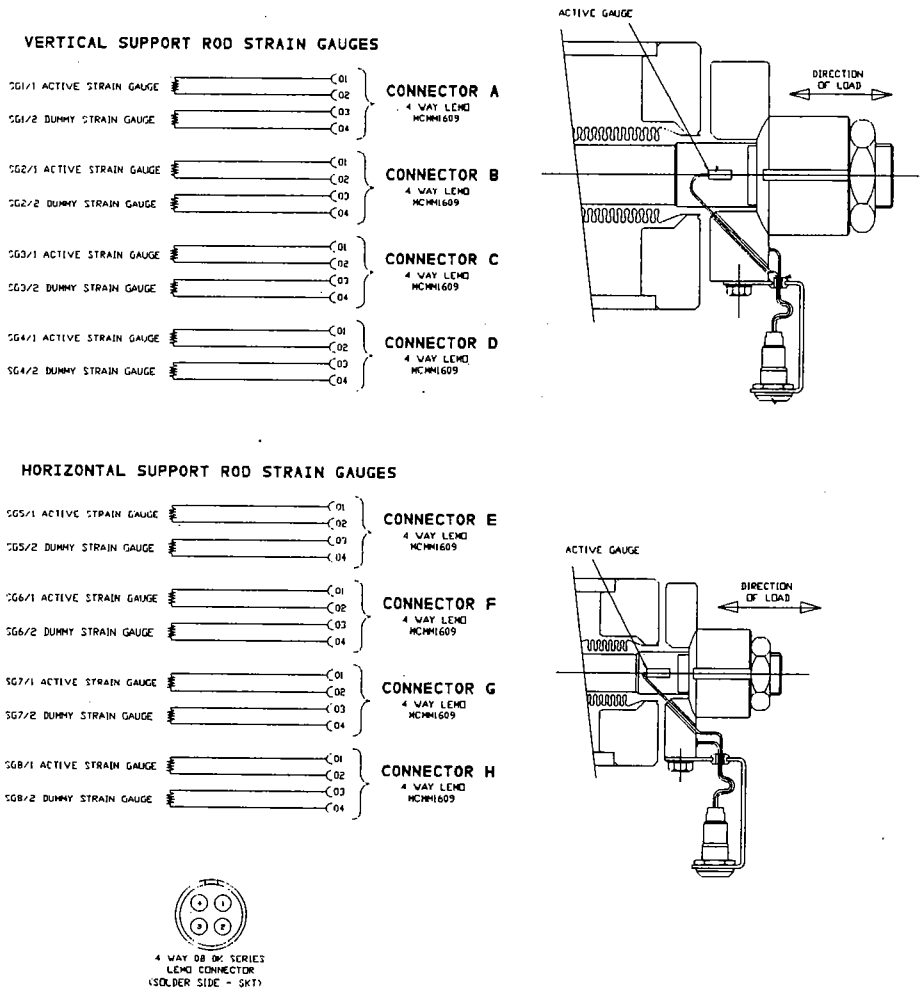


FIGURE 3.4.2 - STRAIN GAUGE WIRING

3.5 The Outer Vacuum Vessel

Drawings ACQC0003 and ACQC0103 show the outer vacuum vessel details for Q1 and Q2/3 respectively. Drawings ACQC0001 and ACQC0101 show the cryostat assemblies for each of the vessels and provide details of the geometrical relationships for the vessels. Figure 3.5.1 shows the cryostat assembly for the Q2/3 vessel.

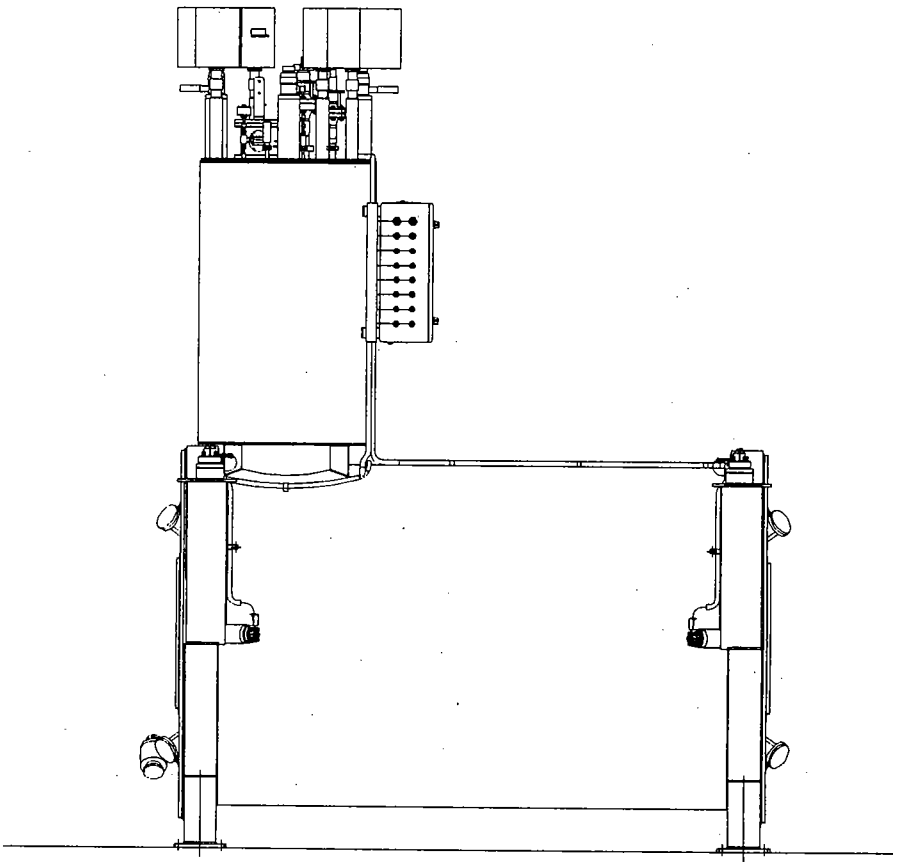


Figure 3.5..1 - Q2/3 Cryostat assembly

The outer vacuum vessel is designed to provide vacuum isolation of the helium vessel and nitrogen shields. Thus it is designed to withstand the vacuum forces and provide location for support fixtures for the cold mass assemblies. The Q2/3 vessel construction are such that the Q1 system may be supported from them in a cantilever arrangement, transmitting the load through support feet onto the HMS carriage assembly.

The vessels are constructed mainly from 304 grade stainless steel with strengthening rings and support pads at both ends of the Q2/3 vessel, and support fixtures on Q1.

Both end plates on the Q2/3 vessel are held in place with a clamping arrangement and EPDM O-rings, or a sealing weld. Due to the beam slot on the Q1 vessel only the end plate at the service turret end is secured in this manner. The end plates provide ports for packing fixtures, vacuum valve, and on Q1, horizontal supports. The bore tubes are constructed from 316L stainless steel and welded such as to minimise the magnetic permeability of the weld.

The end plates of the vessels are designed such that they be removed provided the bore tube is suitably supported. Under no circumstances should such service access be undertaken without prior consultation with Oxford Instruments. Sealing weld preparations are provided such that the system may be welded on completion of preliminary acceptance tests.

4. Service Turret

4.1. Helium Circuit

The helium circuit is defined in the cryogenic schematic ACQC0028. Reference should also be made to the service turret drawings ACQC0015 and the helium can drawings ACQC0107.

4.1.1. Cooldown Circuit

Helium gas at a controlled temperature is fed into the supply bayonet [5] ref CEBAF drawing 75300-E-0060. The bayonet supplies a JT control valve [4] fitted with a 3/8" orifice ref CEBAF drawing 75600-E-0165 via Ø1" tubing. From the control valve the gas is fed to a Ø2" tube running through the helium reservoir. This tube feeds a distribution manifold within the helium vessel. A section of bellows separates the helium reservoir and the helium vessel to take account of any thermal contraction. The distribution manifold feeds helium to the middle of the yoke assembly.

The exhaust gas vents to the reservoir in the service turret through the liquid feed and up the current lead assembly. The reservoir vents initially through the NW50 vent/user port. Once the return gas has reached a sufficiently low temperature it is returned via the control valve [13] to the helium return bayonet [12].

When the magnet temperature falls below 80K control valve [4] is closed . Control valve [6] is then opened allowing 4.5 K helium directly from the refrigerator to flow directly to the yoke distribution pipe work. The cooldown proceeds with liquid first collecting in the helium vessel. Once the vessel has filled with liquid, the liquid overflows into the reservoir and a liquid level will be registered on the level meter.

The level of the liquid in the reservoir is monitored by a superconducting wire type level sensor [10]. Filling continues until the liquid in the reservoir has reached a level of 75% at which point cooldown valve [6] is shut and valve [8] is opened.

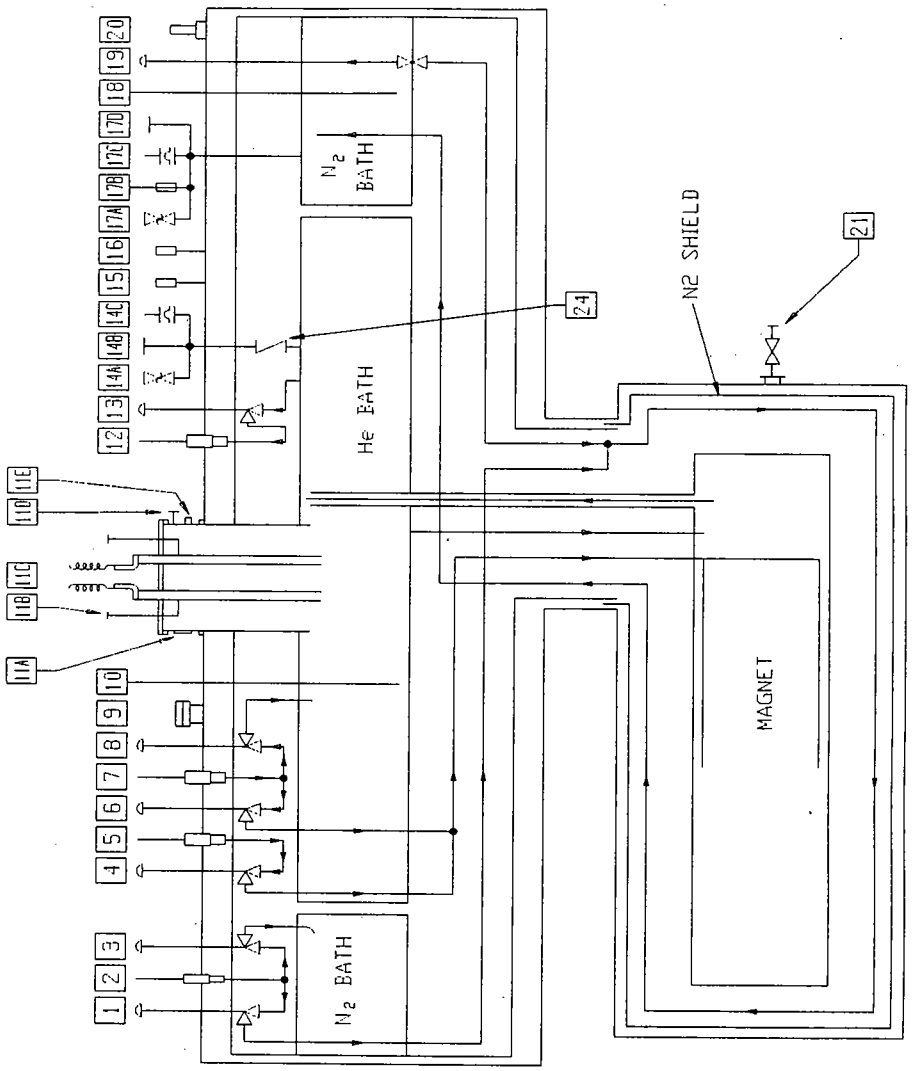


Figure 4.1.1 - Cryogenic Schematic

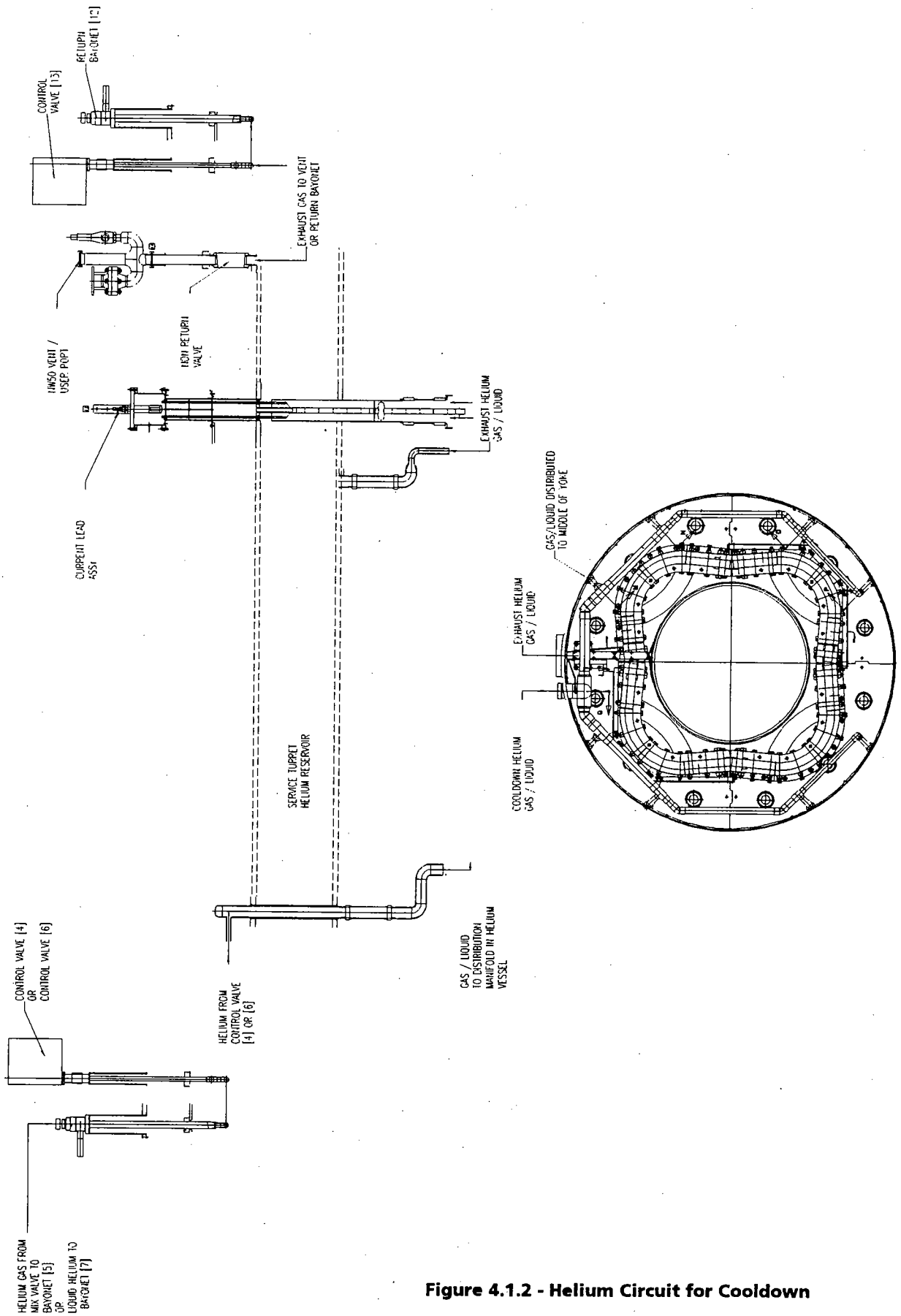


Figure 4.1.2 - Helium Circuit for Cooldown

4.1.2. Normal Operation

During normal operation, cold gas at 5K is fed directly to the reservoir through Ø1" tubing, as shown in figure 4.1.3 via from supply bayonet [7] via control valve [8] fitted with Ø0.1563" orifice. The liquid level is maintained at 75% by JT expansion through control valve [8], and the He can pressure is maintained at 1.35 bar by PID control of the helium gas return valve [13].

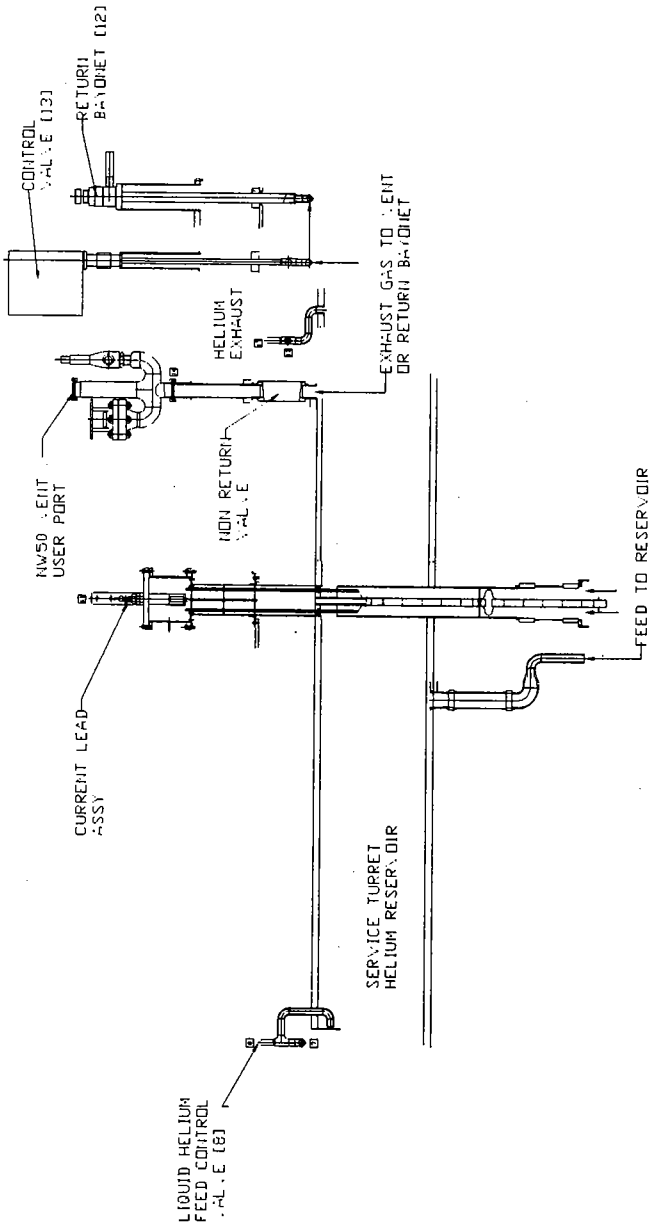


Figure 4.1.3 - Helium Circuit for Normal Operation

Liquid feeds the helium vessel directly via the liquid feed line at the bottom of the reservoir.

In normal operation the exhaust gas is directed to the return bayonet [12] via the control valve [12]. It is possible to bypass this bayonet as in the cooldown mode by exhausting the gas to the NW50 user port. A high mass flow non return valve [24] is fitted to this exhaust such as to prevent thermo acoustic oscillations when the vent line is not in use.

4.3 Current Lead Assembly

The current lead assembly incorporates the main coil 1100 A gas cooled current leads, the 60 A trim coil leads, and all instrumentation wiring exiting the helium space. The latter includes main coil potential taps, main current lead potential taps, trim current lead potential taps, and coil and helium vessel temperature sensors wires both Pt100 and Carbon-Glass types. See ACQC0026 for assembly drawing.

4.3.1 50 Way Connector Pin Out

See Current Lead Assembly Wiring diagram CCQC0026

Signal	Connector	Pin
Main coil pot. tap I+U	50 way D cable Skt A	1
Main coil pot. tap I+M	50 way D cable Skt A	2
Main coil pot. tap I+L	50 way D cable Skt A	3
Main coil pot. tap 1/6	50 way D cable Skt A	4
Main coil pot. tap 1/1	50 way D cable Skt A	5
Main coil pot. tap 2/1	50 way D cable Skt A	6
Main coil pot. tap 2/6	50 way D cable Skt A	7
Main coil pot. tap 3/6	50 way D cable Skt A	8
Main coil pot. tap 3/1	50 way D cable Skt A	9
Main coil pot. tap 4/1	50 way D cable Skt A	10
Main coil pot. tap 4/6	50 way D cable Skt A	11
Main coil pot. tap I-L	50 way D cable Skt A	12
Main coil pot. tap I-M	50 way D cable Skt A	13
Main coil pot. tap I-U	50 way D cable Skt A	14
Trim 1 N=3 I+U	50 way D cable Skt A	23
Trim 1 N=3 I+M	50 way D cable Skt A	24
Trim 1 N=3 I-U	50 way D cable Skt A	25
Trim 1 N=3 I-M	50 way D cable Skt A	26
Trim 2 N=4 I+U	50 way D cable Skt A	19
Trim 2 N=4 I+M	50 way D cable Skt A	20
Trim 2 N=4 I-U	50 way D cable Skt A	21
Trim 2 N=4 I-M	50 way D cable Skt A	22
Trim 3 N=6 I+U	50 way D cable Skt A	15
Trim 3 N=6 I+M	50 way D cable Skt A	16
Trim 3 N=6 I-U	50 way D cable Skt A	17
Trim 3 N=6 I-M	50 way D cable Skt A	18

SERVICE TURRET

Signal	Connector:	pin
Pt100-1/M	50 way D cable Skt B	1
Pt100-1/0	50 way D cable Skt B	2
Pt100-1/C	50 way D cable Skt B	3
Pt100-2/M	50 way D cable Skt B	4
Pt100-2/0	50 way D cable Skt B	5
Pt100-2/C	50 way D cable Skt B	6
Pt100-3/M	50 way D cable Skt B	7
Pt100-3/0	50 way D cable Skt B	8
Pt100-3/C	50 way D cable Skt B	9
Pt100-4/M	50 way D cable Skt B	10
Pt100-4/0	50 way D cable Skt B	11
Pt100-4/C	50 way D cable Skt B	12
Pt100-5/M	50 way D cable Skt B	13
Pt100-5/0	50 way D cable Skt B	14
Pt100-5/C	50 way D cable Skt B	15
Pt100-6/M	50 way D cable Skt B	16
Pt100-6/0	50 way D cable Skt B	17
Pt100-6/C	50 way D cable Skt B	18
Pt100-7/M	50 way D cable Skt B	19
Pt100-7/0	50 way D cable Skt B	20
Pt100-7/C	50 way D cable Skt B	21
Pt100-8/M	50 way D cable Skt B	22
Pt100-8/0	50 way D cable Skt B	23
Pt100-8/C	50 way D cable Skt B	24
Pt100-9/M	50 way D cable Skt B	25
Pt100-9/0	50 way D cable Skt B	26

4.3 Current Lead Assembly

The current lead assembly incorporates the main coil 1100 A gas cooled current leads, the 60 A trim coil leads, and all instrumentation wiring exiting the helium space. The latter includes main coil potential taps, main current lead potential taps, trim current lead potential taps, and coil and helium vessel temperature sensors wires both Pt100 and Carbon-Glass types. See ACQC0026 for assembly drawing.

4.3.1 50 Way Connector Pin Out

See Current Lead Assembly Wiring diagram CCQC0026

Signal	Connector	Pin
Main coil pot. tap I+U	50 way D cable Skt A	1
Main coil pot. tap I+M	50 way D cable Skt A	2
Main coil pot. tap I+L	50 way D cable Skt A	3
Main coil pot. tap 1/6	50 way D cable Skt A	4
Main coil pot. tap 1/1	50 way D cable Skt A	5
Main coil pot. tap 2/1	50 way D cable Skt A	6
Main coil pot. tap 2/6	50 way D cable Skt A	7
Main coil pot. tap 3/6	50 way D cable Skt A	8
Main coil pot. tap 3/1	50 way D cable Skt A	9
Main coil pot. tap 4/1	50 way D cable Skt A	10
Main coil pot. tap 4/6	50 way D cable Skt A	11
Main coil pot. tap I-L	50 way D cable Skt A	12
Main coil pot. tap I-M	50 way D cable Skt A	13
Main coil pot. tap I-U	50 way D cable Skt A	14
Trim 1 N=3 I+U	50 way D cable Skt A	23
Trim 1 N=3 I+M	50 way D cable Skt A	24
Trim 1 N=3 I-U	50 way D cable Skt A	25
Trim 1 N=3 I-M	50 way D cable Skt A	26
Trim 2 N=4 I+U	50 way D cable Skt A	19
Trim 2 N=4 I+M	50 way D cable Skt A	20
Trim 2 N=4 I-U	50 way D cable Skt A	21
Trim 2 N=4 I-M	50 way D cable Skt A	22
Trim 3 N=6 I+U	50 way D cable Skt A	15
Trim 3 N=6 I+M	50 way D cable Skt A	16
Trim 3 N=6 I-U	50 way D cable Skt A	17
Trim 3 N=6 I-M	50 way D cable Skt A	18

Signal	Connector:	pin
Pt100-1/M	50 way D cable Skt B	1
Pt100-1/0	50 way D cable Skt B	2
Pt100-1/C	50 way D cable Skt B	3
Pt100-2/M	50 way D cable Skt B	4
Pt100-2/0	50 way D cable Skt B	5
Pt100-2/C	50 way D cable Skt B	6
Pt100-3/M	50 way D cable Skt B	7
Pt100-3/0	50 way D cable Skt B	8
Pt100-3/C	50 way D cable Skt B	9
Pt100-4/M	50 way D cable Skt B	10
Pt100-4/0	50 way D cable Skt B	11
Pt100-4/C	50 way D cable Skt B	12
Pt100-5/M	50 way D cable Skt B	13
Pt100-5/0	50 way D cable Skt B	14
Pt100-5/C	50 way D cable Skt B	15
Pt100-6/M	50 way D cable Skt B	16
Pt100-6/0	50 way D cable Skt B	17
Pt100-6/C	50 way D cable Skt B	18
Pt100-7/M	50 way D cable Skt B	19
Pt100-7/0	50 way D cable Skt B	20
Pt100-7/C	50 way D cable Skt B	21
Pt100-8/M	50 way D cable Skt B	22
Pt100-8/0	50 way D cable Skt B	23
Pt100-8/C	50 way D cable Skt B	24
Pt100-9/M	50 way D cable Skt B	25
Pt100-9/0	50 way D cable Skt B	26
Pt100-9/C	50 way D cable Skt B	27
Pt100-10/M	50 way D cable Skt B	28

Pt100-10/0	50 way D cable Skt B	29
Pt100-10/C	50 way D cable Skt B	30
Pt100-11/M	50 way D cable Skt B	31
Pt100-11/0	50 way D cable Skt B	32
Pt100-11/C	50 way D cable Skt B	33
Pt100-12/M	50 way D cable Skt B	34
Pt100-12/0	50 way D cable Skt B	35
Pt100-12/C	50 way D cable Skt B	36
CG-1/M	**50 way D cable Skt B**	**37**
CG-1/0	**50 way D cable Skt B**	**38**
CG-1/C	**50 way D cable Skt B**	**39**
CG-2/M	**50 way D cable Skt B**	**40**
CG-2/0	**50 way D cable Skt B**	**41**
CG-2/C	**50 way D cable Skt B**	**42**
CG-3/M	**50 way D cable Skt B**	**43**
CG-3/0	**50 way D cable Skt B**	**44**
CG-3/C	**50 way D cable Skt B**	**45**
CG-4/M	**50 way D cable Skt B**	**46**
CG-4/0	**50 way D cable Skt B**	**47**
CG-4/C	**50 way D cable Skt B**	**48**

4.3.2 Current Lead Cooling

The main current leads are cooled by helium gas flowing from the cold end of the lead to the room temperature end. Cooling is necessary otherwise the lead could burn out, the flow rate is controlled via valves in the distribution box with set point adjusted automatically by the control system in response to the flow rate measured by sensors which also are mounted in the distribution box, and the set current at the main power supply. The flow rate is adjusted between 10 litres per minute at zero magnet current rising to 23 litres per minute at the maximum current, according to the relation

$$\text{Flow} = 10 + \frac{I\,(23-10)}{I_{max}}$$

Where I is the readback current or PSU setcurrent, whichever is the greater.

Should the coolant flow fail, the voltage drop down the lead will increase from about 60 mV at full current to the trip level of the Quench Detector lead monitor, when the energy dump system will be activated by the current lead monitors built into the quench detector. Rapid discharge is essential if the coolant stops to avoid damage to the lead through overheating. Trip levels are set individually for each lead so that they are close to tripping but not vulnerable to nuisance trips.

4.3.3 Neck Cooling

The current lead assembly contains current leads for the three styles of trim coil, each is rated at 60 A which exceeds the trim coil design currents (see page 704 of the User Manual). Although the leads are not individually gas cooled they are cooled by the helium flow up the neck. In practice the neck flow rate should be tuned to minimise icing at the "top hat" but as a guide the expected flow rate with all current leads energised to 20 A is 5 litres per minute.

4.3.4 Current Lead Terminal Heaters

Both main current terminals are fitted with heaters to prevent the build up of ice, each is independently controlled by means of a temperature sensor connected to the gas bleed pipe and a controller built into the distribution box. Stable gas flow up the leads is required before the heater control will function correctly, whereupon the temperature set point will normally be in the range 40° to 60° C. The maximum set point for the heater temperature is 100° C, any higher than this risks a failure in the tubing linking the terminals with the distribution box.

4.3.5 Top Hat Heaters

To minimise icing and condensation on the top hat assemblies heaters are provided adjacent to the top and bottom flanges of the assembly. Each is rated at 75 W at 110 V ac and both are energised whenever mains power is connected to the distribution box.

4.4 Safety Devices

The cryogenic and vacuum vessels are protected from over pressure under a number of fault conditions.

(a) Sudden catastrophic vacuum loss and coil quench

(b) Input JT valves frozen in the most open position with exit valves closed

(c) Loss of helium fluid into the vacuum space

Protection is provided by means of a pressure relief valve and a burst disk on each of the helium and nitrogen vessels. as shown n figure 4.4.1. The pressure relief devices provide primary relief and have been set to relieve at 4 bar gauge. The burst disks will vent at 5 bar gauge and are intended as a secondary safety mechanism in the event insufficient relief capacity or failure of the pressure relief devices.

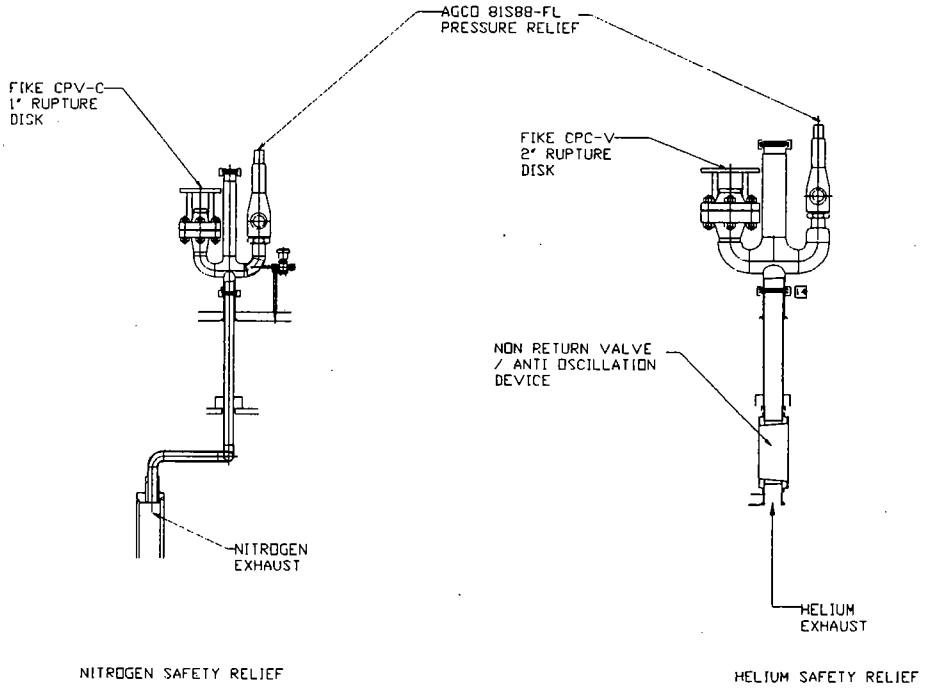


Figure 4.4.1 - Safety Relief Devices

The pressure relief valves on both the helium and nitrogen is an Anderson Greenwood AGCO 81S88-FL which have an orifice diameter of ½". The maximum discharge capacity for the valves are 1000 kg/hr for helium at a pressure of 5.4 bar and a temperature of 10 K, and 800 kg/hr for nitrogen at a pressure of 5.4 bar and temperature of 100 K.

The rupture disks are Fike conventional pre-bulged CPV-C disks. A 2" diameter disk is provided on the helium vessel whilst the nitrogen vessel is protected by a 1" disk. The maximum discharge capacity of the 2" disk is 19,000 kg/hr for helium at a pressure of

6.5 bar and temperature of 10 K. For the 1" disk the discharge capacity is 3700 kg/hr for nitrogen at a pressure of 6.5 bar and a temperature of 100 K.

Calculations of the heat loads, mass flows and relief capacities of the valves and burst disks may be found in project note Q-UM-DN 64/2 submitted in fulfilment of milestone 14 of the contract. In addition to the main safety devices, each of the supply bayonets is fitted with a circle seal relief valve. Table 4.4.1 details a summary of the fault analysis for the quadrupoles indicating the pressure relief mechanism.

Table 4.4.1 Summary of Fault Analysis

Fault Condition	Result		
	Helium Vessel	Nitrogen vessel	OVC
Coil quench through active protection	Vent through pressure relief valve	N/A	N/A
Coil quench and failure of active protection	Vent through burst disk at 5 bar	N/A	N/A
Loss of vacuum through restricted vent to air.	Vent through burst disk at 5 bar	Vent through relief valve at 4 bar	N/A
JT valves fail with input open and exits closed	Vent through pressure relief at 4 bar	Vent through pressure relief at 4 bar	N/A
Loss of vacuum through vent to helium	Vent through burst disk at 5 bar	Vent through burst disk at 5 bar	N/A
Rupture of helium vessel	N/A	N/A	Vent through parallel plate relief at 1.11 bar

- **Import Note**

Do not tamper with or remove any safety device fitted to the quadrupole system without written agreement from the responsible engineer.

5. Power Supplies

As the ampere requirements of all three of the High Momentum Spectrometer Quadrupoles are quite similar, three identical power supplies have been provided to drive them. Each power supply is a nominally 1250A, 5V series mode regulated supply, however each supply is individually limited by front panel and internal current limits as shown in the table below. The supplies are series transistor regulated to limit electromagnetic interference.

- Current limit settings.

Magnet	Front Panel	Internal
Q1	1035	1023
Q2	1045	1035
Q3	1038	1045

- **Key Parameters**

MAINS INPUT:	
Mains Voltage	480V AC ± 10%
Mains Frequency	60 Hz ± 5%
Power consumption	less than 20kW
DC OUTPUT:	
Output Voltage	0 to ± 5V
Output Current	0 to ± 1250A
WATER COOLING:	
Flow	45 litres/min
Maximum input temperature	35°C
REGULATION:	
Current drift	± 10 ppm (8 hours)
Line regulation	(± 10%) 2 ppm
Load regulation	(+ 10%) 25 ppm

For further technical reference consult the Danfysik Magnet Power Supply 853 System 8000 reference manual.

6. The Energy Dump System.

6.1. Functional Description

Refer to the User Guide section 3.5 for a overview of operating principles and to locate and identify the main components.
The quench switch rack (see drg. CCQC0250 sheet 2) houses the quench switch , the current dump resistor, the under-voltage trip, and the 24 Vdc low current power supply used for energising relay RL1, and illuminating the fault lockout and power on Light emitting diodes.
In the upper part of the rack is mounted the connector panel for mains input, and the interface to the control system, also the heavy-duty terminals for the magnet current leads.
In the lower half of the rack is mounted the sub-chassis (see drg. CCQC0250 sheet 1) containing the 2000 Amp triple pole circuit breaker and reset button, the 0.4 Ohm current dump resistor, Terminal block TB1 with fuse F1 mounted on it, control relay RL1, the fault lockout indicator, thermal switch and the 24 Vdc low current power supply. The circuit diagram is shown in drg. CCQC0252 sheet 1.

6.2. Circuit Description

The magnet current circuit consists of a triple-pole 2000 Amp circuit breaker with its poles wired in series to reduce arcing. The circuit breaker is wired in parallel with the current dump resistor, a high current device fabricated from stainless steel strip, and having a dc resistance of 0.4 Ohms.
The quench switch has an under-voltage trip mechanism fitted, operating at 120 Volts ac, isolated from the magnet circuit. The under-voltage trip may act, introducing the dump resistor into the circuit between magnet and power supply for any of the following reasons:

- The mains input to the under-voltage trip falls from its nominal 120 V AC to below about 40 Volts
- The contact closure signal from the Quench Detector is removed (e.g. in the event of a magnet quench)
- Either of the connectors are removed from the front panel of the Quench Switch Rack.

A low current 24 Volt dc power supply provides the energising supply for the control relay RL1, its coil is wired in series with pins A and B of Trident connector SK1 (external interlock). Under normal operating conditions the Quench Detector provides a closed switch contact across pins A and B, holding RL1 in an energised state, closing its contacts 4 and 6 which are wired is series with the 120 volt supply to the under voltage trip. The status of the 24 Volt power supply is indicated by an light emitting diode on the interface panel at the top of the rack.

In the event of a magnet quench, the control system opens the switch between pins A and B of SK1, de-energising RL1 and interrupting the 120 Volt supply to the under voltage trip, causing the quench switch to open.
Contacts 1 and 7 of RL1 close, illuminating the Fault Lockout light emitting diode, a pair of normally open auxiliary contacts fitted to the quench switch close. These contacts are wired is series with the thermal switch , which is mounted on the dump resistor. If the temperature of the dump resistor is above 150 deg C the switch will be open circuit, thereby inhibiting the quench switch from being reset until the temperature has fallen below the switch threshold. The quench switch contacts and thermal switch circuit is wired to pins C and D of SK1 , providing a remote quench switch status indication to the control system.

6.3. Re-setting the quench switch

Refer to section 3.5 of the User Guide for instructions on how to reset the Quench switch.

7. Control System Hardware

7.1. Introduction.

The magnet Control system comprises a single 19" control rack which interfaces the control computer with all the valves and diagnostic sensors on the magnet. The layout of the control rack is shown in section 3.7 of the user manual. The control rack is connected to the magnet distribution box via five control signal cables and one mains power cable. The technical details of the distribution box are covered section 9.1 of this manual. A diagram showing the general control system layout is shown in Fig 7.1-1.

This section describes the Magnet control system hardware and the individual units that are housed in the control rack. These are as follows :

1. Power supply unit.
2. Strain Gauge Amplifier and Keyswitch unit.
3. Computer interface unit.
4. Quench Detector.

The Helium and Nitrogen meters, and the control computer have their own technical manuals and are covered in section 10 of this manual.

The Software control system for the magnet is covered in section 8 of the technical manual.

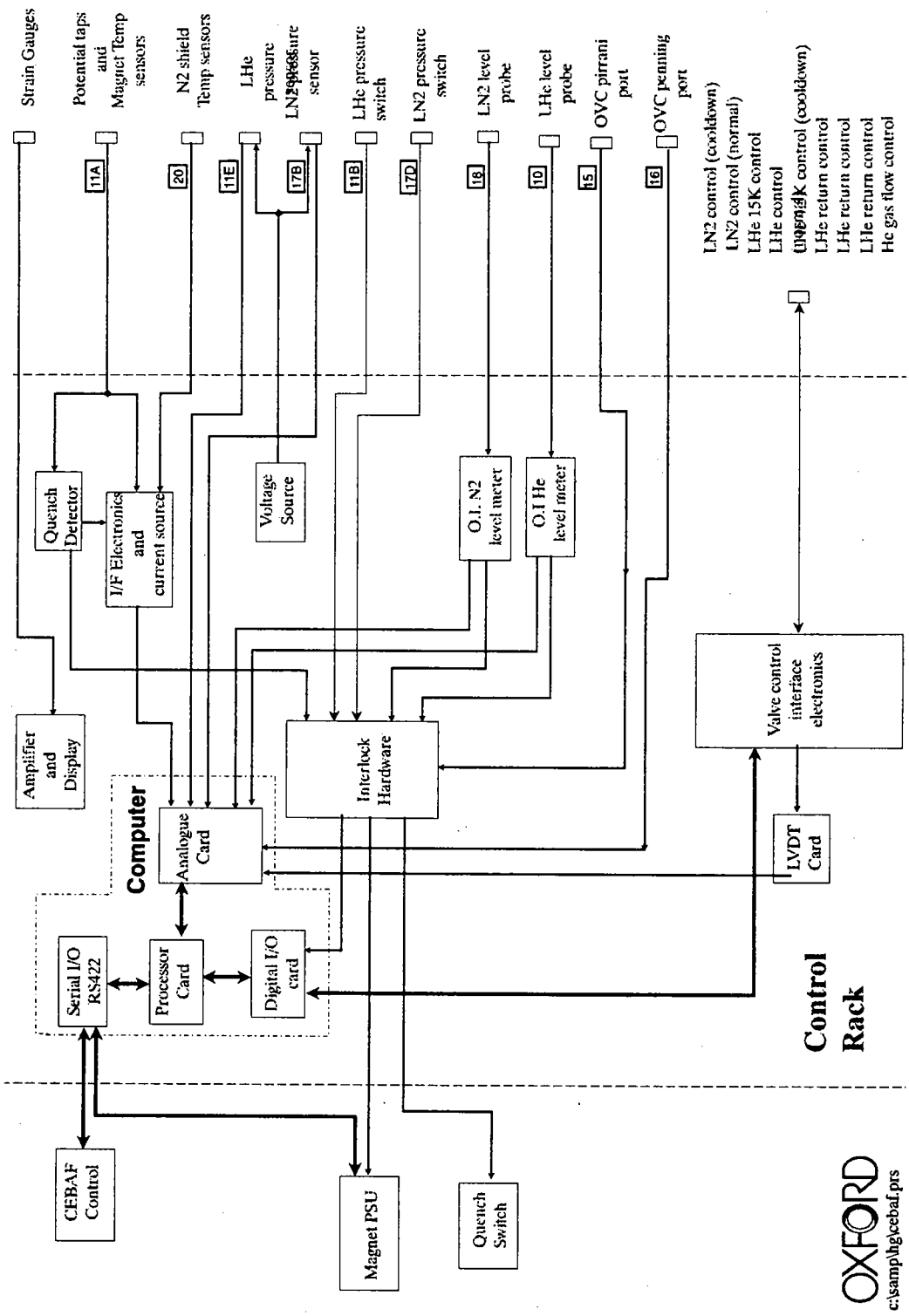


Fig 7.1-1 Control System Schematic Diagram.

7.2. Power Supply Unit

7.2.1. Functional Description

The power supply unit is housed at the bottom of the control rack. It supplies all the DC. power needed in the control rack and on the magnet turret. The panel layout of the unit is shown in Fig 7.2-1.

7.2.2. Technical Description

The unit houses three switch mode power supplies, and the outputs are fed, via fuses on the rear panel, to the Computer interface unit which is mounted just below the computer.

The three power supplies are as follows :

PSU 1 : +24v @ 3A : valve control
PSU 2 : +24v @ 3A : valve control, vacuum sensor power
PSU 3 : +12V @ 3A : control logic, flow sensors, pressure sensors, Qnch Det, Temp sensors, Strain Gauge Amp.

The Key Parameters of the PSU units are as follows ;

Efficiency	65% min
Line Regulation	±0.5% max
Isolation voltage	3750 VAC from input to output 1250 VAC from input to ground
Insulation resistance	10 Mohm min from output to ground
Temperature	0-50 deg C
MTBF	100,000 hrs
EMI requirements	Meets conduction limits of a) FCC 20780 Level B b) VDE 0871 Level A

There are LED indicators on the front panel to indicate that there is power on the output connector pins.

The AC. mains is input via a three pin IEC connector at the rear of the unit. The live line is fused via the 5A fuse on the front panel, and then distributed to all three power supplies.

7.2.3. Connector Pin Allocations

The power supply outputs are fed via three 4w Trident sockets at the rear. The pin allocation is the same for all three connectors and is as follows:

Pin A : +ve voltage

Pin B : 0 volts

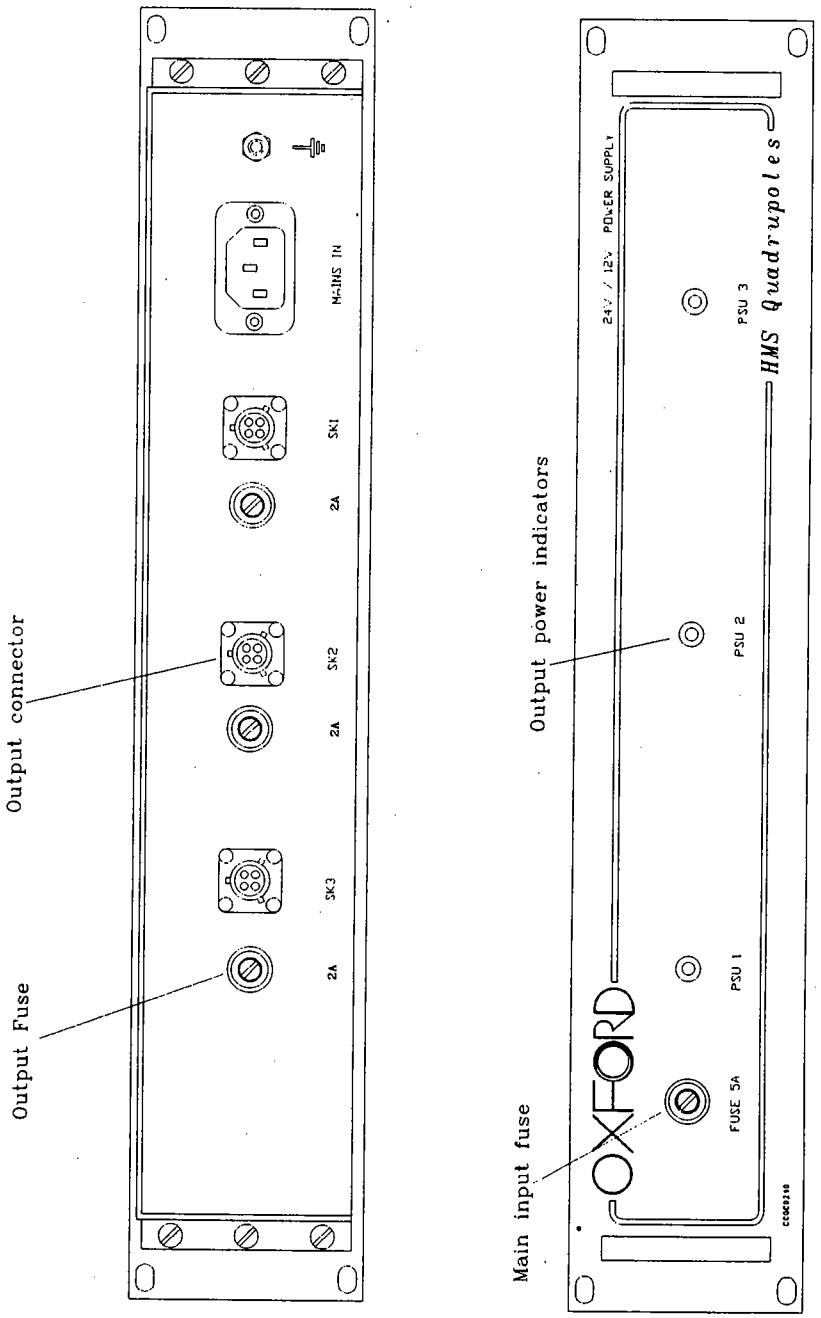


Fig 7.2-1 PSU panel layout

7.3. Strain Gauge Amplifier and Keyswitch Unit.

7.3.1. Functional Description

The display and keyswitch unit is housed above the computer in the Magnet control rack. It houses the display for the Strain gauge Amplifier which monitors the strain gauges on the magnet supports during cooldown, and the operator keyswitch that can enable local or remote operator control of the computer control system. The 12v power for the unit is supplied by the PSU unit in the Control rack and is fused via the 1A fuse on the front panel. The panel layout of the unit is shown in Fig 7.3-2.

7.3.2. Technical Description.

Strain gauge Display.

The inputs from the eight strain gauge bridges are input through connector PL1 on the rear panel. The Amplifier produces a +/- 6 volt bridge supply which is fed to the two strain gauges configured in Half bridge mode as shown in Fig 7.3-1. The amplifier is switched between each of the pairs using the switch on the front of the unit. Only one pair of strain gauges can be read at any one time. The signal is then amplified by a gain of 1000 using a strain gauge amplifier module. The output of the amplifier is then displayed on the front panel in mV/ustrain (3mV = 1ustrain). The display reading is not an absolute reading of strain measured. It displays the change in strain from the reference reading taken before cooldown commenced.

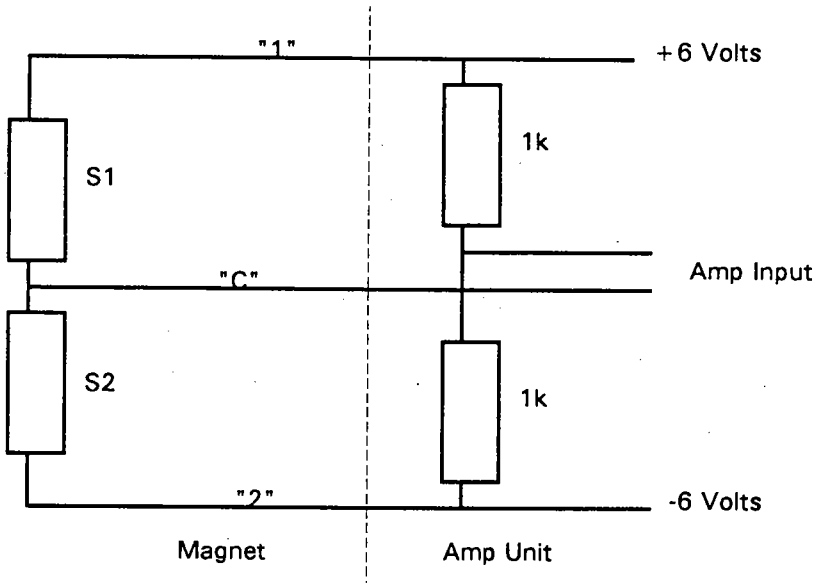


Fig 7.3-1 Half Bridge Gauge Layout

The dual voltage supply required by the amplifier is produced from the +12v supply by the DC DC converter module mounted on the amplifier board. The panel meter configuration is shown in Figure 7.3-2. The circuit for the Strain Gauge PCB is detailed in Figure 7.3-3.

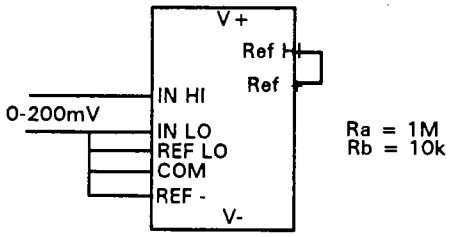


Figure 7.3-2 Panel meter configuration

Strain Gauge Amplifier setup

To change the Bridge voltage across the strain gauges adjust potentiometer VR1 so that the voltage across the gauges reads ± 6 volts.

To adjust the zero offset of the amplifier switch the front panel switch to channel 0 (amplifier input shorted) and adjust potentiometer VR2 until the front panel meter reads 0 volts.

Keyswitch.

The local / Remote keyswitch is located on the front panel of the unit. The switch closes a contact when in the local position that is input to the software via the computer interface unit. When the switch is in remote the software ignores operator commands typed in at the local computer keyboard. The switch key can be removed from the switch when the system is in remote to disable any local operator intervention without authorisation.

7.3.3. Connector Pin Allocations

The strain gauge signals are connected via a 38w Varelco connector on the rear panel of the unit. The pin allocations are listed below, where 1,2, and C relate to the diagram in Fig 7.3-1. Connections to the Computer are via a 12w Trident connector.

Connector PL 2

Pin	Sensor	
A	Gauge 1-1 }	
B	Gauge 1-2 }	Vert A
C	Gauge 1-C }	
E	Gauge 2-1 }	
F	Gauge 2-2 }	Vert B
D	Gauge 2-C }	
J	Gauge 3-1 }	
K	Gauge 3-2 }	Vert C
L	Gauge 3-C }	
M	Gauge 4-1 }	
N	Gauge 4-2 }	Vert D
R	Gauge 4-C }	
S	Gauge 5-1 }	
V	Gauge 5-2 }	Horz E
P	Gauge 5-C }	
U	Gauge 6-1 }	
T	Gauge 6-2 }	Horz F
X	Gauge 6-C }	
Y	Gauge 7-1 }	
Z	Gauge 7-2 }	Horz G
AA	Gauge 7-C }	
Y	Gauge 8-1 }	
BB	Gauge 8-2 }	Horz H
CC	Gauge 8-C }	

Connector PL 1

Pin	Signal
A	} Keyswitch
B	} Contacts
E	+12 volts
F	0 volts

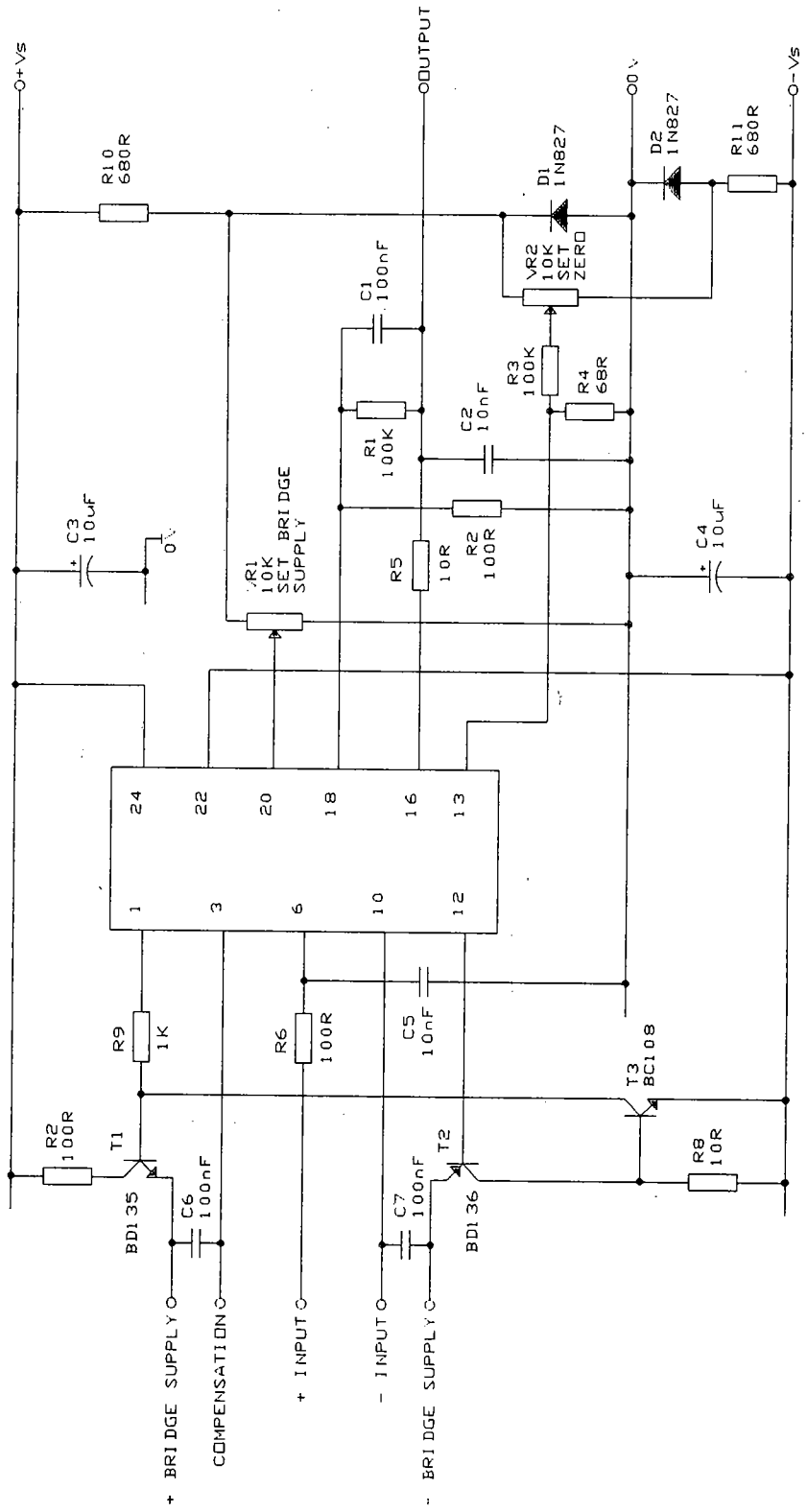


Figure 7.3-3 Strain Gauge Amplifier Circuit Diagram

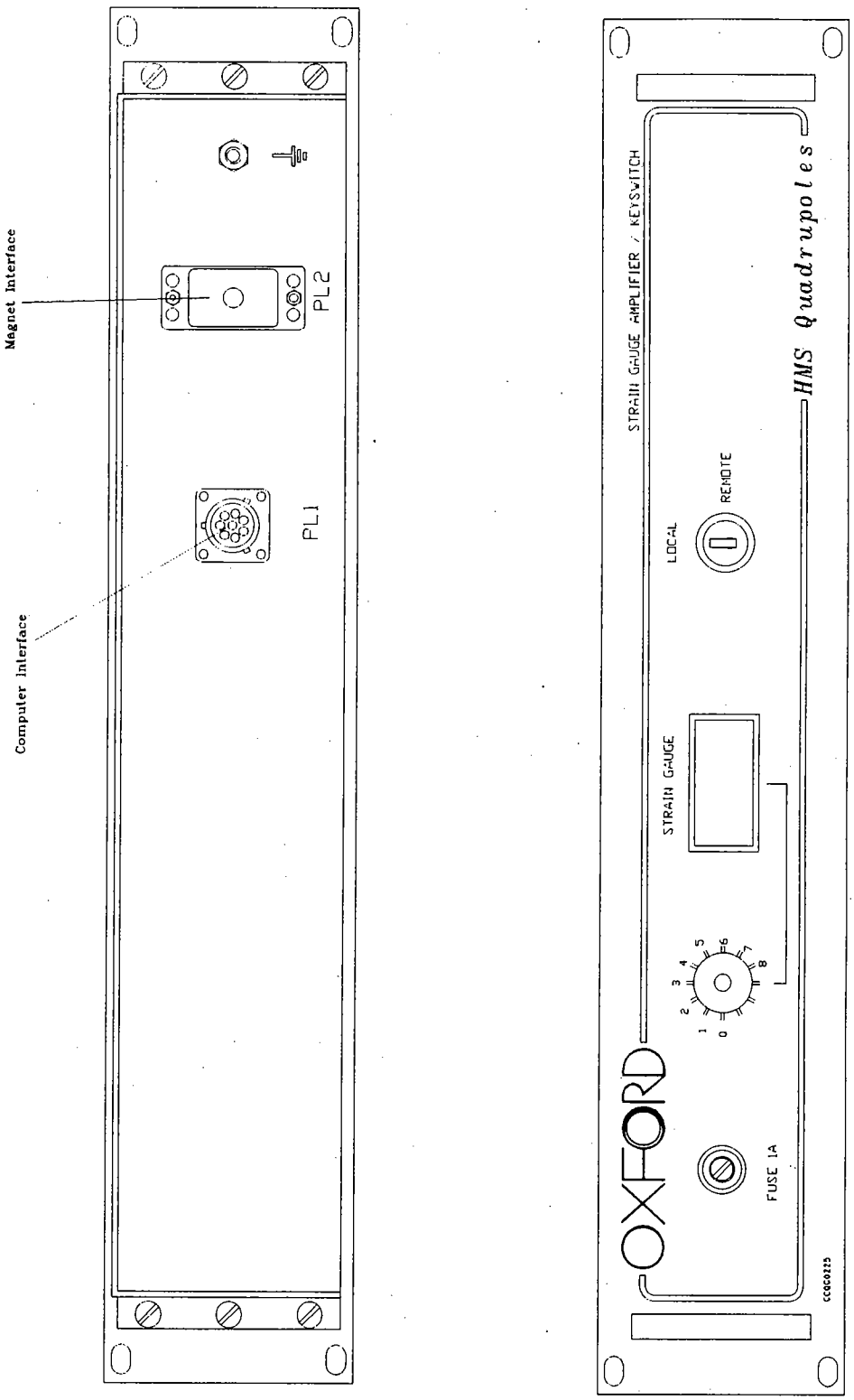


Fig 7.3-4 Strain Gauge Amplifier and Keyswitch panel layout

7.4. Computer Interface Unit.

7.4.1. Functional Description

The interface unit is mounted in the magnet control rack, and is the main interface between the plant units and the control computer. It houses five computer interface boards that read in all the analogue data values and valve position transducer readings, a temperature sensor signal patch PCB, and a main control PCB.

All the interlock signals from different parts of the control system are monitored in the interface unit, and the interlock hardware is operates independently from the computer, thereby ensuring system safety in the event of a computer failure.

The panel layout of the interface unit is shown in Fig 7.4-3. The layout of the component boards in the unit is shown in Fig 7.4-2. The wiring diagram for the interface unit is shown in drawing CCQC0232.

7.4.2. Technical Description.

The interface unit can be split up into sections for ease of reference. These sections are:

1. Computer interface boards
2. Temperature sensor PCBs
3. Main Interface PCB
4. Analogue signals
5. Interlock relay board

Computer interface boards

There are four analogue multiplexer boards and one LVDT control card in the interface unit. They are connected in series via 37 way ribbon cable which is connected to the A/D converter card inside the computer unit mounted in the control rack just above the interface unit. Each of the boards has its own technical manual and are covered in section 10 of this manual.

Temperature sensor signal patch PCB.

Each temperature sensing area on the shield and magnet has two sensors. If one sensor fails, the other sensor can be used without too much disruption.

There are two small PCB assemblies in the unit that input the temperature sensor readings into the analogue interface cards. They are at the front of the unit and are called PCB1 and PCB2. The interface card input connector can easily be switched to the redundant sensor if one temperature sensor fails, without having to interrupt the magnet power supply. The layout of part of the PCB is shown in Fig 7.4-1. Section 3.7 of the user manual describes the location of the different sensors on the magnet.

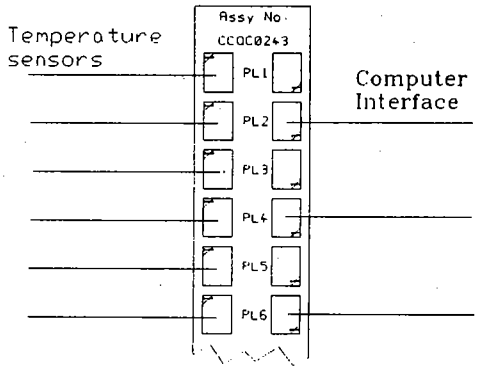


Fig 7.4-1 Diagram of Temperature Sensor PCB

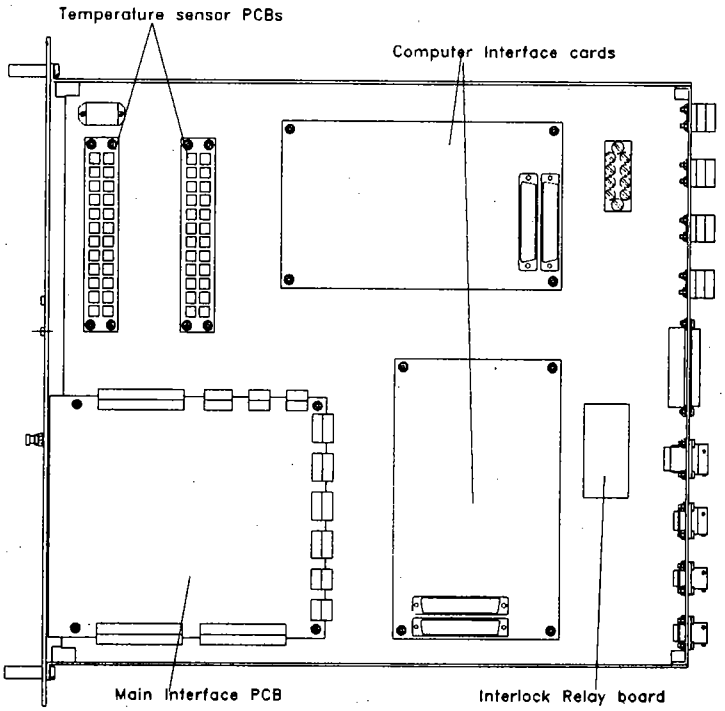


Fig 7.4-2 Interface unit layout

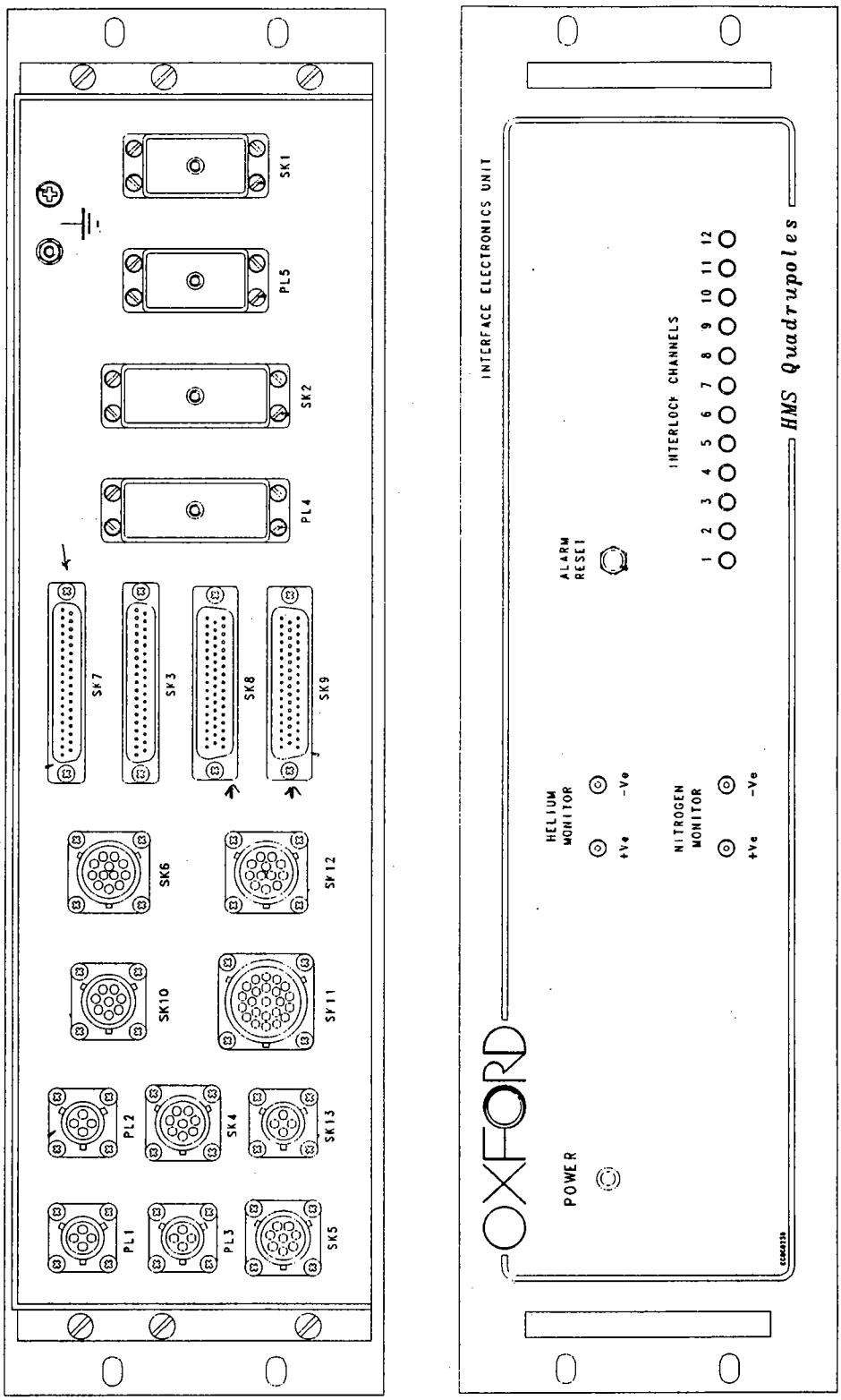


Fig 7.4-3 Interface unit panel layout.

Main interface PCB.

This board interfaces all the digital I/O signals from the computer, generates all the interlock signals, and supplies the temperature sensors with a constant current source. The circuit for this interface PCB is shown on drawing CCQC0237.

Direct Digital I/O signals

The digital I/O signals from the computer are sent via two 50 way IDC connectors. these are connected to the main PCB and distributed off the board to the relevant connectors on the rear panel of the main interface unit.

Constant Current sources.

Constant current sources are needed for the temperature sensors and the He neck flow control valve position sensors.

The current sources are as follows :

1. Platinum sensors : Controlled by VR2 to give a current of 6.8mA
2. Carbon glass : Controlled by IC29 to give a current of 100μA
3. Flow valve position : Controlled by VR1 to give a current of 10mA

Watchdog Circuit.

The watchdog circuit is based around IC28 on the main PCB and monitors the computer software. The computer software sends a reset signal to the circuit at regular intervals. If the circuit is not reset within that time period an interlock signal is generated. Jumper W1 disables the watchdog from closing the magnet control valves when operated. The jumper should be towards U31 to disable the watchdog.

Valve control.

The valve control circuits take up the largest area of the interface PCB. The computer controls the valves by switching +24v power to the valve actuators until the readback signal from the transducer is equal to the control setpoint. There speed of the valve is controlled in the software by pulsing the motor when opening or closing. The valve should take approx 3 mins to open along its full stroke.

The digital control signal from the computer are active low. This prevents false control signals activating the valves when the computer I/O card powers up (during power up all signals from the I/O card are high until initialised).

Interlock Relay Board

The interlock relay board at the rear of the interface unit is used to send the interlock signal to the dump rack. it is powered by one of the 24v power lines. The second relay is used to send the interlocks to the MPS and the CEBAF operator.

Interlock signals.

All digital sensor signals, and magnet status signals are input to the main interface PCB. The interlock circuit on the PCB channels critical status signals from the magnet system and sends the relevant interlock signals to the Power supply, the Quench switch rack, and the CEBAF control system. The interlock circuit latches these input signals to indicate to the operator which signal caused the error. The operator must send a reset signal to the unit before normal operation can be resumed. The interlock signals are :

N2 Buffer pressure high,
He Buffer Pressure high,
Watchdog interlock,
Neck He flow fail,
He level low,
Current lead over voltage,
OVC Vacuum high,
Coil Quench,
Trim Quench
Quench switch status

Interlock to the Dump resistor circuit is triggered by :

Coil Quench
Current lead over voltage

Interlock to ramp down the PSU is triggered by :

N2 Buffer pressure high,
He Buffer Pressure high
Hardware watchdog interlock
Neck He flow fail
He level low
Current lead over voltage
OVC Vacuum high
Coil Quench
Trim Quench
Quench switch / Dump resistor status

CONTROL RACK

The Interlock to CEBAF is triggered by interlock signal to magnet PSU
Interlock signal description.

N2 reservoir pressure high : The N2 reservoir pressure is monitored by a pressure switch (3.0 bar). If the gas pressure rises above a pre-set limit the switch sends an interlock to the magnet PSU, causing it to ramp down the magnet.

He reservoir pressure high : The He reservoir pressure is monitored by a pressure switch (3.0 bar). If the gas pressure rises above a pre-set limit the switch sends an interlock to the magnet PSU, causing it to ramp down the magnet.

Watchdog interlock : The interface hardware has a watchdog circuit that has to be addressed by the computer within a pre-set time limit to indicate that the computer program is operating correctly. If the watchdog circuit is not addressed the PSU is ramped down, the cryogen feed valves are closed, and the He return valve is opened to maximum.

Neck He flow fail : The He flow in the neck is monitored by the computer. If the flow falls below a pre-set level the computer sends an interlock to the PSU to ramp down.

He level low : The He level is monitored by the He level meter. If the level falls below a pre-set level, the meter sends an interlock to the PSU to ramp down.

Current lead over voltage : The Quench detector monitors the voltage across the current leads. If the voltage rises above the Detector threshold, the detector sends an interlock to the PSU and to the Energy dump resistor circuit causing the PSU to ramp down, and the magnet to be discharged.

OVC Vacuum high : If the OVC vacuum rises above a pre defined limit, the pirani gauge sends an interlock to the PSU to ramp down.

Coil Quench : The Quench detector monitors the voltages across the main magnet coils. If the voltage rises by 10mV across a coil, the quench detector sends an interlock to the PSU and to the Energy dump resistor circuit. The PSU is ramped down, and the magnet is discharged.

Trim quench : The Quench detector monitors the voltages across the trim magnet coils. If the voltage rises across the coil, the detector sends an interlock to the PSU to ramp down.

Quench switch status : If the quench switch is open, or the dump resistor temperature is above 150°C an interlock is sent to the PSU, disabling it from ramping up the magnet.

Analogue Signals

All the analogue signals from the magnet sensors are fed to the computer interface cards. The two multiplexer cards MUX1 and MUX2 monitor all the temperature sensor voltages and multiply the signal voltage by a gain of four before sending the signal to the computer. Each temperature sensor generates two voltages. The first is equal to the voltage drop across the sensor and the lead, and the second is equal to the voltage drop across the lead only. The software subtracts the second voltage from the first to obtain the true sensor voltage drop.

The multiplexer card MUX3 monitors all the other sensor signals such as vacuum, pressure, helium flow rates and reservoir levels, and has no on board gain. The He and N2 pressure signals are also output to monitoring sockets on the front panel for monitoring with a DVM.

The multiplexer card MUX 4 monitors the coil voltages from the mail coil, the trim current leads, and the voltage drop down the main current leads.

The channel data for the multiplexer cards is given in section 8.9 of this manual.

7.4.3. Connector Pin Allocations

The connectors on the rear of the interface unit are listed below in numerical order . Sockets 7,8 and 9 are not listed as these are the computer cables to the interface unit.

Plug 1

A	PSU 1 supply +ve
B	PSU 1 supply -ve

Plug 2

A	PSU 2 supply +ve
B	PSU 2 supply -ve

Plug 3

A	PSU 3 supply +ve
B	PSU 3 supply -ve

Plug 4

A	Pt100-1/M
B	Pt100-1/O
C	Pt100-1/C
E	Pt100-2/M
F	Pt100-2/O
H	Pt100-2/C
D	Pt100-3/M
J	Pt100-3/O
K	Pt100-3/C
L	Pt100-4/M
M	Pt100-4/O
N	Pt100-4/C
R	Pt100-5/M
S	Pt100-5/O
T	Pt100-5/C
P	Pt100-6/M
U	Pt100-6/O
V	Pt100-6/C
W	Pt100-7/M
a	Pt100-7/O
b	Pt100-7/C
X	Pt100-8/M
Y	Pt100-8/O
Z	Pt100-8/C
c	Pt100-9/M
d	Pt100-9/O
f	Pt100-9/C
h	Pt100-10/M
k	Pt100-10/O
l	Pt100-10/C
j	Pt100-11/M
m	Pt100-11/O
n	Pt100-11/C
p	Pt100-12/M
r	Pt100-12/O
s	Pt100-12/C
u	Pt100-13/M
v	Pt100-13/O
w	Pt100-13/C
t	Pt100-14/M
x	Pt100-14/O
y	Pt100-14/C
z	Pt100-15/M
AA	Pt100-15/O
BB	Pt100-15/C
DD	Pt100-16/M
EE	Pt100-16/O
FF	Pt100-16/C
CC	Pt100-18/M
HH	Pt100-18/O
JJ	Pt100-18/C
KK	Pt100-18/M
LL	Pt100-18/O
MM	Pt100-18/C
NN	Green to screen

Plug 5

A	Pt100-19/M
B	Pt100-19/O
C	Pt100-19/C
E	Pt100-20/M
F	Pt100-20/O
H	Pt100-20/C
D	Pt100-21/M
J	Pt100-21/O
K	Pt100-21/C
L	Pt100-22/M
M	Pt100-22/O
N	Pt100-22/C
R	Pt100-23/M
S	Pt100-23/O
T	Pt100-23/C
P	Pt100-24/M
U	Pt100-24/O
V	Pt100-24/C
X	CG-1/M
Z	CG-1/O
AA	CG-1/C
Y	CG-2/M
BB	CG-2/O
CC	CG-2/C
DD	CG-3/M
EE	CG-3/O

CONTROL RACK

Plug 5 (cont)

FF	CG-3/C
JJ	CG-4/M
KK	CG-4/O
LL	CG-4/C

SS Green to screen

Skt 1

A	Press supply +ve
B	Press supply -ve
C	LHe Press o/p +
E	LHe Press o/p -
F	LN_2 Press o/p +
H	LN_2 Press o/p -
D	Gas Fl sens +ve
J	Gas Fl sens -ve
K	He sens (I+) o/p
L	He sens (I-) o/p
M	Vac gge supp +ve
N	Vac gge supp -ve
P	Pir gge o/p +ve
R	Pir gge o/p -ve
S	Pir setpoint o/p
T	Pir read setpoint
U	Pen gge o/p +ve
W	Pen gge o/p -ve
LL	He Sens (Nk) o/p
MM	Ground
NN	Green to Screen

Skt 2

A	LVDT-1/A	
B	LVDT-1/B	
C	LVDT-1/C	Valve 8
E	LVDT-1/D	4.5 K He
F	LVDT-1/E	
H	LVDT-1/F	
D	LVDT-2/A	
J	LVDT-2/B	
K	LVDT-2/C	Valve 6
L	LVDT-2/D	He CDown
M	LVDT-2/E	
N	LVDT-2/F	
R	LVDT-3/A	
S	LVDT-3/B	
T	LVDT-3/C	Valve 4
P	LVDT-3/D	80 K He
U	LVDT-3/E	
V	LVDT-3/F	
W	LVDT-4/A	
a	LVDT-4/B	
b	LVDT-4/C	Valve 3
X	LVDT-4/D	LN2 Res
Y	LVDT-4/E	
Z	LVDT-4/F	
c	LVDT-5/A	
d	LVDT-5/B	
f	LVDT-5/C	Valve 1
h	LVDT-5/D	LN2 CD
k	LVDT-5/E	
l	LVDT-5/F	
j	LVDT-6/A	
m	LVDT-6/B	
n	LVDT-6/C	Valve 13
p	LVDT-6/D	He Rtn
r	LVDT-6/E	
s	LVDT-6/F	
u	LVDT-7/A	
v	LVDT-7/B	
w	LVDT-7/C	Valve 19
t	LVDT-7/D	LN2 NRtn
x	LVDT-7/E	
y	LVDT-7/F	

z	LN_2 Press cont
AA	LN_2 Press cont
BB	LHe Press cont
DD	LHe Press cont
EE	Fl vv rb 2/1
FF	Fl vv rb 2/2
CC	Fl vv rb 2/3
HH	Fl vv rb 2/1
JJ	Fl vv rb
KK	Fl vv rb 2/3

NN Green to Screen

Skt 3

1	Valve-1/C
2	Valve-1/D
3	Valve-1/F
4	Valve 1/G
5	Valve-2/C
6	Valve-2/D
7	Valve-2/F
8	Valve 2/G
9	Valve-3/C
10	Valve-3/D
11	Valve-3/F
12	Valve 3/G
13	Valve-4/C
14	Valve-4/D
15	Valve-4/F
16	Valve 4/G
17	Valve-5/C
18	Valve-5/D
19	Valve-5/F
20	Valve 5/G
21	Valve-6/C
22	Valve-6/D
23	Valve-6/F
24	Valve 6/G
25	Valve-7/C
26	Valve-7/D
27	Valve-7/F
28	Valve 7/G
29	Fl vv 1/R
30	Fl vv 1/W
31	Fl vv 1/B
32	Fl vv 1/R
33	Fl vv 1/W
34	Fl vv 1/B
37	Ground.

Skt 4

A	He level I/L
B	He level I/L
C	He level +ve
D	He level -ve

Skt 5

A	N2 level I/L
B	N2 level I/L
C	N2 level +ve
D	N2 level -ve

Skt 6

A	Main Coil Quench
B	Main Coil Quench
C	Trim Coil Quench
D	Trim Coil Quench
E	Current Lead I/L
F	Current Lead I/L
G	Reset Quench Det
H	Reset Quench Det
J	12v Power +ve
K	12v Power -ve

Skt 10

A	Keyswitch monitor
B	Keyswitch monitor
E	12v Power +ve
F	12v Power -ve

Skt 11

A	Mix valve FB/A
B	Mix valve FB/D
C	Mix valve FB/E
D	Mix valve FB/F
E	Mix vlv cont /C
F	Mix vlv cont /D
G	Mix vlv cont /F
H	Mix vlv cont /G
J	Ext IL to CEBAF
K	Ext IL to CEBAF
L	I/L from CEBAF
M	I/L from CEBAF
N	External Inlet Sensor
P	External Inlet Sensor
R	External Inlet Sensor

Skt 12

A	Ext I/L to D. Res
B	Ext I/L to D. Res
C	Quench Sw. status
D	Quench Sw. status
E	Spare IL
F	Spare IL

Skt 13

A	I/L to PSU
B	I/L to PSu

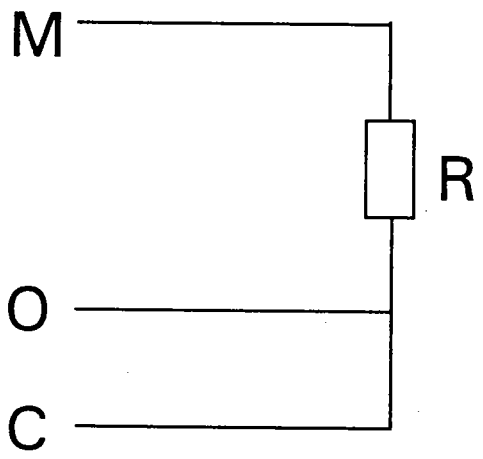
25w D-type (to Quench Detector)

1	+ve current lead signal
2	+ve current lead return
3	Main coil 1 signal
4	Main coil 1 return
5	Main coil 2 signal
6	Main coil 2 return
7	Main coil 3 signal
8	Main coil 3 return
9	Main coil 4 signal
10	Main coil 4 return
11	-ve current lead signal
12	-ve current lead return
13	N3 +ve lead signal
14	N3 +ve lead return
15	N3 -ve lead signal
16	N3 -ve lead return
17	N4 +ve lead signal
18	N4 +ve lead return
19	N4 -ve lead signal
20	N4 -ve lead return
21	N6 +ve lead signal
22	N6 +ve lead return
23	N6 -ve lead signal
24	N6 -ve lead return
25	Screen

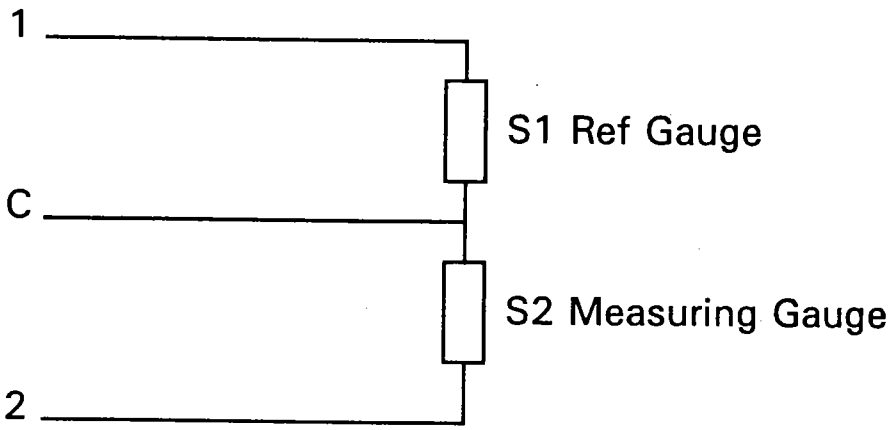
7.6. Magnet signal cable pin allocation

This section describes the signal pin allocation for the five control cables that connect the control rack to the magnet distribution box. This listing should be read with reference to Drawing CCQC0109 Q1/3 Magnet Assembly Wiring, The connectors in the listing are labelled as they are at the control rack.

The temperature sensors have three wires. as shown in the diagram below:



The Strain Gauges also have three wires as shown in the diagram below:



7.5. Quench Detector Unit

7.5.1. Functional Description

The CEBAF quench detector detects a quench in the magnet main coils, the trim coils, and an over-voltage fault in the current leads. The output is a opto isolator contact to the magnet control system, which will initiate a magnet energy discharge when one of the main coils quenches, but only ramp down the PSU if a trim coil quench is detected. The panel layout for the quench detector is shown in Fig 7.5-1. The wiring diagram for the detector is shown on drawing CCQC0217.

7.5.2. Technical Description

Main Quench Detector Card

The circuit for the main Quench detector card is shown on drawing CCQC0222. The front end detector and its associated logic uses two identical circuits to detect a quench in the coils. This redundancy ensures that a quench is detected even in the event of a component failure on one of the detector boards. The outputs of the two circuits are connected in series, so if either of the circuits shows a fault the magnet supply system is shutdown.

A quench in the trim coils is detected using the HELIOS trim detector circuit, which is an active low pass filter that triggers on a 1v rise across any of the trim coils.
The magnet current leads are monitored by the ISO Amplifier with a gain of 20.
When the voltage across the current leads rises between 60-80mV an interlock is sent to the control system.

The output of the detector opto-isolators are fed into the logic circuit. This uses SR latches and NOR gates to latch the signal that generates the interrupt, and inhibits any other signal from being latched until the reset signal is sent from the control system. The output of the logic circuit gives an opto isolator contact signal to indicate a main coil quench, a trim coil quench, or a current lead over-voltage error. The circuit can be reset by a remote command from the control system or the local front panel reset button.

The outputs of the interlock opto-isolators are held on by the logic circuit when no fault is detected. This ensures that component or power failure will result in a fault signal being sent to the control system. The output of the latches are also be displayed on the front panel for local indication of the fault (see panel layout in Fig 7.5-1).

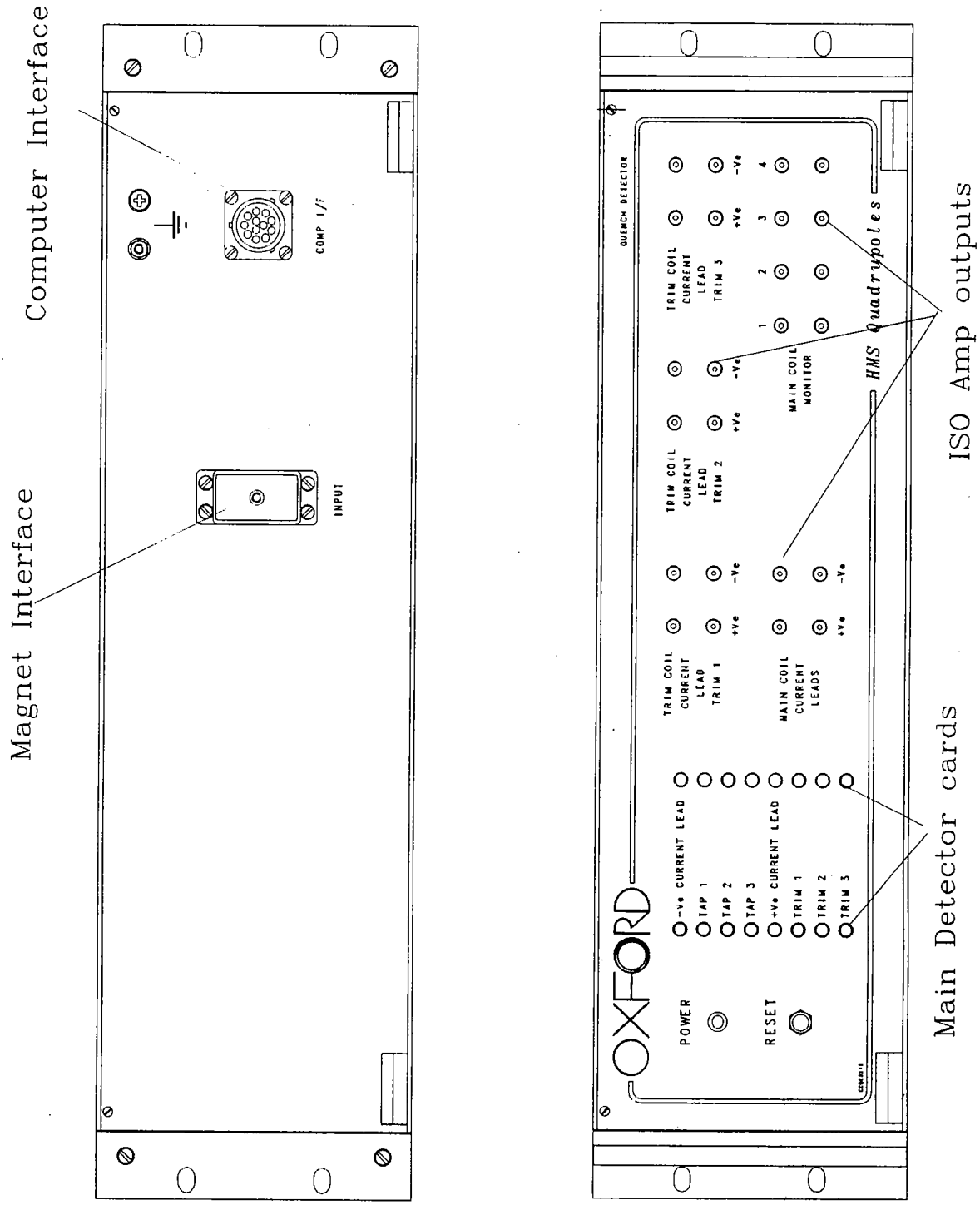


Fig 7.5-1 Quench Detector Panel Layout

Isolated monitor output.

The circuit of the isolation amplifiers is shown on drawing CCQC0223. The voltages across the main coil, trim coils, and current leads are fed to the input of isolating amplifiers. The output of these amplifiers are fed to 1mm sockets on the front panel of the Detector, to enable the voltage across the coils and across the main current leads to be monitored using a standard DVM unit. The outputs from the isolating monitor amplifiers are available on the front panel via standard 1mm panel sockets. They are also relayed to the interface unit via a 25w D-type connector for monitoring and logging by the control computer.

Test Circuit.

The test circuit board in the Quench detector can be used periodically to test the quench detector circuit. The circuit disconnects using the voltage taps from the magnet and connects a quench voltage to each of the detector inputs via push switches mounted on the front of the board. (10mV for main coil, 1.25V for trim coils and 100mV for current leads). The circuit diagram is shown in drawing CCQC0272.

When the test circuit is in operation, a separate relay circuit, which is connected in series with the trim interlock circuit, is de-energised, inhibiting the magnet PSU from ramping up the magnet current.

7.5.3. Quench Detector Test Procedure

Correct operation of the quench detector is essential if the magnet is to be safely discharged in the event of a quench or current lead coolant failure, and to avoid unwanted trips. Two tests are carried out to verify the quench detector, these are the voltage balance check and the sensitivity test.

Quench Detector Balance Check

To test for voltage balance connect an isolated chart recorder across the following test points on both detector boards:

TP15 to TP1 (VR 1)
TP16 to TP2 (VR 2)
TP17 to TP3 (VR 3)

Enter a set current of 10 A at the control console and set the PSU to ON. Note whether or not the Q-det trips when the PSU applies 6.5 V across the magnet and note the peak voltage on the chart recorded. Adjust the appropriate potentiometer

for each pair of test points if necessary until the measured voltage is much less than the 10 mV trip threshold.

Quench Detector Sensitivity Check

It is important that the quench detector be able to detector and trigger on voltage differences as low as 10 mV in order to detect quenches early. A test card is built into the quench detector to allow the detector boards to be temporarily disconnected from the magnet and test voltages applied; as the test card disconnects the detector boards from the magnet it is not necessary to remove the PSU leads from the magnet before hand. To perform a complete quench detector test:

1) Hinge down the quench detector front panel. The test board is on the left hand side of the unit and has a row of buttons on its front edge.
2) A detector channel can be tested only while the red button is depressed; this disconnects the detector boards from the magnet pot. taps and connects them to the test board. Keep the button pressed while testing, reset any trips which occur when the red button is pressed using the front panel reset button.
3) The remaining buttons are, from the top, positive main coil lead, main coil channel 1, main coil channel 2, main coil channel 3, negative main coil lead, trim channel 1, trim channel 2, trim channel 3.
4) Each of the first five buttons should trip the relevant channel within a second or so. The trim channels take approximately 20 seconds to trip.
5) If all channels test satisfactorily, secure the quench detector front panel.

See also section 8.12.2

7.5.4. Connector Pin Allocation

The connector pin allocations for the Quench Detector are listed below, (where MC = Main coil; I = current lead) :

Plug 1

Pin	Signal
A	MC I+U
B	MC I+L
C	MC 1/6
D	MC 3/6
E	MC 1/1
F	MC 2/1
H	MC 2/6
J	MC 3/1
K	MC 4/1
L	MC 4/6
M	I - U

Pin	Signal
N	I - L
P	Trim 1 I - U
R	Trim 1 I + U
S	Trim 1 I - L
T	Trim 2 I + L
U	Trim 2 I + U
X	Trim 2 I - U
Y	Trim 3 I + L
Z	Trim 2 I - L
AA	Trim 3 I + U
BB	Trim 3 I - U
CC	Trim 3 I - L

Plug 2

Pin	Signal
A }	MC quench
B }	
C }	Trim quench
D }	
E }	Curr lead Voltage
F }	
G }	Reset Detector
H }	
J	+12v Power
K	0v

25w D-type

Pin	Signal
1	+ve current lead signal
2	+ve current lead return
3	Main coil 1 signal
4	Main coil 1 return
5	Main coil 2 signal
6	Main coil 2 return
7	Main coil 3 signal
8	Main coil 3 return
9	Main coil 4 signal
10	Main coil 4 return
11	-ve current lead signal
12	-ve current lead return
13	N3 +ve lead signal
14	N3 +ve lead return
15	N3 -ve lead signal
16	N3 -ve lead return
17	N4 +ve lead signal
18	N4 +ve lead return
19	N4 -ve lead signal
20	N4 -ve lead return
21	N6 +ve lead signal
22	N6 +ve lead return
23	N6 -ve lead signal
24	N6 -ve lead return
25	Screen

56w Varelco Plug 1

A	Pt100-1/M
B	Pt100-1/O
C	Pt100-1/C
E	Pt100-2/M
F	Pt100-2/O
H	Pt100-2/C
D	Pt100-3/M
J	Pt100-3/O
K	Pt100-3/C
L	Pt100-4/M
M	Pt100-4/O
N	Pt100-4/C
R	Pt100-5/M
S	Pt100-5/O
T	Pt100-5/C
P	Pt100-6/M
U	Pt100-6/O
V	Pt100-6/C
W	Pt100-7/M
a	Pt100-7/O
b	Pt100-7/C
X	Pt100-8/M
Y	Pt100-8/O
Z	Pt100-8/C
c	Pt100-9/M
d	Pt100-9/O
f	Pt100-9/C
h	Pt100-10/M
k	Pt100-10/O
l	Pt100-10/C
j	Pt100-11/M
m	Pt100-11/O
n	Pt100-11/C
p	Pt100-12/M
r	Pt100-12/O
s	Pt100-12/C
u	Pt100-13/M
v	Pt100-13/O
w	Pt100-13/C
t	Pt100-14/M
x	Pt100-14/O
y	Pt100-14/C
z	Pt100-15/M
AA	Pt100-15/O
BB	Pt100-15/C
DD	Pt100-16/M
EE	Pt100-16/O
FF	Pt100-16/C
CC	Pt100-18/M
HH	Pt100-18/O
JJ	Pt100-18/C
KK	Pt100-18/M
LL	Pt100-18/O
MM	Pt100-18/C
NN	Green to screen

56w Varelco Plug 2

A	Pt100-19/M
B	Pt100-19/O
C	Pt100-19/C
E	Pt100-20/M
F	Pt100-20/O
H	Pt100-20/C
D	Pt100-21/M
J	Pt100-21/O
K	Pt100-21/C
L	Pt100-22/M
M	Pt100-22/O
N	Pt100-22/C
R	Pt100-23/M
S	Pt100-23/O
T	Pt100-23/C
P	Pt100-24/M
U	Pt100-24/O
V	Pt100-24/C
W	CG-1/M
a	CG-1/O
b	CG-1/C
X	CG-2/M
Y	CG-2/O
Z	CG-2/C
c	CG-3/M
d	CG-3/O
f	CG-3/C
h	CG-4/M
k	CG-4/O
l	CG-4/C
j	MC Pot Tap I+U
m	MC Pot Tap I+M
n	MC Pot Tap 1/6
p	MC Pot Tap 1/1
r	MC Pot Tap 2/1
s	MC Pot Tap 2/6
u	MC Pot Tap 3/6
v	MC Pot Tap 3/1
w	MC Pot Tap 4/1
t	MC Pot Tap 4/6
x	MC Pot Tap I-U
y	MC Pot Tap I-M
z	Trim 1 +lead top
AA	Trim 1 +lead bottom
BB	Trim 1 -lead top
DD	Trim 1 -lead bottom
EE	Trim 2 +lead top
FF	Trim 2 +lead bottom
CC	Trim 2 -lead top
HH	Trim 2 -lead bottom
JJ	Trim 3 +lead top
KK	Trim 3 +lead bottom
LL	Trim 3 -lead top
MM	Trim 3 -lead bottom
NN	Green to screen

56w Varelco Socket 1

A	Strain Gauge 1/1
B	Strain Gauge 1/2
C	Strain Gauge 1/C
E	Strain Gauge 2/1
F	Strain Gauge 2/2
H	Strain Gauge 2/C
D	Strain Gauge 3/1
J	Strain Gauge 3/2
K	Strain Gauge 3/C
L	Strain Gauge 4/1
M	Strain Gauge 4/2
N	Strain Gauge 4/C
R	Strain Gauge 5/1
S	Strain Gauge 5/2
T	Strain Gauge 5/C
P	Strain Gauge 6/1
U	Strain Gauge 6/2
V	Strain Gauge 6/C
W	Strain Gauge 7/1
a	Strain Gauge 7/2
b	Strain Gauge 7/C
X	Strain Gauge 8/1
Y	Strain Gauge 8/2
Z	Strain Gauge 8/C
c	Pressure sensors supply +ve
d	Pressure sensors supply -ve
f	LHe Pressure output +ve
h	LHe Pressure output - -ve
k	LN_2 Pressure output +ve
l	LN_2 Pressure output - -ve
j	Gas Flow sensor supply +ve
m	Gas Flow Sensor supply -ve
n	Gas flow sensor 1 output (I+)
p	Gas flow sensor 2 output (I-)
r	LN_2 level probe 1
s	LN_2 level probe 2
u	LN_2 level probe 3
v	LN_2 level probe 4
w	LN_2 level probe 5
t	LHe level probe 1
x	LHe level probe 2
y	LHe level probe 3
z	LHe level probe 4
AA	LHe level probe 5
BB	Vacuum gauges supply +ve
DD	Vacuum gauges supply - -ve
EE	Pirani gauge output +ve
FF	Pirani gauge output -ve
CC	Pirani setpoint output
HH	Pirani read setpoint
JJ	Penning gauge output +ve
KK	Penning gauge output -ve
LL	Gas flow sensor 3 output (Neck)
MM	Ground
NN	Green to Screen

56w Varelco Socket 2

A	LVDT-8/A
B	LVDT-8/B
C	LVDT-8/C
E	LVDT-8/D
F	LVDT-8/E
H	LVDT-8/F
D	LVDT-6/A
J	LVDT-6/B
K	LVDT-6/C
L	LVDT-6/D
M	LVDT-6/E
N	LVDT-6/F
R	LVDT-4/A
S	LVDT-4/B
T	LVDT-4/C
P	LVDT-4/D
U	LVDT-4/E
V	LVDT-4/F
W	LVDT-3/A
a	LVDT-3/B
b	LVDT-3/C
X	LVDT-3/D
Y	LVDT-3/E
Z	LVDT-3/F
c	LVDT-1/A
d	LVDT-1/B
f	LVDT-1/C
h	LVDT-1/D
k	LVDT-1/E
j	LVDT-1/F
j	LVDT-13/A
m	LVDT-13/B
n	LVDT-13/C
p	LVDT-13/D
r	LVDT-13/E
s	LVDT-13/F
u	LVDT-19/A
v	LVDT-19/B
w	LVDT-19/C
t	LVDT-19/D
x	LVDT-19/E
y	LVDT-19/F
z	LN_2 Pressure switch contact
AA	LN_2 Pressure switch contact
BB	LHe Pressure switch contact
DD	LHe Pressure switch contact
EE	Flow valve readback 1/1
FF	Flow valve readback 1/2
CC	Flow valve readback 1/3
HH	Flow valve readback 2/1
JJ	Flow valve readback 2/2
KK	Flow valve readback 2/3
LL	
MM	
NN	Green to Screen

37w D-type Socket

1	Valve-8/C
2	Valve-8/D
3	Valve-8/F
4	Valve 8/G
5	Valve-6/C
6	Valve-6/D
7	Valve-6/F
8	Valve 6/G
9	Valve-4/C
10	Valve-4/D
11	Valve-4/F
12	Valve 4/G
13	Valve-3/C
14	Valve-3/D
15	Valve-3/F
16	Valve 3/G
17	Valve-1/C
18	Valve-1/D
19	Valve-1/F
20	Valve 1/G
21	Valve-13/C
22	Valve-13/D
23	Valve-13/F
24	Valve 13/G
25	Valve-19/C
26	Valve-19/D
27	Valve-19/F
28	Valve 19/G
29	Flow Valve 1/R
30	Flow Valve 1/W
31	Flow Valve 1/B
32	Flow Valve 2/R
33	Flow Valve 2/W
34	Flow Valve 2/B
37	Ground.

When the user-defined event is evaluated, it executes the script using the Node credentials associated with the event. These are either the default Node credentials associated with the Enterprise Manager administrator who registered the event or the overwritten Node credentials specified when the event was registered, as explained in the next section. Note that any environment associated with these Node credentials will not be available when the script is run.

Register the user-defined event in the Console

Once you have created the monitoring script, you are ready to add the script's monitoring functionality to the Enterprise Manager Event system. To create and register a user-defined event for your monitoring script:

1. Choose the Create Event option from the Event menu to display the Event property sheet.
2. Complete the General page. Select the target node as the node on which the monitoring script will be run.
3. Click on the Tests tab to display available tests for the selected target.
4. If not expanded already, expand the Node object in the Available Tests tree list.
5. Select User Defined Event and click the Add button.
6. Click on the Parameters tab to display the Parameters page.
7. Click on User Defined Event in the Selected Tests list to display the user-defined event test parameters. See Figure 6–3, "User-Defined Event Parameters Page".
8. Click Import. The Load File dialog appears.
9. Select the desired script file and click Open. The contents of the script appear in the Script Text window. See Figure 6–3, "User-Defined Event Parameters Page" and "User-Defined Event Parameters" on page 6-26 for more information on other ways to specify user-defined event parameters.
10. Complete the rest of the Event property sheet.
11. Submit the Event. You have three options when submitting the Event:
    a. Choose Submit, to register the event against the selected destinations. The new event is not saved to the Event Library.
    b. Choose Add to the Library (or Save to Library if editing an event from the Library) to save the event to the Event Library. The event will not be submitted to the target destinations at this time. The new event appears in the Event Library dialog.

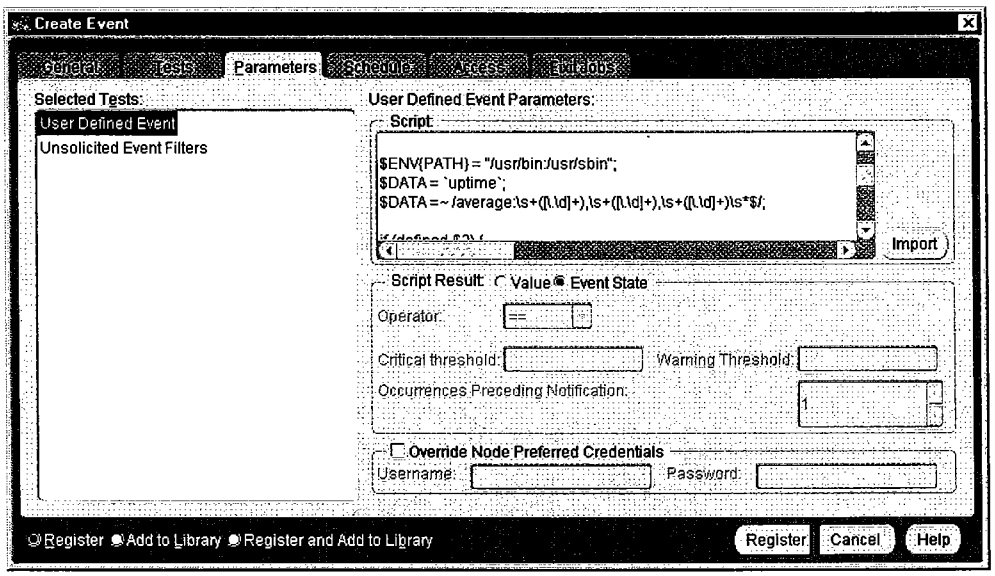
c. Choose Submit and Add to Library (or Submit and Save to Library) to submit the event to the selected targets and save the event to the Event Library. The new event appears in the Event Library dialog.

12. Make sure the Event is registered by selecting Events from the Console Navigator and clicking the Registered tab (Detail view). Make sure "Show Targets" is checked at the bottom of the Registered page in order to see the registration status for each target.

User-Defined Event Parameters

The User-Defined Event parameters page allows you to allows you to specify the user-defined event test information required to successfully register the event in the Enterprise Manager Console.

Figure 6–3 User-Defined Event Parameters Page



User-Defined event test parameters consist of the following:

Script
Enter the monitoring script used for the event evaluation. You can specify this either by entering the full text of the script OR by entering the fully-qualified script name (on the monitored target).

If you choose the enter the full text of the script, and if the script is in a file locally accessible to the console, you can use the "Import" button to load the script from the file instead of manually entering the script.

If your script file resides on the monitored target, you can just specify the fully-qualified filename of the script instead of loading the script text.

Script Result
This parameter indicates the way the results of the event evaluations are returned by your script. You can specify one of two ways in which results are returned: by Value or Event State.

Value: Your script evaluates the condition and returns the value of the monitored metric. Enterprise Manager will then compare the value against specified thresholds.

The following parameters indicate how you want Enterprise Manager to evaluate the value of the monitored metric.

Operator: The operator that Enterprise Manager should use when comparing the value of the monitored metric against the specified thresholds. Select one of the following comparison operators:

- == (equal)
- < (less than)
- > (greater than)
- <= (less than or equal to)
- >= (greater than or equal to)
- != (not equal)

Critical Threshold: The value against which the monitored metric is compared using the specified operator. If it holds true, the event triggers at a Critical level.

Warning Threshold: The value against which the monitored metric is compared using the specified operator. If it holds true, the event triggers at an Warning level.

Occurrences Preceding Notifications: The number of times the event condition should hold true before a notification is sent.

Example:
You may want to create an event that monitors disk space. You can write a script that checks the amount of free disk space and returns that amount as the value to be evaluated. You may want the event to trigger at Warning level when the free disk space is below 500K, and to trigger at Critical level when the free disk space is below 200K. Hence, when defining the event, you would specify the following:

Script: Enter the script text or click Import to load an existing file. If the name of your script is "checkspace.sh" and if it is located on the monitored node, you can, for example, simply enter: `/u1/private/checkspace.sh`.

Event Parameters Page Settings

- Script Result: Choose the "Value" option
- Operator: <
- Critical Threshold: 200000
- Warning Threshold: 500000
- Occurrences Preceding Notification: 1

Event State If you choose this option, the script you write evaluates the event condition and also determines if the event has triggered at a Critical or Warning level, or has not triggered at all (e.g. the event status is Clear or the script has failed to run due to some error). In order to provide the appropriate event status to Enterprise Manager, the script should define and return the appropriate event status. For more information, see "Creating Your Monitoring Script" on page 6-22.

Override Node Preferred Credentials: When your script is executed, it runs as the operating system user specified by the Node credentials associated with the event. These credentials are either the default Node credentials of the Enterprise Manager administrator who is registering this event, or the credentials specified here. It is important to note, however, that any environment associated with the Node credentials will not be used when the script is run.

Output

If the event triggers, the value of the monitored metric is returned. The actual message to be displayed depends on the message you defined in your script via the `<oramessage>` tags. If no message is specified, the default message is: Current

result: <value of monitored metric>. If a failure occurs, then the message displayed is the message specified in the <orafailure> tag.

Bundled User-Defined Event Sample

Enterprise Manager has bundled a sample user-defined event script that monitors the 5-minute load average on the system. The script performs this function by using the 'uptime' command to obtain the average number of jobs in the run queue over the last 5 minutes.

The script is written in Perl and assumes you have Perl interpreter located in /usr/local/bin on the monitored node.

This script, called udeload.pl, is installed in the $ORACLE_HOME/sysman/admin directory where $ORACLE_HOME is the Oracle directory where the Enterprise Manager is installed.

Full text of the script:

```
#!/usr/local/bin/perl

# Description: 5-min load average.
# Sample User Defined Event monitoring script.

$ENV{PATH} = "/usr/bin:/usr/sbin";

$DATA = `uptime`;
$DATA =~ /average:\s+([\.\d]+),\s+([\.\d]+),\s+([\.\d]+)\s*$/;


if (defined $3) {
   print "<oraresult>$2</oraresult>\n";
} else {
   print "<orafailure>Error collecting data</orafailure>\n";
}
```

Setting Up the Sample Script as a User-Defined Event

1. Copy the script (udeload.pl) to the monitored target. For example: /private/myhome. Make sure you have a 9i version of the Intelligent Agent running on this machine.
2. Edit the script, if necessary, to point to the location of the Perl interpreter on the monitored target. By default, the script assumes the Perl interpreter is in /usr/local/bin.

3. As a test, run the script: udeload.pl You may need to set its file permissions such that it runs successfully. You should see output of this form:

```
<oraresult>2.1</oraresult>
```

4. In the Enterprise Manager Console, create a new event as follows:

   a. In the General page, provide a name for the event, say "Test UDE". Choose "Node" as the Target Type. For targets, select the node on which you copied the script.

   b. In the Tests page, select the "User Defined Event" test.

   c. In the Parameters page, enter the following:

      Script: /private/myhome/udeload.pl (.... or the fully qualified path to where the script is)

      Script Result: make sure the "Value" option is selected

      Operator: >=

      Critical threshold: 0.005

      Warning threshold: 0.001

      Occurrences Preceding Notification: 1

      Override Node Credentials: Specify the credentials of an OS user that can execute the script.

      In this example, we want the event to trigger at a Warning level if the 5-minute load average on the machine reaches 0.005, and trigger at a Critical level if the 5-minute load average reaches 0.001. Feel free to change these thresholds depending on your system.

   d. In the Schedule page, set the time interval upon which you'd like this event to be evaluated. By default this is set to every 5 minutes. As a test, you can reduce this to 1 minute.

   e. In the Access page, select the Administrators to be notified when the event triggers

5. Click Register to register the event with the Enterprise Manager Event system.

   When the 5-minute load reaches at least 0.001, you should see the event trigger in the Enterprise Manager Console as well as have the selected administrators be notified of this event.

Creating and Registering an Event

Events include the target type and the event information that you want to monitor. Events can consist of multiple event tests. To create and register an event:

1. Choose the Create Event option from the Event menu to display the Event property sheet. (you can also display the Event property sheet by opening an event from the Event Library dialog.)
2. Complete the fields in the General page. On the Tests page, select the desired event tests. Complete the rest of the pages of the property sheet to create a new event.
3. When you have completed the Event property sheet:
   a. Choose Register, to register the event against the selected destinations. The new event is not saved to the Event Library.
   b. Choose Add to the Library (or Save to Library if editing an event from the Library) to save the event to the Event Library. The event will not be submitted to the target destinations at this time. The new event appears in the Event Library dialog.
   c. Choose Register and Add to Library (or Register and Save to Library) to submit the event to the selected destinations and save the event to the Event Library. The new event appears in the Event Library dialog.

If you registered an event, the Intelligent Agent on the target node processes the event and the event appears in the Registered page of the Event pane. If the "show Targets" checkbox is selected, each destination target is listed separately with the event. If the "Show Targets" box is not checked, only the target name, type, and owner is shown.

Note: There is usually a slight delay between the time the event is registered and the actual notification by the Intelligent Agent.

When threshold values are exceeded for the tests in an event, the event appears in the Alerts page of the Event pane. The notification changes the color of the severity flag for the event in the Alerts page. If a destination icon is displayed in the Group pane, the flag on the icon changes color. The colors and their meaning are:

- Unknown (gray flag)

- Event cleared (green flag)
- Warning (yellow flag)
- Critical (red flag)
- Error (yellow hexagon)

Cases where an event notification is Unknown (gray flag) indicate the Intelligent Agent or node where the event is registered is unavailable or inaccessible, or the Intelligent Agent on that node is unavailable.

Warning: Do not register an UpDown event (included in the Oracle DB Fault event) against the database or node where the Repository schema is stored. If the database containing the Repository goes down, the Management Server also shuts down. Hence, the Intelligent Agent cannot inform the Management Server that the database is down.

The property sheet for creating a new event is the same as the property sheet for modifying an event, except that the event name and target type fields are always read-only. See Figure 6–8, "Event General Page" for an illustration of the Event property sheet.

See "Event Categories and Types" on page 6-8 for more information.

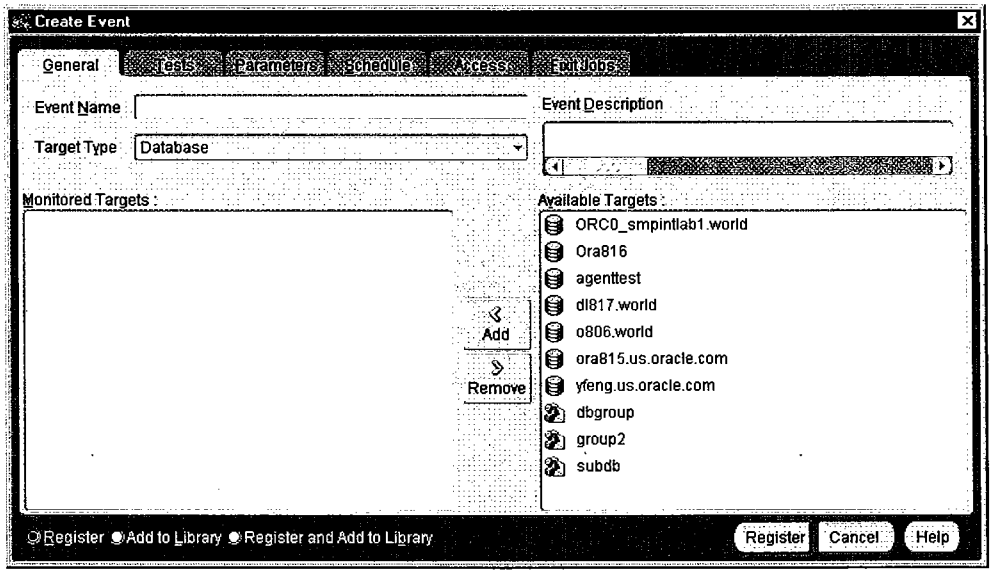
Dynamic Modification of Registered Events

Dynamic event modification allows you to actively modify a registered event and have the changes automatically applied to all monitored targets of that event. For example, you can add an additional database to be monitored if you have an existing Tablespace Full event. The Intelligent Agent for the newly added database will now monitor for tablespace full conditions.

However, not all event attributes can be changed. What you are allowed to change depends on the version of the Intelligent Agent used with each monitored target. You may have older versions of the Intelligent Agent running on different targets within your enterprise and these older versions of the Intelligent Agent will only support a subset of modifications you can make using a 9*i* Agent.

Because pre-9*i* Intelligent Agents do not support dynamic event modification, if an event contains targets running pre-9*i* Intelligent Agents, modification will be limited. If all targets running pre-9*i* Agents are removed from the Monitored Targets list, then full modification of the registered event will be enabled.

Figure 6–4 Event General Page



The following are general usage guidelines for dynamic modification of events:

1. Only the Owner of the registered event can modify all parameters for the event. The owner of a registered event is the administrator who originally registered the event. The owner is shown under the "Owner" column of the Registered page of the Events pane, or via the Owner field in the Access property page of the Edit Event property sheet.
2. An event can be registered against multiple targets on different nodes, each of which is monitored by its own Intelligent Agent. The version of the Intelligent Agent determines the amount of event editing that can be performed against that particular target. You can easily determine the version of the Intelligent Agent running a particular target from the target's Node property sheet.

Figure 6–5 Node Property Sheet

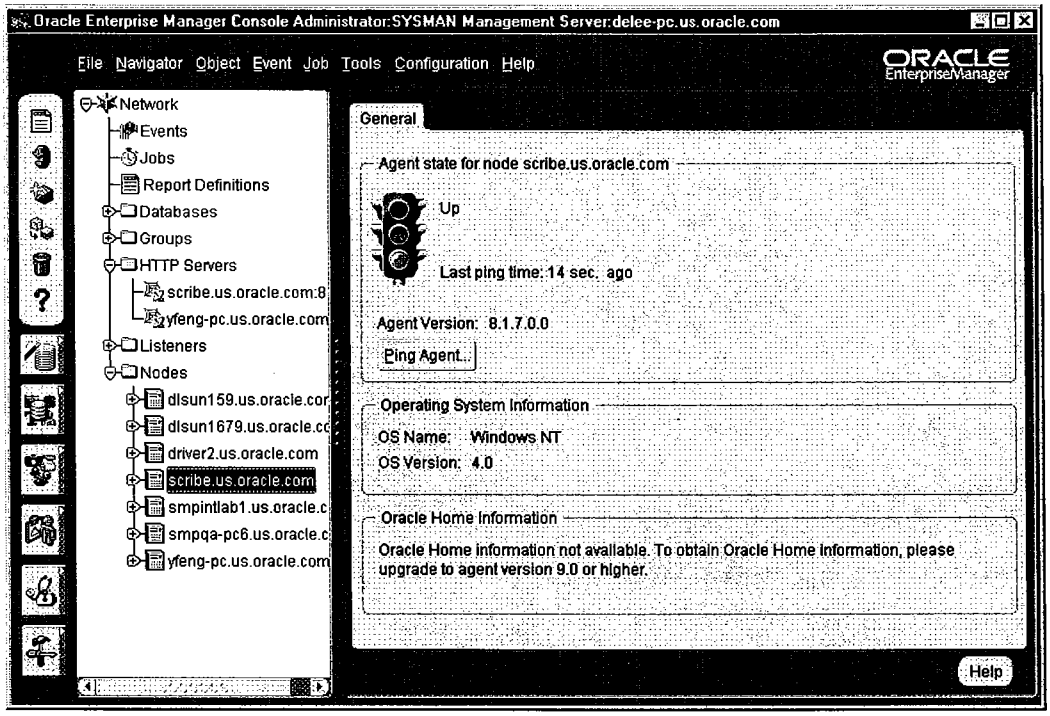


Table 6–2 Modifiable Event Attributes

Event Attribute	Located in this Property Page of the Event Dialog:	If all targets for the event are running with a PRE-9i Agent, can it be modified?	If each target for the event is running with a 9i Agent, can it be modified?	If, for the event, some targets use 9i Agents and some targets use pre-9i Agents, can the event be modified?
Event Description	General	yes	yes	yes
Monitored Targets	General	yes Adding a target creates a new event registration for that target. Deleting a target de-registers the event for that target.	yes Adding a target creates a new event registration for that target. Deleting a target de-registers the event for that target.	yes
Adding or deleting event tests	Tests	no	yes	no
Changing test parameters	Parameters	no	yes	no
Schedule - polling frequency and start time	Schedules	no	yes	no
Permissions	Access	yes	yes	yes
Enabling/Disabling SNMP traps	Access	no	yes	no
Selecting or Creating a fixit job for the event	Fixit Jobs	no	yes	no

General Behavior

When dynamically modifying events, there are general system behaviors of which you should be aware:

- When an event has selected targets with the event registered or pending running both pre-9*i* and 9*i* Intelligent Agents, then only the attributes that can be modified across all Intelligent Agent versions are supported.

- If you want to modify an attribute that cannot be modified using a pre-9*i* Intelligent Agent (e.g. test parameters), then you can:
  1. Modify the event by removing the targets running the pre-9i Intelligent Agent. This will enable editing of 9i targets.
  2. Modify the event attributes as necessary, i.e., test parameters.
  3. Submit the changes. The event will be modified on the 9i targets and deregistered from the pre-9i targets.
  4. Modify the event again by adding back the pre-9i target you removed. It will now contain the attribute that was just modified.
- The Event property sheet will automatically enable or disable property pages depending on the changes supported.

For example, if your event originally had a mix of targets running pre-9*i* and 9i Intelligent Agents, then the Tests, Parameters, Schedule, and Fixit Jobs property pages will be disabled for editing. If during the edit session, you remove the targets running the pre-9i Intelligent Agents, then the Tests, Parameters, Schedule, and Fixit Jobs property pages will now allow editing since the remaining targets support editing of those attributes. However, if any of those attributes are changed in this edit session, you will not be able to bring back the original pre-9i targets you removed. (To bring back the original pre-9i targets, you first have to submit the changes, then re-edit the event to add back the pre-9i targets).

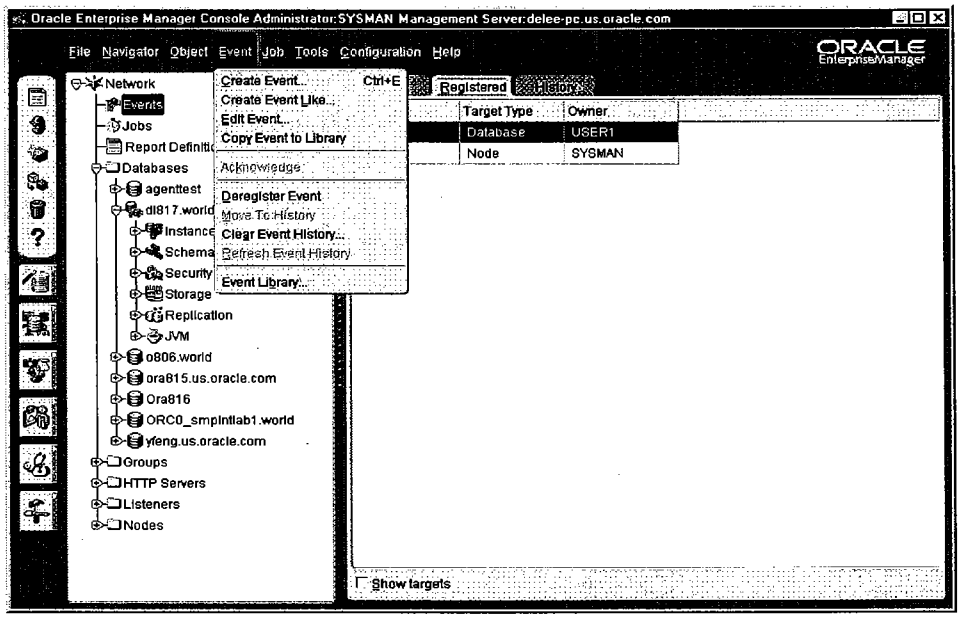
Event Detail View

The Event detail view, which displays when you select the Events object in the Console Navigator, contains the following pages:

- Alerts Page
- History Page
- Registered Page

You can switch between the pages by clicking the tab of each page. The rows in any page can be sorted on any column by clicking the column heading. See Figure 6–6, "Event Menu and Detail View" for an illustration of the Event detail view.

Figure 6–6 Event Menu and Detail View



Because the detail view changes in relation to the object selected in the Console Navigator, Enterprise Manager allows you to "undock" the Event detail view from the Console so that it can be persistently displayed. This allows you to keep an eye on the status of monitored events while you perform other tasks from the Console.

To launch the Event detail view in a floating window, select the Events object from the Navigator and choose 'Display in New Window' from the context-sensitive menu.

Alerts Page

The Alerts page displays event tests that have been triggered.

Severity
Severity of the event occurrence: critical (red flag), warning (yellow flag), clear (green flag), unknown (gray flag), or error state (yellow hexagon).

Name
Name of the event.

Target
Target where the event was triggered.

Target Type
Database, listener, node, or HTTP Server.

Date/Time
Time and date of the event occurrence.

Assigned To
Administrators assigned to work on the event occurrence.

Owner
Administrator who owns the event.

Viewing Alerts

To view details of an event that has occurred, double-click on the event in the Alerts or History page to display the Event Viewer property sheet. See "Event Viewer" on page 6-42 for more information. You can enter notes on the nature and progress of the event condition.

> **Note:** Comments entered into the log are viewable/editable by admins with the Modify permission. After you have reviewed an event, you can move it to the History page. See "Event Viewer" on page 6-42 for more information.

History Page

The Event History page displays a history of events that have occurred and have been moved to History by an administrator or cleared by an Intelligent Agent. The Event History page displays the same columns as the Alerts page.

The History page is refreshed automatically each time you move between the History page and the Alerts or Registered page. However, to refresh the event history list while currently viewing the History pane, you must click the Refresh icon located in the Console toolbar.

To clear all entries in the History page, choose Clear Event History from the Console's Event menu. You can delete entries individually by right-clicking on a

specific event in the History page and choosing Delete Item(s) from the context-sensitive menu.

Registered Page

The Registered page displays the events that have been registered, or submitted, to monitor test conditions on network objects. The Registered page contains the following information:

Name
Name of the event.

Target
Target where the event is monitored. Displayed only when Show Targets is checked.

Target Type
Type of event destination: database, node, listener, web server, Concurrent Manager,

Status
Current registration status of the event: Registered, Registration Pending, De-Registration Pending, Modification Pending, and Registration Failed. Displayed only when Show Targets is checked. The registered event status is only updated when this page is refreshed.

Owner
Administrator who owns the event. Displayed only when Show Targets is checked.

Show Targets
When checked, the Registered page displays Target and Status information. By default, "Show Targets" is not checked.

Under certain circumstances, an event will remain in a Registration Pending state.

1. If this occurs the Intelligent Agent on the node with which you are trying to register the event is down, or the node is not connected to the network. Check the status of the Intelligent Agent by selecting the node on which the Intelligent Agent is running and viewing the Node property sheet. You can also ping the Intelligent Agent to check its availability.
2. The node with which you want to register the event was defined manually (without using the Intelligent Agent). Connections to a manually defined node will not allow you to utilize remote management functionality such as Jobs or Events. You must first de-register any jobs or events against the node, remove

the node from the Console navigator, and then rediscover the node while it is running a 7.3.4 or later Intelligent Agent.

Event Menu

The Event menu allows you to set up event and administrator information. This menu also provides options to register, track, and view specific events. Menu options are enabled or displayed according to the items selected in the Event pane. See Figure 6–6, "Event Menu and Detail View" for an illustration of the Event menu.

Note: When you register or remove an event, there is usually a slight delay while the Intelligent Agent processes the request.

Create Event

Displays the Event property sheet and allows you to create the definition of a new event. See "Event General Page" on page 6-46 for more information.

Create Event Like

Available when an existing event is selected in the Console's Event detail view, this option displays the Event property sheet with the same page and parameter settings as the selected event. You can then save the event as under another event name.

Edit Event

Displays the definition of the selected event and allows you to edit the event. This menu option appears when an event is selected in the Registered page.

Edit Event Occurrence

Displays the definition of an existing event. See "Event General Page" on page 6-46 for more information.

Acknowledge

Acknowledges the selected event in the Alerts page. When an event triggers, an entry is added to the Alerts page. In the severity column, a flag of the appropriate color is displayed along with a pair of eyeglasses. The eyeglasses also appear whenever there is a change in the status of the event (e.g. from 'warning' to 'critical') If you choose to "acknowledge" this event, then it means you are aware of this event occurrence and hence the eyeglasses will disappear. This is useful in multi-administrator environments where the presence or absence of eye glasses indicates whether or not someone has looked at the event.

Copy to Event Library

Copy the selected event in the Event pane to the Event Library.

Deregister Event
Deregisters the event. This menu option only appears when an event test is selected in the Registered page.

Move to History
Moves the selected event in the Alerts page to Event History page of the Event pane. This option is enabled when an item is selected in the Alerts page.

Refresh Event History
Updates the History pane with the most recent entries.

Clear Event History
Clears the contents of the Event History page.

Event Library
Displays the Event Library dialog. See "Event Library Dialog" on page 6-41 for more information.

Context-Sensitive Menus

If you select an item in the Event pane with the right mouse button, the context-sensitive menu for that item appears. This menu is a subset of the Event menu plus selection-specific menu options.

Event Library Dialog

The Event Library dialog displays the events that have been created and saved to the Event Library. The advantage to using the Event Library is that both events and any associated target information can be stored, copied, or modified in the library for future use. When you create an event, you have the option of submitting, saving to the Event Library, or submitting and saving to the Event Library.

This dialog contains the following information:

Event
Name of the event.

Owner
Administrator who created the event.

Editing an Event in the Event Library

Select an event and click Edit to display the property sheet for the library event. The property sheet allows you to view and modify the library event. In addition to editing, you can perform a wide variety of event-related operations such as deleting, registering, and creating new events based on an existing event in the Event Library. If an event of the same name is already actively running, you must first remove the active event from all targets before registering it again.

Refresh

Updates the library events with the current definition at any time.

Oracle Event Tests

Several predefined event tests have been installed with Oracle Enterprise Manager. These appear in the Tests page of the Event property sheet, depending on the target type selected on the General page. You can add these tests to an event. The tests include:

- Database UpDown: checks whether a database is up or down.
- Host UpDown: checks whether a node is up or down.
- Net UpDown: checks whether a listener is up or down.
- HTTP Server UpDown: checks whether a monitored webserver is up or down.

Note: Only the UpDown tests are included with Oracle Enterprise Manager. Additional advanced event tests are available with the optional Oracle Diagnostics Pack. Refer to the *Enterprise Manager Event Test Reference Manual* for a complete list of advanced event tests.

To view the specific tests assigned to an event, double-click on the event in the Event Library dialog and view the Test page of the Event property sheet. See the online help for Oracle events, "Oracle Event Tests" on page 6-56, or the Diagnostic Pack documentation for information on Oracle event tests and their parameters.

Event Viewer

The Event Viewer property sheet displays details on a selected event in the History or Alerts page. When an event triggers, you select the triggered event and bring it up in the Event Viewer. The Event Viewer contains information on why the event triggered. You can also assign the event to a particular administrator and put instructions for other administrators via the Log page.

You can enter optional comments in the Log page, which is good way to share information about an event with other administrators. Once cleared, events are automatically moved to the History page. The pages of the Event Viewer include:

- General
- Log
- Notification Details

Event Viewer: General Page

The Event Viewer General page displays statistics and author information on a selected event. To obtain information on how to respond to an event occurrence, refer to the "User Action" section of the individual event test:

The following statistics are displayed:

Target
Destination of the event.

Target Type
Database, listener, node, or HTTP server.

Last Updated
Time of last update

Owner
Administrator that created the event.

Assigned To
List of administrators to which the event can be assigned. These administrators have at least "view" access to the event.

Show Event Definition
Displays the Edit Event property sheet in view mode.

Test Name
Event test that is performed.

Severity
Severity of the event occurrence: critical, warning, clear, or unknown.

Time/Date
Time and date of the event occurrence.

Message
Message generated from the alert.

Event Viewer: Log Page

The Event Viewer Log page displays an entry whenever an event is moved to history. An event can be moved manually with the Move to History menu option or automatically when the severity of the event changes.

The Log page also allows comments to be entered on a selected event. Any administrator with permissions to modify the event can add comments in this page. Administrators can enter tips on how to resolve the problem which might be useful for other administrators. You enter comments in the text box and select the Apply or OK button to add the comment.

The information displayed in the Log page includes:

Type Entry
Text input field allowing you to add comments.

Entry
Comment that has been entered for this event.

Author
Administrator that entered the comment.

Date/Time
The date and time when the comment was entered.

Event Viewer: Notification Details Page

The Event Viewer Notification Details displays details of email and paging notifications sent for a selected event. The information displayed in Details page includes:

Severity
The severity flag associated with the event occurrence.

Administrator
Administrator that was notified.

Date/Time
The date and time of the notification.

Method
Method of notification: E-mail or page.

Notification Status
Status of the notification, indicating whether the notification was sent, is pending, or has failed.

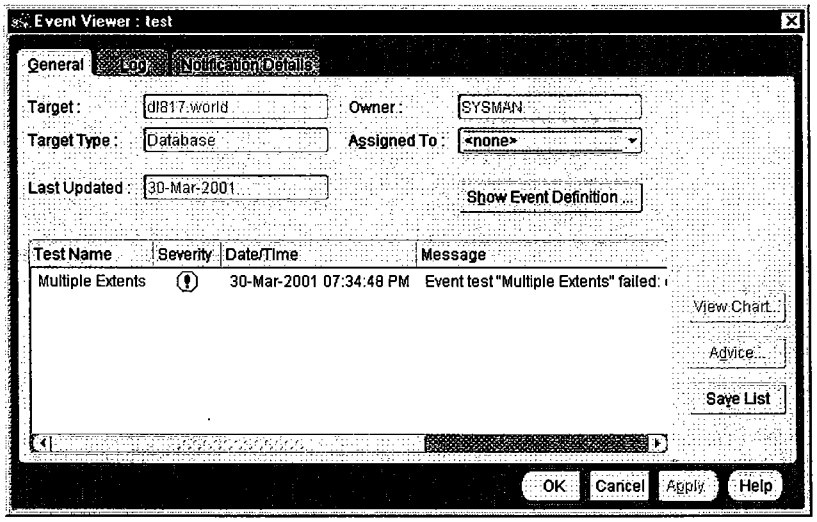
Message
If the notification failed, this message indicates the reason for notification failure.

Responding to Event Occurrences

The online help for each event test will, in general, have a "User Action" section that provides guidelines on how to respond to that particular event tests should it trigger. See the online help Contents page for all available event tests.

Administrators can also obtain diagnostic information about the triggered event from the "View Chart" and "Advice" functionality available from the Event Viewer.

Figure 6–7 Event Viewer

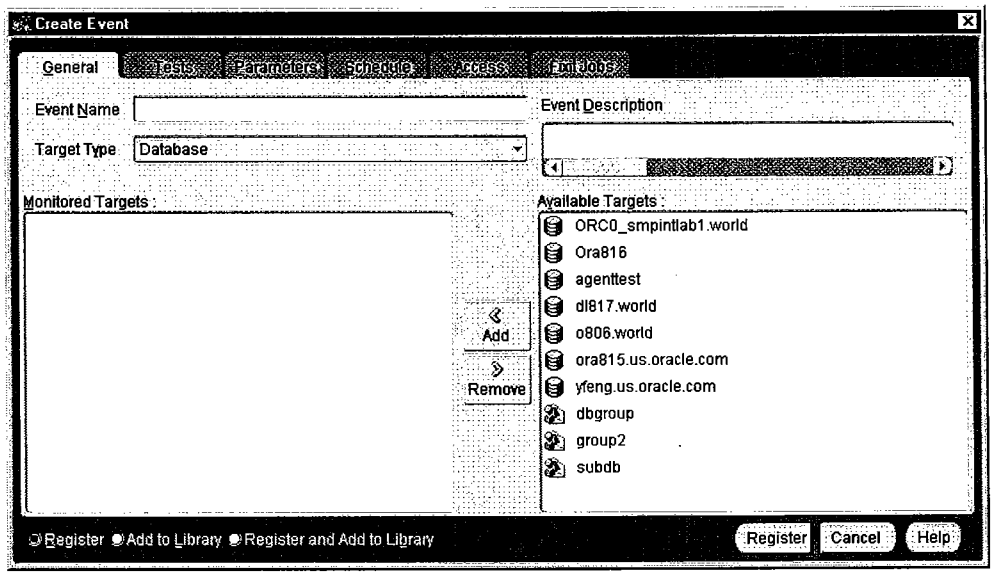


The "View Chart" button allows administrators to look at real-time charts related to the event. The "Advice" button provides administrators diagnostic information to help them address the event condition appropriately.

Event General Page

On the General page, you determine the event name, target type, description, and targets to be monitored.

Figure 6–8 Event General Page



Event Name:
Enter an event name.

Target Type:
Select the target type you want to monitor from the pull-down list. The types include Database, Listener, Node, or other service that is integrated into the Console.

If the selected Target Type is "Node", then a second pull-down list of operating systems will appear. If you choose 'All', then event tests that apply to all types of nodes, i.e. operating systems, will be available. If you choose a particular operating system, (e.g. Solaris), then additional operating-system specific event tests will be available.

The selection of the Target Type determines the list of Available Target. If you choose "Node" and a particular operating system, such as Solaris, then the list of available destinations will show all Solaris nodes that are running at least an 8.1.7 or higher Intelligent Agent. Any Solaris nodes that use older agents will not be shown.

Events can be registered against targets that have an Intelligent Agent. Targets on manually discovered nodes cannot be used as targets for an event. Hence, these

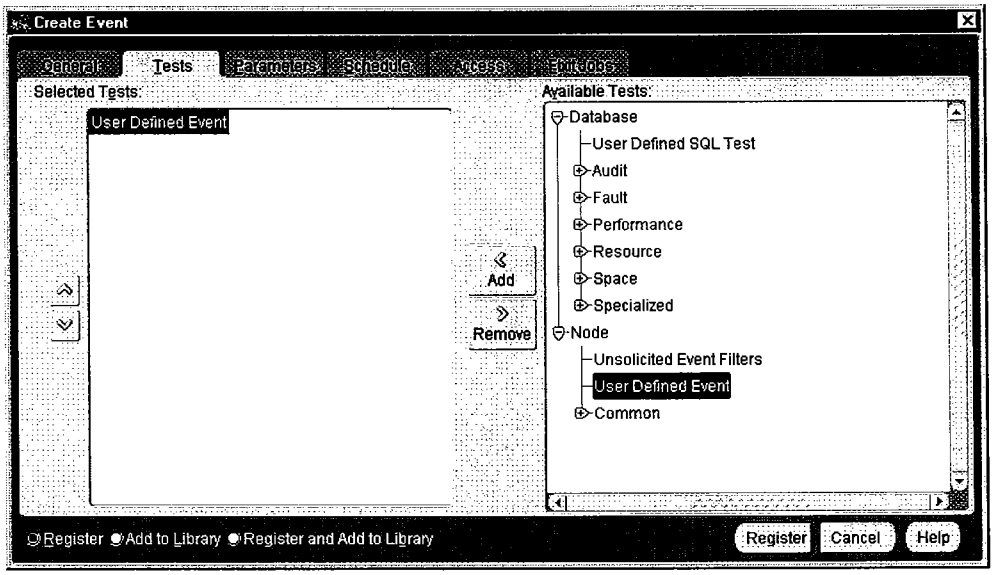
nodes will not appear on the Available Targets list. When an event is registered against a group, it will only be registered against targets that are running an Intelligent Agent. It will not be registered on any target that has been manually discovered.

Event Description:
Enter a description or comment for the event

Event Tests Page

On the Tests page, you determine the event tests that you want to perform. Event test are arranged hierarchically in a tree list for ease of viewing and selection. As with the Console Navigator, you can expand and compress entries in the tree list.

Figure 6–9 Event Tests Page



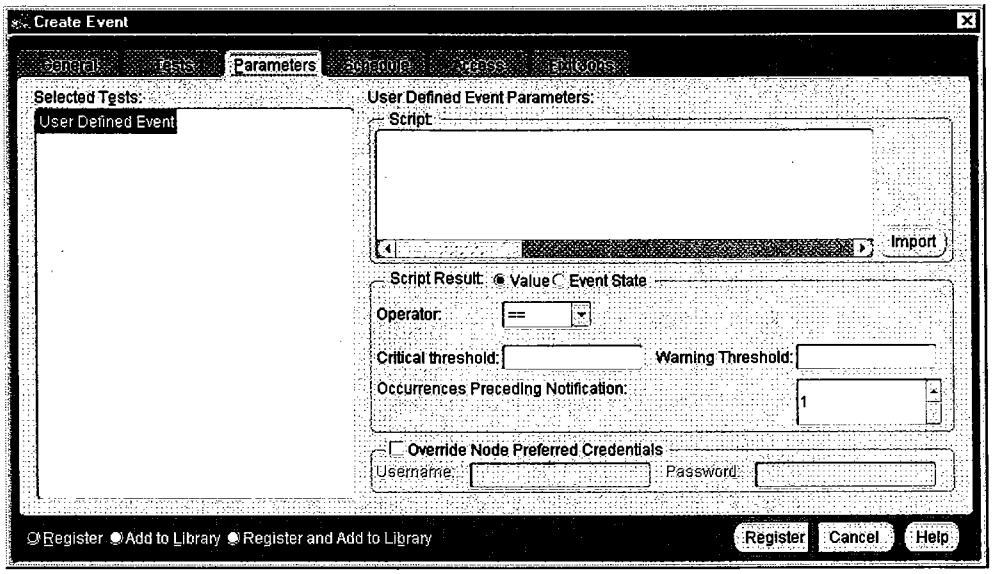
Available Tests:
Select the event tests in the list you want to perform in this event, then click on the << (Add) button to move the events to the Selected Events list. Double-clicking on an Available test will also move it to the Selected Tests list.

Selected Tests:
Select the event tests in the list you want to remove from this event, then click on the >> (Remove) button. Double clicking on a Selected test will also remove it from the Selected Tests list.

Event Parameters Page

The parameter settings for the selected event tests are entered in the Parameters page of the Event property sheet. The settings and types of parameters vary according to the event test selected. Some event tests do not have parameters. See the online help for Oracle events and "Oracle Event Tests" on page 6-56 for information on tests and their parameters. Further information on event tests is available in the Oracle Enterprise Manager Event Test Reference Manual.

Figure 6–10 Event Parameters Page



Parameters

The parameters for an event are displayed when the event is selected in the Selected Tests list. The parameters vary according to the event selected. Some events do not have parameters.

You can accept the default values or change the values for the parameters. To enter parameter values for an event, you can enter a value directly into a parameter field.

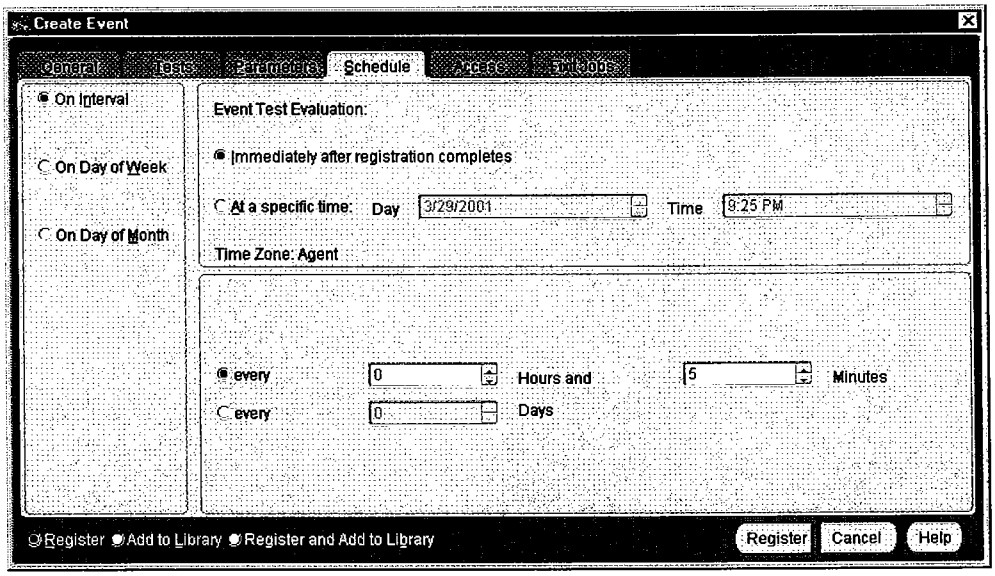
Filtering

Filtering is used in events such as Chunk Small and Maximum Extents. Examples of filters are = `'SYSTEM'`, `LIKE '%SMP%'`, and `IN ('SYSTEM', 'TOOLS')`. Note that the quotes are single quotes. Use uppercase to match the case of the database object names. If you enter a filter value that does not select any objects or is an incorrect value, the event fails.

Event Schedule Page

The Schedule page allows you to schedule the evaluation of an event condition. This allows you to schedule resource-intensive events at off-peak times.

Figure 6–11 Event Schedule Page



You can select when you want event evaluations to occur. The choices are:

On Interval

Allows you to schedule a specific time interval at which the event monitors for a specific condition. The interval can be a combination of hours and minutes, or

number of days. Select the value you want to change and click on the scroll buttons. You can also type in a new value. This is the only schedule type allowed when there are targets running pre-9i Intelligent Agents in the "Selected Targets" list found on the General page.

On Day of Week
Allows you to schedule event monitoring on one or multiple days (Sunday, Monday, etc.) of the week. Click on the days of the week to select the days you want the event scheduled. (Available for targets running 9i versions of the Intelligent Agent)

On Day of Month
Allows you to schedule the event on one or multiple days (1 - 31) of the month. Click on the dates of the month to select the dates you want the task scheduled. (Available for targets running 9i versions of the Intelligent Agent)

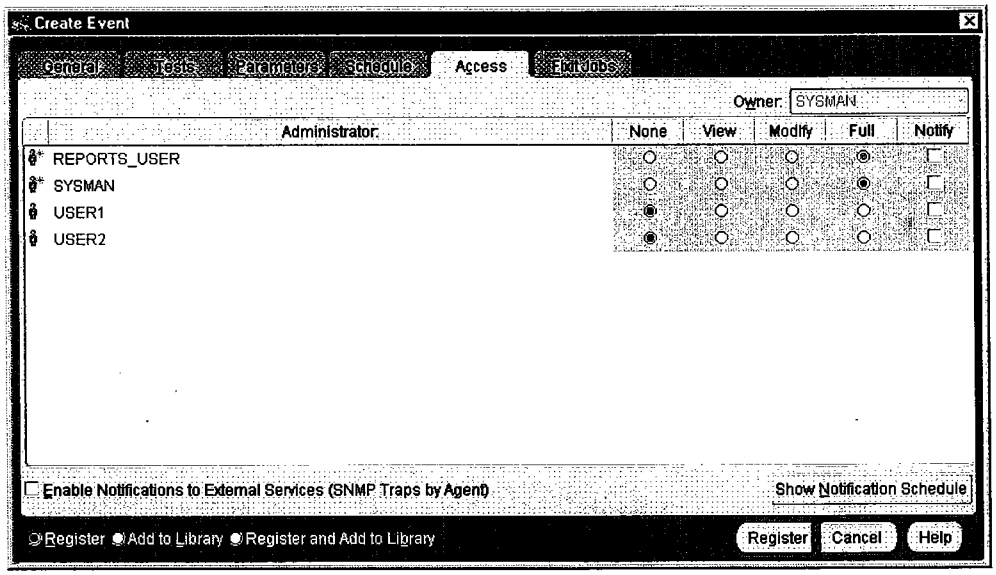
If you choose a day, such as 31, that is not in a month, the event will not be evaluated in that month.

Only the Intelligent Agent time zone is available with this release. Here, the Intelligent Agent schedules event monitoring at each destination based on the actual system time of each Intelligent Agent.

Event Access Page

Determine the administrator access permissions that you want to assign to the event with the Access Page. This allows other administrators to view or modify the event. Notifications are also assigned with this page.

Figure 6–12 Event Access Page



The levels of permission that you can assign to an Enterprise Manager administrator are:

None
Does not allow the administrator to view this event anywhere.

View
Allows the administrator to view the event, inspect event properties, and receive notifications.

Modify
Allows the administrator to modify the event's log (See "Event Viewer" on page 6-42), enable enhanced notifications for other administrators, change event attributes in the event library, and assign triggered events to other administrators.

Full
Allows the administrator to delete the event, modify permissions for other administrators, change event attributes in the event library, clear the event history, and assign triggered events to other administrators.

Notify
Allows the administrator to receive enhanced event notifications on the objects through paging or email. Other notifications will be routed to that particular administrator's Console. Notify permission cannot be assigned if the administrator's permission level is set to None.

Any permissions assigned on this page supersede any administrator default permissions. See "Access" on page 1-23 for more information. Also, the administrator's notification schedule must be set up in order for them to receive the Email/page notification. Superusers cannot be changed from "Full" permissions.

Enable Notifications to External Services (SNMP Traps by Agent)
When checked, permits external notification (SNMP traps) to be sent from the supported SNMP service on the Intelligent Agent node. See the *SNMP Support Reference Manual* for more information.

Show Notification Schedule
Show Notification Schedule displays the notification schedule for the event. The schedule shown on this page is a combined schedule for all administrators that have been given "Notify" privileges for this event. To view administrators assigned to a particular time slot, use the right mouse button to call up the context-sensitive menu, choose the "Remove Recipient" option, and view the list of administrators. To add or remove notifications for an administrator, display the context menu (press the right mouse button) on any time block. The context menu provides options for adding and removing recipients of the notifications.

Table 6–3 summarized user permissions required to perform specific actions within Enterprise Manager.

Table 6–3 User Permissions Table

Action	None	View	Modify	Full	Owner	Super User	Comments
EVENTS - Dynamic Modification of Registered Events							
View progress/details	No	Yes	Yes	Yes	Yes	Yes	Information label appears in General page
Receive notifications (if enabled for administrator)	No	Yes	Yes	Yes	Yes	Yes	
Set permissions for any administrator including yourself	No	No	No	Yes	Yes	Yes	

Table 6–3 User Permissions Table

Action	None	View	Modify	Full	Owner	Super User	Comments
Set Notification checkbox for any administrator	No	No	Yes	Yes	Yes	Yes	
Enable SNMP traps	No	No	No	No	Yes*	No	* New behavior for 9i
Add/remove targets, change description, tests, parameters, schedule, fixit job	No	No	No	No	Yes*	No	* New behavior. Also depends on Intelligent Agent version.
Change owner	No	No	No	No	No*	No	* New behavior. When an administrator is deleted, events are reassigned to the new owner
EVENTS - In the Library							
Change owner (library)	No	No	No	Yes	Yes	Yes	
Add/remove targets	No	No	Yes	Yes	Yes	Yes	
Change description, tests, parameters, schedule, fixit job	No	No	Yes	Yes	Yes	Yes	
Change permissions; enable/disable Notify preferences; enable SNMP	No	No	Yes	Yes	Yes	Yes	
Delete event	No	No	No	Yes	Yes	Yes	
Submit event from the library	No	Yes	Yes	Yes	Yes	Yes	
EVENTS - In the Console							
Delete registered event	No	No	No	No	Yes	Yes	
Clear history	No	No	No	Yes	Yes	Yes	
Assign Event occurrences	No	No	Yes	Yes	Yes	Yes	

Event Fixit Jobs Page

A fixit job is designed to automatically correct a problem when a particular event condition is encountered. For example, you may want the Intelligent Agent to run a job to restart a database when the database instance has shut down unexpectedly. Fixit jobs are created with the Job system and must be designated as fixit jobs. The jobs must be submitted and running on the same destination that the event is set on.

The Fixit Jobs page consists of the following:

If ANY test triggers, run a fixit job:
When selected, allows a fixit job to be associated with the event. When any event test in the "selected Tests" triggers, the fixit job will run.

Fixit Job:
Drop-down list containing existing fixit jobs. If no fixit jobs currently exist, click Create to display the Create Job property sheet. Note: A newly created fixit job will not show up in the drop-down list during the current editing session. The event must be closed and then re-edited before the new fixit job will appear in the list.

Edit:
Displays the Edit Job property sheet for the fixit job selected in the Fixit Job drop-down list. The fixit job owner can edit some attributes of the fixit job.

Create:
Displays the Create Job property sheet which allows you to create a new fixit job.

Selected Tests
Displays all event tests chosen for the current event.

Note: Each event must use a unique fixit job on each destination where the event is registered. Also, when a single agent is monitoring multiple databases at a destination, create a separate event and fixit job for each database.

Event Progress Page

The Event Progress page displays when you edit an event from the Registered page of the Events pane. This page provides the current registration status for the event selected: Registered, Registration Failed, Modification Pending, or Registration Pending. In addition, the target and time and date when registration was attempted is shown.

When the Progress page is displayed, it shows only the status for the selected event. If the selected event is registered, or had been submitted for registration on other targets, you can view the status of this event for those targets by selecting the desired target from the Target pull-down list. The status of the event displays for that target. To view the status of this event for all destinations simultaneously, select <All>.

The following options are available on the Progress page:

Target (pull-down list)
Select the destination of the event you want to view from the pull-down list. Select <All> for all destinations for which this event has either been registered or failed to be registered.

Status
Status for the event: Registered, Registration Pending, Modification Pending, or Registration Failed.

Target
Network destination for the event.

Date/Time
Date and Time the event was submitted for registration.

Show Output
Displays the Event Status Message dialog. This button is active only when you have selected a failed event registration. Selecting this option will allow you to view the reasons for the failure.

Save List
Saves the contents of the list to a text file.

Administrator Event Notification

Oracle Enterprise Manager allows you to specify administrators that are notified when a particular event condition occurs. Each administrator can be associated with an email ID and/or a pager number. When using a paging service or email notification, each administrator can be assigned responsibility for specific systems at specific days and times.

For more information on setting up Oracle Enterprise Manager administrators, see "Managing Enterprise Manager Administrators" on page 1-8.

Oracle Event Tests

This section lists the Event system event tests with their parameters and return values. See "Event Parameters Page" on page 6-49 for information on entering parameter values. A list of event tests with numeric pager event Ids is also provided. See "Numeric Pager Job/Event Ids" on page 6-57 for more information.

Event tests are specified for database, listener, http, and node services. The event tests are also divided into fault, space, resource, and performance management

categories. Only the UpDown event tests are included with Oracle Enterprise Manager. Additional advanced event tests are available with the optional Oracle Diagnostics Pack. See the Oracle Enterprise Manager Event Test Reference Manual for complete information on available event tests. Complete event test information is also available from online help.

Some of the database event tests, such as Chain Row, require access to system tables and require additional permissions. You need to set up preferred credentials for the monitored database with an administrator that has system privileges. See "Enterprise Manager Monitor Role" on page 6-3 and "Preferred Credentials" on page 1-25 for more information.

Numeric Pager Job/Event Ids

The Event Management System provides paging services that notify an administrator with a page when an event has occurred. Alphanumeric pagers provide a brief text message identifying the event. Numeric pagers provide the numeric pager event Ids to identify the event.

For job notifications, you will receive a 6 digit number. The first 3 digits indicate the job-id. The last 3 digits indicate job status.

For event notifications you will receive the event ID with the status code.

For a complete list of pager job/event IDs, see "Paging Status Codes for Numeric Pages" on page 1-20

Event System Features and Requirements

Because the Enterprise Manager framework is a three-tier system that can manage a heterogeneous environment, it is important to keep in mind various software version requirements necessary for proper event system operation. Table 6–4, "Event Features and Associated Requirements" lists event system features and associated software version requirements.

Table 6–4 Event Features and Associated Requirements

Feature Name	Description	Enterprise Manager Version	Required Agent	Management Server/Console Required	Works In Browser
Advanced Events	All events for databases, nodes, listeners. See Enterprise Manager online help for more information.	Diagnostics Pack 1.5.5 and highe.r	All supported agents, latest recommended	For Enterprise Manager 2.x, the Management Server and Console that corresponds with that Pack	yes
Event Handler	Component that allows you to log event information or execute custom commands in response to an event occurrence. See	9.0.1 and higher	n/a	9.0.1 and higher	n/a
Improved Node Up/Down Monitoring	Enhancement to the Node Up/Down event test. Provides more information on whether or not the node is down, the agent is down, etc.	2.2 and higher	all supported	2.2 and higher	yes
User-Defined SQL Test	Allows you to write your own custom SQL to monitor database events	Diagnostics Pack 2.1 and higher	8.1.6 and higher	2.1 and higher	yes
Enhanced monitoring for target subcomponents	"For events whose targets involve multiple subcomponents (e.g. monitor tablespace full for ALL tablespaces), information on which subcomponent is in alarm is now provided	"2.2 and higher	8.1.7 and higher	2.2 and higher	yes
Context sensitive help for Event tests	"In the Parameters tab of the Event dialog, invoking ""Help"" will bring up information pertinent to the current selected event test	"2.2 and higher	n/a	2.2 and higher	yes
Events with synonymous event tests	"Events can be created that have more than one of the same event test (e.g. a ""Tablespace Full"" test for ""SYSTEM"", another ""Tablespace Full"" event test for ""USER"")	"2.2 and higher	all supported by Enterprise Manager 2.2	2.2. and higher	yes
Job and Events Notification filters					

Table 6–4 Event Features and Associated Requirements

Feature Name	Description	Enterprise Manager Version	Required Agent	Management Server/Console Required	Works In Browser
▪ Filters that apply to both paging & email	Allows you to filter pages & emails based on job and event status	2.1	all agents supported by Enterprise Manager 2.1	2.1	yes
▪ Different filters for paging & email	Allows separate filters for pages & emails based on job and event status	2.2 and higher	all agents supported by Enterprise Manager 2.2	2.2 and higher	yes
Customization for paging & email messages	Allows you to customize the messages for email and pages	Diagnostics Pack 2.2. and higher	all agents supported by Enterprise Manager 2.2	2.2 and higher	yes
Advanced O/S event tests	New event tests that monitor operating system specific metrics	2.2 and higher	8.1.7 and higher	2.2 and higher	yes
User-Defined Events	Allows you to define events based on any user-specified monitoring script.	9.0.1 and higher Diagnostics Pack	9.0.1 and higher Intelligent Agent	9.0.1 and higher and higher	yes
Dynamic modification of registered events	Allows you to dynamically change attributes of registered events.	9.0.1 and higher	all Intelligent Agents supported by Enterprise Manager 9i. 9.0.1 and higher versions of the Intelligent Agent allows full modification	9.0.1 and higher	yes
Event Schedules	Allows you to specify event evaluations based on a schedule.	9.0.1 and higher	9.0.1 and higher	9.0.1 and higher	yes
Event Integration with Performance Manager charts	Allows you to create events from Performance Manager charts.	9.0.1 and higher Diagnostics Pack	9.0.1 and higher	9.0.1 and higher	yes
Oracle9*i*AS Events	Events to monitor Oracle9*i*AS	9.0.2 and higher	9.0.2 and higher	9.0.2 and higher	yes
Real Application Clusters Events	Events to monitor Real Application Clusters-specific metrics	9.0.1 and higher	9.0.1 and higher	9.0.1 and higher	yes

Table 6–4 Event Features and Associated Requirements

Feature Name	Description	Enterprise Manager Version	Required Agent	Management Server/Console Required	Works In Browser
Concurrent Manager Events	Events to monitor error conditions against the Oracle Applications Concurrent Processing Server	2.0.4 and higher	8.1.5 and higher	2.0.4 and higher	yes
Forms Server Events	Events to monitor error conditions against the Oracle Developer Forms Server	2.0.4 and higher (2.0.4 console needs Forms Extensions.	8.0.6 and higher (requires Forms Agent Extensions.	2.0.4 and higher (2.0.4 console needs Forms Extensions.	yes
Program Filtering in Concurrent Manager Events	Allows you to monitor particular Oracle Applications Concurrent Programs. Also allows you to exclude particular Concurrent Programs from being monitored.	2.2 and higher	8.1.7 and higher	2.2 and higher	yes