TABLE OF CONTENTS

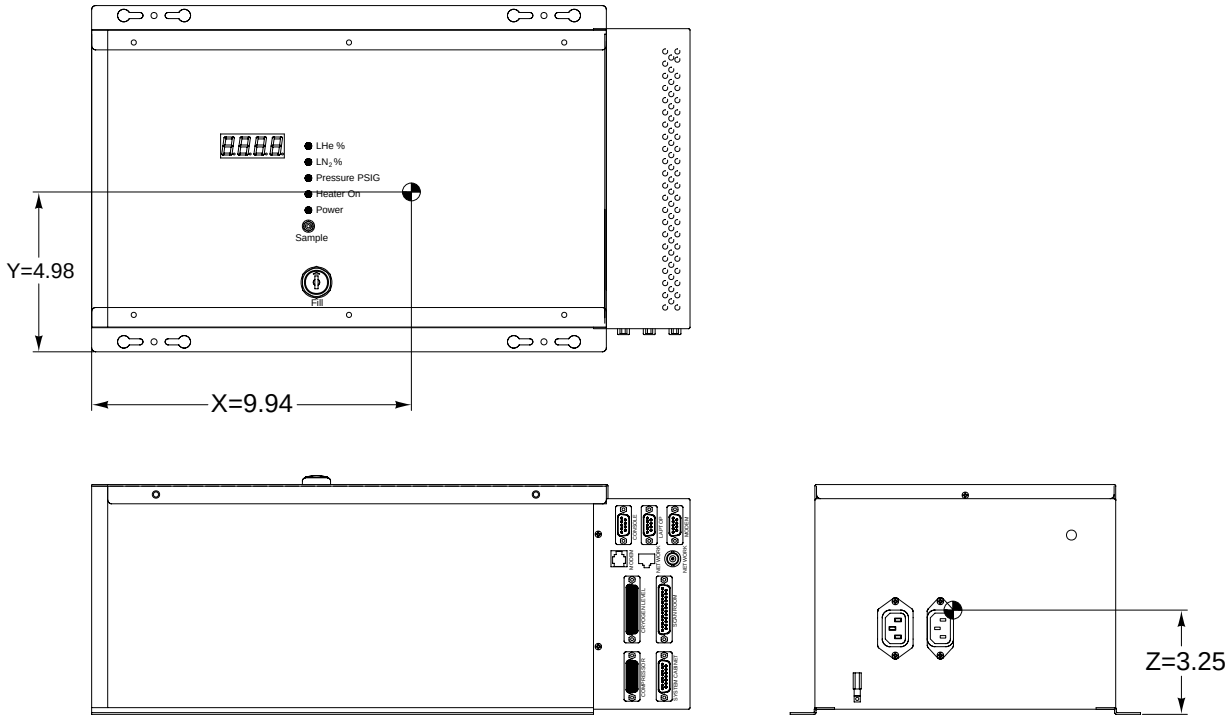
1- EQUIPMENT SPECIFICATIONS

IMPORTANT

This manual now contains the procedure for installing magnet monitor onto older magnets for Excite HD upgrades. See Appendix B for instructions on how to connect the pressure transducer to S-series magnets (S2 through CX).

1-1 Equipment specifications for the Granite Magnet Monitor

Dimensions: 9.4 in. (23.9 cm) H x 18.6 in. (47.3 cm) W x 7.0 in. (17.8 cm) D
Weight: 26 pounds (11.8 kg)
Input Power: 100/120 or 200/220 VAC, 50 or 60 Hz @ 0.5 A
Gauss Limit: 100 Gauss or less
Center of Gravity: See Illustration 1-1



CENTER OF GRAVITY
ILLUSTRATION 1-1

Temperature:
Operating: 0 to 40 degrees C
Non-Operating: -34 to 50 degrees C

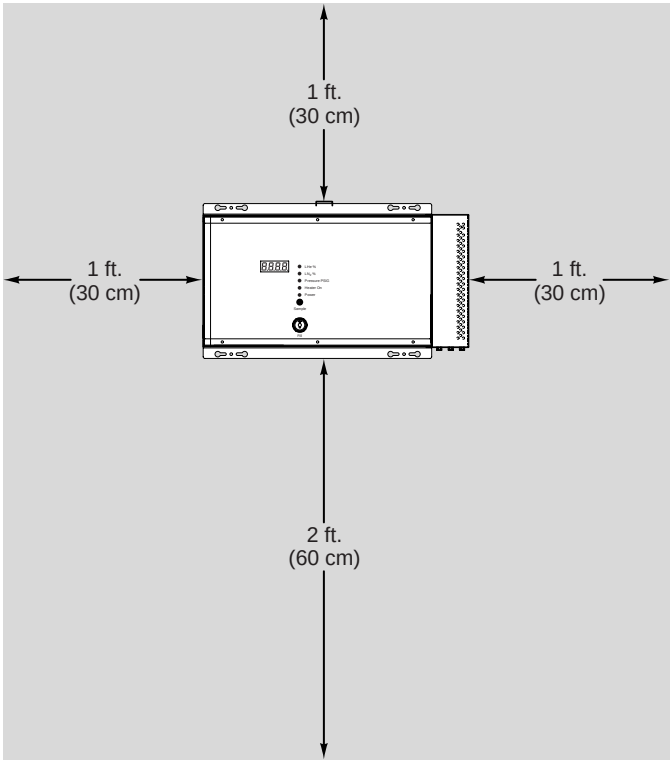
Temperature Change: 5 degrees C per hour

Humidity:
Operating: 10% to 80% non-condensing
Non-Operating: 10% to 90% non-condensing

Altitude: -30 meters to 2133 meters

Mounting: Wall mount

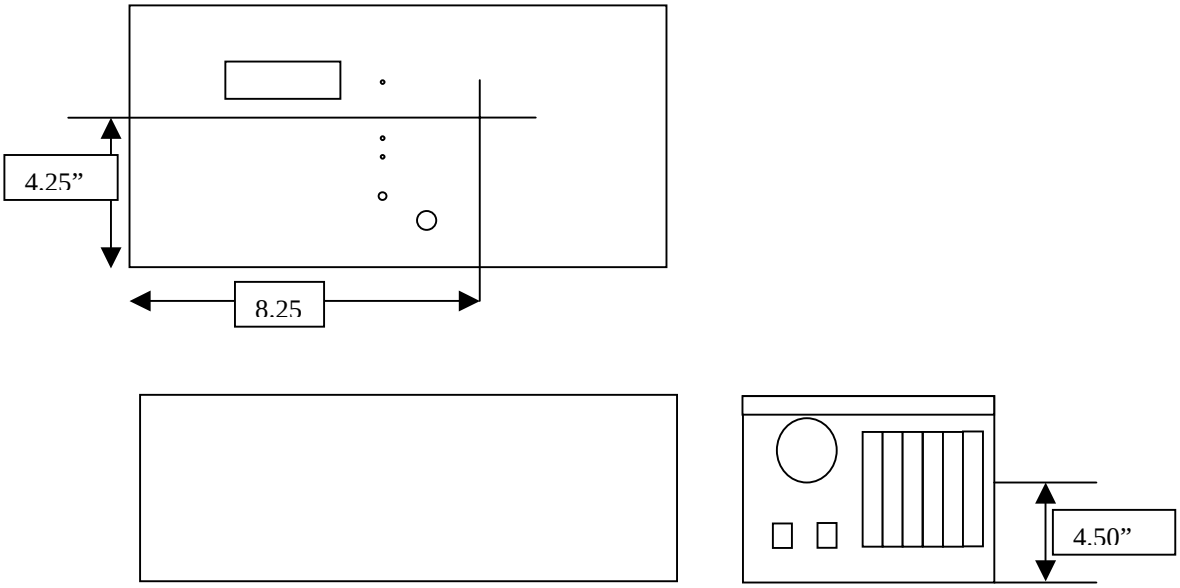
Service Clearance: See Illustration 1-2



SERVICE CLEARANCE
ILLUSTRATION 1-2

1-2 Equipment specifications for the Advantech Magnet Monitor

Dimensions: 10.0 in. (25.4 cm) H x 15.5 in. (39.4 cm) W x 7.0 in. (17.8 cm) D
Weight: 26 pounds (11.8 kg)
Input Power: 100/120 or 200/220 VAC, 50 or 60 Hz @ 0.5 A
Gauss Limit: 50 Gauss or less
Center of Gravity: See Illustration 1-1A



CENTER OF GRAVITY
ILLUSTRATION 1-1A

Temperature:
Operating: 0 to 40 degrees C
Non-Operating: -34 to 50 degrees C

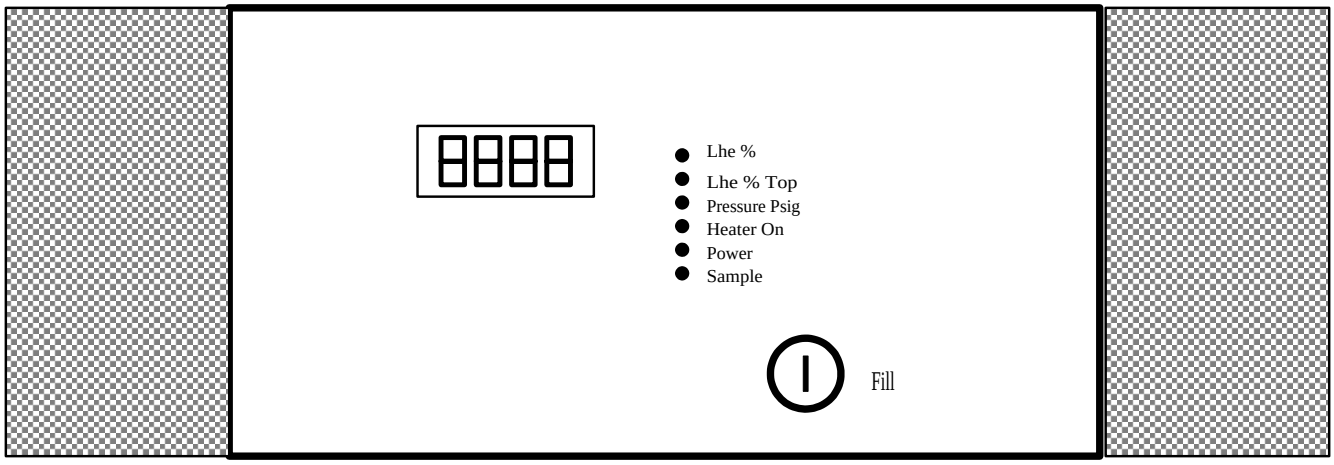
Temperature Change: 5 degrees C per hour

Humidity:
Operating: 10% to 80% non-condensing
Non-Operating: 10% to 90% non-condensing

Altitude: -30 meters to 2133 meters

Mounting: Wall mount

Service Clearance: See Illustration 1-2A



SERVICE CLEARANCE
ILLUSTRATION 1-2A

TABLE 1-1
COMPRESSOR CONNECTION

J9 Pin Number	Definition	Voltage (DC)
1	Water Flow	0 to 5V
2	Water Temperature	0 to 5V
3	Water Flow DC Supply	+12V
4	Water Flow Ground	Ground
5	Compressor Fuse Off	+24V
6	Helium Temperature High	+24V
7	Helium Pressure Low	+24V
8	Compressor On	+24V
9	Klixon Error	+24V
10	Compressor Reset	+24V
11	+24VDC Power	+24V
12	+24VDC Ground	Ground
13	Not Connected	
14	Water Flow #2	0 to 5V
15	Water Temperature #2	0 to 5V

TABLE 1-3
SYSTEM CABINET CONNECTOR

J10 Pin Number	Definition	Voltage (DC)	Maximum Current
1	Not Connected		
2	Not Connected		
3	Not Connected		
4	Not Connected		
5	Not Connected		
6	RF Unblank	+5V	250 mA
7	RF Unblank Return	+5V	250 mA
8	Key		
9	Ground	Ground	250 mA
10	System Power	+5V	250 mA
11	System Power Return	+5V	250 mA
12	Not Connected		
13	Not Connected		
14	Not Connected		
15	Not Connected		

TABLE 1-4
SCAN ROOM CONNECTOR

J8 Pin Number	Definition	Voltage (DC)	Maximum Current
1	First Stage Shield II Diode Source +		10 µA
2	First Stage Shield II Diode Source -		10 µA
3	First Stage Shield II Diode Signal +	0 to 2.5V	10 µA
4	First Stage Shield II Diode Signal -	0 to 2.5V	10 µA
5	-12VDC Power Supply	-12V	250 mA
6	-12VDC Ground	Ground	250 mA
7	Vessel Pressure	1 to 5V	50 mA
8	Differential Pressure	1 to 5V	50 mA
9	+12VDC Power Supply	+12V	250 mA
10	+12VDC Ground	Ground	250 mA
11	First Stage Diode Source +		10 µA
12	First Stage Diode Source -		10 µA
13	First Stage Diode Signal +	0 to 2.5V	10 µA
14	First Stage Diode Signal -	0 to 2.5V	10 µA
15	Second Stage Diode Source +		10 µA
16	Second Stage Diode Source -		10 µA
17	Second Stage Diode Signal +	0 to 2.5V	10 µA
18	Second Stage Diode Signal -	0 to 2.5V	10 µA
19	Reed Switch - Magnet On Sense	TTL Logic	5 mA
20	Reed Switch Common	Ground	5 mA
21	Atmospheric Pressure	1 to 5V	250 mA
22	Second Stage Shield II Diode Source +		10 µA
23	Second Stage Shield II Diode Source -		10 µA
24	Second Stage Shield II Diode Signal +	0 to 2.5V	10 µA
25	Second Stage Shield II Diode Signal -	0 to 2.5V	10 µA

2- INTRODUCTION

2-1 Overview

The Magnet Monitor consists of hardware and software used to measure:

- Helium vessel level
- Helium vessel pressure
- Provide helium vessel pressure control on LCC magnets

2-2 System Requirements

The Magnet Monitor works with Signa 3.x, 4.x, 5.x, LX and TWIN systems with the following magnets: S-II, S-III, S-III Magnishield, S-IV, S-V, S-X, SXc, Cx, LCC, and Max.

2-3 Document Application

The current revision of this document applies to the following combination(s):

2-3-1 Core Magnet with Sumitomo Compressor

This system consists of an LCC magnet with a Sumitomo compressor. There is an external water flow/temperature sensor connected to the water source for the Sumitomo compressor. The water flow/temperature information is sent to the Magnet Monitor.

2-3-2 S Series magnets through CX

System consists of older style magnets that are upgraded to Excite HD.

3- TOOLS AND EQUIPMENT

3-1 Required Tools/Equipment

When installing the Magnet Monitor, you need the following tools:

- Duct tape (if performing installation without a partner)
- Non-magnetic adjustable wrench
- Non-magnetic 9/16-inch combination wrench
- Non-magnetic 3/16-inch flat-blade screwdriver
- Ruler
- Utility knife
- Nut drivers in 3/16-inch and ¼-inch sizes
- Helium Resistance Box (46-265286G1)
- Digital Volt Meter (DVM)
- #2 Phillips screwdriver
- Static wrist strap
- Shallow container (to catch water after disconnecting the hose to the Shield Cooler Compressor)
- Any tools and hardware needed for mounting the magnet monitor to the wall
- Laptop computer (minimum requirement is Windows95 with a modem and Internet Explorer or Netscape Navigator)
  TABLE 3-┌ with modem and cables (46-301708G9)
  TABLE 3-┌ without modem (46-301708G10)
- Serial interface cable, 9-pin female to 9-pin female (for configuring the Magnet Monitor with the laptop computer)

3-2 Optional Parts

The Magnet Monitor provides most of the parts you need during the installation. However you may need to obtain one or more of the following parts, depending on your system requirements.

Additional cables (for sites where the Penetration Panel is more than 60 ft. away from the Magnet Monitor)
-25-Pin Male-Female, 10 ft. Cable (46-271601G19)
-25-Pin Male-Female, 20 ft. Cable (46-271601G21)
-25-Pin Male-Female, 30 ft. Cable (46-271601G23)
-25-Pin Male-Female, 40 ft. Cable (46-271601G25)
-25-Pin Male-Female, 50 ft. Cable (46-271601G27)

Multiplexer with four station lines
-115 VAC power supply (46-328475P1)
-220 VAC, 50 Hz power supply (46-328475P3)

Multiplexer with eight station lines
-115 VAC power supply (46-328475P2)
-220 VAC, 50 Hz power supply (46-328475P4)

3-3 Magnet Monitor Description

The Magnet Monitor is described in the following table.

TABLE 3-1
MAGNET MONITOR STRUCTURED KITS

		Part Number	
Item	**Description**	**Fixed Unit & Transportable/ Relocatable Unit**	**Mobile Unit**
1	Magnet Monitor- **Granite**	2209000	2209000
2	Magnet Monitor- **Advantech**	2219400	2219400
2	LCC Install Cable Kit	2221624	2221624-2
3	Twin Install Cable Kit	2304057	2304057-2
4	Magnet Monitor Operator's Manual	2229090-100	2229090-100
5	Magnet Monitor Hardware Installation Manual	2230681	2230681
6	Uninterruptable Power Supply (UPS) **Option for Advantech only**	E4504AG	Included
7	Remote Alarm Box **Option for Advantech only**	E4054AH	Included

4- INSTALLATION PROCEDURES

Note

Most of the hardware installation can be performed while the customer is using the system. The Magnet Room is needed for only about 30 minutes to install cables and sensors. The three to four hours of installation time in the Computer Room do not require the system to be down. The Magnet Monitor can be shut down and worked on while the Signa system is running.

4-1 Magnet Room Attachments

The Pressure Transducer, Shield Diodes, and Reed Switch generate signals that are incorporated into a cable that enters the Magnet Room through the Penetration Panel. These signals aid in assessing boil off, magnet quench, and proper maintenance of vessel pressures before, during, and after a helium fill.

4-1-1 Before You Begin

Before you begin, you need the following tools:

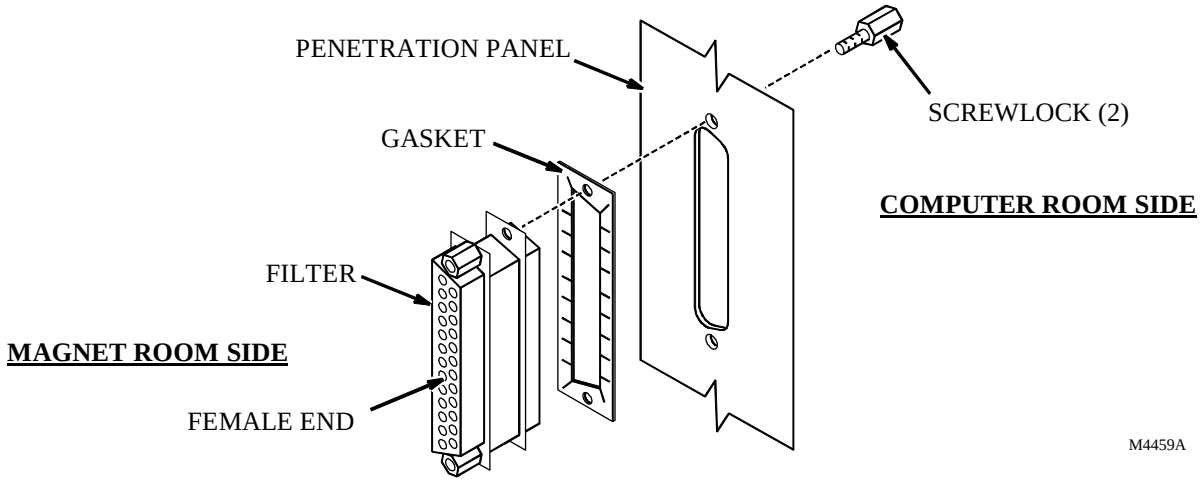
- Duct tape (if performing installation without a partner)
- Non-magnetic adjustable wrench
- Non-magnetic, 3/16-inch flat-blade screwdriver
- Non-magnetic, 3/16-inch nut driver
- 25-Pin “D” punch (if a spare 25-Pin connector opening is not available at site Penetration Panel)

The cable runs installed in the following procedures are diagrammed in Illustrations 8-1, 8-2 and 8-3 System Interconnect Diagram. You will find the instructions easier to follow if you also reference this System Interconnect Diagram and the associated table.

4-1-2 Penetration Panel Connection

1. For Run 825 & 829: Locate a space in the Penetration Panel that will fit a 25-Pin “D” connector (J48 should be available at most sites).
   a. If a space is available, place a piece of duct tape across the blank plate (to keep it from falling between the walls). Using a flat-blade screwdriver, remove the screws holding the blank plate.
   b. If no space is available, use a 25-Pin “D” punch to make an opening in the Penetration Panel.

2. Inside the Magnet Room:
   a. Put the Filter Gasket (46-221754P3) onto the male side of the Penetration Panel Filter (46-271920P3).
   b. Place the filter into the Penetration Panel with the female side toward the magnet room. See Illustration 4-1.
   c. Place a piece of duct tape across the filter to hold it in place.
   d. From the other side of the Penetration Panel, use a pair of screwlocks without washers to secure the filter to the panel.



PENETRATION PANEL CONNECTIONS
ILLUSTRATION 4-1

4-1-3 Connecting the Magnet Room Cables (all systems)

Note

If the cable in the following step is routed before it is connected, be sure you pay attention to gender of the connectors.

Note

Remove the twist locks around the cables before connecting cables in the magnet room.

1. Run 829, 60 ft. Cable:
   a. From the magnet room, use a non-magnetic flat-blade screwdriver to connect the PP1-J48 end to the Penetration Panel Filter.
   b. Route this cable from the Penetration Panel to the rear pedestal.

Note

Do not coil the cables under the rear pedestal. Serpentine any excess cable in the cable trough so it will not interfere with scanning.

2. Run 830 (See Illustration 4-2.):

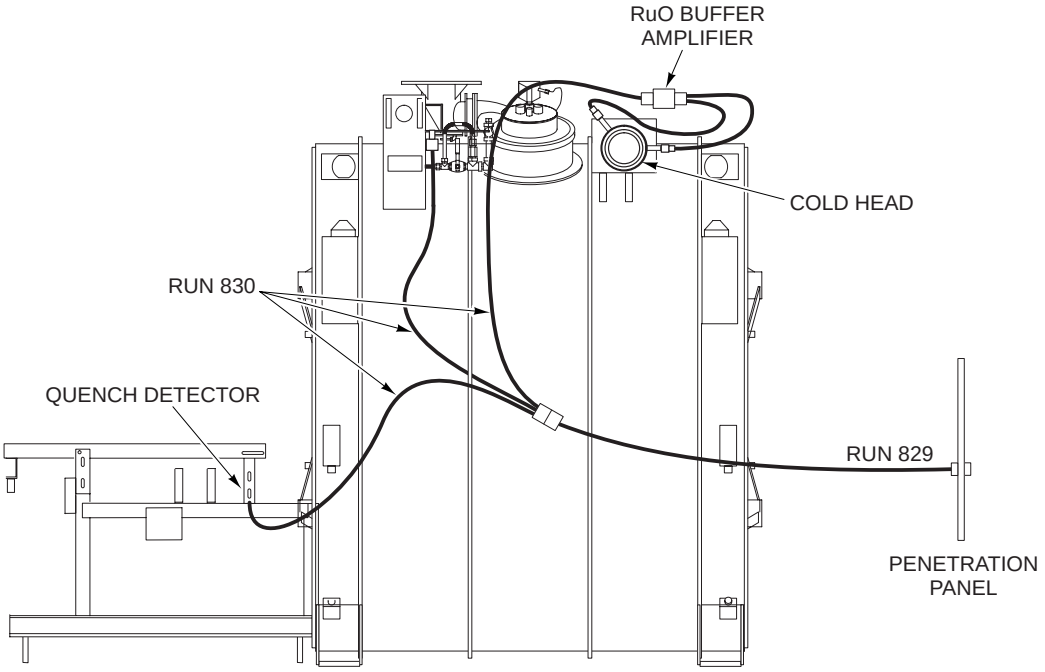
IMPORTANT

When installing the magnet monitor onto an older style magnet, do not use Run 830 that was provided in the original magnet monitor cable kit. Use cable part number 2108726 that was provided in the Magnet Monitor Upgrade kit for non LCC systems, part number 5127838. Connections are the same as noted in following steps a through d, except the 9-pin Female cable connects to the interface cable that routes to the coldhead sleeve. This cable was provided via FMI 60374,

   a. Route the MS1-A5-A2-J1 connector along the magnet enclosure to the top of the magnet and connect to the Pressure Transducer. Wrap the cable using cable ties when necessary.
   b. Install the Reed Switch lead per the following section.
   c. Connect the MS1-A2-J2 connector on the RuO Buffer Amplifier.
   d. Connect the MS1-FJ2 connector of cable run 830 to Run 829. Use two Cable Connector Joiners (46-265067P1) to secure the cable connectors to each other.

Note

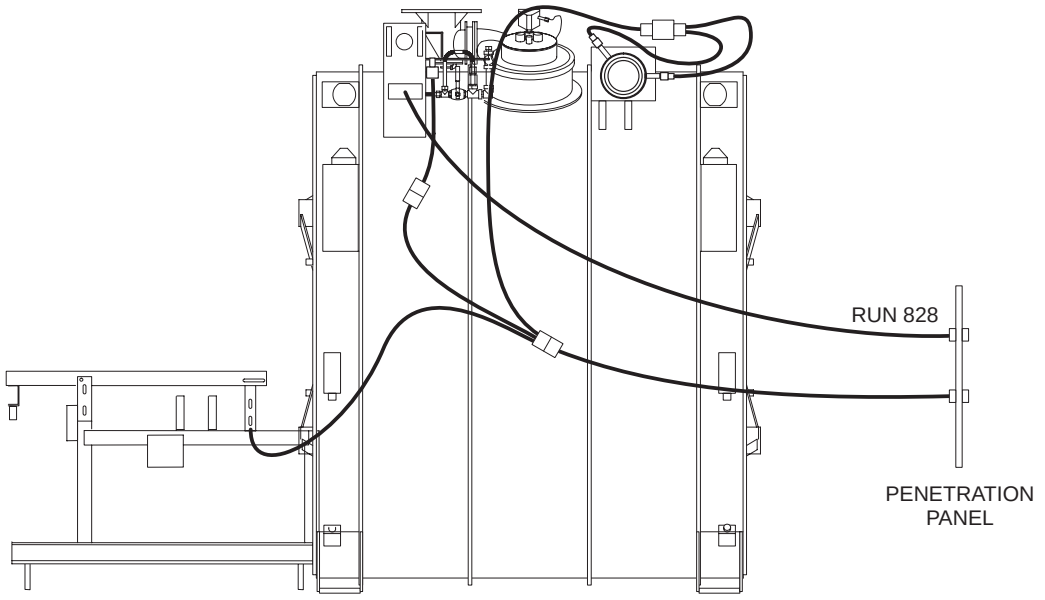
Do not coil the cables under the rear pedestal. Serpentine any excess cable in the cable trough so it will not interfere with scanning.



LCC MAGNET ROOM CABLING
ILLUSTRATION 4-2

4. Run 832: Connect to the coldhead sleeve and to the RuO Buffer Amplifier. See Illustration 4-2.

5. Run 828 (See Illustration 4-3.):
   a. Connect the PP1-J10 connector to J10 on the Penetration Panel.
   b. Connect the MS1-A3-A1-P403 connector to P403 on the magnet.



SENSOR CABLING
ILLUSTRATION 4-3

4-1-4 Connecting the Reed Switch

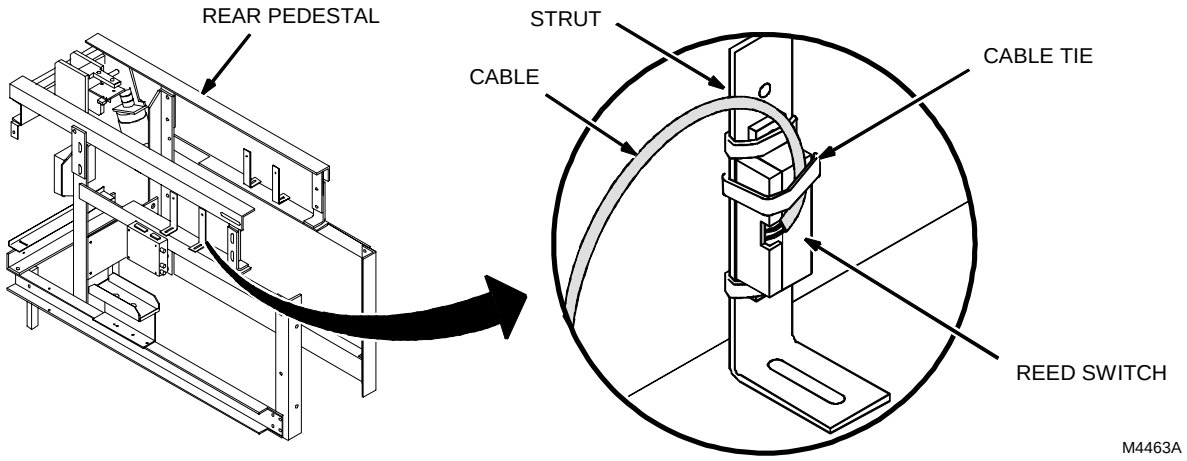
Note

The Reed Switch (2108790) is pre-assembled to Run 830, the Magnet Room Interface Cable (2222797).

1. Position the Reed Switch where it detects the magnetic field. The contacts are Open when the Read Switch detects a magnetic field. Usually you can place the switch vertically on one of the support struts on the rear pedestal. See Illustration 4-4.

2. Wrap two Cable Ties (46-208758P3) around the top and bottom of the Reed Switch and the support strut to hold the Switch in place. See Illustration 4-4.

3. Use an additional Cable Tie to secure the cable to the strut to prevent the wires from being pulled out of the Switch. Move the ends of the Cable Ties to the back of the strut.



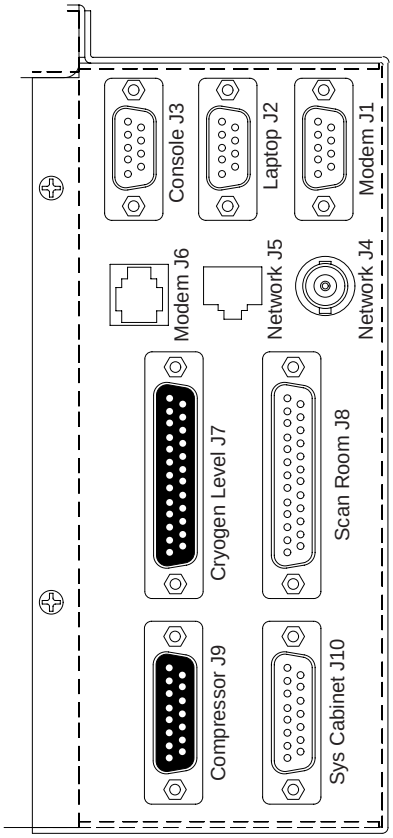
REED SWITCH PLACEMENT
ILLUSTRATION 4-4

4-2 Installing the Magnet Monitor, all Systems

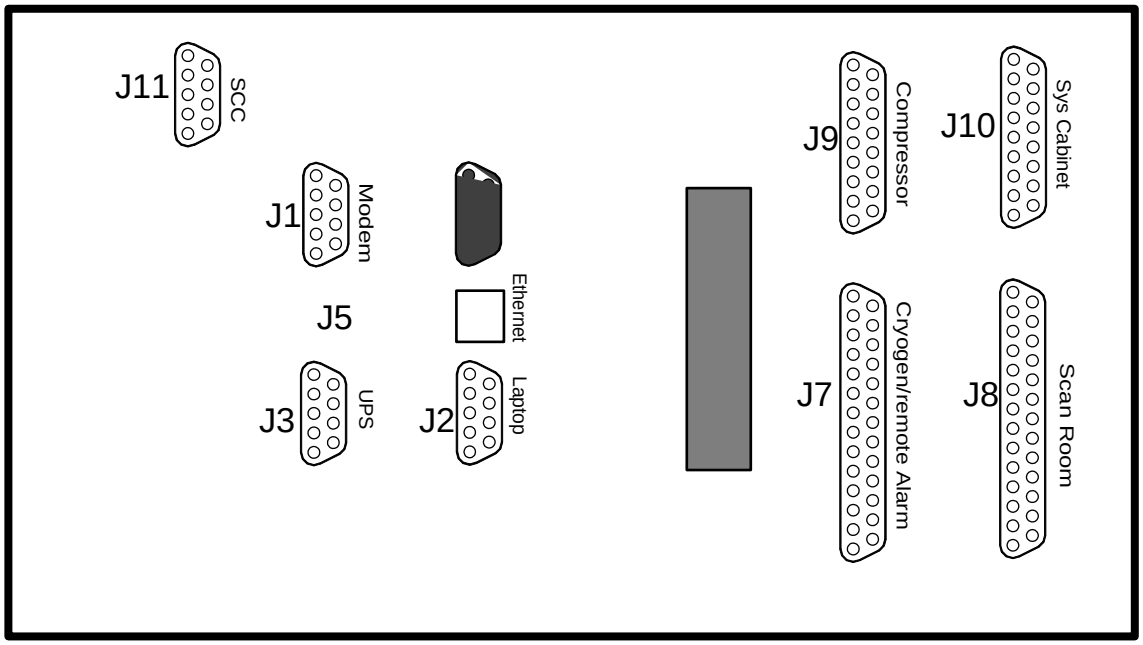
4-2-1 Physical Installation

1. Anchor the Magnet Monitor to the wall using all applicable codes for your site.

2. Run 825:
   a. In the computer room, connect the PP1-J48 end to the Penetration Panel Filter (J48).
   b. Route the cable to the Magnet Monitor and connect to J8. See Illustration 4-5 for the connections to the **Granite** Magnet Monitor. If you are connecting to the **Advantech** Magnet monitor, see Illustration 4-5A.



MAGNET MONITOR INTERFACE PANEL
ILLUSTRATION 4-5



MAGNET MONITOR INTERFACE PANEL
ILLUSTRATION 4-5A

3. Run 831 and 824:
   a. Connect the MSM1-A1-J7 end of Run 831 to the Magnet Monitor.
   b. Connect the FJ1 end of Run 831 to Run 824. Use two cable connector joiners (46-265067P1) to secure the cable conectors to each other. Wrap the cables using cable ties when necessary.
   c. Connect the PP1-J10 end of Run 824 to the Penetration Panel.
   d. Connect Cable run 825 between MSM1-A1-J8 to the Penetration Panel J48.

IMPORTANT

If you need to reset, or power down the Magnet Monitor, do the following steps to properly shut down the software.

- Hold the *Sample* button inuntil **halt** appears on the display.
- Release the *Sample* button, immediately press and release it again. **oooo** (four lower case o's) should appear on the display.
- Wait for at least **90 seconds**, then you may reset or power down the Magnet Monitor.

4. Plug the Magnet Monitor AC power cord into the receptacle using the appropriate power cord. Assure that the power remains available at this receptacle 24 hr/day to assure constant monitoring, and pressure control of the magnet.

Note

If preferred, the magnet Monitor can be plugged into a 220 VAC outlet. For such operation, obtain a power cord with the appropriate connector, and perform the following procedure to change the operating voltage of the Magnet Monitor.

4-2-2 Changing the Operating Voltage of the Magnet Monitor

CAUTION

Do not turn on the Magnet Monitor until the proper input voltage has been set.

4-2-2-1 Changing the operating voltage for a Granite Magnet Monitor

Note

This procedure is only required if you wish to change the operating voltage of the Magnet Monitor from 110 VAC to 220 VAC.

1. Unplug the Magnet Monitor.

2. Remove the four Phillips screws that hold the rear connector housing to the main chassis.

3. Separate the rear connector housing from the chassis and leave all cables attached.

4. The voltage selector switch for the computer power supply is located on the rear, off the main chassis. There is a bright yellow caution sticker next to the switch that reads, “CAUTION Additional line voltage selector switch in unit.” Slide this switch to the desired voltage level setting.

5. Another power supply is located on the inside of the rear connector housing. There is another bright yellow caution sticker that also reads, “CAUTION Additional line voltage selector switch in unit.” Slide this switch to the desired voltage level setting.

Note

Both of the line voltage selector switches must display the same voltage setting and must match the rating of the input supply voltage.

6. Reinstall the rear connector housing using the four Phillips screws.

7. Using an appropriate line cord, plug the Magnet Monitor to a power source that matches the voltage rating selected.

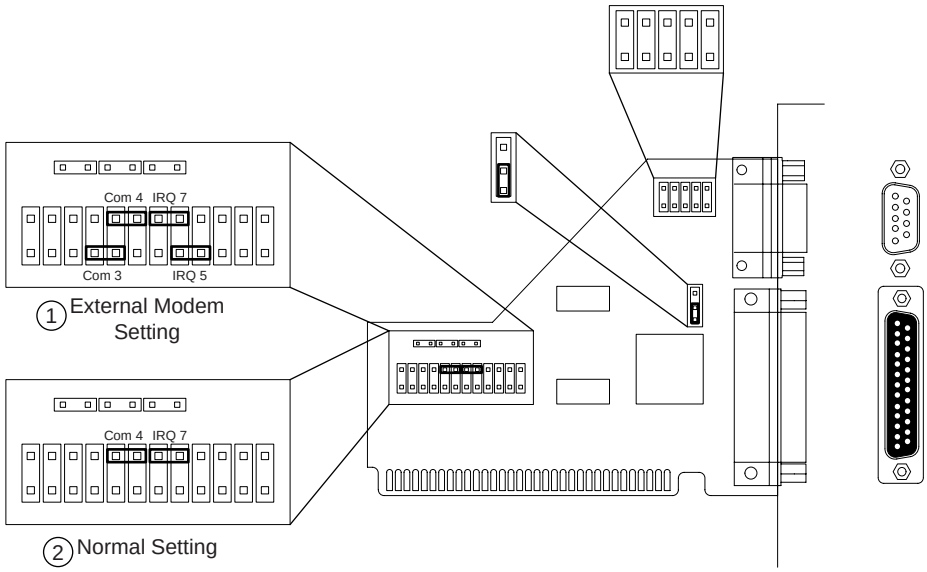
4-2-2-2 Changing the operating voltage for an Advantech Magnet Monitor

There is a 115VAC/220VAC switch located above the input power cable. Select 220VAC if needed for your site.

4-2-3 Configuring Magnet Monitor for External Modem- Granite unit only

1. Remove the modem board from the magnet monitor. It is located in slot 3.

2. Configure the jumpers on the General I/O board as shown in Illustration 4-6.



GENERAL I/O BOARD JUMPER SETTINGS
ILLUSTRATION 4-6

4-2-4 Installing the External Modem (Advantech unit only)

1. Place the Global Modem on the top of the Magnet Monitor. Use existing velcro to secure the modem to the Magnet Monitor.

2. Use the proper power adapters for the power connection from the wall to the power supply. The modem power supply will work for any voltage and frequency.

3. Connect cable run 940, which is provided with the cable kit between Magnet Monitor J1 and Modem serial connector.

4-3 Sumitomo Shield Cooler Sensor Installation for Core and Twin with TGWC only

The Water Flow and Temperature Sensor provides proportional, linear output for both water flow and water temperature. The viewing window on the sensor provides a visual measurement for water flow.

4-3-1 Before You Begin

Before you begin, you need the following tools:

- 3/16-inch flat-blade screwdriver

- shallow container to hold water

You need the following parts from the Magnet Monitoring Kit:

- One of the 15-Pin Female-Male, 60 ft. Cables (46-271603G29)
- Water Flow and Temperature Sensor (46-320835P1) (screws are provided to surface mount sensor, if desired)
- Compressor Interface Cable (46-328578P1)
- One Restricted Label (46-301402P1)

The cable runs installed in the following procedures are diagrammed in Illustration 8-1 System Interconnect Diagram. You will find the instructions easier to follow if you also reference the System Interconnect Diagram and the associated table.

CAUTION

Use caution when attaching the hoses to the Water Flow and Temperature sensor to prevent injury. Sliding the hose onto the fittings does take force.

4-3-2 Attaching the Water Flow and Temperature Sensor

Note

Screws are supplied with the water flow and temperature sensor for mounting to the floor or wall. If it is practical to mount the sensor, place it within 24 inches (61 cm) of the compressor.

Note

The Magnet Monitoring Kit contains a 24-inch (61 cm) hose that is 1/2-inch (13mm) in diameter. If the site has deviated from the 1/2-inch hose barb, you need to modify the plumbing to connect to the Water Flow and Temperature Sensor. Please obtain the necessary parts locally.

1. Turn off power to the Shield Cooler Compressor.

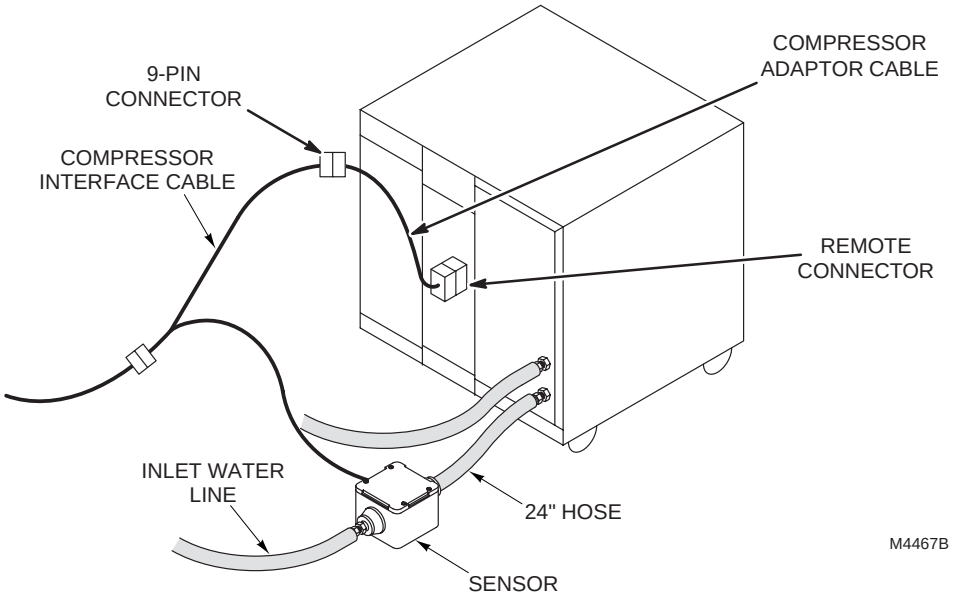
2. Shut off the water flow to the Shield Cooler Compressor. Be sure to shut off both the supply and return lines to minimize water spillage.

CAUTION

If water from the shield cooler spills, clean it up following hospital procedures, as the water may contain chemicals, such as glycol.

3. Disconnect the inlet water line to the Shield Cooler Compressor and place a container under the line to catch any water that may run off.

4. Connect the 24-inch hose to the water inlet on the Shield Cooler Compressor and secure with a hose clamp. See Illustration 4-7.



SUMITOMO COMPRESSOR CONNECTIONS
ILLUSTRATION 4-7

5. Connect the other end of the 24-inch hose to the Sensor and secure with a hose clamp. **Make sure the Water Direction Arrow is pointing toward the compressor inlet.**

6. Connect the inlet water line to the inlet of the Water Flow and Temperature Sensor. Secure with a hose clamp.

7. Turn on the water supply and check all fittings for leaks. Repair leaks as necessary. Record water flow reading in the site log using the visual indicator. If practical, use the supplied screws to wall mount the Water Flow and Temperature Sensor.

8. Run 827:
   a. Connect the MS5-A5-A1-J1 connector to the Water Flow and Temperature Sensor. Align the key on the connector and tighten the screw collar.
   b. Connect the FJ4 connector on Run 827 to Run 833. Use two Cable Connector Joiners (46-265067P1) to secure the cable connectors to each other. See Illustration 4-7.
   c. Connect the FJ3 connector on Run 827 to Run 826. Use two Cable Connector Joiners (46-265067P1) to secure the cable connectors to each other.

9. Run 833: Connect the MS5-A1-A6-JR end of this cable to the remote connector on the Sumitomo compressor.

10. Run 826: Route the cable to the Magnet Monitor, and connect at J9.

11. Turn on power to the Shield Cooler Compressor.

4-4 Installing the Magnet Monitor UPS (Optional)

Note

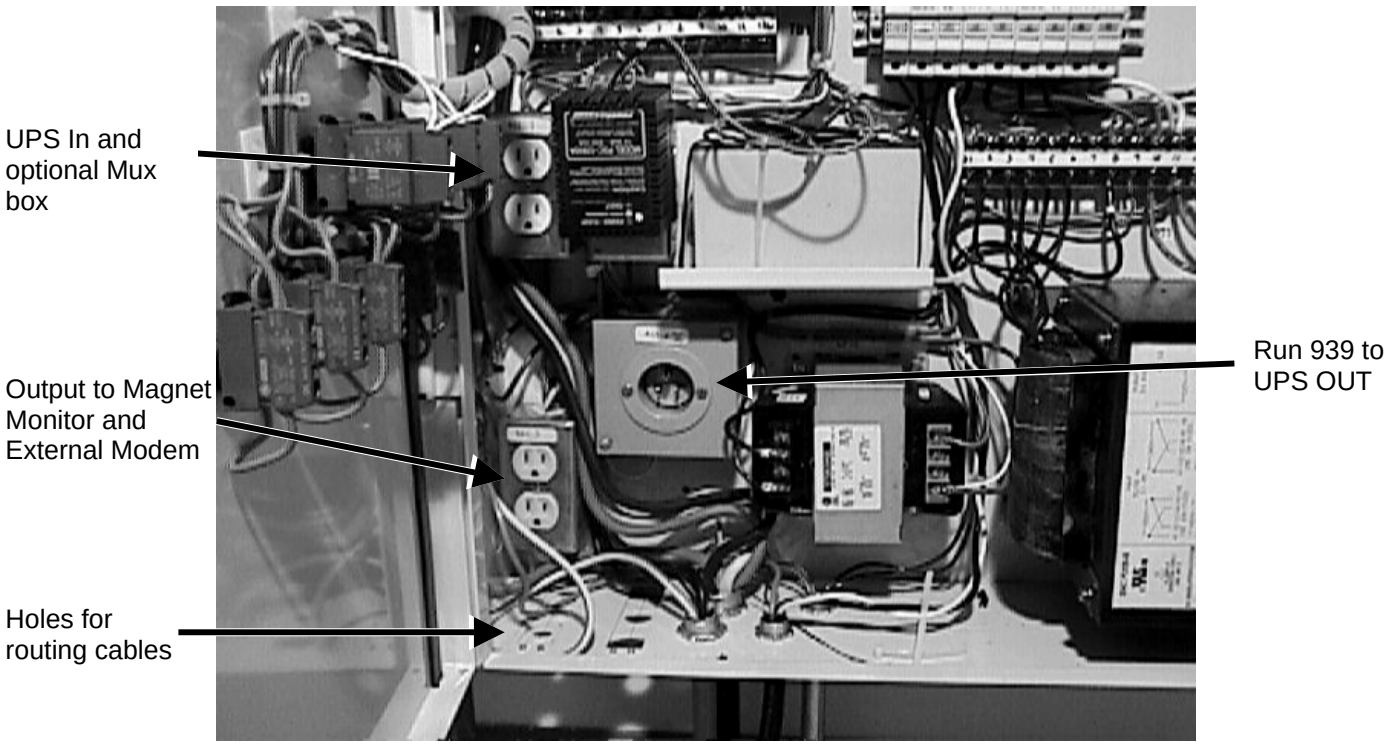
The wiring diagram of the Magnet Monitor UPS is defined in Illustration 8-4.

Note

The Magnet Monitor AC output power is routed through the E-stop circuitry. If the E-stop circuit is not complete at this time it may need to be by-passed.

1. There is an AC jumper between J1 and J2 in the MDP. Remove this jumper. Locate labels **UPS In** and **UPS Out**. Place the UPS In label over outlet J2. Place the UPS Out label over outlet J1.

2. Position the UPS near the Main Disconnect Panel and the Magnet Monitor. Connect the power cable that is provided with the UPS to the MDP AC outlet labeled “UPS Out”. The cable must be routed through the bottom of the MDP cabinet. See Illustration 4-8.



MDP CONNECTIONS
ILLUSTRATION 4-8

3. Find cable run number 939 that is provided with the Magnet Monitoring cable kit. Connect this cable from the UPS output to the MDP AC outlet labeled UPS Input. The AC outlet in the MDP is a Male connector. The cable must be routed through the bottom of the MDP cabinet.

4. Connect the Magnet Monitor AC power cable to the MDP AC outlet labeled Magnet Monitor Output. This cable must be routed through the bottom of the MDP cabinet.

5. Connect the serial cable that is provided with the UPS to the Magnet Monitor, connector J3 to the UPS Comm Port connector.

6. Connect the Customer phone line to the UPS “phone in” connection. Run the customer supplied phone line from the UPS “phone out” connection to the global modem.

7. Connect the provided strain relief’s for the power cables that are routed through the MDP panel. They are included in the Magnet Monitor cable kit.

4-5 Magnet Monitor Calibration and Final Installation

Note

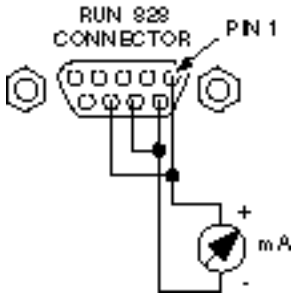
The sensor I/O board in the **Granite** Magnet Monitor is calibrated in the factory. This procedure should only be done once a year, or if the calibration of the helium reading circuit is questionable. The sensor I/O board in the **Advantech** Magnet Monitor has no adjustments. No calibration is required, but the helium reading checks should be performed every year.

4-5-1 Calibrating the Magnet Monitor Helium Level Meter

4-5-1-1 Calibrating the Granite Magnet Monitor

1. In the magnet room, remove Run 828 from P403 (MS1-A3-A1-P403).

2. On the connector of Run 828:
   a. Short pins 1 and 8 together.
   b. Short pins 6 and 7 together.
   c. Attach the Multimeter between pin 1 (+) and pin 7 (-). See Illustration 4-9.



WIRING FOR SENSOR CALIBRATION
ILLUSTRATION 4-9

3. Plug the Magnet Monitor's power cord into an outlet. Turn on the Magnet Monitor.

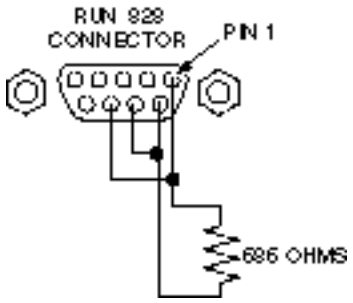
4. Wait approximately two minutes to allow the system to settle.

5. Press the SAMPLE button.

6. Verify the Multimeter reads 75.0 mA.

7. Turn off the Magnet Monitor's power switch.

8. On the connector of Run 828: replace the Multimeter with a 686 ohm resistor capable of dissipating four watts (or use the Helium Resistance Box (46-265286G1) to simulate 686 ohms). The connector pins should now be wired as shown in Illustration 4-10.



WIRING FOR CURRENT SOURCE VOLTAGE CALIBRATION
ILLUSTRATION 4-10

9. Connect the Multimeter between TP1 on the Magnet Monitor Interface Board and the chassis common.

10. Turn on the Magnet Monitor.

11. Wait approximately two minutes to allow the system to settle.

12. Press the SAMPLE button.

13. Adjust the R7 GAIN potentiometer until the Multimeter reads 5.000 Vdc. See Illustration 4-10 for the location of R7.

14. Verify the front panel reads 0% +/- 1.0%.

15. Turn off the Magnet Monitor's power switch.

16. Place a shorting jumper across the 686 ohm test resistor (or set the Helium Resistance Box to zero ohms).

17. Turn on the Magnet Monitor.

18. Wait approximately two minutes to allow the system to settle.

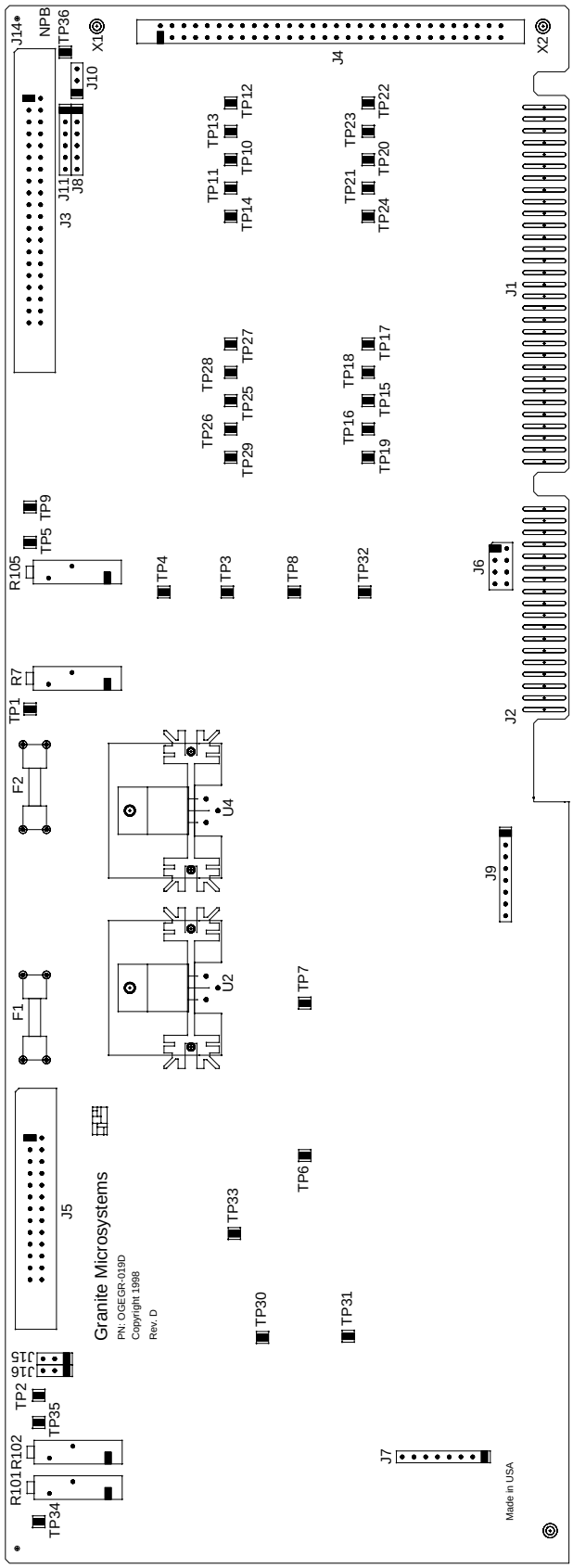
19. Press the SAMPLE button.

20. Verify the voltmeter reads 0.000 Vdc.

21. Verify the front panel reads 100% +/- 1.0%.

22. Repeat from Step 12 until no further changes are necessary.

23. Reconnect Run 828 to P403.



MAGNET MONITOR INTERFACE BOARD
ILLUSTRATION 4-11

4-5-1-2 Checking the helium calibration of the Advantech Magnet Monitor

1. Obtain the Helium Meter Calibration Box part number 46-306864G1.
2. Observe the helium readings for the vessel.
3. Disconnect the helium level cable at the magnet. These cables are located on the Magnet Interconnect which is located on the left side of the magnet when viewing from the front.
4. Connect the Helium Meter Calibration Box to the Cable that was going to P302- Upper. Adjust the resistance on the Helium Meter Calibration Box to the values on the Table 4-1. Hit the "Sample" button on the Magnet Monitor. Verify that the helium reading for the "Upper" vessel is within the specification mentioned below.

RESISTANCE/HELIUM

TABLE 4-1

Resistance Value	Nominal Value	Specification
Zero	100%	100% to 98%
230 Ohms	66.4	63.4 to 69.4 ohms
460 Ohms	32.7	29.7 to 35.7 ohms
686 Ohms	0.0	0.0% to 3%

Note

There are no adjustments for helium level calibration in the Advantech Magnet Monitor. If the helium levels are out of range the magnet monitor should be replaced.

4-5-2 Connecting the Magnet Monitor to the System Cabinet

Note

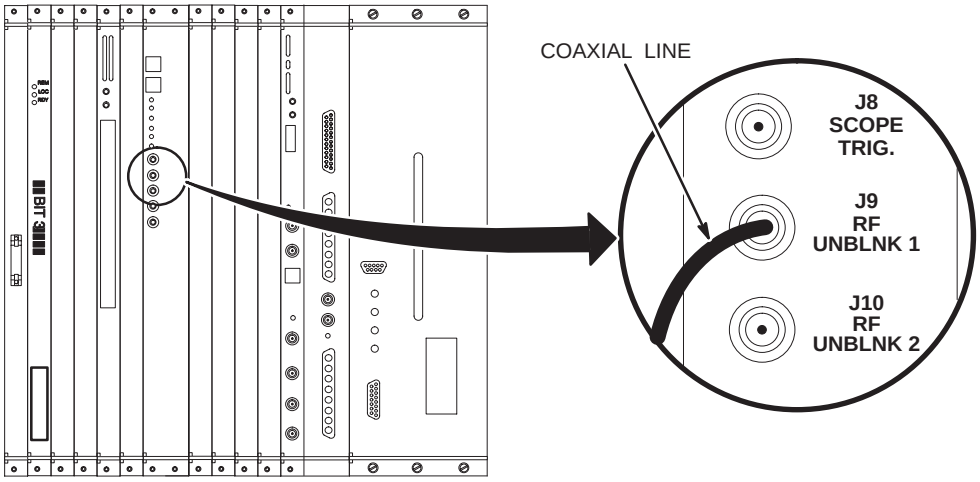
For Excite systems the cable internal to the System's Cabinet is already installed, cable X (no number) does not exist.

Refer to Illustration 8-1, System Interconnect Diagram – LCC/Sumitomo for a diagram of the cable connections described in this section for LX systems.

1. Run 823:
   a. Connect the MSM1-A1-J10 end to the Magnet Monitor.
   b. Route the cable to the interface panel at the lower rear of the System Cabinet.
   c. Install a pair of Connector Joiners (46-265067P1) in an empty 15-Pin opening (J24 if available) on the interface panel.
   c. Connect the MR2-A11-J24 end of Run 823 to the above.

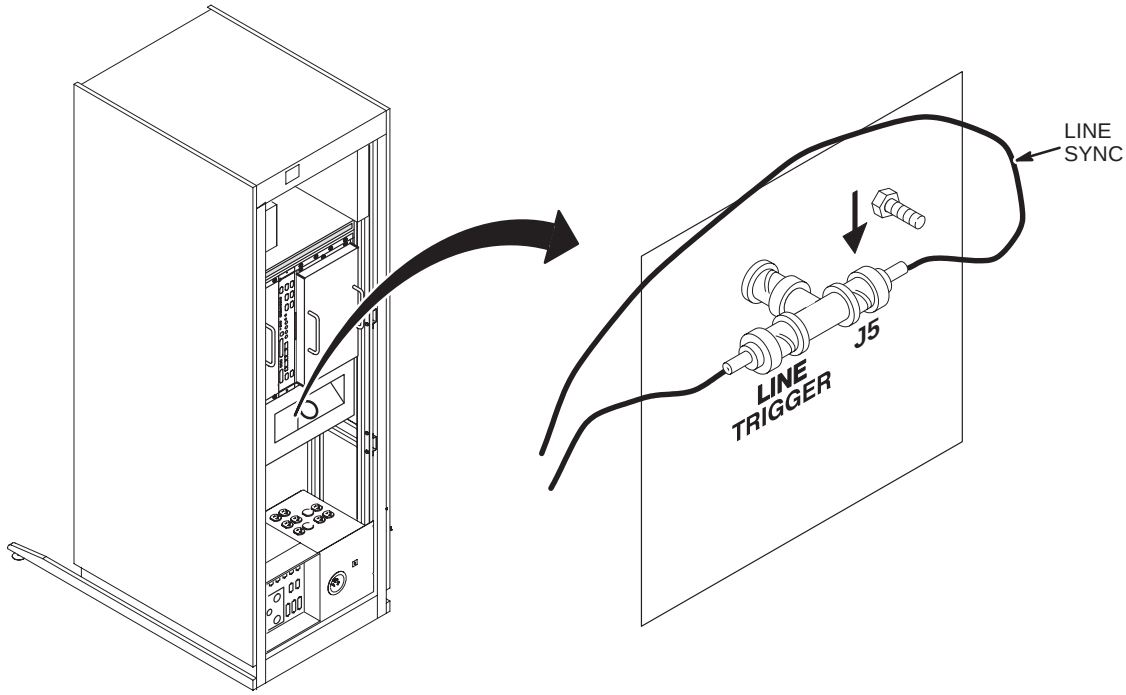
2. Run X (no number):
   a. Connect the MR2-A11-J24 end to the interface panel connectors installed above.

b. Carefully thread the MR2-IPG-J9 end through to the front of the System Cabinet. and connect to J9 (RF UNBLANK1) of the IPG Board on the front of the cabinet (See Illustration 4-12):



RF UNBLANK CONNECTION
ILLUSTRATION 4-12

c. At MR2-PDU-J5 in the System Cabinet, remove the existing cable and replace it with a BNC Tee. Connect the existing cable and the MR2-PDU-J5 end of Run X to the BNC Tee. See Illustration 4-13.



LINE SYNC CONNECTION
ILLUSTRATION 4-13

3. Install the Jumper plug(2239626) on the back of the TYME board in position J5. This jumper eliminates the “low helium” message that the operator would see on the console. Some of the early sites may not have the jumper plug. You can short pins 4 and 6 of connector J5(cryo mon) on the TYME bd to eliminate the message.

4-6 Installing the Global Modem Advantech Magnet Monitor only)

1. Place the Global Modem on the top of the Magnet Monitor. Use existing Velcro to secure the modem to the Magnet Monitor.

2. Plug the Power cord into the UPS into the AC receptacle labeled Magnet Monitor.

3. Connect cable run 940, which is provided with the cable kit between Magnet Monitor J1 and Modem serial connector.

4-7 Installing the MUX Box (Optional)

1. Position the MUX box on top of the magnet monitor.

2. Connect the power cord for the MUX box to the MDP into the AC outlet labeled UPS power.

3. Connect the customer phone line input (through the UPS) to the MUX box port labeled “phone line in”. Connect the phone line between the Global Modem, and the MUX port 1.

IMPORTANT

Make sure that the MUX box, port 1 is used for the Magnet Monitor. The MUX box is not connected to the UPS. If the site were to loose power, the MUX box will default to port 1. This will allow the Magnet Monitor to dial out if the MUX box looses power.

4-8 Installing the Remote Alarm (Optional for Advantech only)

IMPORTANT

The Remote Alarm option will only work on the Advantech Magnet Monitor. It is not compatible with the Granite Magnet Monitor.

1. Place the Remote Alarm near the Operator’s Work Station.
2. Remove cable run 831 from the Magnet Monitor and run 824.

3. Install the Octopus cable, run 916 into the Magnet Monitor, Connector J7.
4. Run cable 915 between the Magnet Monitor and the Remote Alarm and make the connections to Magnet Monitor FJ6, and Remote alarm box J1.
5. Connect Run 824 to FJ1 of Octopus cable run 916.
6. If you plan to connect the remote alarm box to the site's monitoring station, see Appendix A.

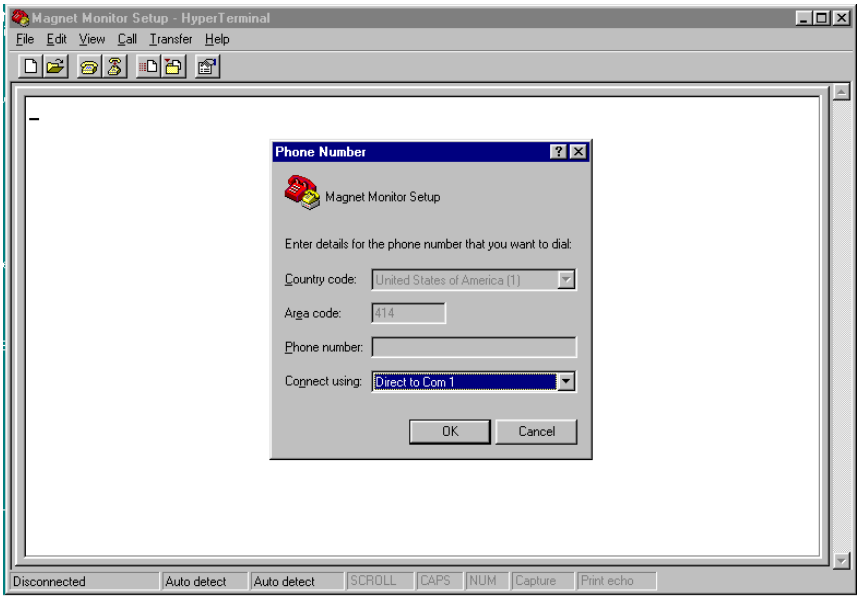
5- Software Configuration

1. Connect a serial interface cable between J2 (Laptop) on the Magnet Monitor and the serial port on a laptop computer.

2. On the laptop, in Windows XP:
   b. Open HyperTerminal by selecting:
   Start/All Programs/Accessories/Communications/HyperTerminal.
   b. Select name for magnet monitor connection such as **Mag Mon**
   c. Press **OK**.

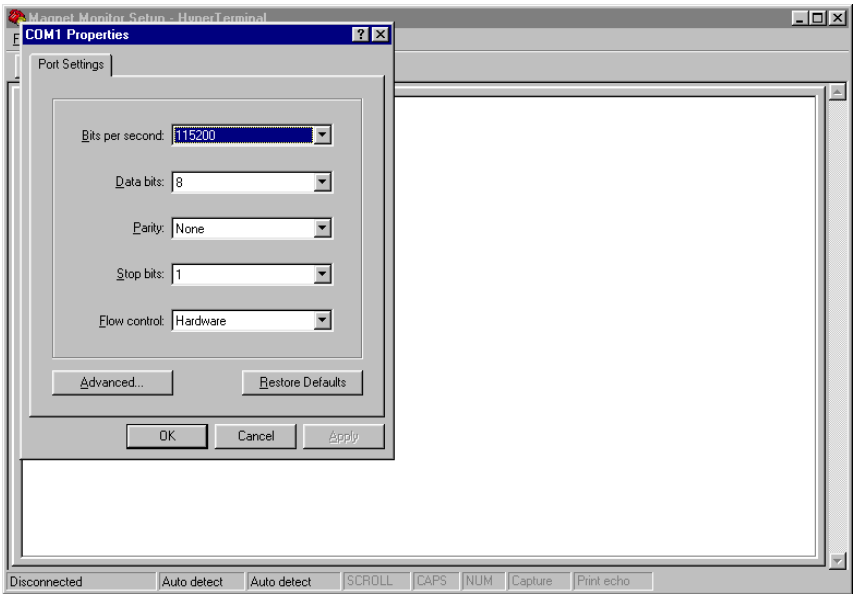
CONNECTION DESCRIPTION SCREEN
ILLUSTRATION 5-1

3. Select (See Illustration 5-2):
   Connecting: **Com1**.
   [OK].



PHONE NUMBER SCREEN
ILLUSTRATION 5-2

4. Select (See Illustration 5-3.):
   Bits per second: **115200**
   Data bits: **8**



COM1 PROPERTIES SCREEN
ILLUSTRATION 5-3

5. Press on the Call icon to display a login screen.

6. Enter:
   Login name: **setup**
   Password: **monitor**

The following will appear on the screen:
Do you wish to change the Configuration Type [y/n] **Y**

There are 2 choices for Configuration Type:
1. hfo
2. lcc

Enter your choice as a number from 1 to 2, or Q to quit: **2 [enter]**

If needed, you can change the Compressor Reset Values. The values mention below should not be changed.

Do you wish to change the Compressor Configuration values? [y/n] **Y**

Do you wish to Enable the Compressor Reset Function? [y/n] **Y**

Enter value for Startup Delay Time (minutes) [1:5] **5**

Enter value for Reset Delay Time (minutes) [1:30] **10**

Enter value for Recheck Delay Time (hours) [1:5] **1**

Enter value for Retry Count (count) [0:10] **2**

Will this Magnet Monitor be serially connected to a UPS [y, n] Select the proper option for this installation.

The Magnet Monitor will now reset.

6- FUNCTIONAL CHECKS

6-1 Magnet Monitor

1. Press Sample button.

2. Check Helium Level for value less than 99%.

3. Check Pressure for a reading that is similar to the gauge reading at the magnet.

4. Allow three days for the magnet to stabilize. Then, verify that the magnet pressure is 3.8 to 4.2 psig, as indicated at the Magnet Monitor.

5. The following will describe the sequential events that will occur as a magnet monitor is re-booted or powered up. The times mentioned may not be exact.

10 sec	The HDD light located on the left side of the unit will come on as the hard drive is accessed. It will flicker during the remainder of the boot-up cycle
45 sec	The display will come on with **8.8.8.8.** displayed, all LED's will light.
60 sec	The helium reading will activate and display the helium level in the magnet vessel. The display cycle between helium level and vessel pressure will begin.

Symptom	Suggested Actions
Message **ER1** appears on the display	This means that there is an open circuit in the helium cable between the Magnet Monitor and the magnet, or the Magnet Monitor is not sending the proper current to the magnet for an accurate helium reading. Check cables between magnet and Magnet Monitor. If continuity is OK check for 75ma coming out of the magnet monitor
Message **ER2** appears on the seven segment display	This means that the magnet heater is stuck on, possibly due to a software hang or other circumstance. Latched pressure was detected and a reboot of the magnet monitor has already occurred. If problem occurs again the Magnet Monitor must be replaced.
Message **ER3** appears on the seven segment display	Heater timeout. The magnet heater was being held on for an extended period. Possible cause might be a slow leak in the magnet, and vessel pressure would never reach the upper limit. In this case the heater would turn off to conserve helium.

6-2 Remote Alarm Check

The Remote alarm that is located by the Operators Console will activate under the following circumstances:

- Magnet helium level is approaching a critical level, the top vessel is less than 50% or the lower vessel is less than 95%.
- Coldhead temperatures are above specification for greater than 90 minutes.
- Magnet Monitor software is hung which will prohibit accurate readings.

6-2-1 Functionality of the Remote Alarm box

Verify magnet pressure is less than 4.1psi. Turn the Cryo-cooler compressor off. After two 90 minutes the Remote Alarm should activate by producing an Audible sound and flashing LED.

7- Maintenance and Replacement

7-1 Maintenance

The only part of the unit that requires maintenance is the fan filter. This filter must be removed and cleaned with mild soap and water solution, rinsed in clean water and reinstalled once per month.

7-2 Magnet Monitor replacement

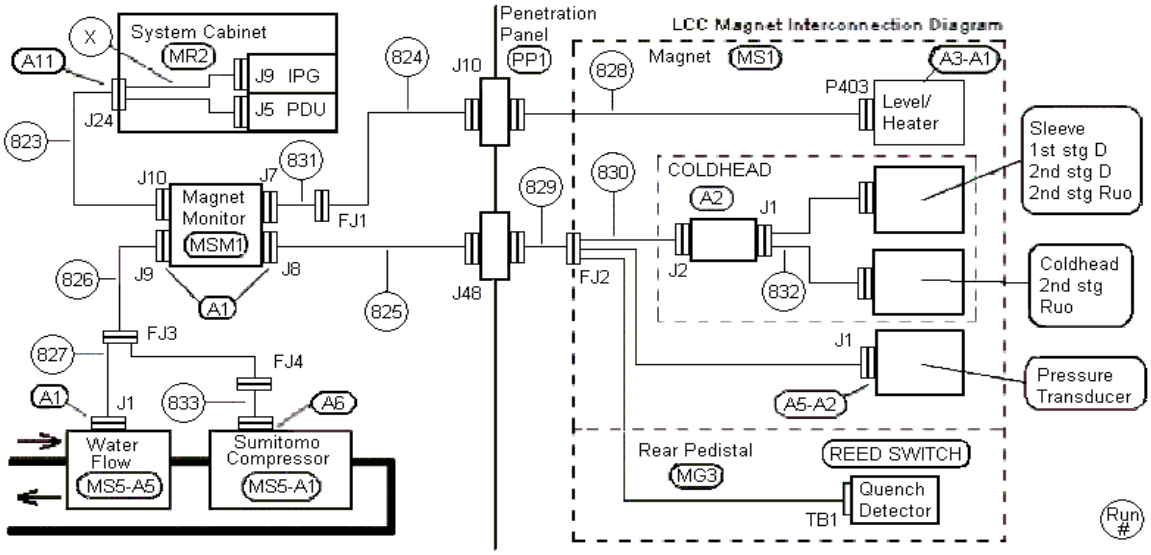
There are no Field Replaceable parts within the magnet monitor. It should be replaced as a unit upon failure. Table 7-1 lists some of the FRU's that can be ordered.

TABLE 7-1
MAGNET MONITOR

Item	Description	Part Number	FRU Code	Qty
1	Advantech Magnet Monitor Unit	2219400	1	1
2	Global Modem	2245794	1	1
3	Cable between Magnet Monitor and Modem	2276568	1	1
4	UPS for magnet monitor	2276094	1	1

8- SCHEMATICS AND INTERCONNECTS

8-1 System Interconnect Diagram for Core product with Water Flow/Temp Sensor



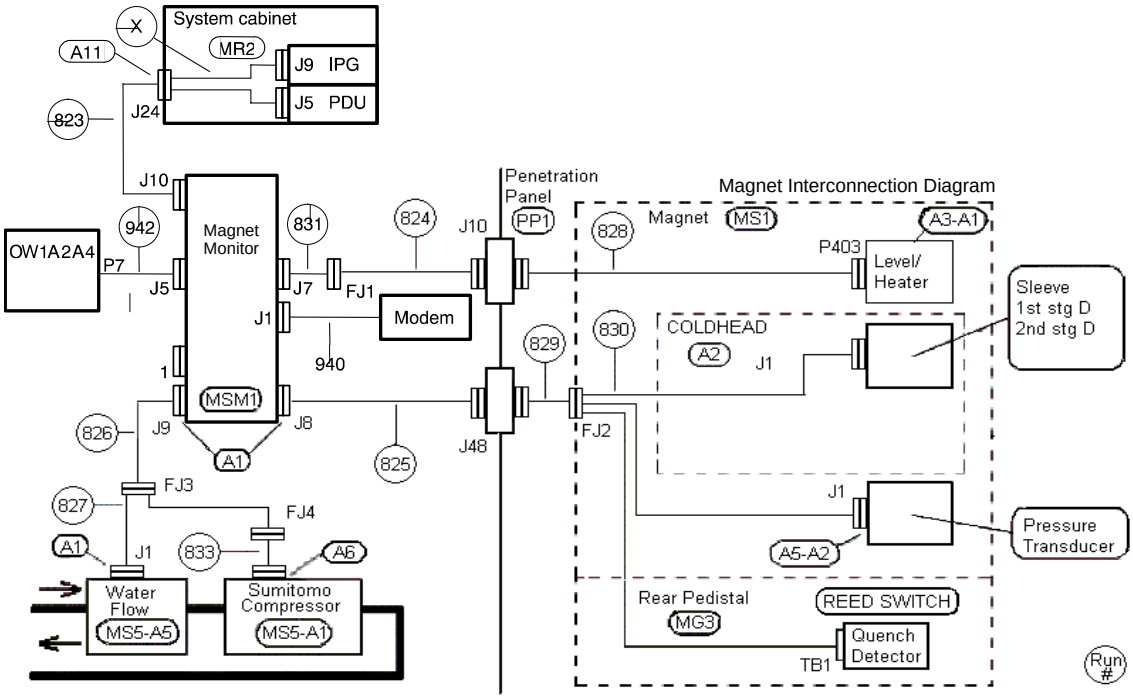
SYSTEM INTERCONNECT DIAGRAM – LCC/SUMITOMO
ILLUSTRATION 8-1

TABLE 8-1
LCC INSTALLED BASE CABLE KIT

Run #	Description	Part Number	From	To
823	Monitor to System Cabinet I/F	46-271603G29	MSM1-A1-J10	MR2-A11-J24
824	Monitor Sensor I/F to Penetration Panel	46-271609G29	PP1-J10	FJ1
825	Monitor Magnet Connector to Penetration Panel	46-271600G29	PP1-J48	MSM1-A1-J8
826	Monitor to Compressor I/F	46-271603G29	MSM1-A1-J9	FJ3
827	Compressor I/F	46-328578P1	FJ3	MS5-A5-A1-J1 & FJ4
828	Penetration Panel to Sensor	46-271609G29	PP1-J10	MS1-A3-A1-P403
829	Penetration Panel to Magnet I/F	46-271601G29	PP1-J48	MS1-FJ2
830	Magnet I/F	2222797	MS1-FJ2	MS1-A2-J2, MS1-A5-A2-J1, & MG3-TB1
831	Monitor to Sensor I/F	2204488-5	FJ1	MSM1-A1-J7
832	Buffer Amp to Cooling Sleeves	2214062	MS1-A2-J1	MS1-SLEEVE & MS1-COLDHEAD,
833*	Compressor to Compressor I/F	2225805	FJ4	MS5-A1-A6-JR
X (no #)	System Cabinet I/F	2204485	MR2-A11-J24	MR2-IPG-J9 & MR2-PDU-J5

*Run 833 is for Sumitomo compressor. This run is compressor specific.

8-2 System Interconnect Diagram for S-Series & CX magnet

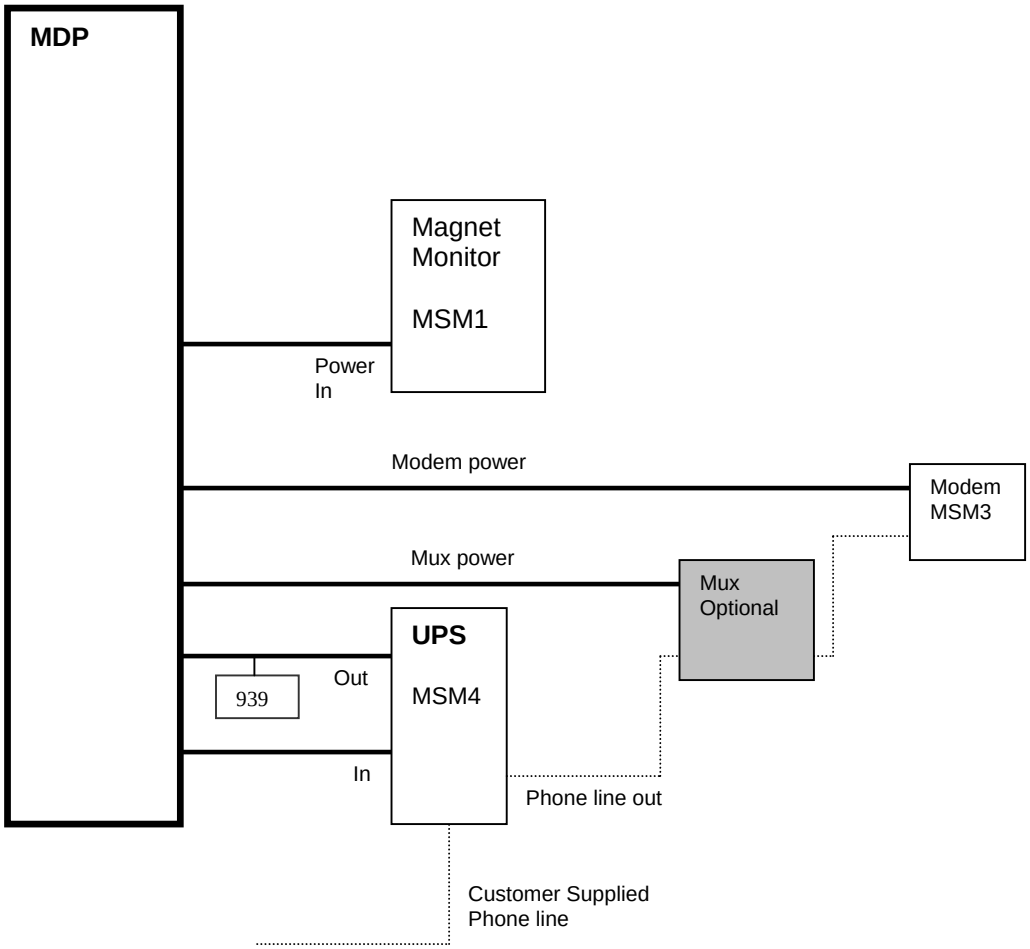


SYSTEM INTERCONNECT DIAGRAM – S-SERIES & CX MAGNET
ILLUSTRATION 8-3

IMPORTANT

Do not use cable run 830 that was included in the magnet monitoring cable kit. Verify that you use the cable that has the nine-pin sub-D connector that will go to the coldhead sleeve.

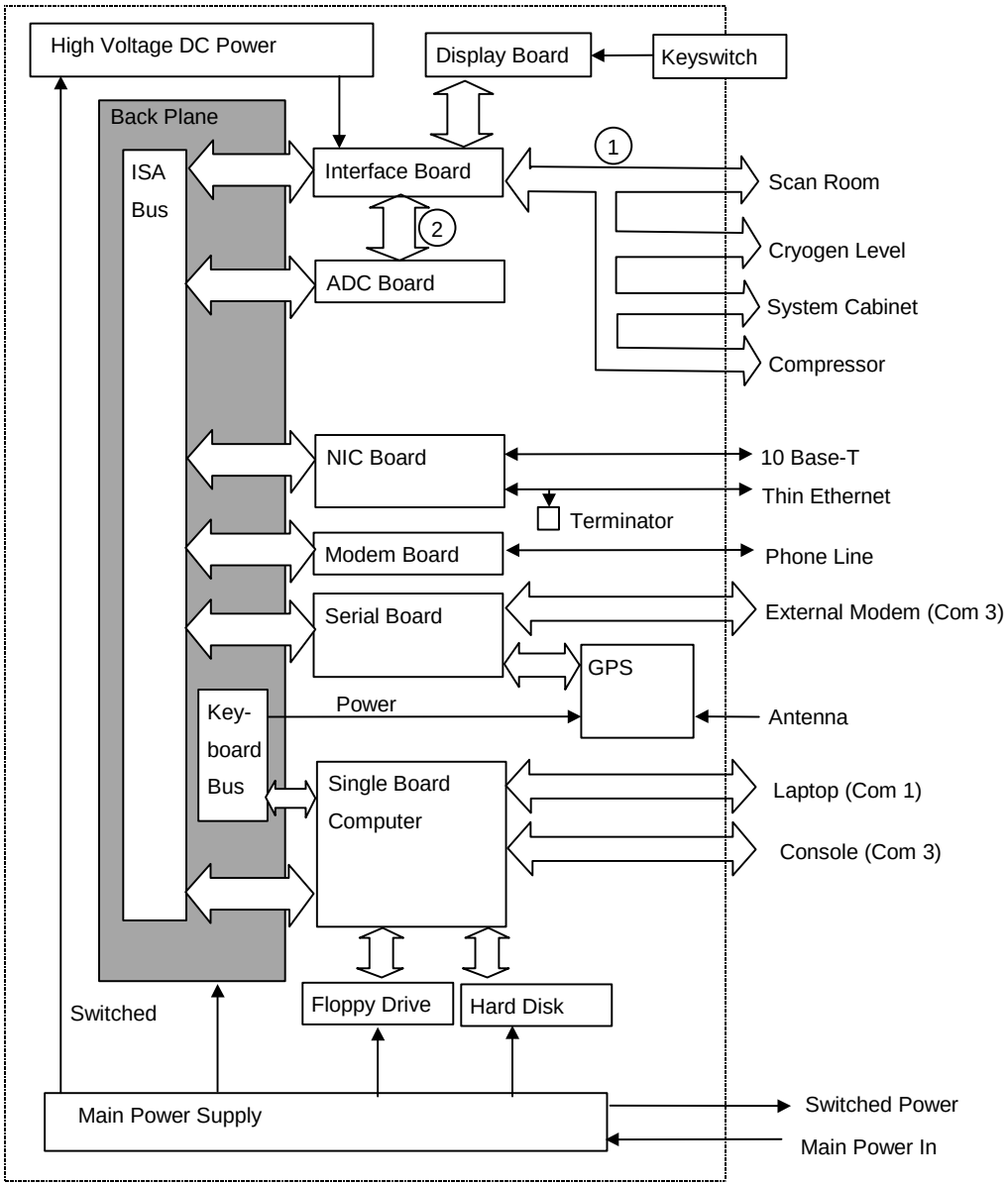
8-3 System interconnect Diagram for UPS (Option for Twin)



INNERCONNECT DIAGRAM FOR UPS POWER & PHONE LINE
ILLUSTRATION 8-4

TABLE 8-4
POWER/PHONE CABLE LIST

Run #	Description	Part Number	From	To
939	MDP to UPS for power out, included with UPS.	2276569	UPS out	MDP in
NA	MDP to UPS (supplied with UPS)	NA	MSM4	MDP
NA	Monitor to MDP (supplied with Monitor)	NA	MSM1 Power	MDP
NA	Modem to MDP (supplied with modem)	NA	MSM3	MDP



MAGNET MONITOR INTERNAL INTERCONNECTS
ILLUSTRATION 8-2

All internal Magnet Monitor cables are straight through cables with one-to-one correspondence between pins for each connector except for the numbered cables. Their pin-outs are shown in the following tables:

TABLE 8-2
INTERNAL OCTOPUS CABLE

Header Pin No. (J4-)	DB Pin Number	DB Connector
1	1	Cryogen Level J7 (DB25 Female)
2	14	Cryogen Level J7 (DB25 Female)
3	2	Cryogen Level J7 (DB25 Female)
4	15	Cryogen Level J7 (DB25 Female)
5	3	Cryogen Level J7 (DB25 Female)
6	16	Cryogen Level J7 (DB25 Female)
7	4	Cryogen Level J7 (DB25 Female)
8	17	Cryogen Level J7 (DB25 Female)
9	5	Cryogen Level J7 (DB25 Female)
10	18	Cryogen Level J7 (DB25 Female)
11	6	Cryogen Level J7 (DB25 Female)
12	19	Cryogen Level J7 (DB25 Female)
13	7	Cryogen Level J7 (DB25 Female)
14	20	Cryogen Level J7 (DB25 Female)
15	8	Cryogen Level J7 (DB25 Female)
16	13	Scan Room J8 (DB25 Male)
17	25	Scan Room J8 (DB25 Male)
18	12	Scan Room J8 (DB25 Male)
19	24	Scan Room J8 (DB25 Male)
20	11	Scan Room J8 (DB25 Male)
21	23	Scan Room J8 (DB25 Male)
22	10	Scan Room J8 (DB25 Male)
23	22	Scan Room J8 (DB25 Male)
24	9	Scan Room J8 (DB25 Male)
25	21	Scan Room J8 (DB25 Male)
26	8	Scan Room J8 (DB25 Male)
27	20	Scan Room J8 (DB25 Male)
28	7	Scan Room J8 (DB25 Male)
29	19	Scan Room J8 (DB25 Male)
30	6	Scan Room J8 (DB25 Male)
31	18	Scan Room J8 (DB25 Male)
32	5	Scan Room J8 (DB25 Male)
33	17	Scan Room J8 (DB25 Male)
34	4	Scan Room J8 (DB25 Male)
35	16	Scan Room J8 (DB25 Male)
36	3	Scan Room J8 (DB25 Male)
37	15	Scan Room J8 (DB25 Male)
38	2	Scan Room J8 (DB25 Male)
39	14	Scan Room J8 (DB25 Male)
40	1	Scan Room J8 (DB25 Male)
41	1	Compressor J9 (DB15 Female)
42	9	Compressor J9 (DB15 Female)
43	2	Compressor J9 (DB15 Female)

44	10	Compressor J9 (DB15 Female)
45	3	Compressor J9 (DB15 Female)
46	11	Compressor J9 (DB15 Female)
47	4	Compressor J9 (DB15 Female)
48	12	Compressor J9 (DB15 Female)
49	5	Compressor J9 (DB15 Female)
50	13	Compressor J9 (DB15 Female)
51	6	Compressor J9 (DB15 Female)
52	14	Compressor J9 (DB15 Female)
53	7	Compressor J9 (DB15 Female)
54	15	Compressor J9 (DB15 Female)
55	8	Compressor J9 (DB15 Female)
56	7	System Cabinet J10 (DB15 Male)
57	6	System Cabinet J10 (DB15 Male)
58	11	System Cabinet J10 (DB15 Male)
59	10	System Cabinet J10 (DB15 Male)
60	9	System Cabinet J10 (DB15 Male)

TABLE 8-3
INTERNAL INTERFACE BOARD TO ADC BOARD CABLE

IDC 2x20 Header (Interface Board End)	IDC Female DB-37 (ADC Board End)
1	1
2	20
3	2
4	21
5	3
6	22
7	4
8	23
9	5
10	24
11	6
12	25
13	7
14	26
15	8
16	27
17	9
18	28
19	10
20	29
21	11
22	30
23	12
24	31
25	13
26	32
27	14
28	33
29	15
30	34
31	16
32	35
33	17
34	36
35	18
36	37
37	19
38	No Connection
39	No Connection
40	No Connection

9- GLOSSARY

Cryogen

A coolant in the form of a liquefied gas such as helium or nitrogen used to cool the magnet to superconducting temperatures.

Excite
Signa LX system with 8 channel technology, released in Fall of 2002.

Gauss
Unit of measurement for the strength of a magnetic field.

Generic Back Plane
A circuit board that has only interconnection hardware (such as an ISA bus) and no electronic circuitry.

Industry Standard Architecture (ISA) Bus
A series of common connection points used to connect ISA compatible boards.

LCC
Low cost cryogen magnet.

Magnet Interface Board
Provides a connection between the Magnet Monitor and the magnet and associated support hardware and electronics such as compressors and cooling shields. The board also drives the display board and conditions analog signals before sending them to the analog to digital converter board (ADC).

Modem
A device used to allow computers to communicate over telephone lines.

Network Interface Card (NIC)
Provides circuitry for connecting a computer to a network.

Penetration Panel
A connection panel used to isolate the magnet room's electrical cables from external cables.

Single Board Computer (SBC)
A single board that contains the main computing hardware such as the central processing unit (CPU), memory, controllers for the disk drives, etc. This board differs from computer "mother boards" in that it does not have a built-in bus for connecting other boards.

TGWC (Twin Gradient Water Cooler)
A water chiller that is used to cool the gradient coil. This system provides data to the Magnet Monitor. It is used when upgrading an existing magnet to the Twin product.

TSCC (Twin Systems Cooling Cabinet)
A water chiller that is used to cool the cryo-cooler compressor and the gradient coil. This system provides data to the Magnet Monitor.

TWIN
MR system that contains a dual gradient coil. This system uses a vacuum between the magnet and encloser/gradient coil to reduce noise.

UPS
Uninturptabe Power Supply which powers the magnet monitor upon power outage.

APPENDIX A – CONNECTING REMOTE ALARM BOX TO HOSPITAL

The Remote Alarm box can be connected to the hospital's warning system. This will inform the security staff of an issue when the MR suite is vacant. The Remote Alarm will activate for a "low helium" alarm, or if the compressor is off for more than 10 minutes.

To connect the Remote Alarm box to a remote panel connect pins 4 and 9 to the device. The relay in the Remote Alarm box is normally open, it will close when the alarm is activated.

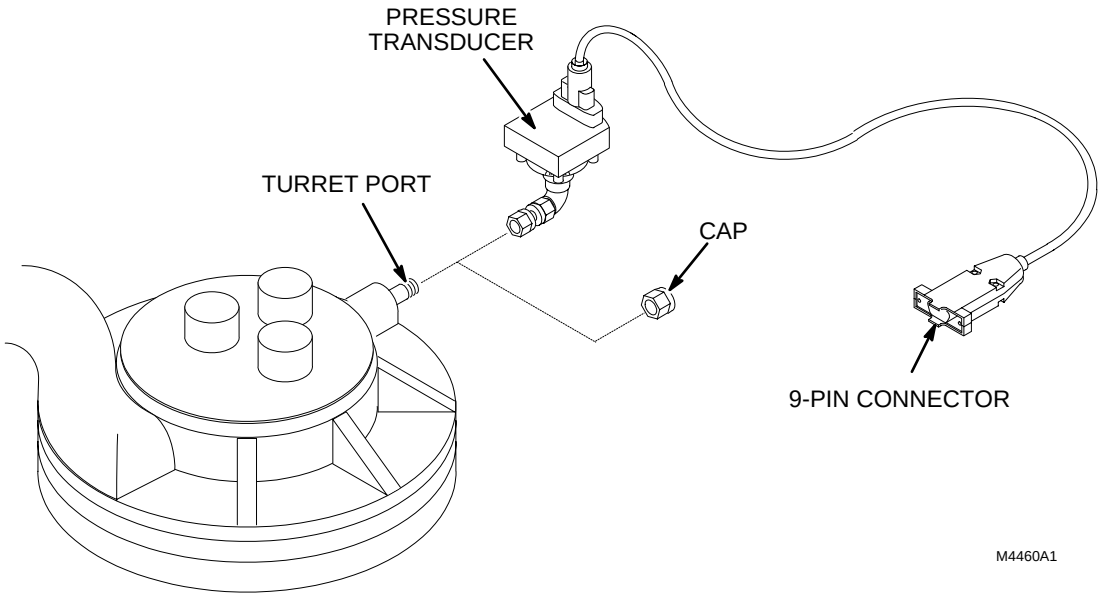
APPENDIX B – CONNECTING PRESSURE TRANSDUCER TO MAGNET

CAUTION

The Pressure Transducer MUST be installed by personnel that have been trained in Magnet Safety per 2301164PRE. Do not attempt to install pressure transducer if you are not trained in Magnet Safety.

B-1 Connecting the Pressure Transducer on S-II, S-III, S-III Magnashield, and 0.5T MAX Magnets

1. Illustration 3-2 shows how to connect the Pressure Transducer on S-II, S-III, S-III Magnashield, and 0.5T MAX (without alternate venting) magnets. If alternate venting has been installed on a 0.5T MAX magnet, the turret port connection is already being used; refer to Section 1-1-4, Connecting the Pressure Transducer on 0.5T MAX Magnets with Alternate Venting.



S-II, S-III, S-III MAGNASHIELD, AND 0.5T MR MAX (WITHOUT ALTERNATE VENTING) PRESSURE TRANSDUCER CONNECTIONS
ILLUSTRATION 3-2

2. Using a non-magnetic 9/16-inch combination wrench, remove the Swagelok cap from the turret port quickly, so that ice does not form on the port. (If a plastic line is connected to the turret port, disconnect it. Leave the plastic line on top of the magnet.)

CAUTION

Always use two wrenches when installing the pressure transducer onto the magnet turret port. Hold the turret port with one wrench to prevent it from further tightening into the plenum while you are tightening the pressure transducer. The plenum can easily crack and will require ramping the magnet down to replace it.

3. Install the Pressure Transducer (46-320840P1) onto the turret port and finger tighten (until Pressure Transducer cannot be rotated). Tilt the Pressure Transducer up to prevent condensation from collecting in the Transducer.
4. Using the non-magnetic adjustable and 9/16-inch wrenches, tighten this connection 1/4 turn past finger–tight.
5. Using leak detection fluid (Snoop), check for leaks in the fittings.
6. Take the 9-Pin Connector attached to the Pressure Transducer and route it towards the rear of the magnet.

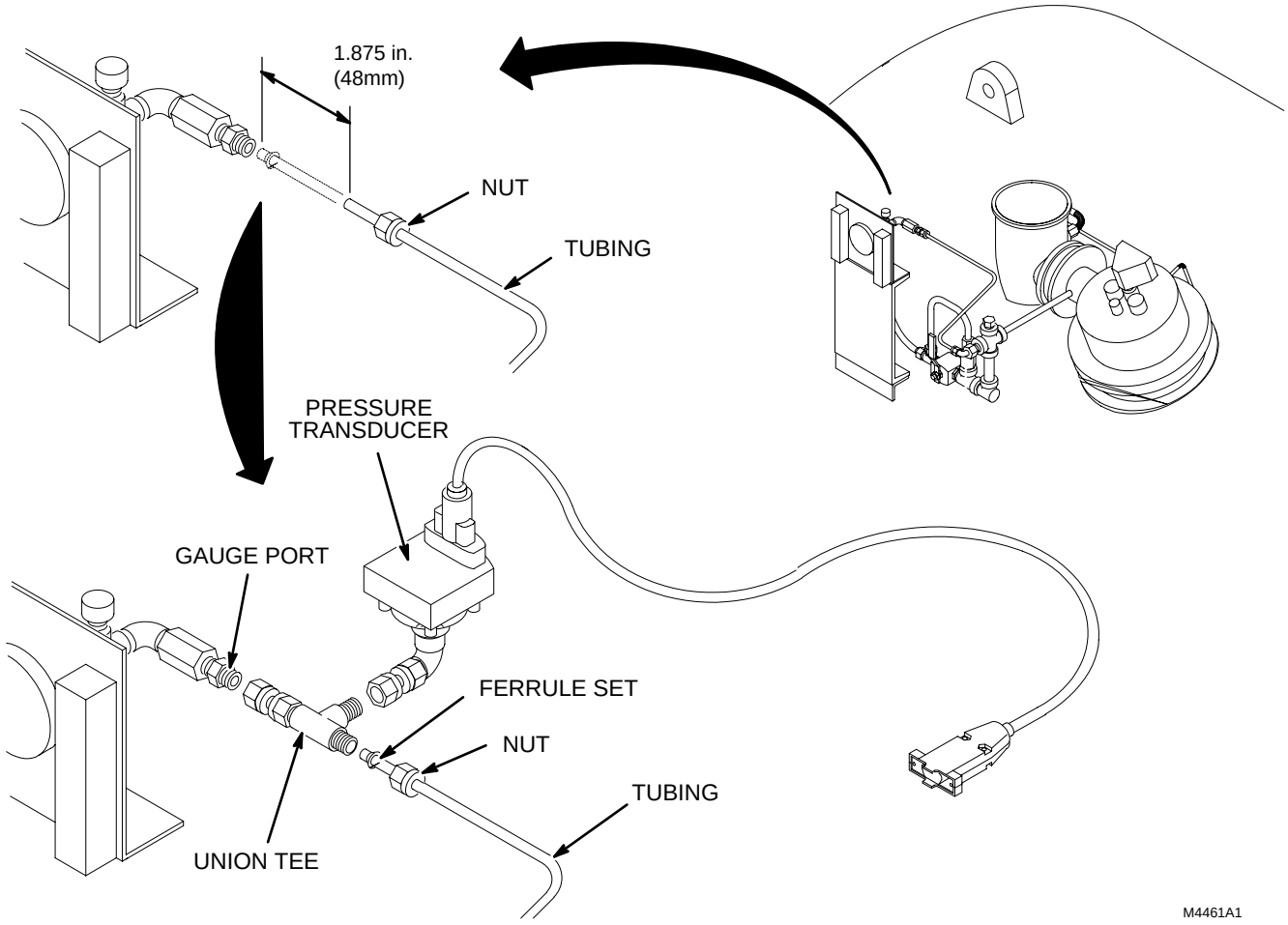
B-2 Connecting the Pressure Transducer on S-IV, S-V, S-X, and S-XC Magnets

1. Illustration 3-3 shows how to connect the Union Tee and the Pressure Transducer on S-IV, S-V, S-X, and S-XC magnets.
2. Loosen the nuts on each end of the 1/4-inch copper tubing that is connected to the instrumentation lead and remove the tubing.
3. Since you will be connecting the Union Tee (46-252294P1) to this copper tubing, you must remove enough of the tubing to make room for the Tee. Line up the Union Tee with the copper tube. Mark where to cut the tubing, approximately 1-7/8 inches (48 mm) from the end.
4. Take the tubing outside of the magnet room and use the tubing cutter to cut the tubing at the mark. Retain the nut for use during installation.

Note

Space restrictions may require you to rotate the Union Tee 180 degrees and install the Pressure Transducer on the other side of the tubing.

5. Connect the Union Tee to the gauge port and finger tighten. The Tee should be aligned as shown in Illustration 3-3. Use the non-magnetic 9/16-inch combination wrench to tighten this connection 1/4 turn past finger–tight.
6. Reinstall the uncut end of the tubing to the location from which it was removed (in Step 2) and finger tighten.
7. Slide the nut (from Step 2) and a ferrule set (from the Union Tee bag in the kit) onto the other end of the tubing. Push this end of the tubing into the Union Tee until it bottoms out. Slide the nut and ferrule set to the Tee and finger tighten the nut. Using the 9/16-inch combination wrench and the adjustable wrench, tighten this connection 1 1/4 turns past finger–tight (to “swage” the fitting).
8. Install the Pressure Transducer (46-320840P1) onto the Union Tee and finger tighten.



S-IV, S-V, S-X, AND S-XC UNION TEE AND PRESSURE TRANSDUCER CONNECTIONS
ILLUSTRATION 3-3

9. Tilt the Pressure Transducer up to prevent condensation from collecting in the Transducer. Use the wrench to tighten this connection 1/4 turn past finger–tight.
10. Using leak detection fluid (Snoop), check for leaks in the fittings.
11. Take the 9-Pin Connector attached to the Pressure Transducer and route it to the side of the magnet.

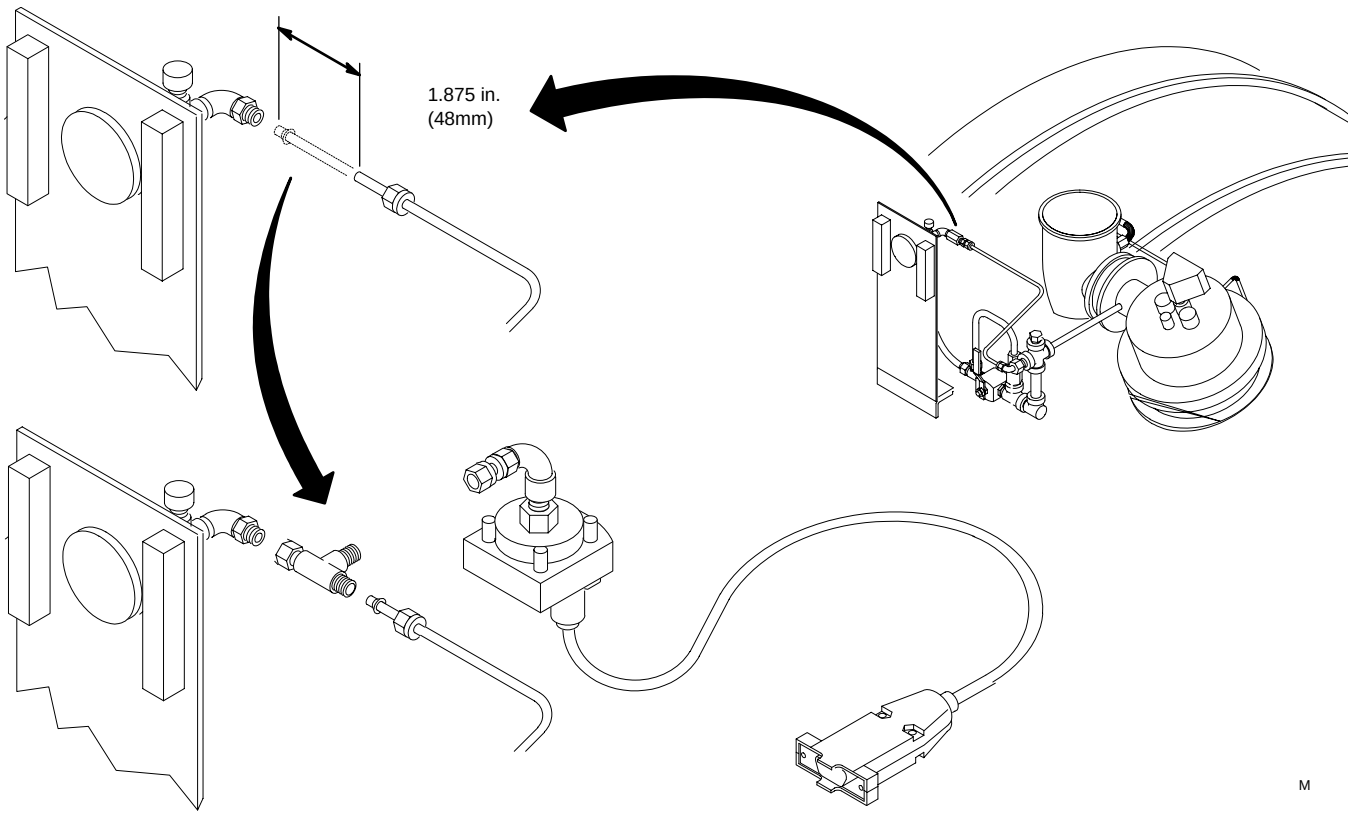
B-3 Connecting the Pressure Transducer on C-X Magnets

1. Illustration 3-5 shows how to connect the Union Tee and the Pressure Transducer on C-X magnets.
2. Loosen the nuts on each end of the 1/4-inch copper tubing that is connected to the instrumentation lead and remove the tubing.
3. Since you will be connecting the Union Tee (46-252294P1) to this copper tubing, you must remove enough of the tubing to make room for the Tee. Line up the Union Tee with the copper tube. Mark where to cut the tubing, approximately 1-7/8 inches (48 mm) from the end.
4. Take the tubing outside of the magnet room and use the tubing cutter to cut the tubing at the mark. Retain the nut for use during installation.

Note

Space restrictions may require you to rotate the Union Tee 180 degrees and install the Pressure Transducer on the other side of the tubing.

5. Connect the Union Tee to the gauge port and finger tighten. The Tee should be aligned as shown in Illustration 3-5. Use the non-magnetic 9/16-inch combination wrench to tighten this connection 1/4 turn past finger–tight.
6. Reinstall the uncut end of the tubing to the location from which it was removed (in Step 2) and finger tighten.
7. Slide the nut (from Step 2) and a ferrule set (from the Union Tee bag in the kit) onto the other end of the tubing. Push this end of the tubing into the Union Tee until it bottoms out. Slide the nut and ferrule set to the Tee and finger tighten the nut. Using the 9/16-inch combination wrench and the adjustable wrench, tighten this connection 1 1/4 turns past finger–tight (to “swage” the fitting).
8. Install the Pressure Transducer (46-320840P1) onto the Union Tee and finger tighten.



C-X UNION TEE AND PRESSURE TRANSDUCER CONNECTIONS
ILLUSTRATION 3-5

9. Tilt the Pressure Transducer up to prevent condensation from collecting in the Transducer. Use the wrench to tighten this connection 1/4 turn past finger–tight.
10. Using leak detection fluid (Snoop), check for leaks in the fittings.
11. Take the 9-Pin Connector attached to the Pressure Transducer and route it to the side of the magnet.

REVISION HISTORY

REV	DATE	AUTHOR	PRIMARY REASONS FOR CHANGE
0	Jan , 1999	P. Kargard	Initial Release
1	Nov, 1999	P. Kargard	Updates after initial release feedback
2	Oct 2001	P. Kargard	Modifications for Advantech and Twin
3	March, 2005	P Kargard	Modifications for installation on older style magnets with Excite HD upgrade.
4	Jun, 2005	P Kargard	Modifications for laptop with XP configuration.
5	July, 2005	P Kargard	Removed wording for Windows 98 laptop
6	Sept, 2005	Stetz	Reworked “Graceful Shutdown Procedure”