Test Plan for the Data Acquisition and Management System for Monitoring the Fuel Oil Spill at the Sandia National Laboratories Installation in Livermore, California

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for Monitoring the Fuel Oil Spill at the Sandia National
Laboratories Installation in Livermore, California**

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**TEST PLAN FOR THE DATA ACQUISITION AND MANAGEMENT
SYSTEM FOR MONITORING THE FUEL OIL SPILL AT THE
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ABSTRACT

This report describes the formal test plan that will be used for the data acquisition and management system developed to monitor a bioremediation study by Argonne National Laboratory in association with Sandia National Laboratories. The data acquisition and management system will record the site data during the bioremediation and assist experts in site analysis. The three major subsystems of this system are described in detail in this report. In addition, this report documents the component- and system-level test procedures that will be implemented at each phase of the project. Results of these test procedures are documented in this report.

1 INTRODUCTION

1.1 PURPOSE

The purpose of this test plan is to describe the formal qualification test procedures and test results for the data acquisition and management system and associated field instrumentation that will monitor activities at the fuel oil spill (FOS) site at the Sandia National Laboratories (SNL) installation in Livermore, California. The plan is an adjunct to the comprehensive quality assurance (QA) plan that addresses, from a total quality management perspective, all hardware, software, and documentation associated with the monitoring activity. Specific hardware and software tests are based on specified and derived system requirements, manufacturer's specifications, and overall QA guidelines, as defined in the aforementioned QA plan.

1.2 OVERVIEW OF TESTING PROCEDURES AND PHASES

The testing procedures for the data acquisition hardware, software, and instrumentation established in this plan correspond to the final three phases of the project life cycle, as defined in the QA plan and shown in Figure 1. Specifically, the procedures involve the following:

- Inspection and testing at Argonne National Laboratory (ANL),
- Installation and checkout at the FOS site (preoperation), and
- Testing after the system is operational at the FOS site.

FIGURE 1 FOS Subsurface Bioremediation Project Life Cycle

Both component- and system-level (i.e., integrated) testing will be performed during each phase. Procedurally, testing during the phases will focus on each of the three major subsystems:

- The monitoring and logging instrumentation subsystem for the transducers, temperature probes, tensiometer, and neutron, gamma, and electromagnetic induction logging tools;
- The data acquisition subsystem for uploading data recorded by the data loggers; and
- The data analysis subsystem for recording laboratory sample analysis results from the air lift samplers and lysimeters, archiving data, analyzing statistics, and modeling the FOS.

If system requirements necessitate modifying a system component after the bioremediation effort has started, the component will be tested and authorized through an approval process. Those test results will be documented independently.

1.3 REFERENCES

The inspection and testing procedures described in this test plan are based in part on the documents and manuals listed below. The ANL Quality Assurance Plan for the data acquisition and management system, and related project documentation, should be viewed as companion documents.

- *Remedial Action Plan for the Fuel Oil Spill at Sandia National Laboratories, Livermore, California*, prepared by Argonne National Laboratory, Argonne, Ill., for the U.S. Department of Energy, Washington, D.C. (July 1992).
- *Draft Report: Work Plan for the Fuel Oil Spill at Sandia National Laboratories, Livermore, California*, Argonne National Laboratory, Argonne, Ill. (June 4, 1993).
- *Quality Assurance Plan for the Data Acquisition and Management System for Monitoring the Fuel Oil Spill at the Sandia National Laboratories Installation in Livermore, California*, ANL/ER-DIS/TM-4, Argonne National Laboratory, Argonne, Ill. (April 1995).
- *IEEE Standard for Software Verification and Validation Plans*, ANSI/IEEE Std 1012-1986, American National Standards Institute and the Institute of Electrical and Electronic Engineers, Inc., New York, N.Y. (Feb. 10, 1987).

- *IEEE Standard for Software Test Documentation*, ANSI/IEEE Std 829-1983, American National Standards Institute and the Institute of Electrical and Electronic Engineers, Inc., New York, N.Y. (Feb. 18, 1983).
- *CR10 Measurement and Control Module Operator's Manual*, Campbell Scientific, Inc., Logan, Utah (Mar. 31, 1992, revised).
- *AM416 4 X 16 Relay Multiplexer Instruction Manual*, Campbell Scientific, Inc., Logan, Utah (Mar. 1992, revised).
- *Micro-Ferrups 500 VA - 3.1 KVA 50/60 Hz User Manual*, Best Power Technology, Inc., Necedeh, Wis. (1992).
- *EnviroCom I Environmental Monitor Operation Instructions*, Best Power Technology, Inc., Necedah, Wis. (no date).
- *YSI 071 Deepwater Probe Specification Sheet*, Yellow Springs, Inc., Yellow Springs, Ohio (1993).
- *5301 Current Transducer Operating Instructions*, Soilmoisture Equipment Corp., Santa Barbara, Calif. (June 1989).
- *Instruction Manual: Vibrating Wire Piezometers Model 4500*, Geokon, Inc., Lebanon, N.H. (Jan. 1992).
- *Borland C++: Programmer's Guide & Related Documentation*, Borland International, Inc., Scotts Valley, Calif. (1992).
- *Greenleaf CommLib Level 2: Reference Manual*, Greenleaf Software, Inc., Dallas, Texas (1993).
- *SAS Procedures Guide & Related Documentation*, SAS Institute, Inc., Cary, N.C. (1990).
- *Siteplanner User Guide & Related Documentation*, ConSolve, Inc., Lexington, Mass. (1993).
- *XESS User's Guide & Related Documentation*, Applied Information Systems, Inc., Chapel Hill, N.C. (1992).

1.4 ORGANIZATION

The remainder of this test plan is organized as follows. Section 2 describes — for each of the final three phases of the project life cycle, as illustrated in Figure 1 — the testing to be performed on the monitoring and logging instrumentation subsystem. Sections 3 and 4 provide similar information for the data acquisition subsystem and the data analysis subsystem, respectively. Section 5 describes the subsystem integration.

These descriptive sections are supplemented by supporting data and test results in Appendixes A through C. In particular, Appendix A contains copies of the manufacturer's data sheets for the field instrumentation. Appendix B contains signed copies of the instrumentation and subsystem test sheets. Finally, Appendix C contains photographs of the three subsystems and the components of each subsystem. The photographs were taken during the inspection and testing phase at ANL, before the subsystems were shipped to the FOS site. The pictures document the wiring patterns and the subsystem assembly.

2 MONITORING AND LOGGING INSTRUMENTATION SUBSYSTEM

This section describes the testing to be performed on each of the major components of the monitoring and logging instrumentation subsystem, which consists of sensors and ancillary equipment. Specifically, the following subsystem components are discussed:

- Pressure transducers,
- Temperature probes,
- Tensiometers,
- Data loggers,
- Multiplexers,
- Short-haul modems,
- Power supplies, and
- Cabling and wiring.

For each component, a description is provided (if appropriate) for the inspection and testing at ANL, the installation and checkout at the FOS site, and the testing after the system is operational at the FOS site. Several types of tests may be performed during each of these phases.

A test code numbering scheme uniquely identifies each test to be performed. The test code is a five-digit combination of letters and numbers that corresponds to (1) the subsystem being tested, (2) the life-cycle phase, (3) the specific component or type of equipment, (4) the test type, and (5) the specific item, if necessary. Tables 1 and 2 delineate the test code numbering scheme.

2.1 PRESSURE TRANSDUCERS

Fifty Geokon Model 4500S vibrating wire pressure transducers will be tested to verify that they are in working order, to verify that the manufacturer calibration information is accurate, and to ensure continuity of the attached cabling. The calibration information, which is provided by the manufacturer, is included in Appendix A.

TABLE 1 Test Code Numbering Scheme^a

Category	Description	Code
1	Subsystem designation	M: Monitoring and logging instrumentation subsystem Q: Data acquisition subsystem A: Data analysis subsystem I: Integrated system
2	Life-cycle phase	A: Inspection and testing at ANL P: Installation and checkout at the FOS site (preoperation)
3	Component or equipment type	Numeric value (Table 2)
4	Test type	Numeric value (varies by component)
5	Specific item number	Numeric value (varies by component)

^a The test code is a sequential designator made up of the five categories identified above. The fifth category — specific item number — is the specific instance of a particular test. For example, MA1-1-49 represents a specific test on the monitoring and logging instrumentation subsystem, performed at ANL, involving pressure transducer number 49.

TABLE 2 Component Numbering Scheme

Number	Component	Number	Component
1	Pressure transducer	15	Data Upload software
2	Temperature probes	16	Tape Backup software
3	Tensiometers	17	Sun SPARCstation 2
4	Multiplexers	18	SitePlanner TM
5	Personal computer	19	Statistical Analysis System (SAS TM)
6	Mirrored hard disk	20	Sensor Data Query software
7	Communications board	21	Chemical Analysis Query software
8	Tape drive	22	Backup Facility software
9	Uninterruptible power supply	23	Data Distribution software
10	Telephone notification system	24	Data acquisition with pressure subunit
11	Computer network card	25	Data acquisition with temperature subunit
12	Data Logger Programmer software	26	Data acquisition with tensiometer subunit
13	Data Acquirer software	27	Data acquisition with data analysis
14	Sensor Monitor software	28	Full operation

2.1.1 Inspection and Testing at ANL

Each pressure transducer will be visually inspected and labeled upon arrival at ANL. In addition, each pressure transducer will be tested in a 3.5-in.-diameter, 6.0-ft-high aluminum column filled with water. Each probe will be submerged to depths of 1, 3, and 5 ft and the frequency-squared reading recorded and converted to pressure by using calibration data supplied with each sensor. Results of the pressure transducer testing will be recorded on data sheets designated MA1-1-1 through MA1-1-57 (Appendix B). The step-by-step test procedure (for each sensor) is as follows:

- Remove the filter assembly from the sensor;
- Connect the cable leads to the Geokon readout box;
- Place the readout box dial in "B" position;
- Lower the sensor into a 6-ft cylinder and eliminate any air bubbles;
- Lower the sensor to depth of 1 ft;
- Record the frequency-squared value, R1;
- Repeat the last two steps for depths of 3 and 5 ft;
- Record zero reading, R0, with the sensor just above the surface of the water;
and
- Convert the frequency-squared readings to pressure by using calibration data for the sensor.

2.1.2 Installation and Checkout at the FOS Site

The pressure transducers and attached cables will be re-inspected physically and electronically at SNL after being shipped from ANL. Physically, the cable seal and the attached cable will be examined for integrity. Electronically, each pressure transducer will be tested for response by using the Geokon readout box. Each pressure transducer will be submerged to a depth of 1 ft in a 55-gal drum filled with water. The frequency-squared readings will be converted to pressure readings by using calibration data supplied with the pressure transducers. The frequency-squared value and corresponding pressure reading for each depth measurement will be recorded.

Before installation, the filter assembly for each sensor will be removed and boiled in deaired water to dissolve any air trapped in the filter assembly. The sensor will then be reassembled beneath the surface in the container of deaired water. The sensor unit will be kept under water until it is time for installation downhole.

Each sensor will be labeled with its assigned monitoring borehole and station. This information will be recorded in the field installation and testing logbook. Before installation, each sensor label will be rechecked for correct monitoring borehole and station assignment. (See Test Sheet MP1-1-1.)

2.1.3 Operational System Testing

Correct operation of each pressure transducer will be constantly monitored by the data acquisition software. When using pressure data in the data analysis subsystem, the analyst can eliminate values judged to be erroneous.

2.2 TEMPERATURE PROBES

Fifty Model 071 Yellow Springs, Inc., thermistor probes will be calibrated by using temperature-controlled water baths. Calibration information for each probe will be recorded on a test sheet, entered into a data file, and input into a program that will generate a temperature offset and multiplier for each probe. After each temperature probe has been calibrated, it will be tested by using the calibration values with a temperature bath in the mid-range of the calibration temperatures. (Note that the wire colors for the temperature probes are *red* for common, *black* for T1, and *white* for T2.)

2.2.1 Inspection and Testing at ANL

As the temperature probes arrive at ANL, they will be visually inspected and labeled. They will then be calibrated and tested in a temperature-controlled water bath. The calibration information will be recorded on data sheets MA2-1-1 through MA2-1-55 (Appendix B). The step-by-step test procedure (for each sensor) is as follows:

- Prepare two water baths: one at 5-7°C and a second at 29-30°C;
- Connect two temperature probes to multiplexer channels 1 and 2;
- Run the CR10 program "temp.dat";

- Place the probes in a cold water bath;
- Submerge temperature probes in water until the reading is constant;
- Record the exact temperature from both thermometer and raw millivolt readings at the same instant;
- Transfer the probes to a warm water bath; and
- Repeat the steps above.

Once the high- and low-temperature and millivolt readings have been recorded, these values will be entered into a data file on a personal computer (PC). A program, developed at ANL, will use this data file to automatically generate multiplier and offsets for each probe. (See Test Sheets MA 2-2-(1-55).) After the multipliers and offsets have been calculated, each probe will be tested for accuracy according to the following step-by-step test procedure:

- Prepare a water bath at 20-21°C,
- Connect the temperature probe to multiplexer channel 1,
- Place the probe in the water bath,
- Let the probe sit in the bath until the reading is constant,
- Edit "temp.dat" with computed multiplier and offset,
- Download "temp.dat" to CR10 and run,
- Check the bath thermometer temperature and calculated value for agreement, and
- Repeat the procedure for all temperature probes.

2.2.2 Installation and Checkout at the FOS Site

The thermistors and attached cables will be re-inspected physically and electronically at SNL after being shipped from ANL. Physically, the neoprene seal and external splice protector on each probe and the attached cable will be examined for integrity. Electronically, each thermistor will be tested for response by using a temperature readout set consisting of an excitation source, range

resistors, unit conversion circuit, and digital voltmeter. Each thermistor will be submerged in a 55-gal drum filled with water, and the temperature reading will be recorded.

Each sensor will be labeled with its assigned monitoring borehole and station. This information will be recorded in the field installation and testing logbook. Before installation, each sensor label will be reattached for correct monitoring borehole and station assignment. (See Test Sheet MP2-1-1.)

2.2.3 Operational System Testing

The operation of each temperature probe will be constantly monitored by the data acquisition software. When using temperature data in the data analysis subsystem, the analyst can eliminate values judged to be erroneous.

2.3 TENSIOMETERS

The 10 Soilmoisture Equipment Corporation Model 2725 Jet Fill tensiometers will have a ceramic bulb, vacuum gauge, and current transducer. The tensiometer will have a "T" fitting to allow both the vacuum gauge and the current transducer to be attached to the tensiometer subunit. Each current tensiometer will be individually tested to ensure correct linear operation.

2.3.1 Inspection and Testing at ANL

Upon arrival at ANL, each ceramic bulb and current transducer will be visually inspected, and all current transducers will be labeled. The current transducers will be tested with a vacuum pump by using a CR10 data logger program. The results of the tests will be recorded on data sheet MA3-1-1 (Appendix B). The step-by-step test procedure (for each transducer) is as follows:

- Run vacuum tubing between the current transducer and vacuum pump,
- Run the CR10 data logger program "tens.dat,"
- Increase the vacuum,
- Determine if the current reading is linear with the vacuum, and
- Repeat the test for all transducers.

2.3.2 Installation and Checkout at the FOS Site

The tensiometer will be re-inspected physically for any damage at SNL after being shipped from ANL. The current transducers will be re-inspected for calibration by measuring the output (in milliamperes) at vacuums of 0, 25, 50, and 75 centibars. The results of the tests will be recorded on data sheet MP3-1-1. The step-by-step test procedure (for each transducer) is as follows:

- Dip the ceramic cup of the tensiometer in water for two minutes to fill the pores and seal off entry of air;
- Remove the tensiometer cap and insert a vacuum hand pump at the top of the unit; and
- Connect the DC probe source to the power leads of the current transducer and an ammeter to input leads, as prescribed in the operating instructions for the 5301 current transducer;
- Apply the above vacuums; and
- Record the reading on the ammeter.

2.3.3 Operational System Testing

Correct operation of each tensiometer will be constantly monitored by the data acquisition software. When using soil moisture data from the tensiometers in the data analysis subsystem, the analyst can eliminate values judged to be erroneous.

2.4 DATA LOGGERS

Three Campbell Scientific Model CR10 data loggers will be used to record the data values read by the sensors in each subunit.

2.4.1 Inspection and Testing at ANL

The data loggers will be visually inspected at ANL. They will be tested as part of the inspection to verify accurate communication with the data acquisition subsystem.

2.4.2 Installation and Checkout at the FOS Site

Each data logger will be tested as part of the subunit testing.

2.4.3 Operational System Testing

If a data logger ceases to operate, the data acquisition system will notify the user through a daily log that a reading cannot be made on that subunit.

2.5 MULTIPLEXERS

The nine Campbell Scientific Model AM416 multiplexers will be individually tested for proper switching of channels, continuity of the signal, identification of manufacturer flaws, damage from shipping, and cross talk between channels.

2.5.1 Inspection and Testing at ANL

Each multiplexer will be tested at ANL, and the results of each test will be recorded and initialed by the tester on data sheets MA4-1-1 through MA4-1-9 (Appendix B). The procedure to verify correct operation of each multiplexer is as follows:

- Apply +12 V to the multiplexed power input,
- Apply +5 V to the common outputs on the multiplexer,
- Apply +5 V to the reset line on the multiplexer,
- Apply a +5 V clock pulse to the clock line on the multiplexer,
- Check for continuity of the signal on channel 1 of the multiplexer,
- Check the next higher and lower channels for crossover, and
- Repeat steps 4 and 5 for all 16 channels on the multiplexer.

2.5.2 Installation and Checkout at the FOS Site

Each multiplexer will be tested during subunit and subsystem operation at the FOS site. If any problems arise, the testing procedures outlined in Section 2.5.1 will be followed. (See Test Sheets MP4-1-1 through MP4-1-9.)

2.5.3 Operational System Testing

Correct operation of each multiplexer will be monitored during subunit and subsystem operation. If any problems arise, the testing procedures outlined in Section 2.5.1 will be followed.

2.6 SHORT-HAUL MODEMS

The six short-haul modems are used during communication with the CR10 data loggers. Three of the short-haul modems are located in the data loggers and are linked to the other three short-haul modems in the PC.

2.6.1 Inspection and Testing at ANL

All of the short-haul modems will be visually inspected for damage upon arrival at ANL. Any problems will be detected during the subunit or subsystem testing. A faulty modem will result in a loss of communication between the PC and the affected subunit.

2.6.2 Installation and Checkout at the FOS Site

Correct operation of the short-haul modems at the FOS site will be verified as described in Section 2.6.1.

2.6.3 Operational System Testing

Correct operation of the short-haul modems will be verified as described in Section 2.6.1.

2.7 POWER SUPPLIES

The three subsystems contain a +12 V power supply, each of which contains a battery. The power supply is mounted in the top container of each subunit near the CR10 data loggers.

2.7.1 Inspection and Testing at ANL

Correct operation of each power supply and battery will be verified as work on each subunit progresses at ANL. A faulty power supply will be detected during assembly of the subsystem. In addition, each battery will be charged during system assembly, and all three subunits will be disconnected from their power line sources to ensure that each battery is operational.

2.7.2 Installation and Checkout at the FOS Site

The power supplies at the FOS site will be tested as described in Section 2.7.1.

2.7.3 Operational System Testing

Correct operation of the power supplies and batteries will be checked during operational system testing by using the procedure described in Section 2.7.1.

2.8 CABLING AND WIRING

A significant amount of wiring is used between internal hardware components inside each subunit and between each subunit's short-haul modems and the data acquisition PC.

2.8.1 Inspection and Testing at ANL

At ANL, the internal subunit wiring between the CR10 data loggers, multiplexers, power supplies, readout boxes, alarm circuits, and temperature calibration boxes will be verified during subunit or subsystem testing. Any problems with internal subunit wiring will be detected at such a time because subunits will not operate correctly with faulty wiring. Wiring between the short-haul modems and the data acquisition subsystem will be tested with a sample run (50 ft) of the shielded wire to be used at the FOS site. If any problems arise with the wiring, the result will be no connection between the data acquisition PC and the subunit in question.

2.8.2 Installation and Checkout at the FOS Site

The internal subunit wiring and the wiring from the short-haul modem to the data acquisition PC wiring will be verified as described in Section 2.8.1. The actual cables used at the FOS site will establish communication with each subunit's data logger.

2.8.3 Operational System Testing

The wiring verification will follow the same procedures as outlined in Section 2.8.1.

3 DATA ACQUISITION SUBSYSTEM

The purpose of the data acquisition subsystem is to retrieve and record sensor information from the pressure, temperature, and tensiometer subunits. Communication is established between the data acquisition subsystem and each of the three subunits through a standard RS-232 interface. Six short-haul modems are used to boost the signals.

Seven components of the data acquisition subsystem and five software programs are discussed in this section:

- Personal computer,
- Mirrored hard disks,
- Communication board,
- Tape drive,
- Uninterruptible power supply,
- Telephone notification system,
- Computer network card,
- Data Logger Programmer software,
- Data Acquirer software,
- Sensor Monitoring software,
- Data Upload software, and
- Tape Backup software.

The software programs are designed to meet the functional requirements specified for the subsystem.

3.1 PERSONAL COMPUTER

The data acquisition PC, a ZEOS 486, reads and stores data from the data loggers, creates sensor data files, and passes these files to the data analysis subsystem. If a problem occurs with a component of the PC, such as with its central processing unit (CPU) or memory chips, the data acquisition will not function as required.

The data acquisition PC consists of the following hardware and system software:

- Intel 486 DX 50 CPU/microprocessor,
- 32-Mbyte RAM and two 500-Mbyte hard disk drives,
- 150/250-Mbyte tape backup unit,
- 17-in. super video graphics array (SVGA) monitor, and
- Multichannel serial communications board (Digiboard).

3.1.1 Inspection and Testing at ANL

When the PC is turned on, it will automatically boot and perform a basic test on the memory and other system components. Any other problems will become apparent during subsystem testing. The results of the test will be recorded on data sheet QA5-1-1 (Appendix B).

3.1.2 Installation and Checkout at the FOS Site

The PC will be booted when installed in the trailer. Any other problems will become apparent during subsystem testing. (See Test Sheet QP5-1-1.)

3.1.3 Operational System Testing

If the PC fails to function, the System Monitor program will be unable to send output to the EnviroCom device. This failure will trigger an alarm state, and the automatic phone dialing unit of the EnviroCom device will call out to notify designated personnel of the problem. Minor problems with the PC may be detected by examining a daily log, which is printed by the sensor monitor, and by visually inspecting the PC screen during operation.

3.2 MIRRORED HARD DISKS

After data values are read from the final storage areas of the data loggers, they are immediately saved to files on the PC's hard disk. Because it is critical that these files are not lost, a dual hard disk scheme was implemented by using a mirror drive controller card and two hard disks. The Silicon Valley integrated device electronics (IDE) mirror card is being used with two Seagate 500-MB hard drives. Sensor readings recorded by the data loggers are written to both of these drives by the controller card when the Data Acquirer program (described in Section 3.10) writes a file to the appropriate directory.

In addition to safeguarding against data loss, this mirror drive setup provides a second important benefit. By using the mirror drives as the boot drive of the computer, the PC can continue to operate even if one of the two mirror drives fails. With an ordinary single-drive configuration, the PC would be incapacitated if the boot drive were to fail. Through the use of a mirrored boot drive, an added level of safety is achieved.

3.2.1 Inspection and Testing at ANL

The IDE mirror card will be inspected and installed in the ZEOS 486 PC at ANL. A test will be conducted in which data will be written to the mirrored hard drive. After disconnecting one of the drives to simulate a disk failure, the PC will be inspected to determine if data have been saved on the remaining disk and if the PC is continuing to operate. The results of the test will be recorded on data sheet QA6-1-1 (Appendix B).

3.2.2 Installation and Checkout at the FOS Site

Data written to the hard drive will be checked to verify that they have been recorded correctly and can be accessed properly.

3.2.3 Operational System Testing

After the system has been fully integrated, the files on the mirrored drives will be inspected to determine if they have been written correctly as part of the tests of the Data Acquirer software.

3.3 COMMUNICATION BOARD

A Digiboard multichannel communication board is providing communication between the data acquisition PC and the data loggers in the monitoring and logging instrumentation subsystem. The board allows data to be transferred to and from the data loggers by means of serial lines. The ProComm 4.0 libraries will be used by the software programs, which will be written by ANL, to facilitate access to the Digiboard.

3.3.1 Inspection and Testing at ANL

The design of the serial communication between the PC and data loggers is an area of technical risk in the data acquisition subsystem design. To minimize this risk, a number of tests will be conducted to quickly determine the feasibility of the design. These tests have three purposes: (1) to verify that the boards and software operate as specified, (2) to verify that no conflicts occur between the communication board and other hardware components in the PC, and (3) to verify that the data logger can operate with this configuration. The results of the tests will be recorded on data sheets QA7-1-1 through QA7-3-1 (Appendix B).

The step-by-step testing procedure for the Digiboard multichannel communication board (QA7-1-1) is as follows:

- Install the Digiboard card in the ZEOS PC;
- Connect the serial cable containing eight connectors to the back of the card in the PC;
- Connect one of the connectors to a laptop computer;
- Run a terminal emulation package on the ZEOS as well as on the laptop;
- Set the appropriate port identifier in each terminal program;
- Verify that data are correctly transmitted to the laptop from the ZEOS, both interactively and through file transfers;
- Verify that data are received by the ZEOS from the laptop; and
- Repeat the test for all serial ports.

The step-by-step testing procedure for the Greenleaf software (QA7-2-1) is as follows:

- Connect the ZEOS and laptop as in the previous test,
- Run the terminal package on the laptop computer,
- Run the demonstration software accompanying the Greenleaf package to ensure that the Greenleaf library correctly uses the Digiboard card,
- Verify that data are correctly transmitted in both directions,
- Run the software written by using the Borland C++ compiler and C++ routines, and
- Verify correct communication with the terminal package on the laptop.

The step-by-step testing procedure for the Digiboard with the data loggers (QA7-3-1) is:

- Connect the ZEOS as in previous tests,
- Connect the serial cable to the data logger,
- Run the terminal software to verify that the data logger can correctly receive data by using the Digiboard, and
- Run the program by using C++ routines to verify that they can correctly access the data logger.

3.3.2 Installation and Checkout at the FOS Site

The operation of the Digiboard will be verified during subsystem testing. If the data acquisition programs cannot access the data loggers, the board will be checked independently.

3.3.3 Operational System Testing

The daily log provided by the Sensor Monitor program will indicate any problems with the communication link between the PC and the data loggers.

3.4 TAPE DRIVE

A 150-MB tape drive will be used by the ZEOS PC to back up the PC system. To minimize the risk of data loss, the data directories will be automatically backed up daily.

3.4.1 Inspection and Testing at ANL

The tape drive will be tested by using commercial backup software (i.e., Conner Backup Exec). Examination of the backup tapes will verify if the backup was successful. The results of the test will be recorded on data sheet QA8-1-1 (Appendix B).

3.4.2 Installation and Checkout at the FOS Site

Any problems with the tape drive will become apparent when the first automatic backup is performed.

3.4.3 Operational System Testing

If a problem develops with the tape drive during operation, the daily Backup Facility software will post error messages on the PC screen.

3.5 UNINTERRUPTIBLE POWER SUPPLY

If a power outage occurs at the FOS site trailer, an uninterruptible power supply (UPS) will provide power to the data acquisition and data analysis subsystems for a limited time.

3.5.1 Inspection and Testing at ANL

The UPS will be visually inspected at ANL. It will be started, and the batteries will be charged. An operational test will be performed. The results of the test will be recorded on data sheet QA9-1-1 (Appendix B).

The step-by-step test procedure for the UPS is as follows:

- Connect the Sun and PC to the UPS, and
- Disconnect the UPS from its external power source to ensure that the computer will be unaffected and continue to run.

3.5.2 Installation and Checkout at the FOS Site

The UPS will be inspected and recharged at the FOS site. The same test as described in Section 3.5.1 will be performed. (See Test Sheet QP9-1-1.)

3.5.3 Operational System Testing

The operation of the UPS will be remotely monitored by using the telephone to access the EnviroCom device. If any problems occur with the power at the site, a notification, via telephone, will be invoked.

3.6 TELEPHONE NOTIFICATION SYSTEM

The EnviroCom I environmental monitor by Best Power Technology Sales Corporation will be tested to verify that each of the three alarm terminals detects voltage on the appropriate lines. Consequently, the EnviroCom I unit should sound an audible alarm and call the appropriate phone number(s).

3.6.1 Inspection and Testing at ANL

The EnviroCom I will be tested at ANL and the results recorded on data sheet QA-10-1-1:

- Apply 120 V power to the EnviroCom I unit;
- Press 'what is', press 'temp' to check the correct audible temperature reading;
- Apply power to the digi-designer board;
- Connect Alert 1 ground (GND) and power terminals to the temporary push button on the digi-designer board;
- Press the push button on the digi-designer board (an audible alarm should sound); and
- Repeat the above steps for Alert 2 and 3 terminals.

3.6.2 Installation and Checkout at the FOS Site

The EnviroCom I will be tested at the FOS site and the results recorded on data sheets QP-10-1-1:

- Program in a phone number to test,
- Set off an alarm manually by turning off the UPS, and
- Wait for EnviroCom to call the phone number.

3.6.3 Operational System Testing

Correct operation of the EnviroCom I will be observed during operation.

3.7 COMPUTER NETWORK CARD

To communicate between the PC and Sun computers, a network communication card (Intel Ether Express 16) and software (PC-NFS) will be used. Through this setup, the PC will be able to (1) transfer sensor data files to the Sun as they are acquired and (2) use the printer attached to the Sun.

3.7.1 Inspection and Testing at ANL

The PC-NFS software will be installed on the PC and tested by using standard network commands, such as "print." Data acquisition software will also be tested to make sure the network file transfer and print operations can be executed by the unattended programs. The results of the test will be recorded on data sheet QA11-1-1 (Appendix B).

3.7.2 Installation and Checkout at the FOS Site

After the computers are installed at the FOS site, they will be connected, and network functions will be tested as described in Section 3.7.1. (See Test Sheet QP11-1-1.)

3.7.3 Operational System Testing

If the network card ceases to function, files will not be copied to the Sun, and the daily log will not be printed by the Sensor Monitor program. Any such problem should have minimal impact on the operation of the system, and data collection should be unaffected.

3.8 DATA LOGGER PROGRAMMER SOFTWARE

A program will be developed to assist the site manager in programming the CR10 data loggers. The standard method for programming these data loggers is through a low-level language interface. However, for the number of sensors involved in this effort, this approach would be error prone and difficult to maintain. The Data Logger Programmer program will generate and send programs to the data logger subunits based on user-entered parameters.

3.8.1 Inspection and Testing at ANL

Programs generated by the software will be visually inspected to ensure that the programs produced are correct. The results of the test will be recorded on data sheet QA12-1-1 (Appendix B). These programs will be sent to the data loggers and further tested through subsystem testing.

3.8.2 Installation and Checkout at the FOS Site

The Data Logger Programmer will be initially used to program the data logger subunits. Final storage areas of memory on the data loggers will be examined to ensure that the programs were executed correctly. (See Test Sheet QP12-1-1.) By examining initial data files created by the Data Acquirer program, the correct operation of the Data Logger Programmer will be additionally verified.

3.8.3 Operational System Testing

Abnormalities in the sensor readings will be investigated to determine which component of the data acquisition system is involved. Programs generated by the Data Logger Programmer will be saved in a directory on the PC for future reference. A log of the execution of the Data Logger Programmer should be printed to record the exact execution steps involved in programming the data loggers on a certain date.

3.9 DATA ACQUIRER SOFTWARE

Because the data acquisition subsystem will be running in an unattended mode, a program is needed to automatically poll the data loggers (for sensor data) at specified time intervals. Through the use of an index file created by the Data Logger Programmer software, the Data Acquirer program will access the data loggers by using the specified communication ports according to the specified schedule. When a reading is made, the data will be written to the appropriate data files, the files will be copied to the data analysis subsystem, and a message will be sent to the Sensor Monitor program.

3.9.1 Inspection and Testing at ANL

As the Data Acquirer reads values in different ways for the three data logging subunits, a test will be performed with one sensor in each category. In system-level testing, additional sensors will be used for more exhaustive testing. The results of the tests will be recorded on data sheets QA13-1-1 through QA13-3-1 (Appendix B).

The step-by-step testing procedure for the Data Acquirer test with the pressure sensor (QA13-1-1) is as follows:

- Connect the PC and Sun computers using network facilities;
- Connect the PC with the pressure subunit with one pressure transducer attached;
- Place the pressure transducer in a water column, at a depth of 1 ft;
- Run the Data Programmer to cause the data logger to read the sensor;
- Run the Data Acquirer with a new time period for several days;
- Observe if data files are written at correct time periods;
- Compare data in files with data in data logger memory;
- Compare data with values expected with barometric pressure at those times;
- Observe that times of readings are recording correctly in the index file;
- Simulate a missed reading by disconnecting the serial cable and verify that values are successfully recovered by the program;

- Verify that error messages are sent to the Sensor Monitor program when needed; and
- Verify that data files are correctly transferred to the Sun.

The step-by-step testing procedure for the Data Acquirer test with the temperature sensor (QA13-2-1) is as follows:

- Connect the PC and Sun computers using network facilities;
- Connect the PC with the temperature subunit with one thermister attached;
- Leave the thermister at ambient temperature; and
- Repeat the same procedure used for the pressure sensor.

The step-by-step testing procedure for the Data Acquirer test with the tensiometer (QA13-3-1) is as follows:

- Connect the PC and Sun computers using network facilities;
- Connect the PC with the tensiometer subunit with one tensiometer attached;
- Attach an air pump to the tensiometer and apply a known vacuum suction; and
- Repeat the same procedure used for the pressure sensor.

3.9.2 Installation and Checkout at the FOS Site

After the system is installed, the initial values read by the program will be examined for reasonableness. The data analysis subsystem will be examined to ensure that files are copied correctly.

3.9.3 Operational System Testing

The Sensor Monitor program will print a daily log of data read by the Data Acquirer program. If the log shows that readings are missed, the operation of the program will be examined. In addition, the data files created by the program can also be examined for reasonableness as data are analyzed.

3.10 SENSOR MONITOR SOFTWARE

Through the Sensor Monitor program, the site manager will receive a daily report on the activity of the Data Acquirer program.

3.10.1 Inspection and Testing at ANL

The Sensor Monitor program will be run at the same time as tests on the Data Acquirer program to ensure that the activity of that program is correctly recorded as it occurs. The results of the test will be recorded on data sheet QA14-1-1 (Appendix B).

3.10.2 Installation and Checkout at the FOS Site

When the system is installed, the Sensor Monitor program will be run, and the system will be thoroughly examined as other tests are performed. (See Test Sheet QP14-1-1.)

3.10.3 Operational System Testing

If the Sensor Monitor program ceases to work, the daily log will not be printed.

3.11 DATA UPLOAD SOFTWARE

The Data Upload program will assist the site manager in copying files to the Sun if the PC is temporarily disconnected from the network.

3.11.1 Inspection and Testing at ANL

Files will be copied by using the Data Upload program. The Sun directories will be examined to ensure that they are copied to the correct locations. The results of the test will be recorded on data sheet QA15-1-1 (Appendix B).

3.11.2 Installation and Checkout at the FOS Site

The previous test will be repeated to make sure no problems occur with the network facilities. (See Test Sheet QP15-1-1.)

3.11.3 Operational System Testing

Because this program is manually run and easy to verify, the user should detect any problems immediately.

3.12 TAPE BACKUP SOFTWARE

To provide daily backups of the system, Conner Backup Exec software will be used to automatically backup the PC system.

3.12.1 Inspection and Testing at ANL

The software will be installed on the ZEOS PC and configured to use the tape drive on the machine. After making a backup of the PC, the resulting tape will be examined to ensure that the data were saved correctly. The results of the test will be recorded on data sheet QA16-1-1 (Appendix B).

3.12.2 Installation and Checkout at the FOS Site

After the data acquisition is installed, the program will be configured to perform daily backups. After running for a period of days, the program will be examined to ensure that it performed backups according to the desired schedule. (See Test Sheet QP16-1-1.)

3.12.3 Operational System Testing

When the weekly backup tape is changed, the user should verify that the program has been correctly creating backups of the system.

4 DATA ANALYSIS SUBSYSTEM

The purpose of the data analysis subsystem is to enable the user to analyze the sensor information by using various commercial off-the-shelf analysis packages. Information is retrieved from the sensors by using the data acquisition subsystem. The sensor information is transferred to the data analysis subsystem by using PC-NFS. Testing of PC-NFS is covered in Section 5.

One hardware component and five software components are involved in the data analysis system:

- Sun SPARCstation 2 computer,
- SitePlanner,
- SAS,
- XESS,
- Sensor Data Query software, and
- Chemical Analysis Interface software.

The purpose of testing the components listed above will be to verify that the hardware and operating system are operating within the stated requirements. The tests will be executed during three phases: (1) inspection and testing at ANL, (2) installation and checkout at the FOS site, and (3) operational system testing.

4.1 SUN SPARCSTATION 2

The Sun SPARCstation 2 consists of the following hardware and system software:

- CPU unit containing an internal hard drive, and a 1.44-Mbyte floppy drive,
- External hard drive and 2.3-Gbyte tape drive,
- CD-ROM drive,
- Communications modem,

- Sun monitor, and
- UNIX operating system.

4.1.1 Inspection and Testing at ANL

When the Sun SPARCstation 2 is turned on, the system will perform internal tests that verify that the monitor, the hard drive subsystem, the printer, and the memory are working properly. If the line "hawk login:" appears, the Sun SPARCstation 2 is operating correctly. Otherwise, the tests performed by the SPARCstation have identified a possible problem. (Note: the Sun owner's manual provides guidance for solving system-related problems.) The results of the test will be recorded on data sheet AA17-1-1 (Appendix B).

4.1.2 Installation and Checkout at the FOS Site

After the Sun is installed at the FOS site, the test described in Section 4.1.1 will be repeated. (See Test Sheet AP17-1-1.)

4.1.3 Operational System Testing

Any problems with the Sun should be readily apparent to the users during operation of the system.

4.2 SITEPLANNER

The SitePlanner program is an environmental analysis package developed by ConSolve, Inc. It allows one to integrate, manage, manipulate, and analyze site data. SitePlanner will be retrieving information from the Sensor Data Query program by using XESS.

4.2.1 Inspection and Testing at ANL

Because the interaction between the Sensor Data Query program and SitePlanner will be tested through the Sensor Data Query program tests, these tests will concentrate solely on SitePlanner operations. The results of the test will be recorded on data sheet AA18-1-1 (Appendix B). The test will be performed by using the SNLL.odl SitePlanner file.

The step-by-step testing procedure for SitePlanner is as follows:

- Verify that snl-object-dictionary.csv (the object dictionary) is loaded when loading the SNLL.odl file;
- Verify that all the wells are located in the correct positions on the map;
- Verify that the borehole diagrams, surface profiles, plan views, and fence diagrams are correctly constructed; and
- Verify that the correct data are associated with each object.

4.2.2 Installation and Checkout at the FOS Site

After the system is installed at the FOS site, the tests performed on the Sensor Data Query program will provide testing of SitePlanner (Sections 4.4 and 4.5).

4.2.3 Operational System Testing

If SitePlanner fails to operate correctly, the user will encounter problems in performing analysis.

4.3 STATISTICAL ANALYSIS SYSTEM

The Statistical Analysis System (SAS) program is a statistical package developed by the SAS Institute. This package allows the user to easily analyze statistical data and prepare graphs of sensor information. SAS will be receiving information from the Sensor Data Query program.

4.3.1 Inspection and Testing at ANL

Because the transfer of information between the Sensor Data Query program and SAS will be covered in other tests, this test will concentrate solely on SAS operations. A sample data file containing sensor information will be generated before executing this test. The results will be

recorded on data sheet AA19-1-1 (Appendix B). Either the SAS user interface or the SAS procedural language will be used to perform the following test:

- Verify that the correct graphs are produced using the graph option, and
- Verify that the correct descriptive statistics (e.g., mean, standard deviation) are produced through the use of the PROC MEANS procedure.

4.3.2 Installation and Checkout at the FOS Site

After the Sun is installed at the FOS site, SAS will be tested as part of the testing procedure for the Sensor Data Query program (Sections 4.4 and 4.5).

4.3.3 Operational System Testing

If the graphs or statistics produced by SAS appear suspect, the raw data can be examined to determine if SAS is incorrectly reading in the data. Other problems with the SAS interface should be apparent to the user.

4.4 SENSOR DATA QUERY SOFTWARE

The Sensor Data Query software is a program that allows the user to retrieve a subset of sensor information for analysis. The program will allow the user to specify particular sensors and time periods for examination through SAS and SitePlanner.

4.4.1 Inspection and Testing at ANL

The Sensor Data Query program will be tested to see if the graphs it produces correspond to the actual data in the data files it uses. Graphs will be examined both on the screen and in hard copy form. The results of the test will be recorded on data sheet AA20-1-1 (Appendix B). The interface between SitePlanner and the program will be examined by bringing up sensor data in SitePlanner and again comparing them to the actual data values. (See Test Sheet AA20-2-1.)

4.4.2 Installation and Checkout at the FOS Site

The tests described in Section 4.4.1 will be repeated at the FOS site. (See Test Sheets AP20-1-1 and AP20-2-1.)

4.4.3 Operational System Testing

If the Sensor Data Query software creates incorrect data files, the problem should become clear to the user when using SAS and SitePlanner on these data files. Problems with the interface of the program will become apparent when using the program to create the subsets of data.

4.5 CHEMICAL ANALYSIS INTERFACE SOFTWARE

To create data files that contain the results of chemical analysis, the Chemical Analysis Interface program will be developed. The program will allow users to enter and verify manually input chemical data. The Chemical Analysis Interface will also allow the user to retrieve a subset of chemical analysis information for further analysis. The program will allow the user to specify chemical types and time periods for examination through XESS and SitePlanner.

4.5.1 Inspection and Testing at ANL

After entering sample chemical data through the interface of the program, the data files produced will be visually examined to ensure that the values were correctly recorded. The data files will be loaded into XESS to ensure that XESS does not have any problems interpreting these data. The results of the test will be recorded on data sheet AA21-1-1 (Appendix B).

4.5.2 Installation and Checkout at the FOS Site

The tests described in Section 4.4.1 will be repeated at the FOS site. (See Test Sheet AP21-1-1.)

4.5.3 Operational System Testing

If the Chemical Analysis Interface software creates incorrect data files, the problem should become clear to the user when using another program that uses these data files. Problems with the interface of the program will become apparent when using the program to create subsets of data.

4.6 BACKUP FACILITY

To backup the data analysis system each day, a backup facility will be developed. The facility will write daily backup files to tapes that will be changed weekly.

4.6.1 Inspection and Testing at ANL

To test the Backup Facility, it will be run for a period of time to see if the correct backups are performed. The results of the test will be recorded on data sheet AA22-1-1 (Appendix B).

4.6.2 Installation and Checkout at the FOS Site

After the data analysis system is installed, the Backup Facility will be run during a testing period. If a backup is unable to be made, the system will automatically send electronic mail to registered users. (See Test Sheet AP22-1-1.)

4.6.3 Operational System Testing

When the tape is changed for the week, the user can inspect the tape to ensure that the backup was performed. If at any time the facility is unable to backup data, it will automatically send electronic mail to users on the Sun.

4.7 DATA DISTRIBUTION SOFTWARE

The Data Distribution software will copy the data directories on the Sun computer to diskettes for distribution to the three analysis sites.

4.7.1 Inspection and Testing at ANL

The Data Distribution software will copy test sets of data generated during subsystem testing from the data directory to backup diskettes. These disks will be visually inspected for completeness. The results of the test will be recorded on data sheet AA23-1-1 (Appendix B).

4.7.2 Installation and Checkout at the FOS Site

The previous test will be repeated after the data acquisition subsystem is installed. The disks generated at the FOS site will be inspected at ANL to ensure compatibility with the analysis machines at that location. (See Test Sheet AP23-1-1.)

4.7.3 Operational System Testing

Because this program is manually run and easy to verify, any problems should be immediately detected by the user by examining a directory of each distribution disk after the files have been created.

5 SUBSYSTEM INTEGRATION

After completing subsystem testing, integrated testing will be performed. Integrated testing provides more detailed testing of the interaction of the different components. The data acquisition subsystem must be tested with the sensor subunits to ensure that the hardware and software components are correctly designed and implemented. Similarly, the data acquisition and data analysis subsystems must be tested together to ensure that file formats and the network design meet the requirements. Finally, the full operational system must be tested to ensure that the different subsystems interface well together.

5.1 DATA ACQUISITION SUBSYSTEM WITH PRESSURE SUBSYSTEM

To record pressure data, the data acquisition subsystem interacts with the pressure subsystem hardware. This interface must be tested to verify that the actual data values recorded correspond to those pressures applied to the pressure sensors.

5.1.1 Inspection and Testing at ANL

After development of the monitoring and logging subsystem and the data acquisition subsystem, the two must be tested together. The results of the test will be recorded on data sheet IA24-1-1 (Appendix B).

The following step-by-step procedure will verify that the systems operate correctly together:

- Attach one pressure sensor to the pressure subunit;
- Use the cables and modems to attach the pressure subunit to a PC;
- Turn on the power to the systems;
- Enter the Data Logger Programmer program on the PC;
- Set the appropriate calibration variables for the pressure sensor being used;
- Request sampling at 1-minute intervals, with readings every 10 minutes;

- Send the program created to the data logger; and
- Start the Data Acquirer to record data values to sensor data files.

Manual inspection of the data values will reveal if the pressure values reflect those recorded for the barometric pressure through other means.

5.1.2 Installation and Checkout at the FOS Site

Individual tests will be performed on the components after installation at the FOS site, as described in previous sections. Further tests will be performed to ensure that the pressure values recorded are not affected by possible noise in the system. Each multiplexer channel will be tested in sequence to ensure that all of the connections are correct. (See Test Sheet IP24-1-1.)

5.1.3 Operational System Testing

Any problems that occur in the interaction between the monitoring subsystem and the data acquisition subsystem should become apparent by examining the data through the data analysis system.

5.2 DATA ACQUISITION SUBSYSTEM WITH TEMPERATURE SUBSYSTEM

To record temperature data, the data acquisition subsystem interacts with the temperature subsystem hardware. This interface must be tested to verify that the actual data values recorded correspond to those temperatures applied to the temperature sensors.

5.2.1 Inspection and Testing at ANL

After development of the monitoring and logging subsystem and the data acquisition subsystem, the two must be tested together. The results of the test will be recorded on data sheet IA25-1-1 (Appendix B).

The following step-by-step procedure will verify that the systems operate correctly together:

- Attach one temperature sensor to the temperature subunit;
- Use the cables and modems to attach the pressure subunit to a PC;

- Turn on the power to the systems;
- Enter the Data Logger Programmer program on the PC;
- Set the appropriate calibration variables for the temperature sensor being used;
- Request sampling at 1-minute intervals, with readings every 10 minutes;
- Send the program created to the data logger; and
- Start the Data Acquirer to record data values to sensor data files.

Manual inspection of the data values will reveal if the temperature values reflect those expected.

5.2.2 Installation and Checkout at the FOS Site

As described in previous sections, individual tests will be performed on the components after installation at the FOS site. Further tests will be performed to ensure that the temperature values recorded are not affected by possible noise in the system. Each multiplexer channel will be tested in sequence to ensure that all of the connections are correct. (See Test Sheet IP25-1-1.)

5.2.3 Operational System Testing

Any problems that occur in the interaction between the monitoring subsystem and the data acquisition subsystem should become apparent by examining the data through the data analysis system.

5.3 DATA ACQUISITION SUBSYSTEM WITH TENSIO-METER SUBSYSTEM

To record soil moisture data, the data acquisition subsystem interacts with the tensiometer subsystem hardware. This interface must be tested to verify that the actual data values recorded correspond to those suction values applied to the tensiometers.

5.3.1 Inspection and Testing at ANL

After development of the monitoring and logging subsystem and the data acquisition subsystem, the two must be tested together. The results of the test will be recorded on data sheet IA26-1-1 (Appendix B).

The following step-by-step procedure will verify that the systems operate correctly together:

- Attach one tensiometer to the tensiometer subunit;
- Use the cables and modems to attach the tensiometer subunit to a PC;
- Attach the tensiometer to a vacuum pump;
- Turn on the power to the systems;
- Enter the Data Logger Programmer program on the PC;
- Set the appropriate calibration variables for the tensiometer being used;
- Request sampling at 1-minute intervals, with readings every 10 minutes;
- Send the program created to the data logger; and
- Start the Data Acquirer to record data values to sensor data files.

Manual inspection of the data values will reveal if the vacuum pressure values reflect those registered on the vacuum pump.

5.3.2 Installation and Checkout at the FOS Site

Individual tests will be performed on the components after installation at the FOS site, as described in previous sections. Additional tests will be performed to ensure that the pressure values recorded are not affected by possible noise in the system. Each multiplexer channel will be tested in sequence to ensure that all of the connections are correct. (See Test Sheets IP26-1-1.)

5.3.3 Operational System Testing

Any problems that occur in the interaction between the monitoring subsystem and the data acquisition subsystem should become apparent by examining the data through the data analysis system.

5.4 DATA ACQUISITION SUBSYSTEM WITH DATA ANALYSIS SUBSYSTEM

After recording data files, the data acquisition system must correctly transfer data files to the data analysis system for processing. It is essential that both subsystems continue to operate correctly when networked together.

5.4.1 Inspection and Testing at ANL

After the data acquisition and data analysis subsystems are implemented and tested independently, they must be tested together to ensure that file formats are compatible and that the operation of the network does not interfere with the operation of either subsystem. The results of the test will be recorded on data sheet IA27-1-1 (Appendix B).

The following step-by-step procedure will verify that the systems operate correctly together:

- Attach the PC and Sun together as a network,
- Initiate the Data Acquirer program on the PC,
- Verify that data files are transferred to the Sun,
- Verify that data are displayed correctly in the data analysis software,
- Disconnect the Sun from the PC, and
- Verify that the data acquisition system continues to operate correctly.

5.4.2 Installation and Checkout at the FOS Site

After the systems are installed at the FOS site, the test described in Section 5.4.1 will be repeated. (See Test Sheet IP27-1-1.)

5.4.3 Operational System Testing

If the data files are not correctly transferred to the data analysis system, it will become apparent to the user. If the operation of the data acquisition system were interrupted in some way by the network, either the sensor monitor software would record missed data readings or the telephone notification system would record that the data acquisition PC was no longer functioning.

5.5 FULL OPERATION SYSTEM

After all three subsystems are completed, they will be tested to verify that they operate correctly together. It is possible that there would be problems in coordinating the different programs and hardware components, so integrated tests will verify that the systems can operate together.

5.5.1 Inspection and Testing at ANL

After testing the systems independently as in Sections 2, 3, and 4 and testing combinations as in Sections 5.1 through 5.4, all three subsystems must be tested together. To simulate the complexity of the final system configuration, a test was developed with all three monitoring subsystems running simultaneously with multiple sensors of each type. The results of the test will be recorded on data sheet IA28-1-1 (Appendix B).

The following step-by-step procedure will verify that the three systems operate correctly together:

- Attach the PC and Sun together as a network;
- Attach 15 pressure sensors to random channels on the pressure subunit;
- Immerse 14 pressure sensors in a water bath, with the remaining sensor registering the barometric pressure;
- Attach 15 temperature sensors to random channels on the temperature subunit;
- Immerse the temperature sensors in a water bath;
- Attach two tensiometers to random channels on the tensiometer subunit;
- Initiate the Data Acquirer program on the PC;

- Verify that data files have been transferred to the Sun; and
- Verify that data are displayed correctly in the data analysis software.

5.5.2 Installation and Checkout at the FOS Site

After the systems are installed at the FOS site, the actual sensors will be connected to the subunits, and the system will be configured for operation. Tests will be performed as in Section 5.5.1 to verify the operation of the full system. (See Test Sheet IP28-1-1.)

5.5.3 Operational System Testing

Problems with the full operational system will be apparent if the data files show erroneous data or are not correctly copied to the data analysis system. Components can then be tested to determine the cause of the problem.

APPENDIX A:
MANUFACTURER DATA SHEETS

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500AL-5Pressure Range: 5 psiSerial Number: 22811Mfg. Number: 2-1784Customer: Argonne Nat. LabsTemp: 19 °CJob No.: 5664Baro: 1028 mbar.Test Gage: 181By: GPA 11Date: 4/27/93

Applied Pressure	First Cycle	Second Cycle	Average	Change
0	15589	15589	15589	
1	14941	14945	14943	646
2	14291	14291	14291	652
3	13650	13652	13651	640
4	13000	13000	13000	651
5	12354	12350	12352	648

Calibration Factor (C): 0.00154 (PSI/Digit)Thermal Factor (K): -0.00556 (PSI/°C. Rise)Calculated Pressure = $C(R0-R1) + K(T1-T0)$

GK-401 Reading at Shipment:

Date: 6/28/93Position "B":* Temperature: 22 °C

or

Position "F":* 15607Baro: 1013 mbar**

* Users are advised to establish their own zero conditions.

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code:

Red and Black: Gage

White and Green: Thermistor

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500AL-5Pressure Range: 5 psiSerial Number: 22812Mfg. Number: 2-1786Customer: Argonne Nat. LabsTemp: 19 °CJob No.: 5664Baro: 1028 mbar.Test Gage: 181By: GPA 15Date: 4/27/93

Applied Pressure	First Cycle	Second Cycle	Average	Change
0	16264	16263	16264	
1	15586	15590	15588	676
2	14905	14903	14904	684
3	14236	14236	14236	668
4	13556	13555	13556	681
5	12877	12877	12877	679

Calibration Factor (C): 0.00148 (PSI/Digit)Thermal Factor (K): -0.00340 (PSI/°C. Rise)Calculated Pressure = $C(R0-R1) + K(T1-T0)$

GK-401 Reading at Shipment:

Date: 6/28/93Position "B":* Temperature: 22 °C

or

Position "F":* 16402Baro: 1013 mbar**

* Users are advised to establish their own zero conditions.

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code:

Red and Black: Gage

White and Green: Thermistor

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23099Mfg. Number: 3-1274Customer: U. of ChicagoTemp: 22 °CJob No.: 5682Baro: 1035.5 mbar.Test Gage: 183By: GPA 4Date: 5/3/93

Applied Pressure	First Cycle	Second Cycle	Average	Change
0	8703	8707	8705	
20	7731	7733	7732	973
40	6756	6760	6758	974
60	5785	5785	5785	973
80	4809	4811	4810	975
100	3839	3841	3840	970

Calibration Factor (C): 0.02055 (PSI/Digit)Thermal Factor (K): -0.02055 (PSI/°C. Rise)Calculated Pressure = $C(R0-R1) + K(T1-T0)$

GK-401 Reading at Shipment:

Position "B":* 8718Date: 8/3/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1018 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code:

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23100Mfg. Number: 3-1275Customer: U. of ChicagoTemp: 22 °CJob No.: 5682Baro: 1035.5 mbar.Test Gage: 183By: GPA 4Date: 5/3/93

Applied Pressure	First Cycle	Second Cycle	Average	Change
0	8926	8930	8928	
20	8028	8030	8029	899
40	7128	7130	7129	900
60	6232	6231	6232	898
80	5330	5332	5331	901
100	4429	4431	4430	901

Calibration Factor (C): 0.02224 (PSI/Digit)Thermal Factor (K): -0.03335 (PSI/°C. Rise)Calculated Pressure = $C(R0-R1) + K(T1-T0)$

GK-401 Reading at Shipment:

Position "B":* 8937Date: 8/3/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1018 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code:

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23101Mfg. Number: 3-1281Customer: U. of ChicagoTemp: 22 °CJob No.: 5682Baro: 1035.5 mbar.Test Gage: 183By: GPA 9Date: 5/3/93

Applied Pressure	First Cycle	Second Cycle	Average	Change
0	8748	8751	8750	
20	8014	8015	8015	735
40	7277	7279	7278	737
60	6543	6542	6543	736
80	5803	5805	5804	739
100	5064	5066	5065	739

Calibration Factor (C): 0.02714 (PSI/Digit)Thermal Factor (K): -0.02443 (PSI/°C. Rise)Calculated Pressure = $C(R0-R1) + K(T1-T0)$

GK-401 Reading at Shipment:

Position "B":* 8761Date: 8/3/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1018 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code:

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23102Mfg. Number: 3-1290Customer: U. of ChicagoTemp: 22 °CJob No.: 5682Baro: 1035.5 mbar.Test Gage: 183By: GPA 10Date: 5/3/93

Applied Pressure	First Cycle	Second Cycle	Average	Change
0	9087	9091	9089	
20	8227	8230	8229	861
40	7362	7363	7363	866
60	6496	6498	6497	866
80	5628	5629	5629	869
100	4764	4767	4766	863

Calibration Factor (C): 0.02312 (PSI/Digit)Thermal Factor (K): -0.02543 (PSI/°C. Rise)Calculated Pressure = $C(R0-R1) + K(T1-T0)$

GK-401 Reading at Shipment:

Position "B":* 9105Date: 8/3/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1018 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code:

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23103Mfg. Number: 3-1294Customer: U. of ChicagoTemp: 22 °CJob No.: 5682Baro: 1035.5 mbar.Test Gage: 183By: GPA 8Date: 5/3/93

Applied Pressure	First Cycle	Second Cycle	Average	Change
0	8631	8636	8634	
20	7679	7682	7681	953
40	6720	6721	6721	960
60	5762	5765	5764	957
80	4802	4804	4803	961
100	3851	3854	3853	951

Calibration Factor (C): 0.02090 (PSI/Digit)Thermal Factor (K): -0.01672 (PSI/°C. Rise)Calculated Pressure = $C(R0-R1)+K(T1-T0)$

GK-401 Reading at Shipment:

Position "B":* 8652Date: 8/3/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1018 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code:

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23104Mfg. Number: 3-1299Customer: U. of ChicagoTemp: 22 °CJob No.: 5682Baro: 1035.5 mbar.Test Gage: 183By: GPA 8Date: 5/3/93

Applied Pressure	First Cycle	Second Cycle	Average	Change
0	9021	9026	9024	
20	8106	8106	8106	918
40	7189	7189	7189	917
60	6271	6273	6272	917
80	5358	5355	5357	916
100	4445	4445	4445	912

Calibration Factor (C): 0.02184 (PSI/Digit)Thermal Factor (K): -0.03057 (PSI/°C. Rise)Calculated Pressure = $C(R0-R1)+K(T1-T0)$

GK-401 Reading at Shipment:

Position "B":* 9037Date: 8/3/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1018 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code:

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23105Mfg. Number: 3-1327Customer: U. of ChicagoTemp: 21 °CJob No.: 5682Baro: 1031 mbar.Test Gage: 183By: GPA_2Date: 5/4/93

Applied Pressure	First Cycle	Second Cycle	Average	Change
0	9447	9451	9449	
20	8571	8571	8571	878
40	7693	7695	7694	877
60	6815	6815	6815	879
80	5936	5937	5937	879
100	5060	5059	5060	877

Calibration Factor (C): 0.02278 (PSI/Digit)Thermal Factor (K): -0.02961 (PSI/°C. Rise)Calculated Pressure = $C(R0-R1) + K(T1-T0)$

GK-401 Reading at Shipment:

Position "B":* 9459Date: 8/3/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1018 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code:

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23106Mfg. Number: 3-1328Customer: U. of ChicagoTemp: 21 °CJob No.: 5682Baro: 1031 mbar.Test Gage: 183By: GPA 9Date: 5/4/93

Applied Pressure	First Cycle	Second Cycle	Average	Change
0	9357	9360	9359	
20	8616	8616	8616	743
40	7874	7875	7875	742
60	7130	7131	7131	744
80	6385	6385	6385	746
100	5640	5639	5640	746

Calibration Factor (C): 0.02689 (PSI/Digit)Thermal Factor (K): -0.02958 (PSI/°C. Rise)Calculated Pressure = $C(R0-R1) + K(T1-T0)$

GK-401 Reading at Shipment:

Position "B":* 9364Date: 8/3/93

or

Position "F":* Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1018 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code:

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23107Mfg. Number: 3-1339Customer: U. of ChicagoTemp: 21 °CJob No.: 5682Baro: 1031 mbar.Test Gage: 183By: GPA 3Date: 5/4/93

Applied Pressure	First Cycle	Second Cycle	Average	Change
0	9302	9309	9306	
20	8447	8449	8448	858
40	7590	7593	7592	857
60	6734	6734	6734	858
80	5874	5876	5875	859
100	5017	5017	5017	858

Calibration Factor (C): 0.02332 (PSI/Digit)Thermal Factor (K): -0.03964 (PSI/°C. Rise)Calculated Pressure = $C(R0-R1)+K(T1-T0)$

GK-401 Reading at Shipment:

Position "B":* 9314Date: 8/3/93

or

Position "F":* Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1018 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code:

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23108Mfg. Number: 3-1347Customer: U. of ChicagoTemp: 21 °CJob No.: 5682Baro: 1031 mbar.Test Gage: 183By: GPA 4Date: 5/4/93

Applied Pressure	First Cycle	Second Cycle	Average	Change
0	9441	9449	9445	
20	8486	8489	8488	958
40	7525	7528	7527	961
60	6568	6568	6568	959
80	5608	5609	5609	960
100	4646	4647	4647	962

Calibration Factor (C): 0.02084 (PSI/Digit)Thermal Factor (K): -0.03751 (PSI/°C. Rise)Calculated Pressure = $C(R0-R1) + K(T1-T0)$

GK-401 Reading at Shipment:

Position "B":* 9454Date: 8/3/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1018 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code:

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23109Mfg. Number: 3-1349Customer: U. of ChicagoTemp: 21 °CJob No.: 5682Baro: 1031 mbar.Test Gage: 183By: GPA 8Date: 5/4/93

Applied Pressure	First Cycle	Second Cycle	Average	Change
0	8455	8465	8460	
20	7413	7415	7414	1046
40	6366	6369	6368	1047
60	5316	5317	5317	1051
80	4266	4268	4267	1050
100	3228	3228	3228	1039

Calibration Factor (C): 0.01910 (PSI/Digit)Thermal Factor (K): -0.01146 (PSI/°C. Rise)Calculated Pressure = $C(R0-R1) + K(T1-T0)$

GK-401 Reading at Shipment:

Position "B":* 8482Date: 8/3/93

or

Position "F":* Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1018 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code:

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23110Mfg. Number: 3-1352Customer: U. of ChicagoTemp: 22 °CJob No.: 5682Baro: 1031 mbar.Test Gage: 183By: GPA 7Date: 5/4/93

Applied Pressure	First Cycle	Second Cycle	Average	Change
0	8127	8133	8130	
20	7163	7163	7163	967
40	6197	6196	6197	967
60	5227	5227	5227	970
80	4257	4258	4258	970
100	3296	3298	3297	961

Calibration Factor (C): 0.02068 (PSI/Digit)Thermal Factor (K): -0.00827 (PSI/°C. Rise)Calculated Pressure = $C(R0-R1) + K(T1-T0)$

GK-401 Reading at Shipment:

Position "B":* 8149Date: 8/3/93

or

Position "F":* Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1018 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code:

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23111Mfg. Number: 3-1356Customer: U. of ChicagoTemp: 22 °CJob No.: 5682Baro: 1031 mbar.Test Gage: 183By: GPA 5Date: 5/4/93

Applied Pressure	First Cycle	Second Cycle	Average	Change
0	8847	8856	8852	
20	7998	7999	7999	853
40	7140	7141	7141	858
60	6287	6287	6287	854
80	5430	5431	5431	857
100	4575	4577	4576	855

Calibration Factor (C): 0.02338 (PSI/Digit)Thermal Factor (K): -0.03274 (PSI/°C. Rise)Calculated Pressure = $C(R0-R1) + K(T1-T0)$

GK-401 Reading at Shipment:

Position "B":* 8865Date: 8/3/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1018 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code:

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Serial Number: 23112Customer: U. of ChicagoJob No.: 5682Test Gage: 183Date: 5/4/93Pressure Range: 100 psiMfg. Number: 3-1360Temp: 22 °CBaro: 1031 mbar.By: GPA 6

Applied Pressure	First Cycle	Second Cycle	Average	Change
0	9491	9500	9496	
20	8591	8591	8591	905
40	7686	7687	7687	905
60	6785	6785	6785	902
80	5878	5879	5879	907
100	4971	4973	4972	907

Calibration Factor (C): 0.02211 (PSI/Digit)Thermal Factor (K): -0.03538 (PSI/°C. Rise)Calculated Pressure = $C(R0-R1)+K(T1-T0)$

GK-401 Reading at Shipment:

Position "B":* 9499Date: 8/3/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1018 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code:

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23113Mfg. Number: 3-1364Customer: U. of ChicagoTemp: 22 °CJob No.: 5682Baro: 1031 mbar.Test Gage: 183By: GPA 7Date: 5/4/93

Applied Pressure	First Cycle	Second Cycle	Average	Change
0	8007	8013	8010	
20	7175	7179	7177	833
40	6339	6341	6340	837
60	5506	5503	5505	836
80	4667	4666	4667	838
100	3832	3831	3832	835

Calibration Factor (C): 0.02392 (PSI/Digit)Thermal Factor (K): -0.01196 (PSI/°C. Rise)Calculated Pressure = $C(R0-R1) + K(T1-T0)$

GK-401 Reading at Shipment:

Position "B":* 8020Date: 8/3/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1018 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code:

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23114Mfg. Number: 3-1858Customer: U. of ChicagoTemp: 21 °CJob No.: 5682Baro: 1011 mbar.Test Gage: 183By: SPE 50Date: 7/12/93

Applied Pressure (psi)	Reading First Cycle	Reading Second Cycle	Average Reading	Change
0	9157	9158	9158	
20	8225	8226	8226	932
40	7286	7287	7287	939
60	6341	6345	6343	944
80	5388	5388	5388	955
100	4427	4426	4427	962

Calibration Factor (C): 0.02114 (PSI/Digit)Thermal Factor (K): -0.01691 (PSI/°C. Rise)

$$\text{Calculated Pressure} = C(R0-R1) + K(T1-T0)$$

GK-401 Reading at Shipment:

Position "B":* 9152Date: 8/3/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1018 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23115Mfg. Number: 3-1859Customer: U. of ChicagoTemp: 21 °CJob No.: 5682Baro: 1011 mbar.Test Gage: 183By: SPE 29Date: 7/12/93

Applied Pressure (psi)	Reading First Cycle	Reading Second Cycle	Average Reading	Change
0	8752	8756	8754	
20	7906	7907	7907	848
40	7056	7058	7057	850
60	6202	6203	6203	855
80	5342	5343	5343	860
100	4480	4480	4480	863

Calibration Factor (C): 0.02340 (PSI/Digit)Thermal Factor (K): -0.01404 (PSI/°C. Rise)Calculated Pressure = $C(R0-R1)+K(T1-T0)$

GK-401 Reading at Shipment:

Position "B":* 8748Date: 8/3/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1018 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23116Mfg. Number: 3-1861Customer: U. of ChicagoTemp: 21 °CJob No.: 5682Baro: 1011 mbar.Test Gage: 183By: SPE 28Date: 7/12/93

Applied Pressure (psi)	Reading First Cycle	Reading Second Cycle	Average Reading	Change
0	8978	8980	8979	
20	8167	8167	8167	812
40	7354	7355	7355	813
60	6537	6538	6538	817
80	5715	5715	5715	823
100	4890	4890	4890	825

Calibration Factor (C): 0.02446 (PSI/Digit)Thermal Factor (K): -0.02201 (PSI/°C. Rise)

$$\text{Calculated Pressure} = C(R0-R1) + K(T1-T0)$$

GK-401 Reading at Shipment:

Position "B":* 8976Date: 8/3/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1018 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23117Mfg. Number: 3-1862Customer: U. of ChicagoTemp: 21 °CJob No.: 5682Baro: 1011 mbar.Test Gage: 183By: SPE 37Date: 7/12/93

Applied Pressure (psi)	Reading First Cycle	Reading Second Cycle	Average Reading	Change
0	8773	8778	8776	
20	7878	7878	7878	898
40	6976	6977	6977	902
60	6071	6071	6071	906
80	5157	5157	5157	914
100	4239	4240	4240	918

Calibration Factor (C): 0.02205 (PSI/Digit)Thermal Factor (K): -0.01102 (PSI/°C. Rise)Calculated Pressure = $C(R0-R1) + K(T1-T0)$

GK-401 Reading at Shipment:

Position "B":* 8776Date: 8/3/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1018 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23118Mfg. Number: 3-1863Customer: U. of ChicagoTemp: 21 °CJob No.: 5682Baro: 1011 mbar.Test Gage: 183By: SPE 25Date: 7/12/93

Applied Pressure (psi)	Reading First Cycle	Reading Second Cycle	Average Reading	Change
0	8717	8719	8718	
20	7826	7828	7827	891
40	6931	6933	6932	895
60	6033	6034	6034	899
80	5129	5129	5129	905
100	4225	4226	4226	904

Calibration Factor (C): 0.02225 (PSI/Digit)Thermal Factor (K): -0.02003 (PSI/°C. Rise)Calculated Pressure = $C(R0-R1) + K(T1-T0)$

GK-401 Reading at Shipment:

Position "B":* 8721Date: 8/3/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1018 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23119Mfg. Number: 3-1864Customer: U. of ChicagoTemp: 21 °CJob No.: 5682Baro: 1011 mbar.Test Gage: 183By: SPE 13Date: 7/12/93

Applied Pressure (psi)	Reading First Cycle	Reading Second Cycle	Average Reading	Change
0	9511	9512	9512	
20	8680	8680	8680	832
40	7848	7849	7849	832
60	7014	7014	7014	835
80	6178	6178	6178	836
100	5339	5339	5339	839

Calibration Factor (C): 0.02397 (PSI/Digit)Thermal Factor (K): -0.04315 (PSI/°C. Rise)Calculated Pressure = $C(R0-R1) + K(T1-T0)$

GK-401 Reading at Shipment:

Position "B":* 9482Date: 8/3/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1018 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23120Mfg. Number: 3-1865Customer: U. of ChicagoTemp: 21 °CJob No.: 5682Baro: 1011 mbar.Test Gage: 183By: SPE 18Date: 7/12/93

Applied Pressure (psi)	Reading First Cycle	Reading Second Cycle	Average Reading	Change
0	8732	8735	8734	
20	7836	7836	7836	898
40	6937	6939	6938	898
60	6040	6040	6040	898
80	5137	5136	5137	904
100	4229	4229	4229	908

Calibration Factor (C): 0.02221 (PSI/Digit)Thermal Factor (K): -0.02221 (PSI/°C. Rise)

$$\text{Calculated Pressure} = C(R0-R1) + K(T1-T0)$$

GK-401 Reading at Shipment:

Position "B":* 8728Date: 8/3/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1018 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23121Mfg. Number: 3-1866Customer: U. of ChicagoTemp: 21 °CJob No.: 5682Baro: 1011 mbar.Test Gage: 183By: SPE 24Date: 7/12/93

Applied Pressure (psi)	Reading First Cycle	Reading Second Cycle	Average Reading	Change
0	8521	8524	8523	
20	7656	7656	7656	867
40	6788	6789	6789	868
60	5918	5918	5918	871
80	5041	5041	5041	877
100	4164	4163	4164	878

Calibration Factor (C): 0.02294 (PSI/Digit)Thermal Factor (K): -0.01606 (PSI/°C. Rise)

$$\text{Calculated Pressure} = C(R0-R1) + K(T1-T0)$$

GK-401 Reading at Shipment:

Position "B":* 8523Date: 8/3/93

or

Position "F":* Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1018 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23122Mfg. Number: 3-1868Customer: U. of ChicagoTemp: 21 °CJob No.: 5682Baro: 1011 mbar.Test Gage: 183By: SPE 16Date: 7/12/93

Applied Pressure (psi)	Reading First Cycle	Reading Second Cycle	Average Reading	Change
0	9779	9781	9780	
20	8927	8930	8929	852
40	8079	8079	8079	850
60	7225	7225	7225	854
80	6367	6366	6367	859
100	5510	5509	5510	857

Calibration Factor (C): 0.02342 (PSI/Digit)Thermal Factor (K): -0.03747 (PSI/°C. Rise)

$$\text{Calculated Pressure} = C(R0-R1) + K(T1-T0)$$

GK-401 Reading at Shipment:

Position "B":* 9778Date: 8/3/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1018 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23123Mfg. Number: 3-1870Customer: U. of ChicagoTemp: 21 °CJob No.: 5682Baro: 1011 mbar.Test Gage: 183By: SPE 24Date: 7/12/93

Applied Pressure (psi)	Reading First Cycle	Reading Second Cycle	Average Reading	Change
0	9409	9411	9410	
20	8474	8474	8474	936
40	7537	7538	7538	937
60	6597	6598	6598	940
80	5650	5650	5650	948
100	4703	4703	4703	947

Calibration Factor (C): 0.02125 (PSI/Digit)Thermal Factor (K): -0.02762 (PSI/°C. Rise)

$$\text{Calculated Pressure} = C(R0-R1) + K(T1-T0)$$

GK-401 Reading at Shipment:

Position "B":* 9406Date: 8/3/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1018 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23124Mfg. Number: 3-1871Customer: U. of ChicagoTemp: 21 °CJob No.: 5682Baro: 1010 mbar.Test Gage: 183By: SPE 12Date: 7/12/93

Applied Pressure (psi)	Reading First Cycle	Reading Second Cycle	Average Reading	Change
0	9287	9292	9290	
20	8358	8361	8360	930
40	7430	7431	7431	929
60	6496	6497	6497	934
80	5561	5561	5561	936
100	4628	4629	4629	933

Calibration Factor (C): 0.02145 (PSI/Digit)Thermal Factor (K): -0.04075 (PSI/°C. Rise)Calculated Pressure = $C(R0-R1) + K(T1-T0)$

GK-401 Reading at Shipment:

Position "B":* 9276Date: 8/9/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1029 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23125Mfg. Number: 3-1872Customer: U. of ChicagoTemp: 21 °CJob No.: 5682Baro: 1010 mbar.Test Gage: 183By: SPE 13Date: 7/12/93

Applied Pressure (psi)	Reading First Cycle	Reading Second Cycle	Average Reading	Change
0	8994	8999	8997	
20	7993	7996	7995	1002
40	6991	6992	6992	1003
60	5988	5989	5989	1003
80	4978	4978	4978	1011
100	3972	3973	3973	1006

Calibration Factor (C): 0.01990 (PSI/Digit)Thermal Factor (K): -0.02587 (PSI/°C. Rise)

$$\text{Calculated Pressure} = C(R_0 - R_1) + K(T_1 - T_0)$$

GK-401 Reading at Shipment:

Position "B":* 8987Date: 8/9/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1029 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23126Mfg. Number: 3-1875Customer: U. of ChicagoTemp: 21 °CJob No.: 5682Baro: 1010 mbar.Test Gage: 183By: SPE 14Date: 7/12/93

Applied Pressure (psi)	Reading First Cycle	Reading Second Cycle	Average Reading	Change
0	9094	9098	9096	
20	8236	8239	8238	859
40	7379	7381	7380	858
60	6520	6521	6521	860
80	5655	5655	5655	866
100	4793	4793	4793	862

Calibration Factor (C): 0.02324 (PSI/Digit)Thermal Factor (K): -0.02789 (PSI/°C. Rise)

$$\text{Calculated Pressure} = C(R0-R1) + K(T1-T0)$$

GK-401 Reading at Shipment:

Position "B":* 9082Date: 8/9/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1029 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23127Mfg. Number: 3-1877Customer: U. of ChicagoTemp: 21 °CJob No.: 5682Baro: 1010 mbar.Test Gage: 183By: SPE 27Date: 7/12/93

Applied Pressure (psi)	Reading First Cycle	Reading Second Cycle	Average Reading	Change
0	8784	8788	8786	
20	7938	7941	7940	847
40	7090	7091	7091	849
60	6239	6240	6240	851
80	5382	5381	5382	858
100	4521	4522	4522	860

Calibration Factor (C): 0.02345 (PSI/Digit)Thermal Factor (K): -0.02345 (PSI/°C. Rise)

$$\text{Calculated Pressure} = C(R0-R1) + K(T1-T0)$$

GK-401 Reading at Shipment:

Position "B":* 8774Date: 8/9/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1029 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23128Mfg. Number: 3-1878Customer: U. of ChicagoTemp: 21 °CJob No.: 5682Baro: 1010 mbar.Test Gage: 183By: SPE 12Date: 7/12/93

Applied Pressure (psi)	Reading First Cycle	Reading Second Cycle	Average Reading	Change
0	8874	8879	8877	
20	7900	7903	7902	975
40	6923	6924	6924	978
60	5948	5948	5948	976
80	4966	4965	4966	983
100	3986	3986	3986	980

Calibration Factor (C): 0.02045 (PSI/Digit)Thermal Factor (K): -0.02658 (PSI/°C. Rise)

$$\text{Calculated Pressure} = C(R_0 - R_1) + K(T_1 - T_0)$$

GK-401 Reading at Shipment:

Position "B":* 8864Date: 8/9/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1029 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23129Mfg. Number: 3-1879Customer: U. of ChicagoTemp: 21 °CJob No.: 5682Baro: 1010 mbar.Test Gage: 183By: SPE 39Date: 7/12/93

Applied Pressure (psi)	Reading First Cycle	Reading Second Cycle	Average Reading	Change
0	8683	8687	8685	
20	7809	7812	7811	875
40	6931	6932	6932	879
60	6048	6049	6049	883
80	5157	5156	5157	892
100	4261	4262	4262	895

Calibration Factor (C): 0.02261 (PSI/Digit)Thermal Factor (K): -0.01130 (PSI/°C. Rise)Calculated Pressure = $C(R0-R1) + K(T1-T0)$

GK-401 Reading at Shipment:

Position "B":* 8678Date: 8/9/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1029 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23130Mfg. Number: 3-1882Customer: U. of ChicagoTemp: 21 °CJob No.: 5682Baro: 1010 mbar.Test Gage: 183By: SPE 28Date: 7/12/93

Applied Pressure (psi)	Reading First Cycle	Reading Second Cycle	Average Reading	Change
0	9561	9566	9564	
20	8841	8844	8843	721
40	8121	8122	8122	721
60	7396	7397	7397	725
80	6666	6665	6666	731
100	5934	5935	5935	731

Calibration Factor (C): 0.02756 (PSI/Digit)Thermal Factor (K): -0.02205 (PSI/°C. Rise)

$$\text{Calculated Pressure} = C(R0-R1) + K(T1-T0)$$

GK-401 Reading at Shipment:

Position "B":* 9549Date: 8/9/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1029 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23131Mfg. Number: 3-1883Customer: U. of ChicagoTemp: 21 °CJob No.: 5682Baro: 1010 mbar.Test Gage: 183By: SPE 31Date: 7/12/93

Applied Pressure (psi)	Reading First Cycle	Reading Second Cycle	Average Reading	Change
0	8990	8991	8991	
20	8043	8043	8043	948
40	7093	7094	7094	950
60	6136	6136	6136	958
80	5175	5175	5175	961
100	4210	4213	4212	964

Calibration Factor (C): 0.02092 (PSI/Digit)Thermal Factor (K): -0.02301 (PSI/°C. Rise)

$$\text{Calculated Pressure} = C(R_0 - R_1) + K(T_1 - T_0)$$

GK-401 Reading at Shipment:

Position "B":* 8975Date: 8/9/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1029 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23132Mfg. Number: 3-1884Customer: U. of ChicagoTemp: 21 °CJob No.: 5682Baro: 1010 mbar.Test Gage: 183By: SPE 38Date: 7/12/93

Applied Pressure (psi)	Reading First Cycle	Reading Second Cycle	Average Reading	Change
0	8925	8926	8926	
20	8115	8116	8116	810
40	7303	7304	7304	812
60	6483	6482	6483	821
80	5659	5659	5659	824
100	4830	4832	4831	828

Calibration Factor (C): 0.02442 (PSI/Digit)Thermal Factor (K): -0.01709 (PSI/°C. Rise)Calculated Pressure = $C(R0-R1) + K(T1-T0)$

GK-401 Reading at Shipment:

Position "B":* 8913Date: 8/9/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1029 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23133Mfg. Number: 3-1885Customer: U. of ChicagoTemp: 21 °CJob No.: 5682Baro: 1010 mbar.Test Gage: 183By: SPE 32Date: 7/12/93

Applied Pressure (psi)	Reading First Cycle	Reading Second Cycle	Average Reading	Change
0	8832	8834	8833	
20	8097	8098	8098	736
40	7363	7364	7364	734
60	6623	6622	6623	741
80	5875	5876	5876	747
100	5128	5130	5129	747

Calibration Factor (C): 0.02700 (PSI/Digit)Thermal Factor (K): -0.01350 (PSI/°C. Rise)

Calculated Pressure = C(R0-R1)+K(T1-T0)

GK-401 Reading at Shipment:

Position "B":* 8817Date: 8/9/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1029 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23134Mfg. Number: 3-1886Customer: U. of ChicagoTemp: 21 °CJob No.: 5682Baro: 1010 mbar.Test Gage: 183By: SPE 33Date: 7/12/93

Applied Pressure (psi)	Reading First Cycle	Reading Second Cycle	Average Reading	Change
0	8679	8681	8680	
20	7816	7817	7817	864
40	6946	6948	6947	870
60	6074	6074	6074	873
80	5195	5195	5195	879
100	4311	4314	4313	883

Calibration Factor (C): 0.02289 (PSI/Digit)Thermal Factor (K): -0.01832 (PSI/°C. Rise)Calculated Pressure = $C(R0-R1) + K(T1-T0)$

GK-401 Reading at Shipment:

Position "B":* 8665Date: 8/9/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1029 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23135Mfg. Number: 3-1889Customer: U. of ChicagoTemp: 21 °CJob No.: 5682Baro: 1010 mbar.Test Gage: 183By: SPE 22Date: 7/12/93

Applied Pressure (psi)	Reading First Cycle	Reading Second Cycle	Average Reading	Change
0	8947	8949	8948	
20	8044	8044	8044	904
40	7137	7138	7138	907
60	6230	6230	6230	908
80	5316	5317	5317	914
100	4399	4401	4400	917

Calibration Factor (C): 0.02199 (PSI/Digit)Thermal Factor (K): -0.02639 (PSI/°C. Rise)

$$\text{Calculated Pressure} = C(R0-R1) + K(T1-T0)$$

GK-401 Reading at Shipment:

Position "B":* 8934Date: 8/9/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1029 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code

Red and Black: Gage

White and Green: Thermister

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Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100

Pressure Range: 100 psi

Serial Number: 23136

Mfg. Number: 3-1891

Customer: U. of Chicago

Temp: 21 °C

Job No.: 5682

Baro: 1010 mbar.

Test Gage: 183

By: SPE 20

Date: 7/12/93

Applied Pressure (psi)	Reading First Cycle	Reading Second Cycle	Average Reading	Change
0	9414	9414	9414	
20	8561	8562	8562	853
40	7708	7709	7709	853
60	6851	6850	6851	858
80	5990	5990	5990	861
100	5127	5129	5128	862

Calibration Factor (C): 0.02333 (PSI/Digit)

Thermal Factor (K): -0.02566 (PSI/°C. Rise)

Calculated Pressure = $C(R0-R1)+K(T1-T0)$

GK-401 Reading at Shipment:

Position "B":* 9399

Date: 8/9/93

or

Position "F":*

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1029 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23137Mfg. Number: 3-1892Customer: U. of ChicagoTemp: 21 °CJob No.: 5682Baro: 1010 mbar.Test Gage: 183By: SPE 23Date: 7/12/93

Applied Pressure (psi)	Reading First Cycle	Reading Second Cycle	Average Reading	Change
0	8995	8998	8997	
20	8207	8208	8208	789
40	7417	7418	7418	790
60	6623	6622	6623	795
80	5824	5824	5824	799
100	5025	5027	5026	798

Calibration Factor (C): 0.02518 (PSI/Digit)Thermal Factor (K): -0.02770 (PSI/°C. Rise)Calculated Pressure = $C(R0-R1) + K(T1-T0)$

GK-401 Reading at Shipment:

Position "B":* 8986Date: 8/9/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1029 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23138Mfg. Number: 3-1893Customer: U. of ChicagoTemp: 21 °CJob No.: 5682Baro: 1010 mbar.Test Gage: 183By: SPE 32Date: 7/12/93

Applied Pressure (psi)	Reading First Cycle	Reading Second Cycle	Average Reading	Change
0	8501	8501	8501	
20	7551	7553	7552	949
40	6596	6598	6597	955
60	5636	5637	5637	961
80	4671	4672	4672	965
100	3701	3704	3703	969

Calibration Factor (C): 0.02084 (PSI/Digit)Thermal Factor (K): -0.00417 (PSI/°C. Rise)Calculated Pressure = $C(R0-R1)+K(T1-T0)$

GK-401 Reading at Shipment:

Position "B":* 8489Date: 8/9/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1029 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23139Mfg. Number: 3-1895Customer: U. of ChicagoTemp: 21 °CJob No.: 5682Baro: 1010 mbar.Test Gage: 183By: SPE 40Date: 7/12/93

Applied Pressure (psi)	Reading First Cycle	Reading Second Cycle	Average Reading	Change
0	8864	8867	8866	
20	7889	7891	7890	976
40	6908	6912	6910	980
60	5922	5922	5922	988
80	4927	4928	4928	995
100	3926	3927	3927	1001

Calibration Factor (C): 0.02025 (PSI/Digit)Thermal Factor (K): -0.01215 (PSI/°C. Rise)Calculated Pressure = $C(R0-R1)+K(T1-T0)$

GK-401 Reading at Shipment:

Position "B":* 8855Date: 8/9/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1029 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23140Mfg. Number: 3-1896Customer: U. of ChicagoTemp: 21 °CJob No.: 5682Baro: 1010 mbar.Test Gage: 183By: SPE 12Date: 7/12/93

Applied Pressure (psi)	Reading First Cycle	Reading Second Cycle	Average Reading	Change
0	9285	9289	9287	
20	8501	8503	8502	785
40	7719	7722	7721	782
60	6932	6933	6933	788
80	6145	6146	6146	787
100	5358	5358	5358	788

Calibration Factor (C): 0.02545 (PSI/Digit)Thermal Factor (K): -0.01273 (PSI/°C. Rise)

$$\text{Calculated Pressure} = C(R0-R1) + K(T1-T0)$$

GK-401 Reading at Shipment:

Position "B":* 9278Date: 8/9/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1029 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23141Mfg. Number: 3-1897Customer: U. of ChicagoTemp: 21 °CJob No.: 5682Baro: 1010 mbar.Test Gage: 183By: SPE 19Date: 7/12/93

Applied Pressure (psi)	Reading First Cycle	Reading Second Cycle	Average Reading	Change
0	8388	8392	8390	
20	7536	7538	7537	853
40	6682	6686	6684	853
60	5825	5826	5826	859
80	4965	4965	4965	861
100	4104	4105	4105	861

Calibration Factor (C): 0.02333 (PSI/Digit)Thermal Factor (K): -0.02333 (PSI/°C. Rise)Calculated Pressure = $C(R0-R1) + K(T1-T0)$

GK-401 Reading at Shipment:

Position "B":* 8379Date: 8/9/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1029 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23142Mfg. Number: 3-1898Customer: U. of ChicagoTemp: 21 °CJob No.: 5682Baro: 1010 mbar.Test Gage: 183By: SPE 29Date: 7/12/93

Applied Pressure (psi)	Reading First Cycle	Reading Second Cycle	Average Reading	Change
0	9008	9011	9010	
20	8174	8176	8175	835
40	7332	7336	7334	841
60	6490	6490	6490	844
80	5641	5641	5641	849
100	4790	4791	4791	851

Calibration Factor (C): 0.02370 (PSI/Digit)Thermal Factor (K): -0.01896 (PSI/°C. Rise)Calculated Pressure = $C(R0-R1) + K(T1-T0)$

GK-401 Reading at Shipment:

Position "B":* 8998Date: 8/9/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1029 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23143Mfg. Number: 3-1899Customer: U. of ChicagoTemp: 21 °CJob No.: 5682Baro: 1010 mbar.Test Gage: 183By: SPE 16Date: 7/12/93

Applied Pressure (psi)	Reading First Cycle	Reading Second Cycle	Average Reading	Change
0	8644	8647	8646	
20	7719	7722	7721	925
40	6790	6793	6792	929
60	5859	5860	5860	932
80	4926	4927	4927	933
100	3992	3993	3993	934

Calibration Factor (C): 0.02149 (PSI/Digit)Thermal Factor (K): -0.02363 (PSI/°C. Rise)Calculated Pressure = $C(R0-R1)+K(T1-T0)$

GK-401 Reading at Shipment:

Position "B":* 8640Date: 8/9/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1029 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23144Mfg. Number: 3-1900Customer: U. of ChicagoTemp: 21 °CJob No.: 5682Baro: 1010 mbar.Test Gage: 183By: SPE 25Date: 7/12/93

Applied Pressure (psi)	Reading First Cycle	Reading Second Cycle	Average Reading	Change
0	8768	8772	8770	
20	7908	7909	7909	862
40	7039	7043	7041	868
60	6170	6171	6171	871
80	5296	5297	5297	874
100	4420	4421	4421	876

Calibration Factor (C): 0.02299 (PSI/Digit)Thermal Factor (K): -0.02069 (PSI/°C. Rise)

$$\text{Calculated Pressure} = C(R0-R1) + K(T1-T0)$$

GK-401 Reading at Shipment:

Position "B":* 8761Date: 8/9/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1029 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23145Mfg. Number: 3-1901Customer: U. of ChicagoTemp: 21 °CJob No.: 5682Baro: 1010 mbar.Test Gage: 183By: SPE 21Date: 7/12/93

Applied Pressure (psi)	Reading First Cycle	Reading Second Cycle	Average Reading	Change
0	8880	8884	8882	
20	7988	7989	7989	894
40	7093	7097	7095	894
60	6195	6196	6196	900
80	5294	5294	5294	902
100	4390	4391	4391	904

Calibration Factor (C): 0.02226 (PSI/Digit)Thermal Factor (K): -0.02449 (PSI/°C. Rise)Calculated Pressure = $C(R0-R1) + K(T1-T0)$

GK-401 Reading at Shipment:

Position "B":* 8879Date: 8/9/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1029 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23146Mfg. Number: 3-1902Customer: U. of ChicagoTemp: 21 °CJob No.: 5682Baro: 1010 mbar.Test Gage: 183By: SPE 20Date: 7/12/93

Applied Pressure (psi)	Reading First Cycle	Reading Second Cycle	Average Reading	Change
0	9209	9213	9211	
20	8237	8238	8238	974
40	7259	7263	7261	977
60	6282	6282	6282	979
80	5298	5299	5299	984
100	4312	4313	4313	986

Calibration Factor (C): 0.02041 (PSI/Digit)Thermal Factor (K): 0.02041 (PSI/°C. Rise)Calculated Pressure = $C(R0-R1) + K(T1-T0)$

GK-401 Reading at Shipment:

Position "B":* 9199Date: 8/9/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1029 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23147Mfg. Number: 3-1903Customer: U. of ChicagoTemp: 21 °CJob No.: 5682Baro: 1010 mbar.Test Gage: 183By: SPE 40Date: 7/12/93

Applied Pressure (psi)	Reading First Cycle	Reading Second Cycle	Average Reading	Change
0	9063	9067	9065	
20	8202	8203	8203	- 863
40	7329	7333	7331	872
60	6453	6454	6454	878
80	5573	5573	5573	881
100	4687	4688	4688	886

Calibration Factor (C): 0.02284 (PSI/Digit)Thermal Factor (K): -0.02740 (PSI/°C. Rise)Calculated Pressure = $C(R0-R1)+K(T1-T0)$

GK-401 Reading at Shipment:

Position "B":* 9058Date: 8/9/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1029 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23148Mfg. Number: 3-1904Customer: U. of ChicagoTemp: 21 °CJob No.: 5682Baro: 1010 mbar.Test Gage: 183By: SPE 27Date: 7/12/93

Applied Pressure (psi)	Reading First Cycle	Reading Second Cycle	Average Reading	Change
0	8746	8750	8748	
20	7943	7945	7944	804
40	7132	7136	7134	810
60	6321	6321	6321	813
80	5505	5505	5505	816
100	4686	4686	4686	819

Calibration Factor (C): 0.02461 (PSI/Digit)Thermal Factor (K): -0.02461 (PSI/°C. Rise)

$$\text{Calculated Pressure} = C(R_0 - R_1) + K(T_1 - T_0)$$

GK-401 Reading at Shipment:

Position "B":* 8740Date: 8/9/93

or

Position "F":*

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1029 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23149Mfg. Number: 3-1905Customer: U. of ChicagoTemp: 21 °CJob No.: 5682Baro: 1010 mbar.Test Gage: 183By: SPE 15Date: 7/12/93

Applied Pressure (psi)	Reading First Cycle	Reading Second Cycle	Average Reading	Change
0	8761	8764	8763	
20	7903	7904	7904	859
40	7040	7043	7042	862
60	6176	6177	6177	865
80	5310	5310	5310	867
100	4445	4445	4445	865

Calibration Factor (C): 0.02315 (PSI/Digit)Thermal Factor (K): -0.01852 (PSI/°C. Rise)Calculated Pressure = $C(R0-R1) + K(T1-T0)$

GK-401 Reading at Shipment:

Position "B":* 8754Date: 8/9/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1029 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23150Mfg. Number: 3-1906Customer: U. of ChicagoTemp: 21 °CJob No.: 5682Baro: 1010 mbar.Test Gage: 183By: SPE 16Date: 7/12/93

Applied Pressure (psi)	Reading First Cycle	Reading Second Cycle	Average Reading	Change
0	9929	9933	9931	
20	9155	9157	9156	775
40	8383	8387	8385	771
60	7608	7609	7609	777
80	6828	6829	6829	780
100	6049	6050	6050	779

Calibration Factor (C): 0.02577 (PSI/Digit)Thermal Factor (K): 0.02319 (PSI/°C. Rise)Calculated Pressure = $C(R0-R1)+K(T1-T0)$

GK-401 Reading at Shipment:

Position "B":* 9918Date: 8/9/93

or

Position "F":* Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1029 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23151Mfg. Number: 3-1359Customer: U. of ChicagoTemp: 22 °CJob No.: 5682Baro: 1031 mbar.Test Gage: 183By: GPA 3Date: 5/4/93

Applied Pressure	First Cycle	Second Cycle	Average	Change
0	9019	9031	9025	
20	8109	8110	8110	916
40	7194	7196	7195	915
60	6284	6284	6284	911
80	5367	5368	5368	917
100	4452	4454	4453	915

Calibration Factor (C): 0.02188 (PSI/Digit)Thermal Factor (K): -0.02625 (PSI/°C. Rise)Calculated Pressure = $C(R0-R1) + K(T1-T0)$

GK-401 Reading at Shipment:

Position "B":* 9031Date: 8/9/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1029 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code:

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23152Mfg. Number: 3-1636Customer: U. of ChicagoTemp: 21 °CJob No.: 5682Baro: 1014 mbar.Test Gage: 183By: SPE 5Date: 6/21/93

Applied Pressure (psi)	Reading First Cycle	Reading Second Cycle	Average Reading	Change
0	9152	9153	9153	
20	8230	8231	8231	922
40	7309	7311	7310	921
60	6391	6392	6392	919
80	5468	5468	5468	924
100	4546	4544	4545	923

Calibration Factor (C): 0.02171 (PSI/Digit)Thermal Factor (K): -0.03474 (PSI/°C. Rise)

$$\text{Calculated Pressure} = C(R0-R1) + K(T1-T0)$$

GK-401 Reading at Shipment:

Position "B":* 9152Date: 8/9/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1029 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code

Red and Black: Gage

White and Green: Thermister

Vibrating Wire Pressure Transducer Calibration

Model Number: 4500S-100Pressure Range: 100 psiSerial Number: 23153Mfg. Number: 3-1637Customer: U. of ChicagoTemp: 21 °CJob No.: 5682Baro: 1014 mbar.Test Gage: 183By: SPE 10Date: 6/21/93

Applied Pressure (psi)	Reading First Cycle	Reading Second Cycle	Average Reading	Change
0	9391	9391	9391	
20	8514	8515	8515	877
40	7633	7634	7634	881
60	6754	6754	6754	880
80	5872	5872	5872	882
100	4989	4988	4989	884

Calibration Factor (C): 0.02271 (PSI/Digit)Thermal Factor (K): -0.02726 (PSI/°C. Rise)Calculated Pressure = $C(R0-R1) + K(T1-T0)$

GK-401 Reading at Shipment:

Position "B":* 9391Date: 8/9/93

or

Position "F":* _____

Temperature: 21 °C

* Users are advised to establish their own zero conditions.

Baro: 1029 mbar**

** Barometric pressure is corrected for 580 ft. above sea level.

Wiring Code

Red and Black: Gage

White and Green: Thermister

APPENDIX B:

ARGONNE NATIONAL LABORATORY TEST SHEETS

TABLE B.1 Test Sheet Reference

Test Sheet Number	Test Plan Section	Test Sheet Number	Test Plan Section	Test Sheet Number	Test Plan Section
MA1-1-(1-57)	2.1.1	QA5-1-1	3.1.1	AA17-1-1	4.1.1
MP1-1-1	2.1.2	QP5-1-1	3.1.2	AP17-1-1	4.1.2
MA2-1-(1-55)	2.2.1	QA6-1-1	3.2.1	AA18-1-1	4.2.1
MA2-2-(1-55)	2.2.1	QA7-(1-3)-1	3.3.1	AA19-1-1	4.3.1
MP2-1-1	2.2.2	QA8-1-1	3.4.1	AA20-(1-2)-1	4.4.1
MA3-1-1	2.3.1	QA9-1-1	3.5.1	AP20-(1-2)-1	4.4.2
MP3-1-1	2.3.2	QP9-1-1	3.5.2	AA21-1-1	4.5.1
MA4-1-(1-9)	2.5.1	QA10-1-1	3.6.1	AP21-1-1	4.5.2
MP4-1-(1-9)	2.5.2	QP10-1-1	3.6.2	AA22-1-1	4.6.1
		QA11-1-1	3.7.1	AP22-1-1	4.6.2
		QP11-1-1	3.7.2	AA23-1-1	4.7.1
		QA12-1-1	3.8.1	AP23-2-1	4.7.2
		QP12-1-1	3.8.2		
		QA13-(1-3)-1	3.9.1	IA24-1-1	5.1.1
		QA14-1-1	3.10.1	IP24-1-1	5.1.2
		QP14-1-1	3.10.2	IA25-1-1	5.2.1
		QA15-1-1	3.11.1	IP25-1-1	5.2.2
		QP15-1-1	3.11.2	IA26-1-1	5.3.1
		QA16-1-1	3.12.1	IP26-1-1	5.3.2
		QP16-1-1	3.12.2	IA27-1-1	5.4.1
				IP27-1-1	5.4.2
				IA28-1-1	5.5.1
				IP28-1-1	5.5.2

MA 1-1-(1-57)

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 10/29/93-11/1/93

Test Executor: Cathy Leser

Test Plan Section: 2.1.1 Pressure Transducers

Results: All pressure transducers were tested and results were recorded on the following data sheets.

Test Recorder: Dana Dominiak DD - man

Date: 5/1/94

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02055	
Serial Number:	23099	Thermal Factor (K):	-0.02055	
Mfg. Number:	3-1274	Barometric Pressure (mbar):	985.8	
Tester:	CCL	Ambient Temp. (°C):	21.2	
Date:	10/29/93	Water Temp. (°C):	20.5	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 8726				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	8707	0.39045	0.04305	
3 ft. (1.3005 psi)	8665	1.25355	0.04695	42
5 ft. (2.1675 psi)	8623	2.11665	0.05085	42
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02224	
Serial Number:	23100	Thermal Factor (K):	-0.0335	
Mfg. Number:	3-1275	Barometric Pressure (mbar):	985.8	
Tester:	CCL	Ambient Temp. (°C):	21.2	
Date:	10/29/93	Water Temp. (°C):	20.5	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 8949				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	8930	0.42256	0.01094	
3 ft. (1.3005 psi)	8891	1.28992	0.01058	39
5 ft. (2.1675 psi)	8852	2.15728	0.01022	39
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02714	
Serial Number:	23101	Thermal Factor (K):	-0.02443	
Mfg. Number:	3-1281	Barometric Pressure (mbar):	985.8	
Tester:	CCL	Ambient Temp. (°C):	21.2	
Date:	10/29/93	Water Temp. (°C):	20.5	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 8766				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	8751	0.4071	0.0264	
3 ft. (1.3005 psi)	8720	1.24844	0.05206	31
5 ft. (2.1675 psi)	8689	2.08978	0.07772	31
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02312	
Serial Number:	23102	Thermal Factor (K):	-0.02543	
Mfg. Number:	3-1290	Barometric Pressure (mbar):	985.8	
Tester:	CCL	Ambient Temp. (°C):	21.2	
Date:	10/29/93	Water Temp. (°C):	20.5	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 9114				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	9096	0.41616	210.73302	
3 ft. (1.3005 psi)	9059	1.2716	0.0289	37
5 ft. (2.1675 psi)	9021	2.15016	0.01734	38
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.0209	
Serial Number:	23103	Thermal Factor (K):	-0.01672	
Mfg. Number:	3-1294	Barometric Pressure (mbar):	985.8	
Tester:	CCL	Ambient Temp. (°C):	21.2	
Date:	10/29/93	Water Temp. (°C):	20.5	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 8658				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	8638	0.418	0.0155	
3 ft. (1.3005 psi)	8597	1.2749	0.0256	41
5 ft. (2.1675 psi)	8556	2.1318	0.0357	41
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02184	
Serial Number:	23104	Thermal Factor (K):	-0.03057	
Mfg. Number:	3-1299	Barometric Pressure (mbar):	985.8	
Tester:	CCL	Ambient Temp. (°C):	21.2	
Date:	10/29/93	Water Temp. (°C):	20.5	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 9046				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	9029	0.37128	0.06222	
3 ft. (1.3005 psi)	8989	1.24488	0.05562	40
5 ft. (2.1675 psi)	8949	2.11848	0.04902	40
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02278	
Serial Number:	23105	Thermal Factor (K):	-0.02961	
Mfg. Number:	3-1327	Barometric Pressure (mbar):	985.8	
Tester:	CCL	Ambient Temp. (°C):	21.2	
Date:	10/29/93	Water Temp. (°C):	20.5	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 9469				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	9450	0.43282	0.00068	
3 ft. (1.3005 psi)	9412	1.29846	0.00204	38
5 ft. (2.1675 psi)	9374	2.1641	0.0034	38
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02689	
Serial Number:	23106	Thermal Factor (K):	-0.02958	
Mfg. Number:	3-1328	Barometric Pressure (mbar):	985.8	
Tester:	CCL	Ambient Temp. (°C):	21.2	
Date:	10/29/93	Water Temp. (°C):	20.5	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 9370				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	9355	0.40335	0.03015	
3 ft. (1.3005 psi)	9327	1.15627	0.14423	28
5 ft. (2.1675 psi)	9294	2.04364	0.12386	33
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02332	
Serial Number:	23107	Thermal Factor (K):	-0.03964	
Mfg. Number:	3-1339	Barometric Pressure (mbar):	985.8	
Tester:	CCL	Ambient Temp. (°C):	21.2	
Date:	10/29/93	Water Temp. (°C):	20.5	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 9323				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	9305	0.41976	0.01374	
3 ft. (1.3005 psi)	9268	1.2826	0.0179	37
5 ft. (2.1675 psi)	9231	2.14544	0.02206	37
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02084	
Serial Number:	23108	Thermal Factor (K):	-0.03751	
Mfg. Number:	3-1347	Barometric Pressure (mbar):	985.8	
Tester:	CCL	Ambient Temp. (°C):	21.2	
Date:	10/29/93	Water Temp. (°C):	20.5	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 9466				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	9445	0.43764	-0.00414	
3 ft. (1.3005 psi)	9404	1.29208	0.00842	41
5 ft. (2.1675 psi)	9363	2.14652	0.02098	41
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.0191	
Serial Number:	23109	Thermal Factor (K):	-0.01146	
Mfg. Number:	3-1349	Barometric Pressure (mbar):	984	
Tester:	CCL	Ambient Temp. (°C):	21.2	
Date:	10/29/93	Water Temp. (°C):	20.5	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 8480				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	8459	0.4011	0.0324	
3 ft. (1.3005 psi)	8414	1.2606	0.0399	45
5 ft. (2.1675 psi)	8369	2.1201	0.0474	45
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02068	
Serial Number:	23110	Thermal Factor (K):	-0.00827	
Mfg. Number:	3-1352	Barometric Pressure (mbar):	984	
Tester:	CCL	Ambient Temp. (°C):	21.1	
Date:	10/29/93	Water Temp. (°C):	20.5	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 8149				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	8129	0.4136	0.0199	
3 ft. (1.3005 psi)	8087	1.28216	0.01834	42
5 ft. (2.1675 psi)	8045	2.15072	0.01678	42
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02338	
Serial Number:	23111	Thermal Factor (K):	-0.03274	
Mfg. Number:	3-1356	Barometric Pressure (mbar):	984	
Tester:	CCL	Ambient Temp. (°C):	21.1	
Date:	10/29/93	Water Temp. (°C):	20.5	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 8871				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	8853	0.42084	0.01266	
3 ft. (1.3005 psi)	8818	1.23914	0.06136	35
5 ft. (2.1675 psi)	8780	2.12758	0.03992	38
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02211	
Serial Number:	23112	Thermal Factor (K):	-0.03538	
Mfg. Number:	3-1360	Barometric Pressure (mbar):	984	
Tester:	CCL	Ambient Temp. (°C):	21.1	
Date:	10/29/93	Water Temp. (°C):	20.5	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 9515				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	9497	0.39798	0.03552	
3 ft. (1.3005 psi)	9458	1.26027	0.04023	39
5 ft. (2.1675 psi)	9418	2.14467	0.02283	40
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02392	
Serial Number:	23113	Thermal Factor (K):	-0.01196	
Mfg. Number:	3-1364	Barometric Pressure (mbar):	984	
Tester:	CCL	Ambient Temp. (°C):	21.1	
Date:	10/29/93	Water Temp. (°C):	20.5	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 8029				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	8011	0.43056	0.00294	
3 ft. (1.3005 psi)	7981	1.14816	0.15234	30
5 ft. (2.1675 psi)	7944	2.0332	0.1343	37
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02114	
Serial Number:	23114	Thermal Factor (K):	-0.01691	
Mfg. Number:	3-1858	Barometric Pressure (mbar):	984	
Tester:	CCL	Ambient Temp. (°C):	21.1	
Date:	10/29/93	Water Temp. (°C):	20.5	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 9160				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	9140	0.4228	0.0107	
3 ft. (1.3005 psi)	9100	1.2684	0.0321	40
5 ft. (2.1675 psi)	9060	2.114	0.0535	40
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.0234	
Serial Number:	23115	Thermal Factor (K):	-0.01404	
Mfg. Number:	3-1859	Barometric Pressure (mbar):	984	
Tester:	CCL	Ambient Temp. (°C):	21.1	
Date:	10/29/93	Water Temp. (°C):	20.5	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 8753				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	8736	0.3978	0.0357	
3 ft. (1.3005 psi)	8700	1.2402	0.0603	36
5 ft. (2.1675 psi)	8663	2.106	0.0615	37
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02446	
Serial Number:	23116	Thermal Factor (K):	-0.02201	
Mfg. Number:	3-1861	Barometric Pressure (mbar):	984	
Tester:	CCL	Ambient Temp. (°C):	21.1	
Date:	10/29/93	Water Temp. (°C):	20.5	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 8983				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	8967	0.39136	0.04214	
3 ft. (1.3005 psi)	8932	1.24746	0.05304	35
5 ft. (2.1675 psi)	8897	2.10356	0.06394	35
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02205	
Serial Number:	23117	Thermal Factor (K):	-0.01102	
Mfg. Number:	3-1862	Barometric Pressure (mbar):	984	
Tester:	CCL	Ambient Temp. (°C):	21.1	
Date:	10/29/93	Water Temp. (°C):	20.5	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 8779				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	8761	0.3969	0.0366	
3 ft. (1.3005 psi)	8723	1.2348	0.0657	38
5 ft. (2.1675 psi)	8684	2.09475	0.07275	39
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02225	
Serial Number:	23118	Thermal Factor (K):	-0.02003	
Mfg. Number:	3-1863	Barometric Pressure (mbar):	984	
Tester:	CCL	Ambient Temp. (°C):	21.1	
Date:	10/29/93	Water Temp. (°C):	20.5	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 8723				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	8705	0.4005	0.033	
3 ft. (1.3005 psi)	8667	1.246	0.0545	38
5 ft. (2.1675 psi)	8628	2.11375	0.05375	39
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02397	
Serial Number:	23119	Thermal Factor (K):	-0.04315	
Mfg. Number:	3-1864	Barometric Pressure (mbar):	984	
Tester:	CCL	Ambient Temp. (°C):	21.1	
Date:	10/29/93	Water Temp. (°C):	20.5	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 9491				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	9474	0.40749	0.02601	
3 ft. (1.3005 psi)	9439	1.24644	0.05406	35
5 ft. (2.1675 psi)	9402	2.13333	0.03417	37
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02221	
Serial Number:	23120	Thermal Factor (K):	-0.02221	
Mfg. Number:	3-1865	Barometric Pressure (mbar):	985.8	
Tester:	CCL	Ambient Temp. (°C):	21.1	
Date:	10/29/93	Water Temp. (°C):	20.5	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 8737				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	8718	0.42199	0.01151	
3 ft. (1.3005 psi)	8680	1.26597	0.03453	38
5 ft. (2.1675 psi)	8640	2.15437	0.01313	40
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02294	
Serial Number:	23121	Thermal Factor (K):	-0.01606	
Mfg. Number:	3-1866	Barometric Pressure (mbar):	984	
Tester:	CCL	Ambient Temp. (°C):	21.1	
Date:	10/29/93	Water Temp. (°C):	20.5	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 8525				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	8507	0.41292	0.02058	
3 ft. (1.3005 psi)	8471	1.23876	0.06174	36
5 ft. (2.1675 psi)	8434	2.08754	0.07996	37
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02342	
Serial Number:	23122	Thermal Factor (K):	-0.03747	
Mfg. Number:	3-1868	Barometric Pressure (mbar):	984	
Tester:	CCL	Ambient Temp. (°C):	21.1	
Date:	10/29/93	Water Temp. (°C):	20.5	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 9785				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	9767	0.42156	0.01194	
3 ft. (1.3005 psi)	9730	1.2881	0.0124	37
5 ft. (2.1675 psi)	9693	2.15464	0.01286	37
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02125	
Serial Number:	23123	Thermal Factor (K):	-0.02762	
Mfg. Number:	3-1870	Barometric Pressure (mbar):	985.8	
Tester:	CCL	Ambient Temp. (°C):	21.2	
Date:	10/29/93	Water Temp. (°C):	20.5	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 9413				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	9393	0.425	0.0085	
3 ft. (1.3005 psi)	9353	1.275	0.0255	40
5 ft. (2.1675 psi)	9312	2.14625	0.02125	41
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02145	
Serial Number:	23124	Thermal Factor (K):	-0.04075	
Mfg. Number:	3-1871	Barometric Pressure (mbar):	985.8	
Tester:	CCL	Ambient Temp. (°C):	21.2	
Date:	10/29/93	Water Temp. (°C):	20.5	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 9295				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	9276	0.40755	0.02595	
3 ft. (1.3005 psi)	9236	1.26555	0.03495	40
5 ft. (2.1675 psi)	9196	2.12355	0.04395	40
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.0199	
Serial Number:	23125	Thermal Factor (K):	-0.02587	
Mfg. Number:	3-1872	Barometric Pressure (mbar):	984	
Tester:	CCL	Ambient Temp. (°C):	21.1	
Date:	10/29/93	Water Temp. (°C):	20.5	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 9001				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	8979	0.4378	-0.0043	
3 ft. (1.3005 psi)	8936	1.2935	0.007	43
5 ft. (2.1675 psi)	8892	2.1691	-0.0016	44
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02324	
Serial Number:	23126	Thermal Factor (K):	-0.02789	
Mfg. Number:	3-1875	Barometric Pressure (mbar):	984	
Tester:	CCL	Ambient Temp. (°C):	21.1	
Date:	10/29/93	Water Temp. (°C):	20.5	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 9097				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	9080	0.39508	0.03842	
3 ft. (1.3005 psi)	9043	1.25496	0.04554	37
5 ft. (2.1675 psi)	9005	2.13808	0.02942	38
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION

Pressure Range:	0-100 psi	Calibration Factor (C):	0.02345
Serial Number:	23127	Thermal Factor (K):	-0.02345
Mfg. Number:	3-1877	Barometric Pressure (mbar):	984
Tester:	CCL	Ambient Temp. (°C):	21.1
Date:	10/29/93	Water Temp. (°C):	20.5

Testing with the Model GK-401 Vibrating Wire Readout Box

Zero Reading (Position "B") (R0): 8789

Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	8772	0.39865	0.03485	
3 ft. (1.3005 psi)	8736	1.24285	0.05765	36
5 ft. (2.1675 psi)	8699	2.1105	0.057	37

$$\text{Calculated Pressure} = C \cdot (R0 - R1)$$

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02045	
Serial Number:	23128	Thermal Factor (K):	-0.03	
Mfg. Number:	3-1878	Barometric Pressure (mbar):	984	
Tester:	CCL	Ambient Temp. (°C):	21.1	
Date:	10/29/93	Water Temp. (°C):	20.5	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 8883				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	8864	0.39	0.05	
3 ft. (1.3005 psi)	8822	1.25	0.05	42.00
5 ft. (2.1675 psi)	8780	2.11	0.06	42.00
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02261	
Serial Number:	23129	Thermal Factor (K):	-0.01	
Mfg. Number:	3-1879	Barometric Pressure (mbar):	984	
Tester:	CCL	Ambient Temp. (°C):	21.1	
Date:	10/29/93	Water Temp. (°C):	20.5	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 8688				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	8670	0.41	0.03	
3 ft. (1.3005 psi)	8634	1.22	0.08	36.00
5 ft. (2.1675 psi)	8595	2.10	0.06	39.00
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02756	
Serial Number:	23130	Thermal Factor (K):	-0.02	
Mfg. Number:	3-1882	Barometric Pressure (mbar):	984	
Tester:	CCL	Ambient Temp. (°C):	21.1	
Date:	10/29/93	Water Temp. (°C):	20.5	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 9564				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	9549	0.41	0.02	
3 ft. (1.3005 psi)	9518	1.27	0.03	31.00
5 ft. (2.1675 psi)	9487	2.12	0.05	31.00
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02092	
Serial Number:	23131	Thermal Factor (K):	-0.02	
Mfg. Number:	3-1883	Barometric Pressure (mbar):	985.8	
Tester:	CCL	Ambient Temp. (°C):	21.2	
Date:	10/29/93	Water Temp. (°C):	20.5	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 8994				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	8976	0.38	0.06	
3 ft. (1.3005 psi)	8935	1.23	0.07	41.00
5 ft. (2.1675 psi)	8894	2.09	0.08	41.00
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02442	
Serial Number:	23132	Thermal Factor (K):	-0.02	
Mfg. Number:	3-1884	Barometric Pressure (mbar):	984	
Tester:	CCL	Ambient Temp. (°C):	21.1	
Date:	10/29/93	Water Temp. (°C):	20.5	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 8929				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	8912	0.42	0.02	
3 ft. (1.3005 psi)	8878	1.25	0.06	34.00
5 ft. (2.1675 psi)	8842	2.12	0.04	36.00
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.027	
Serial Number:	23133	Thermal Factor (K):	-00135	
Mfg. Number:	3-1885	Barometric Pressure (mbar):	984	
Tester:	CCL	Ambient Temp. (°C):	21.1	
Date:	11/1/93	Water Temp. (°C):	20.5	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 8833				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	8818	0.41	0.03	
3 ft. (1.3005 psi)	8790	1.16	0.14	28.00
5 ft. (2.1675 psi)	8759	2.00	0.17	31.00
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02289	
Serial Number:	23134	Thermal Factor (K):	-0.02	
Mfg. Number:	3-1886	Barometric Pressure (mbar):	984	
Tester:	CCL	Ambient Temp. (°C):	21.1	
Date:	10/29/93	Water Temp. (°C):	20.5	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 8679				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	8660	0.43	0.00	
3 ft. (1.3005 psi)	8623	1.28	0.02	37.00
5 ft. (2.1675 psi)	8586	2.13	0.04	37.00
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02199	
Serial Number:	23135	Thermal Factor (K):	-0.03	
Mfg. Number:	3-1889	Barometric Pressure (mbar):	984	
Tester:	CCL	Ambient Temp. (°C):	21.1	
Date:	10/29/93	Water Temp. (°C):	20.5	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 8950				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	8932	0.40	0.04	
3 ft. (1.3005 psi)	8893	1.25	0.05	39.00
5 ft. (2.1675 psi)	8854	2.11	0.06	39.00
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02333	
Serial Number:	23136	Thermal Factor (K):	-0.03	
Mfg. Number:	3-1891	Barometric Pressure (mbar):	984	
Tester:	CCL	Ambient Temp. (°C):	21.1	
Date:	10/29/93	Water Temp. (°C):	20.5	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 9413				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	9396	0.40	0.04	
3 ft. (1.3005 psi)	9360	1.24	0.06	36.00
5 ft. (2.1675 psi)	9323	2.10	0.07	37.00
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02518	
Serial Number:	23137	Thermal Factor (K):	-0.03	
Mfg. Number:	3-1892	Barometric Pressure (mbar):	984	
Tester:	CCL	Ambient Temp. (°C):	21.6	
Date:	11/29/93	Water Temp. (°C):	20.4	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 8995				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	8980	0.38	0.06	
3 ft. (1.3005 psi)	8948	1.18	0.12	32.00
5 ft. (2.1675 psi)	8913	2.06	0.10	35.00
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02084	
Serial Number:	23138	Thermal Factor (K):	0.00	
Mfg. Number:	3-1893	Barometric Pressure (mbar):	999.7	
Tester:	CCL	Ambient Temp. (°C):	21	
Date:	11/1/93	Water Temp. (°C):	20.2	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 8494				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	8476	0.38	0.06	
3 ft. (1.3005 psi)	8435	1.23	0.07	41.00
5 ft. (2.1675 psi)	8395	2.06	0.10	40.00
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02025	
Serial Number:	23139	Thermal Factor (K):	-0.01	
Mfg. Number:	3-1895	Barometric Pressure (mbar):	999.7	
Tester:	CCL	Ambient Temp. (°C):	21	
Date:	11/1/93	Water Temp. (°C):	20.2	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 8858				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	8840	0.36	0.07	
3 ft. (1.3005 psi)	8797	1.24	0.07	43.00
5 ft. (2.1675 psi)	8755	2.09	0.08	42.00
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02545	
Serial Number:	23140	Thermal Factor (K):	-0.01	
Mfg. Number:	3-1896	Barometric Pressure (mbar):	999.7	
Tester:	CCL	Ambient Temp. (°C):	21	
Date:	11/1/93	Water Temp. (°C):	20.2	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 9279				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	9263	0.41	0.03	
3 ft. (1.3005 psi)	9230	1.25	0.05	33.00
5 ft. (2.1675 psi)	9197	2.09	0.08	33.00
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02333	
Serial Number:	23141	Thermal Factor (K):	-0.02	
Mfg. Number:	3-1897	Barometric Pressure (mbar):	999.7	
Tester:	CCL	Ambient Temp. (°C):	21	
Date:	11/1/93	Water Temp. (°C):	20.2	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 8387				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	8370	0.40	0.04	
3 ft. (1.3005 psi)	8334	1.24	0.06	36.00
5 ft. (2.1675 psi)	8296	2.12	0.04	38.00
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.0237	
Serial Number:	23142	Thermal Factor (K):	-0.02	
Mfg. Number:	3-1898	Barometric Pressure (mbar):	999.7	
Tester:	CCL	Ambient Temp. (°C):	21	
Date:	11/1/93	Water Temp. (°C):	20.2	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 9005				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	8989	0.38	0.05	
3 ft. (1.3005 psi)	8953	1.23	0.07	36.00
5 ft. (2.1675 psi)	8916	2.11	0.06	37.00
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02149	
Serial Number:	23143	Thermal Factor (K):	-0.02	
Mfg. Number:	3-1889	Barometric Pressure (mbar):	999.7	
Tester:	CCL	Ambient Temp. (°C):	21.6	
Date:	11/29/93	Water Temp. (°C):	20.4	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 8646				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	8627	0.41	0.03	
3 ft. (1.3005 psi)	8587	1.27	0.03	40.00
5 ft. (2.1675 psi)	8546	2.15	0.02	41.00
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02299	
Serial Number:	23144	Thermal Factor (K):	-0.02	
Mfg. Number:	3-1900	Barometric Pressure (mbar):	999.7	
Tester:	CCL	Ambient Temp. (°C):	21	
Date:	11/1/93	Water Temp. (°C):	20.2	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 8766				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	8750	0.37	0.07	
3 ft. (1.3005 psi)	8712	1.24	0.06	38.00
5 ft. (2.1675 psi)	8674	2.12	0.05	38.00
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02226	
Serial Number:	23145	Thermal Factor (K):	-0.02449	
Mfg. Number:	3-1901	Barometric Pressure (mbar):	999.7	
Tester:	CCL	Ambient Temp (°C):	21.6	
Date:	11/29/93	Water Temp. (°C):	20.4	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 8881				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	8865	0.36	0.08	
3 ft. (1.3005 psi)	8826	1.22	0.08	39.00
5 ft. (2.1675 psi)	8787	2.09	0.08	39.00
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02041	
Serial Number:	23146	Thermal Factor (K):	0.02041	
Mfg. Number:	3-1902	Barometric Pressure (mbar):	999.7	
Tester:	CCL	Ambient Temp. (°C):	21.6	
Date:	11/29/93	Water Temp. (°C):	20.4	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 9203				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	9184	0.39	0.05	
3 ft. (1.3005 psi)	9143	1.22	0.08	41.00
5 ft. (2.1675 psi)	9101	2.08	0.09	42.00
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02284	
Serial Number:	23147	Thermal Factor (K):	-0.03	
Mfg. Number:	3-1903	Barometric Pressure (mbar):	999.7	
Tester:	CCL	Ambient Temp. (°C):	21	
Date:	11/1/93	Water Temp. (°C):	20.2	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 9064				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	9045	0.43	0.00	
3 ft. (1.3005 psi)	9009	1.26	0.04	36.00
5 ft. (2.1675 psi)	8971	2.12	0.04	38.00
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02461	
Serial Number:	23148	Thermal Factor (K):	-0.02	
Mfg. Number:	3-1904	Barometric Pressure (mbar):	1002	
Tester:	CCL	Ambient Temp. (°C):	21	
Date:	11/16/93	Water Temp. (°C):	20.7	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 8744				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	8729	0.37	0.06	
3 ft. (1.3005 psi)	8696	1.18	0.12	33.00
5 ft. (2.1675 psi)	8660	2.07	0.10	36.00
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02315	
Serial Number:	23149	Thermal Factor (K):	-0.02	
Mfg. Number:	3-1905	Barometric Pressure (mbar):	999.7	
Tester:	CCL	Ambient Temp. (°C):	21	
Date:	11/1/93	Water Temp. (°C):	20.2	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 8761				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	8743	0.42	0.02	
3 ft. (1.3005 psi)	8706	1.27	0.03	37.00
5 ft. (2.1675 psi)	8668	2.15	0.01	38.00
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02577	
Serial Number:	23150	Thermal Factor (K):	0.02319	
Mfg. Number:	3-1906	Barometric Pressure (mbar):	999.7	
Tester:	CCL	Ambient Temp. (°C):	21	
Date:	11/1/93	Water Temp. (°C):	20.2	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 9919				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	9904	0.39	0.05	
3 ft. (1.3005 psi)	9871	1.24	0.06	33.00
5 ft. (2.1675 psi)	9836	2.14	0.03	35.00
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02188	
Serial Number:	23151	Thermal Factor (K):	-0.03	
Mfg. Number:	3-1359	Barometric Pressure (mbar):	999.7	
Tester:	CCL	Ambient Temp. (°C):	21	
Date:	11/1/93	Water Temp. (°C):	20.2	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 9038				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	9020	0.39	0.04	
3 ft. (1.3005 psi)	8980	1.27	0.03	40.00
5 ft. (2.1675 psi)	8940	2.14	0.02	40.00
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02171	
Serial Number:	23152	Thermal Factor (K):	-0.03	
Mfg. Number:	3-1636	Barometric Pressure (mbar):	999.7	
Tester:	CCL	Ambient Temp. (°C):	21	
Date:	11/1/93	Water Temp. (°C):	20.2	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 9150				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	9133	0.37	0.06	
3 ft. (1.3005 psi)	9094	1.22	0.08	39.00
5 ft. (2.1675 psi)	9052	2.13	0.04	42.00
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-100 psi	Calibration Factor (C):	0.02271	
Serial Number:	23153	Thermal Factor (K):	-0.03	
Mfg. Number:	3-1637	Barometric Pressure (mbar):	999.7	
Tester:	CCL	Ambient Temp. (°C):	21	
Date:	11/1/93	Water Temp. (°C):	20.2	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 9390				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	9373	0.39	0.05	
3 ft. (1.3005 psi)	9335	1.25	0.05	38.00
5 ft. (2.1675 psi)	9296	2.13	0.03	39.00
Calculated Pressure = C*(R0-R1)				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-5 psi	Calibration Factor (C):	0.00154	
Serial Number:	22811	Thermal Factor (K):	-0.01	
Mfg. Number:	2-1784	Barometric Pressure (mbar):	1005	
Tester:	CCL	Ambient Temp. (°C):	21.4	
Date:	12/01/93	Water Temp. (°C):	20.3	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "F") (R0): 15523				
Depth of Water	Reading Position "F" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	15305	0.33572	0.10	
3 ft. (1.3005 psi)	14744	1.19966	0.10	561.00
5 ft. (2.1675 psi)	14,196.00	2.04	0.12	548.00
Calculated Pressure = C*(R0-R1)				
Comment: These readings were taken at Position "F"; all other probes were read at Position "B".				
In Position "B", this probe read 00000 at a depth of 3 ft.				

GEOKON MODEL 4500S PRESSURE TRANSDUCER CALIBRATION				
Pressure Range:	0-5 psi	Calibration Factor (C):	0.00148	
Serial Number:	22812	Thermal Factor (K):	0.00	
Mfg. Number:	2-1786	Barometric Pressure (mbar):	1005	
Tester:	CCL	Ambient Temp. (°C):	21.4	
Date:	12/01/93	Water Temp. (°C):	20.3	
Testing with the Model GK-401 Vibrating Wire Readout Box				
Zero Reading (Position "B") (R0): 16282				
Depth of Water	Reading Position "B" (R1)	Calculated Pressure (Psi)	Difference = Actual - Calculated (Psi)	Change in R1
1 ft. (0.4335 psi)	16061	0.33	0.11	
3 ft. (1.3005 psi)	15472	1.20	0.10	589.00
5 ft. (2.1675 psi)	14886	2.07	0.10	586.00
Calculated Pressure = C*(R0-R1)				

MP 1-1-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 2/1/94-2/2/94

Test Executor: Cathy Leser

Test Plan Section: 2.1.2 Pressure Transducers

Results: All pressure transducers were tested for response and results were recorded on the following sheet.

Test Recorder: Dana Dominiak DD-man

Date: 5-1-94

MP 1-1-1

GEOKON 4500S PRESSURE TRANSDUCER RESPONSE TESTING AT SANDIA NATIONAL LABORATORY						
Serial No.	Calibration Factor (C)	Reading @ Depth of 1ft (R1)	Zero Reading (R0)	Calculated Pressure (psi)	Difference = Theoretical-Calculated (psi)	Date Tested
23099	0.02055	8700	8718	0.3699	0.0636	2/1/94
23100	0.02224	8929	8955	0.5782	-0.1447	2/1/94
23101	0.02714	8748	8769	0.5699	-0.1364	2/1/94
23102	0.02312	9099	9120	0.4855	-0.052	2/2/94
23103	0.0209	8635	8660	0.5225	-0.089	2/2/94
23104	0.02184	9031	9056	0.546	-0.1125	2/2/94
23105	0.02278	9461	9484	0.5239	-0.0904	2/2/94
23106	0.02689	9359	9378	0.5109	-0.0774	2/2/94
23107	0.02332	9315	9335	0.4664	-0.0329	2/2/94
23108	0.02084	9455	9481	0.5418	-0.1083	2/2/94
23109	0.0191	8453	8480	0.5157	-0.0822	2/2/94
23110	0.02068	8123	8147	0.4963	-0.0628	2/2/94
23111	0.02338	8859	8882	0.5377	-0.1042	2/2/94
23112	0.02211	9506	9530	0.5306	-0.0971	2/2/94
23113	0.02392	8008	8030	0.5262	-0.0927	2/2/94
23114	0.02114	9141	9165	0.5074	-0.0739	2/2/94
23115	0.02234	8733	8755	0.5148	-0.0813	2/2/94
23116	0.02446	8968	8989	0.5137	-0.0802	2/2/94
23117	0.02205	8759	8781	0.4851	-0.0516	2/2/94
23118	0.02225	8707	8729	0.4895	-0.056	2/2/94
23119	0.02397	9486	9507	0.5034	-0.0699	2/2/94
23120	0.02221	8718	8743	0.5553	-0.1218	2/2/94
23121	0.02294	8506	8529	0.5276	-0.0941	2/2/94
23122	0.02342	9777	9800	0.5387	-0.1052	2/2/94
23123	0.02125	9395	9420	0.5313	-0.0978	2/2/94
23124	0.02145	9284	9310	0.5577	-0.1242	2/2/94
23125	0.0199	8981	9009	0.5572	-0.1237	2/2/94
23126	0.02324	9085	9106	0.488	-0.0545	2/2/94
23127	0.02345	8774	8795	0.4925	-0.059	2/2/94
23128	0.02045	8867	8896	0.5931	-0.1596	2/2/94
23129	0.02261	8667	8692	0.5653	-0.1318	2/2/94
23130	0.02756	9550	9569	0.5236	-0.0901	2/2/94
23131	0.02092	8976	9001	0.523	-0.0895	2/2/94
23132	0.02442	8913	8935	0.5372	-0.1037	2/2/94
23133	0.027	8814	8832	0.486	-0.0525	2/2/94
23134	0.02289	8659	8683	0.5494	-0.1159	2/2/94
23135	0.02199	8935	8952	0.3738	0.0597	2/2/94
23136	0.02333	9398	9422	0.5599	-0.1264	2/2/94

MP 1-1-1

GEOKON 4500S PRESSURE TRANSDUCER RESPONSE TESTING AT SANDIA NATIONAL LABORATORY (CONT.)						
Serial No.	Calibration Factor (C)	Reading @ Depth of 1ft (R1)	Zero Reading (R0)	Calculated Pressure (psi)	Difference = Theoretical-Calculated (psi)	Date Tested
23137	0.02518	8985	9003	0.4532	-0.0197	2/2/94
23138	0.02084	8476	8504	0.5835	-0.15	2/2/94
23139	0.02025	8844	8871	0.5468	-0.1133	2/2/94
23140	0.02545	9266	9288	0.5599	-0.1264	2/2/94
23141	0.02333	8379	8399	0.4666	-0.0331	2/2/94
23142	0.0237	8994	9017	0.5451	-0.1116	2/2/94
23143	0.02149	8634	8659	0.5373	-0.1038	2/2/94
23144	0.02299	8761	8781	0.4598	-0.0263	2/2/94
23145	0.02226	8871	8893	0.4897	-0.0562	2/2/94
23146	0.02041	9169	9190	0.4286	0.0049	2/2/94
23147	0.02284	9057	9081	0.5482	-0.1147	2/2/94
23148	0.02461	8739	8759	0.4922	-0.0587	2/2/94
23149	0.02315	8750	8772	0.5093	-0.0758	2/2/94
23150	0.02577	9893	9915	0.5669	-0.1334	2/2/94
23151	0.02188	9031	9054	0.5032	-0.0697	2/2/94
23152	0.02171	9141	9168	0.5862	-0.1527	2/2/94
23153	Remained at ANL					
22811	0.00154	15352	15603	0.3365	0.097	2/2/94
22812	0.00148	16099	16360	0.3863	0.0472	2/2/94

Theoretical pressure at depth of 1 foot = 0.4335 psi
Calculated pressure = C*(R0 - R1)

MA 2-1-(1-55)

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 10/21/93-11/1/93

Test Executor: Cathy Leser

Test Plan Section: 2.2.1 Temperature Probes

Results: All temperature probes were calibrated and recorded on the following calibration sheets.

Test Recorder: Dana Dominiak _____

Date: 5/1/94

YSI 44018 THERMISTOR CALIBRATION					
Number: 1		Tester: CCL			
Date: 10/21/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
6.9	814				
30.3	1430				
A. Multiplier					
	Max. Temp. (°C)	30.3		Max. Vout (mV)	1430
	Min. Temp. (°C)	6.9		Min. Vout (mV)	814
	Temp. Range (°C)	23.4		Vout Range (mV)	616
	Multiplier = Temp. Range/Vout Range (°C/mV)			0.03799	
B. Offset					
	Min. Vout * Multiplier (°C)		30.92143	(A)	
	Max. Vout * Multiplier (°C)		54.32143	(B)	
	Offset = (A) - Min. Temp. (°C)		24.02143		
	Offset = (B) - Max. Temp. (°C)		24.02143		
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp.(°C)		
20.3	1170	20.4	-0.1		

YSI 44018 THERMISTOR CALIBRATION					
Number: 2		Tester: CCL			
Date: 10/21/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout				
	(millivolts)				
6.9	816				
30.3	1430.5				
A. Multiplier					
	Max. Temp. (°C)	30.3		Max. Vout (mV)	1430.5
	Min. Temp. (°C)	6.9		Min. Vout (mV)	816
	Temp. Range (°C)	23.4		Vout Range (mV)	614.5
	Multiplier = Temp. Range/Vout Range (°C/mV)			0.03808	
B. Offset					
	Min. Vout * Multiplier (°C)		31.07307	(A)	
	Max. Vout * Multiplier (°C)		54.47307	(B)	
	Offset = (A) - Min. Temp. (°C)		24.17307		
	Offset = (B) - Max. Temp. (°C)		24.17307		
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
	(millivolts)				
20.3	1171	20.4	-0.1		

YSI 44018 THERMISTOR CALIBRATION				
Number: 3		Tester: CCL		
Date: 10/21/93		Comments:		
I. Determination of Multiplier and Offset				
Water Bath Temperature (°C)	Vout (millivolts)			
7	817.5			
29.8	1417			
A. Multiplier				
	Max. Temp. (°C)	29.8	Max. Vout (mV)	1417
	Min. Temp. (°C)	7	Min. Vout (mV)	817.5
	Temp. Range (°C)	22.8	Vout Range (mV)	599.5
	Multiplier = Temp. Range/Vout Range (°C/mV)		0.03803	
B. Offset				
	Min. Vout * Multiplier (°C)		31.09091	(A)
	Max. Vout * Multiplier (°C)		53.89091	(B)
	Offset = (A) - Min. Temp. (°C)		24.09091	
	Offset = (B) - Max. Temp. (°C)		24.09091	
II. Check of Calibration Accuracy				
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)	
20.3	1171	20.4	-0.1	

YSI 44018 THERMISTOR CALIBRATION					
Number: 4		Tester: CCL			
Date: 10/21/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
7	816				
29.8	1418				
A. Multiplier					
	Max. Temp. (°C)	29.8		Max. Vout (mV)	1418
	Min. Temp. (°C)	7		Min. Vout (mV)	816
	Temp. Range (°C)	22.8		Vout Range (mV)	602
		Multiplier = Temp. Range/Vout Range (°C/mV)		0.03787	
B. Offset					
		Min. Vout * Multiplier (°C)		30.90498 (A)	
		Max. Vout * Multiplier (°C)		53.70498 (B)	
		Offset = (A) - Min. Temp. (°C)		23.90498	
		Offset = (B) - Max. Temp. (°C)		23.90498	
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.3	1171	20.4	-0.1		

YSI 44018 THERMISTOR CALIBRATION					
Number: 5		Tester: CCL			
Date: 10/21/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
7.25	822.5				
29.4	1407.5				
A. Multiplier					
	Max. Temp. (°C)	29.4		Max. Vout (mV)	1407.5
	Min. Temp. (°C)	7.25		Min. Vout (mV)	822.5
	Temp. Range (°C)	22.15		Vout Range (mV)	585
	Multiplier = Temp. Range/Vout Range (°C/mV)			0.03786	
B. Offset					
	Min. Vout * Multiplier (°C)		31.14252	(A)	
	Max. Vout * Multiplier (°C)		53.29252	(B)	
	Offset = (A) - Min. Temp. (°C)		23.89252		
	Offset = (B) - Max. Temp. (°C)		23.89252		
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.3	1171	20.4	-0.1		

YSI 44018 THERMISTOR CALIBRATION				
Number: 6		Tester: CCL		
Date: 10/21/93		Comments:		
I. Determination of Multiplier and Offset				
Water Bath Temperature (°C)	Vout (millivolts)			
7.25	820.5			
29.4	1404			
A. Multiplier				
	Max. Temp. (°C)	29.4	Max. Vout (mV)	1404
	Min. Temp. (°C)	7.25	Min. Vout (mV)	820.5
	Temp. Range (°C)	22.15	Vout Range (mV)	583.5
	Multiplier = Temp. Range/Vout Range (°C/mV)		0.03796	
B. Offset				
	Min. Vout * Multiplier (°C)		31.14666	(A)
	Max. Vout * Multiplier (°C)		53.29666	(B)
	Offset = (A) - Min. Temp. (°C)		23.89666	
	Offset = (B) - Max. Temp. (°C)		23.89666	
II. Check of Calibration Accuracy				
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)	
20.3	1170	20.5	-0.2	

YSI 44018 THERMISTOR CALIBRATION					
Number: 7		Tester: CCL			
Date: 10/22/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
6.2	792				
29.6	1412				
A. Multiplier					
	Max. Temp. (°C)	29.6		Max. Vout (mV)	1412
	Min. Temp. (°C)	6.2		Min. Vout (mV)	792
	Temp. Range (°C)	23.4		Vout Range (mV)	620
	Multiplier = Temp. Range/Vout Range (°C/mV)			0.03774	
B. Offset					
	Min. Vout * Multiplier (°C)		29.89161	(A)	
	Max. Vout * Multiplier (°C)		53.29161	(B)	
	Offset = (A) - Min. Temp. (°C)		23.69161		
	Offset = (B) - Max. Temp. (°C)		23.69161		
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.3	1171	20.5	-0.2		

YSI 44018 THERMISTOR CALIBRATION				
Number: 8		Tester: CCL		
Date: 10/22/93		Comments:		
I. Determination of Multiplier and Offset				
Water Bath Temperature (°C)	Vout (millivolts)			
6.2	793			
29.6	1413			
A. Multiplier				
	Max. Temp. (°C)	29.6	Max. Vout (mV)	1413
	Min. Temp. (°C)	6.2	Min. Vout (mV)	793
	Temp. Range (°C)	23.4	Vout Range (mV)	620
	Multiplier = Temp. Range/Vout Range (°C/mV)		0.03774	
B. Offset				
	Min. Vout * Multiplier (°C)		29.92935 (A)	
	Max. Vout * Multiplier (°C)		53.32935 (B)	
	Offset = (A) - Min. Temp. (°C)		23.72935	
	Offset = (B) - Max. Temp. (°C)		23.72935	
II. Check of Calibration Accuracy				
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)	
20.3	1171	20.4	-0.1	

YSI 44018 THERMISTOR CALIBRATION					
Number: 9		Tester: CCL			
Date: 10/22/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
6.3	805				
29.2	1405				
A. Multiplier					
	Max. Temp. (°C)	29.2		Max. Vout (mV)	1405
	Min. Temp. (°C)	6.3		Min. Vout (mV)	805
	Temp. Range (°C)	22.9		Vout Range (mV)	600
	Multiplier = Temp. Range/Vout Range (°C/mV)			0.03817	
B. Offset					
	Min. Vout * Multiplier (°C)		30.72417	(A)	
	Max. Vout * Multiplier (°C)		53.62417	(B)	
	Offset = (A) - Min. Temp. (°C)		24.42417		
	Offset = (B) - Max. Temp. (°C)		24.42417		
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.3	1172	20.3	0		

YSI 44018 THERMISTOR CALIBRATION					
Number: 10		Tester: CCL			
Date: 10/22/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
6.3	805				
29.2	1405				
A. Multiplier					
	Max. Temp. (°C)	29.2		Max. Vout (mV)	1405
	Min. Temp. (°C)	6.3		Min. Vout (mV)	805
	Temp. Range (°C)	22.9		Vout Range (mV)	600
	Multiplier = Temp. Range/Vout Range (°C/mV)			0.03817	
B. Offset					
	Min. Vout * Multiplier (°C)		30.72417	(A)	
	Max. Vout * Multiplier (°C)		53.62417	(B)	
	Offset = (A) - Min. Temp. (°C)		24.42417		
	Offset = (B) - Max. Temp. (°C)		24.42417		
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.3	1172	20.3	0		

YSI 44018 THERMISTOR CALIBRATION					
Number: 11		Tester: CCL			
Date: 10/22/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)		Vout (millivolts)			
6.5		810			
28.8		1392			
A. Multiplier					
Max. Temp. (°C)		28.8		Max. Vout (mV)	1392
Min. Temp. (°C)		6.5		Min. Vout (mV)	810
Temp. Range (°C)		22.3		Vout Range (mV)	582
Multiplier = Temp. Range/Vout Range (°C/mV)				0.03832	
B. Offset					
Min. Vout * Multiplier (°C)		31.03608		(A)	
Max. Vout * Multiplier (°C)		53.33608		(B)	
Offset = (A) - Min. Temp. (°C)		24.53608			
Offset = (B) - Max. Temp. (°C)		24.53608			
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)		Reading Vout (millivolts)		Datalogger Temp. (°C)	
20.3		1171		20.3	
				Water Bath - Datalogger Temp. (°C)	
				0	

YSI 44018 THERMISTOR CALIBRATION					
Number: 12		Tester: CCL			
Date: 10/22/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
6.5	807				
28.8	1392				
A. Multiplier					
	Max. Temp. (°C)	28.8		Max. Vout (mV)	1392
	Min. Temp. (°C)	6.5		Min. Vout (mV)	807
	Temp. Range (°C)	22.3		Vout Range (mV)	585
	Multiplier = Temp. Range/Vout Range (°C/mV)			0.03812	
B. Offset					
	Min. Vout * Multiplier (°C)		30.76256	(A)	
	Max. Vout * Multiplier (°C)		53.06256	(B)	
	Offset = (A) - Min. Temp. (°C)		24.26256		
	Offset = (B) - Max. Temp. (°C)		24.26256		
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.3	1171.5	20.4	-0.1		

YSI 44018 THERMISTOR CALIBRATION				
Number: 13		Tester: CCL		
Date: 10/22/93		Comments:		
I. Determination of Multiplier and Offset				
Water Bath Temperature (°C)	Vout (millivolts)			
6.9	815			
29.2	1403			
A. Multiplier				
	Max. Temp. (°C)	29.2	Max. Vout (mV)	1403
	Min. Temp. (°C)	6.9	Min. Vout (mV)	815
	Temp. Range (°C)	22.3	Vout Range (mV)	588
	Multiplier = Temp. Range/Vout Range (°C/mV)		0.03793	
B. Offset				
	Min. Vout * Multiplier (°C)		30.90901 (A)	
	Max. Vout * Multiplier (°C)		53.20901 (B)	
	Offset = (A) - Min. Temp. (°C)		24.00901	
	Offset = (B) - Max. Temp. (°C)		24.00901	
II. Check of Calibration Accuracy				
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)	
20.3	1170.5	20.3	0	

YSI 44018 THERMISTOR CALIBRATION				
Number: 14		Tester: CCL		
Date: 10/22/93		Comments:		
I. Determination of Multiplier and Offset				
Water Bath Temperature (°C)	Vout (millivolts)			
6.9	814			
29.2	1404			
A. Multiplier				
	Max. Temp. (°C)	29.2	Max. Vout (mV)	1404
	Min. Temp. (°C)	6.9	Min. Vout (mV)	814
	Temp. Range (°C)	22.3	Vout Range (mV)	590
		Multiplier = Temp. Range/Vout Range (°C/mV)		0.03780
B. Offset				
		Min. Vout * Multiplier (°C)		30.76644 (A)
		Max. Vout * Multiplier (°C)		53.06644 (B)
		Offset = (A) - Min. Temp. (°C)		23.86644
		Offset = (B) - Max. Temp. (°C)		23.86644
II. Check of Calibration Accuracy				
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)	
20.3	1171	20.4	-0.1	

YSI 44018 THERMISTOR CALIBRATION					
Number: 15		Tester: CCL			
Date: 10/22/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
7.8	838				
29.8	1418				
A. Multiplier					
	Max. Temp. (°C)	29.8		Max. Vout (mV)	1418
	Min. Temp. (°C)	7.8		Min. Vout (mV)	838
	Temp. Range (°C)	22		Vout Range (mV)	580
Multiplier = Temp. Range/Vout Range (°C/mV)				0.03793	
B. Offset					
Min. Vout * Multiplier (°C)		31.78621	(A)		
Max. Vout * Multiplier (°C)		53.78621	(B)		
Offset = (A) - Min. Temp. (°C)		23.98621			
Offset = (B) - Max. Temp. (°C)		23.98621			
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.3	1171	20.4	-0.1		

YSI 44018 THERMISTOR CALIBRATION					
Number: 16		Tester: CCL			
Date: 10/22/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
7.8	837				
29.8	1417				
A. Multiplier					
	Max. Temp. (°C)	29.8		Max. Vout (mV)	1417
	Min. Temp. (°C)	7.8		Min. Vout (mV)	837
	Temp. Range (°C)	22		Vout Range (mV)	580
Multiplier = Temp. Range/Vout Range (°C/mV)				0.03793	
B. Offset					
		Min. Vout * Multiplier (°C)		31.74828 (A)	
		Max. Vout * Multiplier (°C)		53.74828 (B)	
		Offset = (A) - Min. Temp. (°C)		23.94828	
		Offset = (B) - Max. Temp. (°C)		23.94828	
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.3	1171	20.4	-0.1		

YSI 44018 THERMISTOR CALIBRATION					
Number: 17		Tester: CCL			
Date: 10/22/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
5.5	781				
29.4	1407				
A. Multiplier					
	Max. Temp. (°C)	29.4		Max. Vout (mV)	1407
	Min. Temp. (°C)	5.5		Min. Vout (mV)	781
	Temp. Range (°C)	23.9		Vout Range (mV)	626
Multiplier = Temp. Range/Vout Range (°C/mV)				0.03818	
B. Offset					
Min. Vout * Multiplier (°C)		29.81773	(A)		
Max. Vout * Multiplier (°C)		53.71773	(B)		
Offset = (A) - Min. Temp. (°C)		24.31773			
Offset = (B) - Max. Temp. (°C)		24.31773			
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.3	1171	20.4	-0.1		

YSI 44018 THERMISTOR CALIBRATION					
Number: 18		Tester: CCL			
Date: 10/22/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
5.5	779				
29.4	1407.5				
A. Multiplier					
	Max. Temp. (°C)	29.4		Max. Vout (mV)	1407.5
	Min. Temp. (°C)	5.5		Min. Vout (mV)	779
	Temp. Range (°C)	23.9		Vout Range (mV)	628.5
	Multiplier = Temp. Range/Vout Range (°C/mV)			0.03803	
B. Offset					
	Min. Vout * Multiplier (°C)		29.62307	(A)	
	Max. Vout * Multiplier (°C)		53.52307	(B)	
	Offset = (A) - Min. Temp. (°C)		24.12307		
	Offset = (B) - Max. Temp. (°C)		24.12307		
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.3	1171	20.4	-0.1		

YSI 44018 THERMISTOR CALIBRATION					
Number: 19		Tester: CCL			
Date: 10/22/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
6.1	794				
29.2	1406				
A. Multiplier					
	Max. Temp. (°C)	29.2		Max. Vout (mV)	1406
	Min. Temp. (°C)	6.1		Min. Vout (mV)	794
	Temp. Range (°C)	23.1		Vout Range (mV)	612
	Multiplier = Temp. Range/Vout Range (°C/mV)			0.03775	
B. Offset					
	Min. Vout * Multiplier (°C)		29.96961	(A)	
	Max. Vout * Multiplier (°C)		53.06961	(B)	
	Offset = (A) - Min. Temp. (°C)		23.86961		
	Offset = (B) - Max. Temp. (°C)		23.86961		
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.3	1171	20.3	0		

YSI 44018 THERMISTOR CALIBRATION					
Number: 20		Tester: CCL			
Date: 10/22/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
6.1	794				
29.2	1410				
A. Multiplier					
	Max. Temp. (°C)	29.2		Max. Vout (mV)	1410
	Min. Temp. (°C)	6.1		Min. Vout (mV)	794
	Temp. Range (°C)	23.1		Vout Range (mV)	616
Multiplier = Temp. Range/Vout Range (°C/mV)				0.03750	
B. Offset					
Min. Vout * Multiplier (°C)		29.77500	(A)		
Max. Vout * Multiplier (°C)		52.87500	(B)		
Offset = (A) - Min. Temp. (°C)		23.67500			
Offset = (B) - Max. Temp. (°C)		23.67500			
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.3	1171	20.2	0.1		

YSI 44018 THERMISTOR CALIBRATION					
Number: 21		Tester: CCL			
Date: 10/22/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
5.9	792				
28.8	1391				
A. Multiplier					
	Max. Temp. (°C)	28.8		Max. Vout (mV)	1391
	Min. Temp. (°C)	5.9		Min. Vout (mV)	792
	Temp. Range (°C)	22.9		Vout Range (mV)	599
	Multiplier = Temp. Range/Vout Range (°C/mV)			0.03823	
B. Offset					
	Min. Vout * Multiplier (°C)		30.27846	(A)	
	Max. Vout * Multiplier (°C)		53.17846	(B)	
	Offset = (A) - Min. Temp. (°C)		24.37846		
	Offset = (B) - Max. Temp. (°C)		24.37846		
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.7	1183	20.8	-0.1		

YSI 44018 THERMISTOR CALIBRATION					
Number: 22		Tester: CCL			
Date: 10/21/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
5.9	792				
28.8	1392				
A. Multiplier					
	Max. Temp. (°C)	28.8		Max. Vout (mV)	1392
	Min. Temp. (°C)	5.9		Min. Vout (mV)	792
	Temp. Range (°C)	22.9		Vout Range (mV)	600
	Multiplier = Temp. Range/Vout Range (°C/mV)			0.03817	
B. Offset					
	Min. Vout * Multiplier (°C)		30.22800	(A)	
	Max. Vout * Multiplier (°C)		53.12800	(B)	
	Offset = (A) - Min. Temp. (°C)		24.32800		
	Offset = (B) - Max. Temp. (°C)		24.32800		
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.7	1183	20.8	-0.1		

YSI 44018 THERMISTOR CALIBRATION					
Number: 23		Tester: CCL			
Date: 10/22/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
6.2	795				
28.7	1387				
A. Multiplier					
	Max. Temp. (°C)	28.7		Max. Vout (mV)	1387
	Min. Temp. (°C)	6.2		Min. Vout (mV)	795
	Temp. Range (°C)	22.5		Vout Range (mV)	592
Multiplier = Temp. Range/Vout Range (°C/mV)				0.03801	
B. Offset					
Min. Vout * Multiplier (°C)		30.21537	(A)		
Max. Vout * Multiplier (°C)		52.71537	(B)		
Offset = (A) - Min. Temp. (°C)		24.01537			
Offset = (B) - Max. Temp. (°C)		24.01537			
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.8	1182.5	20.9	-0.1		

YSI 44018 THERMISTOR CALIBRATION					
Number: 24		Tester: CCL			
Date: 10/22/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
6.2	796				
28.7	1390				
A. Multiplier					
	Max. Temp. (°C)	28.7		Max. Vout (mV)	1390
	Min. Temp. (°C)	6.2		Min. Vout (mV)	796
	Temp. Range (°C)	22.5		Vout Range (mV)	594
Multiplier = Temp. Range/Vout Range (°C/mV)				0.03788	
B. Offset					
	Min. Vout * Multiplier (°C)		30.15152	(A)	
	Max. Vout * Multiplier (°C)		52.65152	(B)	
	Offset = (A) - Min. Temp. (°C)		23.95152		
	Offset = (B) - Max. Temp. (°C)		23.95152		
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.8	1185	20.9	-0.1		

YSI 44018 THERMISTOR CALIBRATION					
Number: 25		Tester: CCL			
Date: 10/22/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
6.8	811				
28.6	1387				
A. Multiplier					
	Max. Temp. (°C)	28.6		Max. Vout (mV)	1387
	Min. Temp. (°C)	6.8		Min. Vout (mV)	811
	Temp. Range (°C)	21.8		Vout Range (mV)	576
		Multiplier = Temp. Range/Vout Range (°C/mV)		0.03785	
B. Offset					
	Min. Vout * Multiplier (°C)		30.69410	(A)	
	Max. Vout * Multiplier (°C)		52.49410	(B)	
	Offset = (A) - Min. Temp. (°C)		23.89410		
	Offset = (B) - Max. Temp. (°C)		23.89410		
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.8	1184.5	20.9	-0.1		

YSI 44018 THERMISTOR CALIBRATION					
Number: 26		Tester: CCL			
Date: 10/22/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
6.8	812				
28.6	1388				
A. Multiplier					
	Max. Temp. (°C)	28.6		Max. Vout (mV)	1388
	Min. Temp. (°C)	6.8		Min. Vout (mV)	812
	Temp. Range (°C)	21.8		Vout Range (mV)	576
		Multiplier = Temp. Range/Vout Range (°C/mV)		0.03785	
B. Offset					
		Min. Vout * Multiplier (°C)		30.73194 (A)	
		Max. Vout * Multiplier (°C)		52.53194 (B)	
		Offset = (A) - Min. Temp. (°C)		23.93194	
		Offset = (B) - Max. Temp. (°C)		23.93194	
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.8	1185	20.9	-0.1		

YSI 44018 THERMISTOR CALIBRATION					
Number: 27		Tester: CCL			
Date: 10/22/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
7.1	820				
29	1408				
A. Multiplier					
	Max. Temp. (°C)	29		Max. Vout (mV)	1408
	Min. Temp. (°C)	7.1		Min. Vout (mV)	820
	Temp. Range (°C)	21.9		Vout Range (mV)	588
		Multiplier = Temp. Range/Vout Range (°C/mV)		0.03724	
B. Offset					
		Min. Vout * Multiplier (°C)		30.54082 (A)	
		Max. Vout * Multiplier (°C)		52.44082 (B)	
		Offset = (A) - Min. Temp. (°C)		23.44082	
		Offset = (B) - Max. Temp. (°C)		23.44082	
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.8	1184.5	20.7	0.1		

YSI 44018 THERMISTOR CALIBRATION					
Number: 28		Tester: CCL			
Date: 10/22/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
7.1	821				
29	1402				
A. Multiplier					
	Max. Temp. (°C)	29		Max. Vout (mV)	1402
	Min. Temp. (°C)	7.1		Min. Vout (mV)	821
	Temp. Range (°C)	21.9		Vout Range (mV)	581
	Multiplier = Temp. Range/Vout Range (°C/mV)			0.03769	
B. Offset					
	Min. Vout * Multiplier (°C)		30.94647	(A)	
	Max. Vout * Multiplier (°C)		52.84647	(B)	
	Offset = (A) - Min. Temp. (°C)		23.84647		
	Offset = (B) - Max. Temp. (°C)		23.84647		
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.8	1185	20.8	0		

YSI 44018 THERMISTOR CALIBRATION					
Number: 29		Tester: CCL			
Date: 10/22/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
7.9	840.5				
29.1	1401				
A. Multiplier					
	Max. Temp. (°C)	29.1		Max. Vout (mV)	1401
	Min. Temp. (°C)	7.9		Min. Vout (mV)	840.5
	Temp. Range (°C)	21.2		Vout Range (mV)	560.5
Multiplier = Temp. Range/Vout Range (°C/mV)				0.03782	
B. Offset					
Min. Vout * Multiplier (°C)		31.79054	(A)		
Max. Vout * Multiplier (°C)		52.99054	(B)		
Offset = (A) - Min. Temp. (°C)		23.89054			
Offset = (B) - Max. Temp. (°C)		23.89054			
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.8	1185	20.9	-0.1		

YSI 44018 THERMISTOR CALIBRATION					
Number: 30		Tester: CCL			
Date: 10/22/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
7.9	840				
29.1	1412				
A. Multiplier					
	Max. Temp. (°C)	29.1		Max. Vout (mV)	1412
	Min. Temp. (°C)	7.9		Min. Vout (mV)	840
	Temp. Range (°C)	21.2		Vout Range (mV)	572
Multiplier = Temp. Range/Vout Range (°C/mV)				0.03706	
B. Offset					
	Min. Vout * Multiplier (°C)		31.13287	(A)	
	Max. Vout * Multiplier (°C)		52.33287	(B)	
	Offset = (A) - Min. Temp. (°C)		23.23287		
	Offset = (B) - Max. Temp. (°C)		23.23287		
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.8	1184	20.6	0.2		

YSI 44018 THERMISTOR CALIBRATION					
Number: 31		Tester: CCL			
Date: 10/22/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
6.6	809				
29.1	1399				
A. Multiplier					
	Max. Temp. (°C)	29.1		Max. Vout (mV)	1399
	Min. Temp. (°C)	6.6		Min. Vout (mV)	809
	Temp. Range (°C)	22.5		Vout Range (mV)	590
	Multiplier = Temp. Range/Vout Range (°C/mV)			0.03814	
B. Offset					
	Min. Vout * Multiplier (°C)		30.85169	(A)	
	Max. Vout * Multiplier (°C)		53.35169	(B)	
	Offset = (A) - Min. Temp. (°C)		24.25169		
	Offset = (B) - Max. Temp. (°C)		24.25169		
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.8	1184	20.9	-0.1		

YSI 44018 THERMISTOR CALIBRATION					
Number: 32		Tester: CCL			
Date: 10/22/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
6.6	809				
29.1	1400				
A. Multiplier					
	Max. Temp. (°C)	29.1		Max. Vout (mV)	1400
	Min. Temp. (°C)	6.6		Min. Vout (mV)	809
	Temp. Range (°C)	22.5		Vout Range (mV)	591
Multiplier = Temp. Range/Vout Range (°C/mV)				0.03807	
B. Offset					
	Min. Vout * Multiplier (°C)		30.79949	(A)	
	Max. Vout * Multiplier (°C)		53.29949	(B)	
	Offset = (A) - Min. Temp. (°C)		24.19949		
	Offset = (B) - Max. Temp. (°C)		24.19949		
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.8	1184	20.85	-0.05		

YSI 44018 THERMISTOR CALIBRATION					
Number: 33		Tester: CCL			
Date: 10/22/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
7.3	827				
29.2	1404.5				
A. Multiplier					
	Max. Temp. (°C)	29.2		Max. Vout (mV)	1404.5
	Min. Temp. (°C)	7.3		Min. Vout (mV)	827
	Temp. Range (°C)	21.9		Vout Range (mV)	577.5
	Multiplier = Temp. Range/Vout Range (°C/mV)			0.03792	
B. Offset					
	Min. Vout * Multiplier (°C)		31.36156	(A)	
	Max. Vout * Multiplier (°C)		53.26156	(B)	
	Offset = (A) - Min. Temp. (°C)		24.06156		
	Offset = (B) - Max. Temp. (°C)		24.06156		
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.8	1186	20.9	-0.1		

YSI 44018 THERMISTOR CALIBRATION					
Number: 34		Tester: CCL			
Date: 10/21/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
7.3	823				
29.2	1402				
A. Multiplier					
	Max. Temp. (°C)	29.2		Max. Vout (mV)	1402
	Min. Temp. (°C)	7.3		Min. Vout (mV)	823
	Temp. Range (°C)	21.9		Vout Range (mV)	579
Multiplier = Temp. Range/Vout Range (°C/mV)				0.03782	
B. Offset					
	Min. Vout * Multiplier (°C)		31.12902	(A)	
	Max. Vout * Multiplier (°C)		53.02902	(B)	
	Offset = (A) - Min. Temp. (°C)		23.82902		
	Offset = (B) - Max. Temp. (°C)		23.82902		
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.8	1182	20.9	-0.1		

YSI 44018 THERMISTOR CALIBRATION					
Number: 35		Tester: CCL			
Date: 10/22/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
6.3	799				
29.1	1401.5				
A. Multiplier					
	Max. Temp. (°C)	29.1		Max. Vout (mV)	1401.5
	Min. Temp. (°C)	6.3		Min. Vout (mV)	799
	Temp. Range (°C)	22.8		Vout Range (mV)	602.5
Multiplier = Temp. Range/Vout Range (°C/mV)				0.03784	
B. Offset					
	Min. Vout * Multiplier (°C)		30.23602	(A)	
	Max. Vout * Multiplier (°C)		53.03602	(B)	
	Offset = (A) - Min. Temp. (°C)		23.93602		
	Offset = (B) - Max. Temp. (°C)		23.93602		
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.7	1184	20.8	-0.1		

YSI 44018 THERMISTOR CALIBRATION					
Number: 36		Tester: CCL			
Date: 10/22/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
6.3	802				
29.1	1400.5				
A. Multiplier					
	Max. Temp. (°C)	29.1		Max. Vout (mV)	1400.5
	Min. Temp. (°C)	6.3		Min. Vout (mV)	802
	Temp. Range (°C)	22.8		Vout Range (mV)	598.5
Multiplier = Temp. Range/Vout Range (°C/mV)				0.03810	
B. Offset					
	Min. Vout * Multiplier (°C)		30.55238	(A)	
	Max. Vout * Multiplier (°C)		53.35238	(B)	
	Offset = (A) - Min. Temp. (°C)		24.25238		
	Offset = (B) - Max. Temp. (°C)		24.25238		
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.7	1184	20.85	-0.15		

YSI 44018 THERMISTOR CALIBRATION					
Number: 37		Tester: CCL			
Date: 10/22/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
6.6	809				
29.2	1402				
A. Multiplier					
	Max. Temp. (°C)	29.2		Max. Vout (mV)	1402
	Min. Temp. (°C)	6.6		Min. Vout (mV)	809
	Temp. Range (°C)	22.6		Vout Range (mV)	593
	Multiplier = Temp. Range/Vout Range (°C/mV)			0.03811	
B. Offset					
	Min. Vout * Multiplier (°C)		30.83204	(A)	
	Max. Vout * Multiplier (°C)		53.43204	(B)	
	Offset = (A) - Min. Temp. (°C)		24.23204		
	Offset = (B) - Max. Temp. (°C)		24.23204		
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.7	1183	20.8	-0.1		

YSI 44018 THERMISTOR CALIBRATION					
Number: 38		Tester: CCL			
Date: 10/22/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
6.6	807				
29.2	1402				
A. Multiplier					
	Max. Temp. (°C)	29.2		Max. Vout (mV)	1402
	Min. Temp. (°C)	6.6		Min. Vout (mV)	807
	Temp. Range (°C)	22.6		Vout Range (mV)	595
	Multiplier = Temp. Range/Vout Range (°C/mV)			0.03798	
B. Offset					
	Min. Vout * Multiplier (°C)		30.65244	(A)	
	Max. Vout * Multiplier (°C)		53.25244	(B)	
	Offset = (A) - Min. Temp. (°C)		24.05244		
	Offset = (B) - Max. Temp. (°C)		24.05244		
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.7	1183	20.7	0		

YSI 44018 THERMISTOR CALIBRATION					
Number: 39		Tester: CCL			
Date: 10/22/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
7.1	818				
29.1	1399.5				
A. Multiplier					
	Max. Temp. (°C)	29.1		Max. Vout (mV)	1399.5
	Min. Temp. (°C)	7.1		Min. Vout (mV)	818
	Temp. Range (°C)	22		Vout Range (mV)	581.5
	Multiplier = Temp. Range/Vout Range (°C/mV)			0.03783	
B. Offset					
	Min. Vout * Multiplier (°C)		30.94755	(A)	
	Max. Vout * Multiplier (°C)		52.94755	(B)	
	Offset = (A) - Min. Temp. (°C)		23.84755		
	Offset = (B) - Max. Temp. (°C)		23.84755		
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.7	1182	20.8	-0.1		

YSI 44018 THERMISTOR CALIBRATION					
Number: 40		Tester: CCL			
Date: 10/22/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
7.1	818				
29.1	1401				
A. Multiplier					
	Max. Temp. (°C)	29.1		Max. Vout (mV)	1401
	Min. Temp. (°C)	7.1		Min. Vout (mV)	818
	Temp. Range (°C)	22		Vout Range (mV)	583
	Multiplier = Temp. Range/Vout Range (°C/mV)			0.03774	
B. Offset					
	Min. Vout * Multiplier (°C)		30.86792	(A)	
	Max. Vout * Multiplier (°C)		52.86792	(B)	
	Offset = (A) - Min. Temp. (°C)		23.76792		
	Offset = (B) - Max. Temp. (°C)		23.76792		
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.7	1182	20.8	-0.1		

YSI 44018 THERMISTOR CALIBRATION					
Number: 41		Tester: CCL			
Date: 10/22/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
7.5	827				
29.2	1399.5				
A. Multiplier					
	Max. Temp. (°C)	29.2		Max. Vout (mV)	1399.5
	Min. Temp. (°C)	7.5		Min. Vout (mV)	827
	Temp. Range (°C)	21.7		Vout Range (mV)	572.5
	Multiplier = Temp. Range/Vout Range (°C/mV)			0.03790	
B. Offset					
	Min. Vout * Multiplier (°C)		31.34655	(A)	
	Max. Vout * Multiplier (°C)		53.04655	(B)	
	Offset = (A) - Min. Temp. (°C)		23.84655		
	Offset = (B) - Max. Temp. (°C)		23.84655		
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.7	1180	20.9	-0.2		

YSI 44018 THERMISTOR CALIBRATION					
Number: 42		Tester: CCL			
Date: 11/1/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
5.1	770				
29.7	1414				
A. Multiplier					
	Max. Temp. (°C)	29.7		Max. Vout (mV)	1414
	Min. Temp. (°C)	5.1		Min. Vout (mV)	770
	Temp. Range (°C)	24.6		Vout Range (mV)	644
	Multiplier = Temp. Range/Vout Range (°C/mV)			0.03820	
B. Offset					
	Min. Vout * Multiplier (°C)		29.41304	(A)	
	Max. Vout * Multiplier (°C)		54.01304	(B)	
	Offset = (A) - Min. Temp. (°C)		24.31304		
	Offset = (B) - Max. Temp. (°C)		24.31304		
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.3	1170	20.3	0		

YSI 44018 THERMISTOR CALIBRATION					
Number: 43		Tester: CCL			
Date: 11/4/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
5.1	772				
29.7	1416				
A. Multiplier					
	Max. Temp. (°C)	29.7		Max. Vout (mV)	1416
	Min. Temp. (°C)	5.1		Min. Vout (mV)	772
	Temp. Range (°C)	24.6		Vout Range (mV)	644
Multiplier = Temp. Range/Vout Range (°C/mV)				0.03820	
B. Offset					
	Min. Vout * Multiplier (°C)		29.48944	(A)	
	Max. Vout * Multiplier (°C)		54.08944	(B)	
	Offset = (A) - Min. Temp. (°C)		24.38944		
	Offset = (B) - Max. Temp. (°C)		24.38944		
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.4	1172	20.4	0		

YSI 44018 THERMISTOR CALIBRATION					
Number: 44		Tester: CCL			
Date: 11/1/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
5	766				
29.8	1415				
A. Multiplier					
	Max. Temp. (°C)	29.8		Max. Vout (mV)	1415
	Min. Temp. (°C)	5		Min. Vout (mV)	766
	Temp. Range (°C)	24.8		Vout Range (mV)	649
Multiplier = Temp. Range/Vout Range (°C/mV)				0.03821	
B. Offset					
	Min. Vout * Multiplier (°C)		29.27088	(A)	
	Max. Vout * Multiplier (°C)		54.07088	(B)	
	Offset = (A) - Min. Temp. (°C)		24.27088		
	Offset = (B) - Max. Temp. (°C)		24.27088		
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.2	1167	20.3	-0.1		

YSI 44018 THERMISTOR CALIBRATION					
Number: 45		Tester: CCL			
Date: 11/1/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
5	777				
29.8	1417				
A. Multiplier					
	Max. Temp. (°C)	29.8		Max. Vout (mV)	1417
	Min. Temp. (°C)	5		Min. Vout (mV)	777
	Temp. Range (°C)	24.8		Vout Range (mV)	640
	Multiplier = Temp. Range/Vout Range (°C/mV)			0.03875	
B. Offset					
	Min. Vout * Multiplier (°C)		30.10875	(A)	
	Max. Vout * Multiplier (°C)		54.90875	(B)	
	Offset = (A) - Min. Temp. (°C)		25.10875		
	Offset = (B) - Max. Temp. (°C)		25.10875		
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.5	1178	20.5	0		

YSI 44018 THERMISTOR CALIBRATION					
Number: 46		Tester: CCL			
Date: 11/1/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
5.3	773				
29.8	1417.5				
A. Multiplier					
	Max. Temp. (°C)	29.8		Max. Vout (mV)	1417.5
	Min. Temp. (°C)	5.3		Min. Vout (mV)	773
	Temp. Range (°C)	24.5		Vout Range (mV)	644.5
	Multiplier = Temp. Range/Vout Range (°C/mV)			0.03801	
B. Offset					
	Min. Vout * Multiplier (°C)		29.38479	(A)	
	Max. Vout * Multiplier (°C)		53.88479	(B)	
	Offset = (A) - Min. Temp. (°C)		24.08479		
	Offset = (B) - Max. Temp. (°C)		24.08479		
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.5	1178	20.6	-0.1		

YSI 44018 THERMISTOR CALIBRATION					
Number: 47		Tester: CCL			
Date: 11/1/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
5.4	776.5				
29.8	1423.5				
A. Multiplier					
	Max. Temp. (°C)	29.8		Max. Vout (mV)	1423.5
	Min. Temp. (°C)	5.4		Min. Vout (mV)	776.5
	Temp. Range (°C)	24.4		Vout Range (mV)	647
Multiplier = Temp. Range/Vout Range (°C/mV)				0.03771	
B. Offset					
Min. Vout * Multiplier (°C)		29.28377	(A)		
Max. Vout * Multiplier (°C)		53.68377	(B)		
Offset = (A) - Min. Temp. (°C)		23.88377			
Offset = (B) - Max. Temp. (°C)		23.88377			
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.2	1169	20.2	0		

YSI 44018 THERMISTOR CALIBRATION					
Number: 48		Tester: CCL			
Date: 11/1/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
5.6	781				
29.8	1423.5				
A. Multiplier					
	Max. Temp. (°C)	29.8		Max. Vout (mV)	1423.5
	Min. Temp. (°C)	5.6		Min. Vout (mV)	781
	Temp. Range (°C)	24.2		Vout Range (mV)	642.5
	Multiplier = Temp. Range/Vout Range (°C/mV)			0.03767	
B. Offset					
	Min. Vout * Multiplier (°C)		29.41665	(A)	
	Max. Vout * Multiplier (°C)		53.61665	(B)	
	Offset = (A) - Min. Temp. (°C)		23.81665		
	Offset = (B) - Max. Temp. (°C)		23.81665		
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.2	1168	20.1	0.1		

YSI 44018 THERMISTOR CALIBRATION					
Number: 49		Tester: CCL			
Date: 11/1/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
5.7	784				
29.8	1418				
A. Multiplier					
	Max. Temp. (°C)	29.8		Max. Vout (mV)	1418
	Min. Temp. (°C)	5.7		Min. Vout (mV)	784
	Temp. Range (°C)	24.1		Vout Range (mV)	634
	Multiplier = Temp. Range/Vout Range (°C/mV)			0.03801	
B. Offset					
	Min. Vout * Multiplier (°C)		29.80189	(A)	
	Max. Vout * Multiplier (°C)		53.90189	(B)	
	Offset = (A) - Min. Temp. (°C)		24.10189		
	Offset = (B) - Max. Temp. (°C)		24.10189		
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.6	1179	20.7	-0.1		

YSI 44018 THERMISTOR CALIBRATION					
Number: 50		Tester: CCL			
Date: 11/1/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
6	792				
29.9	1419.5				
A. Multiplier					
	Max. Temp. (°C)	29.9		Max. Vout (mV)	1419.5
	Min. Temp. (°C)	6		Min. Vout (mV)	792
	Temp. Range (°C)	23.9		Vout Range (mV)	627.5
	Multiplier = Temp. Range/Vout Range (°C/mV)			0.03809	
B. Offset					
	Min. Vout * Multiplier (°C)		30.16542	(A)	
	Max. Vout * Multiplier (°C)		54.06542	(B)	
	Offset = (A) - Min. Temp. (°C)		24.16542		
	Offset = (B) - Max. Temp. (°C)		24.16542		
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.5	1176	20.6	-0.1		

YSI 44018 THERMISTOR CALIBRATION					
Number: 51		Tester: CCL			
Date: 11/1/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
6.2	799				
29.8	1417.5				
A. Multiplier					
	Max. Temp. (°C)	29.8		Max. Vout (mV)	1417.5
	Min. Temp. (°C)	6.2		Min. Vout (mV)	799
	Temp. Range (°C)	23.6		Vout Range (mV)	618.5
	Multiplier = Temp. Range/Vout Range (°C/mV)			0.03816	
B. Offset					
	Min. Vout * Multiplier (°C)		30.48731	(A)	
	Max. Vout * Multiplier (°C)		54.08731	(B)	
	Offset = (A) - Min. Temp. (°C)		24.28731		
	Offset = (B) - Max. Temp. (°C)		24.28731		
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.5	1176	20.5	0		

YSI 44018 THERMISTOR CALIBRATION					
Number: 52		Tester: CCL			
Date: 11/1/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
5.7	784				
29.9	1418.5				
A. Multiplier					
	Max. Temp. (°C)	29.9		Max. Vout (mV)	1418.5
	Min. Temp. (°C)	5.7		Min. Vout (mV)	784
	Temp. Range (°C)	24.2		Vout Range (mV)	634.5
	Multiplier = Temp. Range/Vout Range (°C/mV)			0.03814	
B. Offset					
	Min. Vout * Multiplier (°C)		29.90197	(A)	
	Max. Vout * Multiplier (°C)		54.10197	(B)	
	Offset = (A) - Min. Temp. (°C)		24.20197		
	Offset = (B) - Max. Temp. (°C)		24.20197		
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.5	1175	20.6	-0.1		

YSI 44018 THERMISTOR CALIBRATION					
Number: 53		Tester: CCL			
Date: 11/1/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
5.6	784				
29.9	1419.5				
A. Multiplier					
	Max. Temp. (°C)	29.9		Max. Vout (mV)	1419.5
	Min. Temp. (°C)	5.6		Min. Vout (mV)	784
	Temp. Range (°C)	24.3		Vout Range (mV)	635.5
	Multiplier = Temp. Range/Vout Range (°C/mV)			0.03824	
B. Offset					
	Min. Vout * Multiplier (°C)		29.97828	(A)	
	Max. Vout * Multiplier (°C)		54.27828	(B)	
	Offset = (A) - Min. Temp. (°C)		24.37828		
	Offset = (B) - Max. Temp. (°C)		24.37828		
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.5	1174	20.5	0		

YSI 44018 THERMISTOR CALIBRATION					
Number: 54		Tester: CCL			
Date: 11/1/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
5.7	784.5				
29.8	1419.5				
A. Multiplier					
	Max. Temp. (°C)	29.8		Max. Vout (mV)	1419.5
	Min. Temp. (°C)	5.7		Min. Vout (mV)	784.5
	Temp. Range (°C)	24.1		Vout Range (mV)	635
	Multiplier = Temp. Range/Vout Range (°C/mV)			0.03795	
B. Offset					
	Min. Vout * Multiplier (°C)		29.77394	(A)	
	Max. Vout * Multiplier (°C)		53.87394	(B)	
	Offset = (A) - Min. Temp. (°C)		24.07394		
	Offset = (B) - Max. Temp. (°C)		24.07394		
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.4	1174	20.4	0		

YSI 44018 THERMISTOR CALIBRATION					
Number: 55		Tester: CCL			
Date: 11/1/93		Comments:			
I. Determination of Multiplier and Offset					
Water Bath Temperature (°C)	Vout (millivolts)				
5.8	786				
29.9	1417.5				
A. Multiplier					
	Max. Temp. (°C)	29.9		Max. Vout (mV)	1417.5
	Min. Temp. (°C)	5.8		Min. Vout (mV)	786
	Temp. Range (°C)	24.1		Vout Range (mV)	631.5
	Multiplier = Temp. Range/Vout Range (°C/mV)			0.03816	
B. Offset					
	Min. Vout * Multiplier (°C)		29.99620	(A)	
	Max. Vout * Multiplier (°C)		54.09620	(B)	
	Offset = (A) - Min. Temp. (°C)		24.19620		
	Offset = (B) - Max. Temp. (°C)		24.19620		
II. Check of Calibration Accuracy					
Water Bath Temperature (°C)	Reading Vout (millivolts)	Datalogger Temp. (°C)	Water Bath - Datalogger Temp. (°C)		
20.4	1172	20.4	0		

MA 2-2-(1-55)

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 10/21/93-11/1/93

Test Executor: Cathy Leser

Test Plan Section: 2.2.1 Temperature Probes

Results: All temperature probes were tested, and the results recorded on the test sheets. See the bottom half of the individual data sheets MA2-1-1 through MA2-1-52.

Test Recorder: Cathy Leser CCL

Date: 5/1/94

MP 2-1-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 2/3/94

Test Executor: Cathy Leser

Test Plan Section: 2.2.2 Temperature Probes

Results: All temperature probes were tested for responses, and the results were recorded on the following sheet.

Test Recorder: Cathy Leser CCL

Date: 5/1/94

MP 2-1-1

YSI 44018 THERMISTOR RESPONSE AT SNL		
Thermistor No.	Reading (C)	Date Tested
1	10	2/3/94
2	10.1	2/3/94
3	10	2/3/94
4	10.1	2/3/94
5	9.7	2/3/94
6	10.2	2/3/94
7	10.1	2/3/94
8	10.1	2/3/94
9	10.1	2/3/94
10	9.5	2/3/94
11	10.1	2/3/94
12	10.1	2/3/94
13	10	2/3/94
14	9.9	2/3/94
15	10	2/3/94
16	9.7	2/3/94
17	9.6	2/3/94
18	10	2/3/94
19	9.9	2/3/94
20	9.8	2/3/94
21	9.8	2/3/94
22	9.8	2/3/94
23	9.7	2/3/94
25	10.1	2/3/94
26	10.2	2/3/94
24	9.6	2/3/94

MP 2-1-1

YSI 44018 THERMISTOR RESPONSE AT SNL (CONT.)		
Thermistor No.	Reading (C)	Date Tested
27	10.2	2/3/94
28	9.5	2/3/94
29	9.8	2/3/94
30	9.9	2/3/94
31	9.7	2/3/94
32	9.7	2/3/94
33	9.3	2/3/94
34	9.7	2/3/94
35	9.1	2/3/94
36	9.9	2/3/94
37	9.5	2/3/94
38	9.7	2/3/94
39	9.2	2/3/94
40	9.4	2/3/94
41	9	2/3/94
42	9.2	2/3/94
43	9	2/3/94
44	9.1	2/3/94
45	9.2	2/3/94
46	9.4	2/3/94
47	9.4	2/3/94
48	9.6	2/3/94
49	9.4	2/3/94
50	9.3	2/3/94
51	9.3	2/3/94
52	9.4	2/3/94
53	9.1	2/3/94
54	9.2	2/3/94
55	Remained at ANL	

MA 3-1-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 11/1/93

Test Executor: Dana Dominiak

Test Plan Section: 2.3.1 Tensiometers

Results: The tensiometers were tested with the vacuum pump and operated correctly.

Test Recorder: Dana Dominiak DD-man

Date: 3/23/95

MP 3-1-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 8/23/94

Test Executor: Cathy Leser

Test Plan Section: 2.3.2 Tensiometers

Results: Only the first 7 tensiometers were tested, since all 10 tensiometers were not installed at the site. The results are recorded in the two tables on the following pages.

Test Recorder: Cathy Leser CCL

Date: 5/1/94

MP 3-1-1

SOILMOISTURE MODEL 2725 JET FILL TENSIO METER RESPONSE TESTING AT SNL			
Ceramic Cup Number	Inspection at Argonne 11/12/93		Re-inspected SNL 02/02/94
	Ceramic Condition	Comments	Comments
1	Good		Same as at ANL 11/12/93
2	Good		Same as at ANL 11/12/93
3	Good		Same as at ANL 11/12/93
4	Good		Same as at ANL 11/12/93
5	Good		Same as at ANL 11/12/93
6	Good		Same as at ANL 11/12/93
7	Good		Same as at ANL 11/12/93
8	Ok	Small hole/chip approx. 3/4" from bottom of bulb	Same as at ANL 11/12/93
9	Good		Same as at ANL 11/12/93
10	Good		Same as at ANL 11/12/93
11	Good		Same as at ANL 11/12/93

MP 3-1-1

Tensiometer No.	Ceramic Cup No.	Current Transducer No.	Vacuum Gauge (cb)	Current Transducer (mA)	Theoretical (mA)	Difference (mA)
1	1	1	0	4.01	4	-0.01
			25	8.1	8	-0.1
			50	11.9	12	0.1
			75	15.8	16	0.2
2	2	2	0	3.98	4	0.02
			25	8.18	8	-0.18
			50	11.98	12	0.02
			75	16.13	16	-0.13
3	3	3	0	3.96	4	0.04
			25	7.99	8	0.01
			50	11.92	12	0.08
			75	15.85	16	0.15
4	4	4	0	3.88	4	0.12
			25	8.08	8	-0.08
			50	12.04	12	-0.04
			75	16.1	16	-0.1
5	5	5	0	3.99	4	0.01
			25	7.78	8	0.22
			50	11.8	12	0.2
			75	15.8	16	0.2
6	6	6	0	3.98	4	0.02
			25	8.25	8	-0.25
			50	12.72	12	-0.72
			75	16.61	16	-0.61
7	7	7	0	3.98	4	0.02
			25	8.72	8	-0.72
			50	12.93	12	-0.93
			75	16.79	16	-0.79

Note: Current transducers #8-#11 were not tested at this time.
Only these seven tensiometers will be installed.

MA 4-1-1**Test Sheet for Data Acquisition and Management System for
Monitoring the FOS Site**

Test Date: ~11/1/93

Test Executor: Dana Dominiak

Test Plan Section: 2.5.1 Multiplexers

Results: Multiplexer #1

Channel 1: OK
Channel 2: OK
Channel 3: OK
Channel 4: OK
Channel 5: OK
Channel 6: OK
Channel 7: OK
Channel 8: OK
Channel 9: OK
Channel 10: OK
Channel 11: OK
Channel 12: OK
Channel 13: OK
Channel 14: OK
Channel 15: OK
Channel 16: OK

Test Recorder: Dana Dominiak DD-Mar

Date: 5/1/94

MA 4-1-2

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: ~11/1/93

Test Executor: Dana Dominiak

Test Plan Section: 2.5.1 Multiplexers

Results: Multiplexer #2

Channel 1: OK
Channel 2: OK
Channel 3: OK
Channel 4: OK
Channel 5: OK
Channel 6: OK
Channel 7: OK
Channel 8: OK
Channel 9: OK
Channel 10: OK
Channel 11: OK
Channel 12: OK
Channel 13: OK
Channel 14: OK
Channel 15: OK
Channel 16: OK

Test Recorder: Dana Dominiak DD - mar

Date: 5/1/94

MA 4-1-3

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: ~11/1/93

Test Executor: Dana Dominiak

Test Plan Section: 2.5.1 Multiplexers

Results: Multiplexer #3

Channel 1: OK
Channel 2: OK
Channel 3: OK
Channel 4: OK
Channel 5: OK
Channel 6: OK
Channel 7: OK
Channel 8: OK
Channel 9: OK
Channel 10: OK
Channel 11: OK
Channel 12: OK
Channel 13: OK
Channel 14: OK
Channel 15: OK
Channel 16: OK

Test Recorder: Dana Dominiak DD-man

Date: 5/1/94

MA 4-1-4

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: ~11/1/93

Test Executor: Dana Dominiak

Test Plan Section: 2.5.1 Multiplexers

Results: Multiplexer #4

Channel 1:	OK
Channel 2:	OK
Channel 3:	OK
Channel 4:	OK
Channel 5:	OK
Channel 6:	OK
Channel 7:	OK
Channel 8:	OK
Channel 9:	OK
Channel 10:	OK
Channel 11:	OK
Channel 12:	OK
Channel 13:	OK
Channel 14:	OK
Channel 15:	OK
Channel 16:	OK

Test Recorder: Dana Dominiak DD-man

Date: 5/1/94

MA 4-1-5

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: ~11/1/93

Test Executor: Dana Dominiak

Test Plan Section: 2.5.1 Multiplexers

Results: Multiplexer #5

Channel 1: OK
Channel 2: OK
Channel 3: OK
Channel 4: OK
Channel 5: OK
Channel 6: OK
Channel 7: OK
Channel 8: OK
Channel 9: OK
Channel 10: OK
Channel 11: OK
Channel 12: OK
Channel 13: OK
Channel 14: OK
Channel 15: OK
Channel 16: OK

Test Recorder: Dana Dominiak DD-man

Date: 5/1/94

MA 4-1-6**Test Sheet for Data Acquisition and Management System for
Monitoring the FOS Site**

Test Date: ~11/1/93

Test Executor: Dana Dominiak

Test Plan Section: 2.5.1 Multiplexers

Results: Multiplexer #6

Channel 1: OK

Channel 2: OK

Channel 3: OK

Channel 4: OK

Channel 5: OK

Channel 6: OK

Channel 7: OK

Channel 8: OK

Channel 9: OK

Channel 10: OK

Channel 11: OK

Channel 12: OK

Channel 13: OK

Channel 14: OK

Channel 15: OK

Channel 16: OK

Test Recorder: Dana Dominiak DD-man

Date: 5/1/94

MA 4-1-7

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: ~11/1/93

Test Executor: Dana Dominiak

Test Plan Section: 2.5.1 Multiplexers

Results: Multiplexer #7

Channel 1: OK
Channel 2: OK
Channel 3: OK
Channel 4: OK
Channel 5: OK
Channel 6: OK
Channel 7: OK
Channel 8: OK
Channel 9: OK
Channel 10: OK
Channel 11: OK
Channel 12: OK
Channel 13: OK
Channel 14: OK
Channel 15: OK
Channel 16: OK

Test Recorder: Dana Dominiak DD-MAN

Date: 5/1/94

MA 4-1-8

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: ~11/1/93

Test Executor: Dana Dominiak

Test Plan Section: 2.5.1 Multiplexers

Results: Multiplexer #8

Channel 1: OK
Channel 2: OK
Channel 3: OK
Channel 4: OK
Channel 5: OK
Channel 6: OK
Channel 7: OK
Channel 8: OK
Channel 9: OK
Channel 10: OK
Channel 11: OK
Channel 12: OK
Channel 13: OK
Channel 14: OK
Channel 15: OK
Channel 16: OK

Test Recorder: Dana Dominiak DD-man

Date: 5/1/94

MA 4-1-9

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: ~11/1/93

Test Executor: Dana Dominiak

Test Plan Section: 2.5.1 Multiplexers

Results: Multiplexer #9

Channel 1: OK
Channel 2: OK
Channel 3: OK
Channel 4: OK
Channel 5: OK
Channel 6: OK
Channel 7: OK
Channel 8: OK
Channel 9: OK
Channel 10: OK
Channel 11: OK
Channel 12: OK
Channel 13: OK
Channel 14: OK
Channel 15: OK
Channel 16: OK

Test Recorder: Dana Dominiak DD-Man

Date: 5/1/94

MP 4-1-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 2/3/94

Test Executor: Dana Dominiak

Test Plan Section: 2.5.2 Multiplexers

Results: Multiplexer #1

Channel 1: OK
Channel 2: OK
Channel 3: OK
Channel 4: OK
Channel 5: OK
Channel 6: OK
Channel 7: OK
Channel 8: OK
Channel 9: OK
Channel 10: OK
Channel 11: OK
Channel 12: OK
Channel 13: OK
Channel 14: OK
Channel 15: OK
Channel 16: OK

Test Recorder: Dana Dominiak DD-MCW

Date: 3/23/95

MP 4-1-2

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 2/3/94

Test Executor: Dana Dominiak

Test Plan Section: 2.5.2 Multiplexers

Results: Multiplexer #2

Channel 1: OK
Channel 2: OK
Channel 3: OK
Channel 4: OK
Channel 5: OK
Channel 6: OK
Channel 7: OK
Channel 8: OK
Channel 9: OK
Channel 10: OK
Channel 11: OK
Channel 12: OK
Channel 13: OK
Channel 14: OK
Channel 15: OK
Channel 16: OK

Test Recorder: Dana Dominiak AD-MAN

Date: 3/23/95

MP 4-1-3

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 2/3/94

Test Executor: Dana Dominiak

Test Plan Section: 2.5.2 Multiplexers

Results: Multiplexer #3

Channel 1: OK
Channel 2: OK
Channel 3: OK
Channel 4: OK
Channel 5: OK
Channel 6: OK
Channel 7: OK
Channel 8: OK
Channel 9: OK
Channel 10: OK
Channel 11: OK
Channel 12: OK
Channel 13: OK
Channel 14: OK
Channel 15: OK
Channel 16: OK

Test Recorder: Dana Dominiak DD-THW

Date: 3/23/95

MP 4-1-4

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 2/3/94

Test Executor: Dana Dominiak

Test Plan Section: 2.5.2 Multiplexers

Results: Multiplexer #4

Channel 1: OK
Channel 2: OK
Channel 3: OK
Channel 4: OK
Channel 5: OK
Channel 6: OK
Channel 7: OK
Channel 8: OK
Channel 9: OK
Channel 10: OK
Channel 11: OK
Channel 12: OK
Channel 13: OK
Channel 14: OK
Channel 15: OK
Channel 16: OK

Test Recorder: Dana Dominiak DD-man

Date: 3/23/95

MP 4-1-5

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 2/3/94

Test Executor: Dana Dominiak

Test Plan Section: 2.5.2 Multiplexers

Results: Multiplexer #5

Channel 1: OK
Channel 2: OK
Channel 3: OK
Channel 4: OK
Channel 5: OK
Channel 6: OK
Channel 7: OK
Channel 8: OK
Channel 9: OK
Channel 10: OK
Channel 11: OK
Channel 12: OK
Channel 13: OK
Channel 14: OK
Channel 15: OK
Channel 16: OK

Test Recorder: Dana Dominiak DD-MW

Date: 3/23/95

MP 4-1-6

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 2/3/94

Test Executor: Dana Dominiak

Test Plan Section: 2.5.2 Multiplexers

Results: Multiplexer #6

Channel 1: OK
Channel 2: OK
Channel 3: OK
Channel 4: OK
Channel 5: OK
Channel 6: OK
Channel 7: OK
Channel 8: OK
Channel 9: OK
Channel 10: OK
Channel 11: OK
Channel 12: OK
Channel 13: OK
Channel 14: OK
Channel 15: OK
Channel 16: OK

Test Recorder: Dana Dominiak DD-mv

Date: 3/23/95

MP 4-1-7

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 2/3/94

Test Executor: Dana Dominiak

Test Plan Section: 2.5.2 Multiplexers

Results: Multiplexer #7

Channel 1: OK

Channel 2: OK

Channel 3: OK

Channel 4: OK

Channel 5: OK

Channel 6: OK

Channel 7: OK

Channel 8: OK

Channel 9: OK

Channel 10: OK

Channel 11: OK

Channel 12: OK

Channel 13: OK

Channel 14: OK

Channel 15: OK

Channel 16: OK

Test Recorder: Dana Dominiak DD

Date: 3/23/95

MP 4-1-8

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 2/3/94

Test Executor: Dana Dominiak

Test Plan Section: 2.5.2 Multiplexers

Results: Multiplexer #8

Channel 1: OK
Channel 2: OK
Channel 3: OK
Channel 4: OK
Channel 5: OK
Channel 6: OK
Channel 7: OK
Channel 8: OK
Channel 9: OK
Channel 10: OK
Channel 11: OK
Channel 12: OK
Channel 13: OK
Channel 14: OK
Channel 15: OK
Channel 16: OK

Test Recorder: Dana Dominiak DD:Man

Date: 3/23/95

MP 4-1-9

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 2/3/94

Test Executor: Dana Dominiak

Test Plan Section: 2.5.2 Multiplexers

Results: Multiplexer #9

Channel 1: OK
Channel 2: OK
Channel 3: OK
Channel 4: OK
Channel 5: OK
Channel 6: OK
Channel 7: OK
Channel 8: OK
Channel 9: OK
Channel 10: OK
Channel 11: OK
Channel 12: OK
Channel 13: OK
Channel 14: OK
Channel 15: OK
Channel 16: OK

Test Recorder: Dana Dominiak DD-man

Date: 3/23/95

QA 5-1-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 9/28/93

Test Executor: Mary Ann Widing

Test Plan Section: 3.1.1 Personal Computer

Results: The ZEOS 486 computer operates correctly. Unneeded software was removed to make room for additional software. The PC was configured and tested under DOS and MS Windows.

Test Recorder: Mary Ann Widing MAW Date: 4/26/94

QP 5-1-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 9/13/94

Test Executor: Mary Ann Widing

Test Plan Section: 3.1.2 Personal Computer

Results: The ZEOS 486 computer operates correctly. The PC was configured and tested under DOS and MS Windows.

Test Recorder: Mary Ann Widing MAW Date: 3/23/95

QA 6-1-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 9/28/93

Test Executor: Mary Ann Widing

Test Plan Section: 3.2.1 Mirrored Hard Disks

Results: The ZEOS 486 computer was configured with the mirrored hard disks and controller card. Tests were successfully performed with the disks operating as desired.

Test Recorder: Mary Ann Widing MAW Date: 4/26/94

QA 7-1-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 10/19/93

Test Executor: Mary Ann Widing

Test Plan Section: 3.3.1 Communications Board

Results: The Digiboard card was installed in the ZEOS 486 computer. The standard MS Windows terminal program was used to interact with a terminal on a laptop connected through the Digiboard. No problems were encountered.

Test Recorder: Mary Ann Widing MAW Date: 4/26/94

QA 7-2-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 10/19/93

Test Executor: Mary Ann Widing

Test Plan Section: 3.3.1 Communications Board

Results: The Greenleaf software was used on the ZEOS computer to test its use of the Digiboard. No problems were encountered.

Test Recorder: Mary Ann Widing MAW Date: 4/26/94

QA 7-3-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 10/19/93

Test Executor: Mary Ann Widing

Test Plan Section: 3.3.1 Communications Board

Results: A program using the Greenleaf library software was used to communicate with a data logger. The routines could successfully read data from the data logger memory area.

Test Recorder: Mary Ann Widing MAW Date: 4/26/94

QA 8-1-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 11/20/93

Test Executor: Mary Ann Widing

Test Plan Section: 3.4.1 Tape Drive

Results: The Conner Backup Exec software was used to make a system backup of the ZEOS PC. The tape was examined and found to contain the desired files.

Test Recorder: Mary Ann Widing MAW Date: 4/26/94

QA 9-1-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 11/20/93

Test Executor: Pat Sapinski

Test Plan Section: 3.5.1 Uninterruptible Power Supply

Results: The UPS was disconnected from its power supply. The Sun and PC continued to operate uninterrupted.

Test Recorder: Mary Ann Widing man

Date: 4/26/94

QP 9-1-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 9/15/94

Test Executor: Mary Ann Widing

Test Plan Section: 3.5.2 Uninterruptible Power Supply

Results: The UPS was disconnected from its power supply. The Sun and PC continued to operate uninterrupted.

Test Recorder: Mary Ann Widing Man Date: 5/23/95

QA 10-1-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: ~11/1/94

Test Executor: Dana Dominiak

Test Plan Section: 3.6.1 Telephone Notification System

Results: The EnvirCom I unit operated correctly.

Test Recorder: Dana Dominiak DD-Maw Date: 5/1/94

QP 10-1-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: ~11/1/94

Test Executor: Dana Dominiak

Test Plan Section: 3.6.2 Telephone Notification System

Results: The EnvirCom I unit responded to the simulated alarm correctly.

Test Recorder: Dana Dominiak DD Date: 5/1/94

QA 11-1-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: ~11/04/93

Test Executor: Mary Ann Widing

Test Plan Section: 3.7.1 Computer Network Card

Results: Simple commands were used to test the network connection between the PC and Sun computers. The PC was able to mount directories and copy files to and from the Sun correctly.

Test Recorder: Mary Ann Widing *MAW* Date: 4/26/94

QP 11-1-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 9/12/94

Test Executor: Mary Ann Widing

Test Plan Section: 3.7.1 Computer Network Card

Results: Simple commands were used to test the network connection between the PC and Sun computers. The PC was able to mount directories and copy files to and from the Sun correctly.

Test Recorder: Mary Ann Widing MAW

Date: 3/23/95

QA 12-1-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 11/17/93

Test Executor: Mary Ann Widing

Test Plan Section: 3.8.1 Data Logger Programmer Software

Results: Several programs were generated with the software and visually inspected.
The calibration parameters were inserted in the produced programs in the
correct locations.

Test Recorder: Mary Ann Widing MAW Date: 4/26/94

QP 12-1-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 9/15/95

Test Executor: Mary Ann Widing

Test Plan Section: 3.8.2 Data Logger Programmer Software

Results: Several programs were generated with the software and visually inspected.
The program was able to communicate with the modems correctly.

Test Recorder: Mary Ann Widing MAW Date: 3/23/95

QA 13-1-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 11/25/93

Test Executor: Mary Ann Widing

Test Plan Section: 3.9.1 Data Acquirer Software

Results: The Data Acquirer was tested with a pressure sensor.

Test Recorder: Mary Ann Widing MAW Date: 4/26/94

QA 13-2-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 11/20/93

Test Executor: Mary Ann Widing

Test Plan Section: 3.9.1 Data Acquirer Software

Results: The Data Acquirer was tested with a thermistor. The readings of the sensor corresponded with the temperature expected.

Test Recorder: Mary Ann Widing MAW Date: 4/26/94

QA 13-3-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 11/20/93

Test Executor: Mary Ann Widing

Test Plan Section: 3.9.1 Data Acquirer Software

Results: The Data Acquirer was tested with a tensiometer. The value read corresponded well with the value recorded on the vacuum pump.

Test Recorder: Mary Ann Widing MAW

Date: 4/26/94 .

QA 14-1-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 11/26/93

Test Executor: Mary Ann Widing

Test Plan Section: 3.10.1 Sensor Monitor Software

Results: The Sensor Monitor Software was run continuously for several days. It correctly printed out the daily log with the status of the Data Acquirer program.

Test Recorder: Mary Ann Widing MAW Date: 4/26/94

QP 14-1-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 9/15/94

Test Executor: Mary Ann Widing

Test Plan Section: 3.10.2 Sensor Monitor Software

Results: The Sensor Monitor Software was run continuously for several days. Some problems occurred with its print handling, but these were resolved on 11/15/94.

Test Recorder: Mary Ann Widing MAW Date: 5/23/95

QA 15-1-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 11/21/93

Test Executor: Mary Ann Widing

Test Plan Section: 3.11.1 Data Upload Software

Results: The Data Upload program was run. The directories on the Sun were examined and found to contain the appropriate files that had been copied from the PC.

Test Recorder: Mary Ann Widing man Date: 4/26/94

QP 15-1-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 9/16/94

Test Executor: Mary Ann Widing

Test Plan Section: 3.11.2 Data Upload Software

Results: The Data Upload program was run. The directories on the Sun were examined and found to contain the appropriate files that had been copied from the PC.

Test Recorder: Mary Ann Widing MW

Date: 3/23/95

QA 16-1-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 11/20/93

Test Executor: Mary Ann Widing

Test Plan Section: 3.12.1 Tape Backup Software

Results: The Conner Backup Exec software was run. The resulting tape was examined and found to contain the correct data.

Test Recorder: Mary Ann Widing MAW Date: 4/26/94

QP 16-1-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 9/13/94

Test Executor: Mary Ann Widing

Test Plan Section: 3.12.1 Tape Backup Software

Results: The Conner Backup Exec software was run. The resulting tape was examined and found to contain the correct data.

Test Recorder: Mary Ann Widing MAW Date: 3/23/95

AA 17-1-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: ~11/04/93

Test Executor: Pat Sapinski

Test Plan Section: 4.1.1 Sun SPARCstation 2

Results: The Sun was booted and automatically performed its system tests. No problems were encountered.

Test Recorder: Mary Ann Widing MAW Date: 4/26/94

AP 17-1-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 9/13/94

Test Executor: Mary Ann Widing

Test Plan Section: 4.1.1 Sun SPARCstation 2

Results: The Sun was booted and automatically performed its system tests. No problems were encountered.

Test Recorder: Mary Ann Widing MW Date: 3/23/95

AA 18-1-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: ~11/04/93

Test Executor: Pat Sapinski

Test Plan Section: 4.2.1 SitePlanner

Results: The SitePlanner program was installed and tested on the Sun. No problems were encountered.

Test Recorder: Mary Ann Widing man Date: 4/26/94

AA 19-1-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: ~11/04/93

Test Executor: Pat Sapinski

Test Plan Section: 4.3.1 Statistical Analysis System

Results: The SAS program was installed and tested on the Sun. No problems were encountered.

Test Recorder: Mary Ann Widing Maw Date: 4/26/94

AA 20-1-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 2/27/95

Test Executor: Mary Ann Widing

Test Plan Section: 4.4.1 Sensor Data Query Software

Results: The program was tested. Values in the data files were compared to values displayed in SAS graphs, and no problems were encountered.

Test Recorder: Mary Ann Widing MAW Date: 2/27/95

AA 20-2-1

**Test Sheet for Data Acquisition and Management System for
Monitoring the FOS Site**

Test Date: 2/27/95

Test Executor: Mary Ann Widing

Test Plan Section: 4.4.1 Sensor Data Query Software

Results: The program was tested with SitePlanner. The data values corresponded to those in the data files.

Test Recorder: Mary Ann Widing Date: 2/27/95

AP 20-1-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 5/16/95

Test Executor: Mary Ann Widing

Test Plan Section: 4.4.2 Sensor Data Query Software

Results: The software was installed and tested at the FOS site. Values in the data files were compared with graphed values. The program operated correctly.

Test Recorder: Mary Ann Widing MAW Date: 5/16/95

AP 20-2-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 5/16/95

Test Executor: Mary Ann Widing

Test Plan Section: 4.4.2 Sensor Data Query Software

Results: Data created by the Query Tool were examinedd in SitePlanner. The data corresponded to the data in the original source files.

Test Recorder: Mary Ann Widing MAW Date: 5/16/95

AA 21-1-1

**Test Sheet for Data Acquisition and Management System for
Monitoring the FOS Site**

Test Date: 3/7/95

Test Executor: Mary Ann Widing

Test Plan Section: 4.5.1 Chemical Analysis Interface Software

Results: The program was tested with Xess. The data values were recorded correctly in files and were correctly loaded into Xess.

Test Recorder: Mary Ann Widing man Date: 3/7/95

AP 21-1-1

**Test Sheet for Data Acquisition and Management System for
Monitoring the FOS Site**

Test Date: 5/16/95

Test Executor: Mary Ann Widing

Test Plan Section: 4.5.2 Chemical Analysis Interface Software

Results: The Chemical Analysis Interface was loaded on the machine at the FOS site. All operations worked correctly. Data values were correctly loaded into Xess.

Test Recorder: Mary Ann Widing MAW Date: 5/16/95

AA 22-1-1

**Test Sheet for Data Acquisition and Management System for
Monitoring the FOS Site**

Test Date: ~11/04/93

Test Executor: Pat Sapinski

Test Plan Section: 4.6.1 Backup Facility

Results: The Backup Facility was installed and tested on the Sun. No problems were encountered. When backups were not made, it correctly notified the users.

Test Recorder: Mary Ann Widing Man Date: 4/26/94

AP 22-1-1

**Test Sheet for Data Acquisition and Management System for
Monitoring the FOS Site**

Test Date: 9/15/94

Test Executor: Mary Ann Widing

Test Plan Section: 4.6.1 Backup Facility

Results: The Backup Facility was tested on the Sun. Initial problems that were encountered at the FOS site were resolved over the network on 9/26/94.

Test Recorder: Mary Ann Widing MAW Date: 3/23/95

AA 23-1-1

**Test Sheet for Data Acquisition and Management System for
Monitoring the FOS Site**

Test Date: 12/12/94

Test Executor: Mary Ann Widing

Test Plan Section: 4.7.1 Data Distribution Software

Results: The Data Distribution program was run on the computer named "sanibel" at ANL. The directories on the diskette were examined and found to contain the appropriate files that had been copied from the PC.

Test Recorder: Mary Ann Widing MAW Date: 12/12/94

AP 23-1-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 12/12/94

Test Executor: Mary Ann Widing

Test Plan Section: 4.7.2 Data Distribution Software

Results: The Data Distribution program was installed via modem on the Sun at the FOS site. Sandia site operators tested the program. The initial distribution disk revealed that there were initial operational problems with the program. After these problems were resolved, subsequent disk examinations showed that the data were distributed correctly.

Test Recorder: Mary Ann Widing manw Date: 3/23/95

IA 24-1-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 11/25/93

Test Executor: Mary Ann Widing

Test Plan Section: 5.1.1 Data Acquisition Subsystem with Pressure Subsystem

Results: The system was connected to one pressure sensor exposed to the air. The readings of the sensor over time were compared with those values recorded by the barometer in Building 203. As shown on the following graphs, the pressure values corresponded well. Data files were correctly read by the PC.

Test Recorder: Mary Ann Widing MAW Date: 4/26/94

Barometric Pressure vs. Time

Creation Date: 4/26/94

Creation Date: 4/26/94

Creation Date: 4/26/94

IP 24-1-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 9/14/94

Test Executor: Dana Dominiak

Test Plan Section: 5.1.2 Data Acquisition Subsystem with Pressure Subsystem

Results: The pressure subsystem was attached to pressure sensors as shown in the table on the following page. The values were checked for reasonableness and appeared to be correct.

Test Recorder: Dana Dominiak DD-MDW Date: 3/23/95

IP 24-1-1

Pressure Multiplexer #1							
ch #	sensor	ch #	sensor	ch #	sensor	ch #	sensor
16		12	23144 PMB5-STA4	8	23149 PMB10-STA3	4	23103 PMB9-STA5
15	23141 PMB5-STA1	11	23143 PMB5-STA3	7	23150 PMB10-STA4	3	23102 PMB9-STA4
14	23142 PMB5-STA2	10	23151 PMB10-STA5	6	23146 PMB10-STA1	2	23100 PMB9-STA2
13	23145 PMB5-STA5	9	23147 PMB10-STA2	5	23099 PMB9-STA1	1	23101 PMB9-STA3

Pressure Multiplexer #2							
c h #	sensor	c h #	sensor	c h #	sensor	c h #	sensor
1 6		1 2		8		4	23135 PMB4-STA2
1 5		1 1		7	23140 PMB4-STA5	3	23137 PMB4-STA3
1 4		1 0		6		2	23136 PMB4-STA1
1 3		9		5	23138 PMB4-STA4	1	23125 PMB3-STA1

Pressure Multiplexer #3							
c h #	sensor	c h #	sensor	c h #	sensor	c h #	sensor
1 6		1 2	23105 PMB1-STA1	8	23111 PMB8-STA2	4	23120 PMB7-STA1
1 5	23106 PMB1-STA2	1 1	23107 PMB1-STA3	7	23114 PMB8-STA5	3	23124 PMB7-STA5
1 4	23108 PMB1-STA4	1 0	23110 PMB8-STA1	6	23112 PMB8-STA3	2	23121 PMB7-STA2
1 3	23109 PMB1-STA5	9	23113 PMB8-STA4	5	23122 PMB7-STA3	1	23123 PMB7-STA4

Pressure Multiplexer #4							
c h #	sensor	c h #	sensor	c h #	sensor	c h #	sensor
1 6	22812 BARO-0	1 2	23129 PMB3-STA5	8	23118 PMB2-STA2	4	23133 PMB6-STA4
1 5		1 1	23127 PMB3-STA3	7	23117 PMB2-STA3	3	23130 PMB6-STA1
1 4	23126 PMB3-STA2	1 0	23115 PMB2-STA5	6	23116 PMB2-STA4	2	23132 PMB6-STA3
1 3	23128 PMB3-STA4	9	23119 PMB2-STA1	5	23131 PMB6-STA2	1	23134 PMB6-STA5

IA 25-1-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 11/25/93

Test Executor: Mary Ann Widing

Test Plan Section: 5.2.1 Data Acquisition Subsystem with Temperature Subsystem

Results: The system was connected to one temperature sensor exposed to the air. The readings of the sensor over time were found to correspond to those values expected. Data files were correctly read by the PC.

Test Recorder: Mary Ann Widing MAW Date: 4/26/94

IP 25-1-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 9/14/94

Test Executor: Dana Dominiak

Test Plan Section: 5.2.2 Data Acquisition Subsystem with Temperature Subsystem

Results: The temperature subsystem was attached to the temperature sensors as shown in the table on the following page. The values were checked for reasonableness. The data values were also examined on the data acquisition PC and appeared to be correct.

Test Recorder: Dana Dominiak DD-Man Date: 3/23/95

IP 25-1-1

Temperature Multiplexer #1							
ch #	sensor	ch #	sensor	ch #	sensor	ch #	sensor
16		12	44, PMB5-STA4	8	40, PMB10-STA3	4	5, PMB9-STA5
15	46, PMB5-STA1	11	47, PMB5-STA3	7	48, PMB10-STA4	3	4, PMB9-STA4
14	45, PMB5-STA2	10	50, PMB10-STA5	6	42, PMB10-STA1	2	2, PMB9-STA2
13	43, PMB5-STA5	9	41, PMB10-STA2	5	1, PMB9-STA1	1	3, PMB9-STA3

Temperature Multiplexer #2							
ch #	sensor	ch #	sensor	ch #	sensor	ch #	sensor
16		12		8		4	34, PMB4-STA2
15		11		7	31, PMB4-STA5	3	32, PMB4-STA3
14		10		6		2	35, PMB4-STA1
13		9		5	33, PMB4-STA4	1	

Temperature Multiplexer #3							
ch #	sensor	ch #	sensor	ch #	sensor	ch #	sensor
16	12, PMB8-STA4	12	10, PMB1-STA1	8	14, PMB8-STA2	4	27, PMB7-STA1
15	9, PMB1-STA2	11	3, PMB1-STA3	7	11, PMB8-STA5	3	21, PMB7-STA5
14	7, PMB1-STA4	10	15, PMB8-STA1	6	13, PMB8-STA3	2	24, PMB7-STA2
13	6, PMB1-STA5	9		5	23, PMB7-STA3	1	22, PMB7-STA4

Temperature Multiplexer #4							
ch #	sensor	ch #	sensor	ch #	sensor	ch #	sensor
16		12	25, PMB3-STA5	8	19, PMB2-STA2	4	49, PMB6-STA4
15	30, PMB3-STA1	11	28, PMB3-STA3	7	18, PMB2-STA3	3	39, PMB6-STA1
14	29, PMB3-STA2	10	16, PMB2-STA5	6	17, PMB2-STA4	2	37, PMB6-STA3
13	26, PMB3-STA4	9	20, PMB2-STA1	5	38, PMB6-STA2	1	36, PMB6-STA5

IA 26-1-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 11/25/93

Test Executor: Mary Ann Widing

Test Plan Section: 5.3.1 Data Acquisition Subsystem with Tensiometer Subsystem

Results: The system was connected to one tensiometer connected to a vacuum pump. The readings of the sensor over time were found to correspond to those suctions applied by varying the vacuum pump. Data files were correctly read by the PC.

Test Recorder: Mary Ann Widing MAW Date: 4/26/94

IP 26-1-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 9/14/94

Test Executor: Dana Dominiak

Test Plan Section: 5.3.2 Data Acquisition Subsystem with Tensiometer Subsystem

Results: The tensiometer subsystem was attached to the tensiometers as shown in the table on the following page. The values were checked for reasonableness and appeared to be correct.

Test Recorder: Dana Dominiak DD-man Date: 3/23/95

IP 26-1-1

Tensiometer Multiplexer #1							
ch #	sensor	ch #	sensor	ch #	sensor	ch #	sensor
16		12		8		4	4, TENS4
15		11		7	7, TENS7	3	3, TENS3
14		10		6	6, TENS6	2	2, TENS2
13		9		5	5, TENS5	1	1, TENS1

IA 27-1-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 11/20/93

Test Executor: Mary Ann Widing

Test Plan Section: 5.4.1 Data Acquisition Subsystem with Data Analysis Subsystem

Results: The data acquisition system was connected to the data analysis system. Data files were transferred correctly to the Sun after they were read by the PC during data acquisition. The data files were correctly displayed using the analysis software. The PC continued to operate after the Sun was disconnected from it.

Test Recorder: Mary Ann Widing MAW Date: 4/26/94

IP 27-1-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 9/15/94

Test Executor: Mary Ann Widing

Test Plan Section: 5.4.2 Data Acquisition Subsystem with Data Analysis Subsystem

Results: The data acquisition system was connected to the data analysis system. Data files were transferred correctly to the Sun after they were read by the PC during data acquisition. The data files were correctly displayed using the analysis software. The PC continued to operate after the Sun was disconnected from it.

Test Recorder: Mary Ann Widing MAW Date: 3/23/95

IA 28-1-1

Test Sheet for Data Acquisition and Management System for Monitoring the FOS Site

Test Date: 11/25/93-11/27/93

Test Executor: Mary Ann Widing

Test Plan Section: 5.5.1 Full Operation System

Results: The data acquisition system was connected to the data-analysis system. The system was run for several days connected to sixteen pressure sensors, fifteen temperature sensors, and two tensiometers. Data files were transferred correctly to the Sun after they were read by the PC. The following graphs show some of the results of these tests. Examining the data reveals that some noise is apparent in the pressure and temperature readings. This merits further investigation during test IP28-1-1.

Test Recorder: Mary Ann Widing MAW Date: 4/26/94

Creation Date: 4/1/94

Creation Date: 4/1/94

STATION=Station #3 DATE=11/25/93

Creation Date: 4/1/94

Creation Date: 4/1/94

STATION=Station #5 DATE=11/25/93

Pressure (psi)

0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 2 2 2 2 2
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4
 :
 0
 0

Time (GMT)

Well —◆— FDG-1 —●— FDG-2 —▲— FDG-3
 —+— FI-1 —+— FI-2 + + + FI-3

Creation Date: 4/1/94

Creation Date: 4/1/94

STATION=Station #2 DATE=11/25/93

Creation Date: 4/1/94

Creation Date: 4/1/94

Creation Date: 4/1/94

Creation Date: 4/1/94

Creation Date: 4/26/94

IP 28-1-1**Test Sheet for Data Acquisition and Management System for
Monitoring the FOS Site**

Test Date: 9/18/94

Test Executor: Mary Ann Widing

Test Plan Section: 5.5.1 Full Operation System

Results: The data acquisition system was connected to the data analysis system. The system was run for several days connected to the sensors at the FOS site. Data files were transferred correctly to the Sun after they were read by the PC. The following graphs show some of the results of these tests. Examining the data reveals that the initial noise is no longer present and is believed to have been caused by the initial breaking-in period of the batteries on the data subunits. The data values correspond to those expected during the background period. Barometric values and temperature values corresponded to local values over that period of time. Note that the current transducer #7 for tensiometer #7 was replaced by current transducer #10 in early 2/95 by SNL personnel after these tests were performed because of erratic tensiometer readings.

Test Recorder: Mary Ann Widing MAW Date: 3/23/95

Station=Station #1 DATE=09/18/94

Pressure (psi)
Average

Time (GMT)

Well *-*-* PMB1 ◊-◊- PMB10 ▲-▲- PMB2 ~-~ PMB3 #-#- PMB4
 ●-●- PMB5 ○-○- PMB6 *-*-* PMB7 PMB8 x-x-x PMB9

Pressure (psi)
Average

Pressure (psi)
Average

•

Station=Station #5 DATE=09/18/94

Temperature (C)
Average

Station=Station #3 DATE=09/18/94

Temperature (C)
Average

Time (GMT)

Well *-*-* PMB1 *-*-* PMB10 *-*-* PMB2 PMB3 *-*-* PMB4
 --* PMB5 *-*-* PMB6 *-*-* PMB7 PMB8 *-*-* PMB9

Station=Station #4 DATE=09/18/94

Temperature (C)
Average

APPENDIX C:
SUBSYSTEM PHOTOGRAPHS

AM416
RELAY MULTIPLEXER

MADE IN USA

RES
CLK
GND
12V

H1
L1
H2
L2
SHIELD
H1
L1
H2
L2

COM

H1
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H2
L2
SHIELD
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SHIELD
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