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Instruction Manual

Model 8020 (Micro-10)

Multi-Channel Datalogger

(Doc Rev J, 2/2003)

Warranty Statement

Geokon, Inc. warrants its products to be free of defects in materials and workmanship, under normal use and service for a period of 13 months from date of purchase. If the unit should malfunction, it must be returned to the factory for evaluation, freight prepaid. Upon examination by Geokon, if the unit is found to be defective, it will be repaired or replaced at no charge. However, the WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of being damaged as a result of excessive corrosion or current, heat, moisture or vibration, improper specification, misapplication, misuse or other operating conditions outside of Geokon's control. Components which wear or which are damaged by misuse are not warranted. This includes fuses and batteries.

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OVERVIEW

The MICRO-10 datalogger is designed to support a wide variety and number of instruments for various unattended data collection applications. Waterproof packaging allows the unit to be installed in field environments where inhospitable conditions prevail. The Nema 4 enclosure also has provision for locking to limit access to responsible field personnel.

The basic system consists of the MICRO-10 datalogger and a multiplexer. Multiplexers expand the system by increments of 16 or 32 channels depending on the instrument type and configuration. The maximum number of multiplexers that can be connected to a MICRO-10 is 8 (with appropriate interfaces), hence, 256 (32×8) channels are measurable.

The controller portion of the MICRO-10 datalogger consists of a Campbell Scientific CR10X Measurement and Control Module. For complete specifications on the CR10X see Appendix A.1. To fully understand the workings of the CR10 it is necessary to read the Overview section of the CR10X Operator's Manual. This manual will not attempt to describe all the capabilities of the Control Module, only those relevant to the MICRO-10 system will be discussed.

See Figure 1 for a typical MICRO-10 configuration.

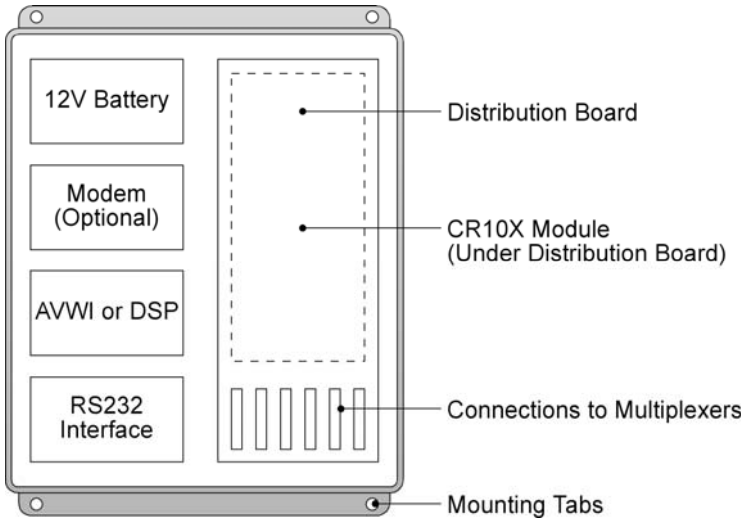

Figure 1 - Typical MICRO-10 Configuration

1. SOFTWARE INSTALLATION

The MICRO-10 datalogger may be supplied with either PC208W software (developed by Campbell Scientific, Logan, Utah) or Multilogger software (developed by Canary Systems, Inc, New London, NH). In either case please refer to the manual supplied with the software for instructions on installing the software on a PC. At time of printing of this revision of the Micro-10 manual PC208W is being supplied in version 3.3 and Multilogger is being supplied in version 2.1.0.

2. HARDWARE INSTALLATION

2.1 The recommended method of installation involves attaching the various boxes (MICRO-10 and multiplexers) to a fixed structure, such as a wall, in an upright position.

See Figures 2 and 3 for hole dimensions on the MICRO-10 enclosure (stainless steel Nema 4 enclosure) and multiplexers (fiberglass Nema 4X enclosure). The enclosures are rated to be dust and water proof (when the lids are properly secured) however, it is recommended that these influences be kept to a minimum. If the system will be installed outdoors a protective enclosure (another box) is highly recommended.

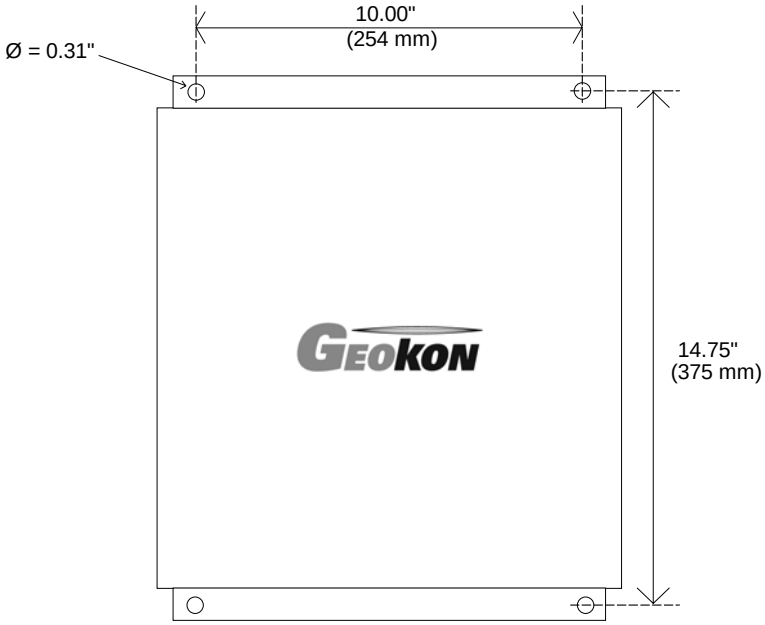

Figure 2 - MICRO-10 Mounting Hole Dimensions

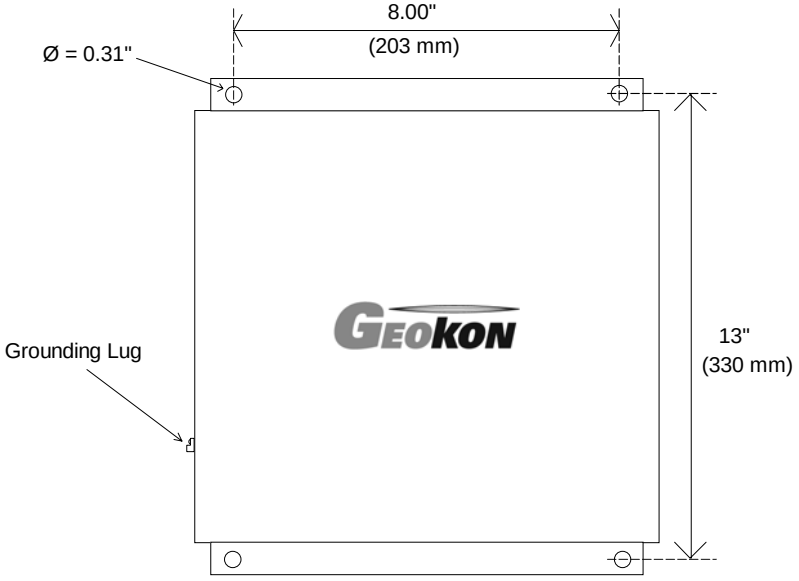

Figure 3 - Model 8032 Multiplexer Mounting Hole Dimensions

2.2 Once the datalogger and multiplexers are installed the charger can be plugged into the AC mains. It is recommended that the charger be left plugged in at all times (Section 3.1).

2.3 Optionally, especially if the installation is out-of-doors, a grounding rod can be driven (or other suitable attachment to earth utilized) to ground the system and provide a path to earth for a lightning strike (either direct or indirect). A 6' to 8' copper stake with appropriate large gauge wire (12 AWG or larger) connected to the MICRO-10 enclosure is suggested. The stake should be driven as close to the datalogger as possible. A grounding lug is supplied on the exterior of the Micro-10 enclosure to connect to.

2.4 If it has not been done so already, the instruments can be installed at this time. Associated with the sensor installation is the running of cables to the multiplexers. Be sure if splices are made that all shield drain wires are also spliced! Also, make sure all cables are clearly labeled at the multiplexers and records kept of all modifications (splices, repairs, junctions, etc.).

2.5 Following sensor and cable installation, connections to the multiplexers can be made. See Appendix B for the wiring order for different instrument types. Be sure that detailed records are kept of the wiring sequence for each multiplexer. These records will be used later in entering gage information (types, labels, factors, etc.) and data reduction.

2.6 The multiplexers can be connected to the datalogger now. Notice the 6 mux connectors on the side (Figure 5) of the MICRO-10 enclosure (number and order may vary depending on the particular system). Connect each mux to the appropriate port with the supplied cables.

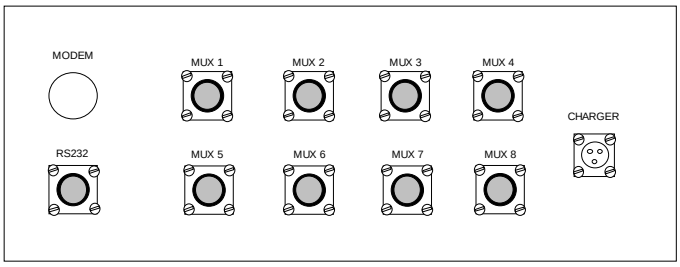

Figure 4 - Side View of Typical MICRO-10

2.7 Note the 'RS232' connector on the MICRO-10 enclosure (Figure 4). Connect to COM port on the computer with the 10 Pin Bendix to DB-9 cable (use 25 to 9 pin adaptor if necessary).

2.8 System is now ready to be configured. Please follow the instructions in the appropriate software manual to configure the datalogger.

3. MAINTENANCE

3.1 Charging

The MICRO-10 is supplied with an AC adaptor for charging the battery. It is recommended that the adaptor be left plugged in at all times. If not plugged in, the system will operate for at least a month before the battery goes dead. Actual time for each system will vary depending on configuration and scan interval, however, it can be determined for a particular system by configuring, charging the battery, and then monitoring the supply voltage periodically (at least once a week). When the voltage drops below 11 volts the battery should be charged. If the voltage drops below 9.6 volts operation of the datalogger will become erratic as evidenced by communication problems, possible improper measurements and/or loss of data.

If AC is not available for the adaptor the following suggestions should be considered;

- Install an external battery to extend operating time (Section 3.2).
- Install solar panels (consult factory).
- Charge battery periodically with portable generator or return unit to AC source.

3.2 External Power

The MICRO-10 datalogger has provision for external power via the 3 pin Amphenol plug mounted on the side of the unit. Included with the system is a 3 pin plug to alligator clip leads cable for connecting an external supply. The nominal operating voltage of the datalogger is 12 volts. Any standard 12 volt battery (auto, marine, or motorcycle) can be used to considerably lengthen the operating time of the datalogger. In addition, if AC is available a standard 12 volt DC power supply could be substituted for a battery. The maximum input voltage is 16 volts. The minimum for proper operation of the datalogger is 9.6 volts. The internal battery is automatically disconnected when an external battery is used.

To connect the external power attach the black clip lead to negative(-) of the battery or power supply. Then, attach the red lead to the positive(+). Plug the connector on the cable into the datalogger. Note: If the clips are hooked up backwards, or they are shorted together the internal fuse of the datalogger will blow! Consult Section 3.4 for information as to fuse replacement.

When a solar panel is used to charge the internal battery the switch on the distribution board must be set to SOLAR.

3.3 Battery Replacement: If the internal Lead acid battery has failed it is recommended that the unit be returned to the factory for service by Geokon personnel. However, with skilled personnel and appropriate tools, it is possible for the user to replace the battery. **Consult the factory before attempting!**

3.4 Fuse Replacement: Note that there are five fuses on the distribution board of the MICRO-10.

Once removed, the fuse can be checked visually and for confirmation with an ohmmeter. A gap will be in evidence (with a bit of smoke) on the inner filament if the fuse is blown. This can be verified by a very high resistance measurement (megohms) with the ohmmeter. If it is blown, insert one of the supplied replacement fuses. If there are no replacement fuses left consult the factory for more, or they can be purchased from an electrical supply house. There are four 2 amp SLO-BLO fuses (F1-F4) and one 0.6 amp fuse (F5) on the distribution board. The fuses are 5 x 20 mm.

3.5 Troubleshooting: This section will NOT attempt to cover all possible problems that could be encountered in the course of datalogger operations. Consult the factory if other problems arise or remain unresolved.

- **Cannot communicate with the datalogger.**

Suggestions:

1. The wrong communication cables are being used or the cables in use are defective. Consult Appendix E.2.1 to verify cable pinout. Consult the factory for interfacing information.

2. The internal battery could be dead. Charge overnight and try again. If it still doesn't work check the voltage across the terminals of the battery. If the voltage is still below 10 volts the battery may need to be replaced.

3. The wrong communication port is being used on the host computer (default is COM1). Consult the appropriate software manual for instructions on changing the communication port.

4. The communication port on the host computer is defective. Verify the functioning and configuration of the COM port by using it with another RS-232 device, such as a modem or serial printer.

- **The system battery voltage and panel temperature read odd numbers.**

Suggestions:

1. The system battery could be low. Charge and check again (see previous section).

2. A disruptive current loop may be operating as a result of improper grounding or excessive noise. Consult the factory for more information.

- **The internal battery measurement does not increase when the AC adaptor is plugged in.**

Suggestions:

1. The adaptor may be damaged. Check the output pins of the adaptor with a voltmeter.

2. The charger fuse is blown. Consult Section 3.4 for checking and/or replacement.

3. The internal battery is no good. Consult the factory.

- **The datalogger will not operate on external power.**

Suggestions:

1. The external voltage supply is below operating limits. If the external source is a battery, charge it. If its a power supply, check the output with a voltmeter.

2. The external power or battery fuse is blown. See Section 3.4.

3. The control switch is set on SOLAR. Set the switch to BATTERY.

- **Loss of CR10X program and/or data.**

Suggestions:

1. The system has experienced a voltage dropout or surge which disrupted operations. If the AC charger is being used, install overvoltage protection on the AC line. Check both fuses (Section 3.4).

2. The surge originated as a result of lightning. Install appropriate grounding. Install lighting protection devices on all incoming and outgoing lines (consult factory).

- **Sensor readings show -99999 or are unstable.**

Suggestions:

1. The wrong sensor type has been selected. Check the model number of the sensor against the software setting.

2. The cable(s) to the sensor(s) have been damaged permitting moisture and debris to enter the jacket. Wires may be shorted together. Inspect the cable.

3. If all sensors on a particular multiplexer are erratic or returning '-99999' perhaps the multiplexer cable has been damaged. Inspect the cable. Try another cable to verify proper functioning.

4.The sensor(s) have been damaged. For example, overrange on a vibrating wire sensor can cause erratic readings.

5.There is an electrical noise source nearby. Move the sensor, cables, and datalogger away from the noise source. Install grounding devices. Consult the factory.

- **The sensor readings show OVERRANGE or 0000000 all the time.**

Suggestions

1.The 'Sensor Type' selected for that particular channel is 'None'. This is applicable for users of Multilogger. Please refer to the Multilogger manual.

2.A scan has not been initiated yet because of the 'Start Time' setting (Multilogger users only).

3.‘Update’ has not been run (Multilogger users only).

4. WARRANTY/LIABILITY

4.1 Product Warranty

Geokon, Inc. warrants its products to be free from defects in materials and workmanship for a period of 13 months from the date of purchase. This warranty period is comprised of the standard 12 month term plus 1 month as a grace period. This ensures that our customers will receive the maximum coverage on their product. This herein stated warranty is null and void should the unit be tampered with by other than Geokon, Inc. personnel or the damage be a result of corrosion, supply transients, lightning, heat, moisture, immersion, improper specification, heavy equipment, shock, misapplication, misuse or other operating conditions beyond the knowledge and control of Geokon. In addition, fuses and batteries are not covered by the warranty, regardless.

If, in the course of use the product malfunctions or ceases operation the steps as outlined in the 'Troubleshooting' section should be followed first. If the cause of the problem is not determined, contact the factory for further assistance (Phone: (603) 448 1562, Fax: (603) 448 3216). If the problem is of a serious or unknown nature it will be required that the unit be returned to the factory (freight charges prepaid to Geokon, Inc.) for examination by Geokon personnel. If the defect is found to be the result of poor workmanship, and is within the afore mentioned warranty period, it will be repaired or replaced, at Geokons discretion, by Geokon, Inc. at no charge.

If the warranty is null and void as a result of improper use or expiration of the warranty all costs related to servicing of the unit will be borne by the purchaser, hereafter referred to as the 'user'. This includes shipping both ways, duties, fees, components and Geokon personnel time.

Geokon personnel are available, at user cost, to service the equipment on-site.

4.2 Limit of Liability

The Multilogger software has been developed for use with the MICRO-10 datalogger **(Model 8020)** and, as such, Geokon, Inc. assumes no responsibility for its use with other existing systems. For the user conducting particularly unusual or sensitive analysis it is recommended that additional tests are conducted to confirm data resulting from use of the Multilogger software and datalogger. Also, the program and datalogger is provided 'as is' and Geokon, Inc. assumes no responsibility as to results, performance, or interpretation associated with its use. We reserve the right to revise this publication and/or program from time to time with no obligation to notify users of these changes.

> **All things considered, Geokon, Inc., is not liable, for any claims, injuries, or damages caused directly or indirectly by the proper or improper use of the MICRO-10, beyond the purchase price of the system.**

APPENDIX A - SPECIFICATIONS

A.1 CR10X Measurement and Control Module

Power requirements: 9.6 to 16 VDC
Analog measurement current drain: 46 mA
Processing current drain: 13 mA
Quiescent current drain: 1.0 mA
Operating temperature: -25° to +50° C
Processor: Hitachi 6303
Memory: 32k ROM, 128K RAM (CR10X module)
Storage capacity: 62000 Final Storage locations ('Low' resolution) with 128K module, expandable to 1,000,000 with 2MB module
Real time clock accuracy: ±1 minute per month
Expansion capability: up to 8 32 channel multiplexers (single ended)
System battery: 12 V, 7 Ahr lead acid
Communication: 9600 baud 1 start bit, 8 data bits, no parity, 1 stop bit

A.1.1 Analog Inputs

Configuration: 6 differential or 12 single-ended
Voltage measurement accuracy: 0.1% of FSR (0.05% of FSR for 0° to 40°C)
Voltage measurement ranges and resolution:

Range	Resolution
±2.5 V	333.3 µV
±250 mV	33.3 µV
±25.0 mV	3.3 µV
±7.5 mV	1.00 µV
±2.5 mV	.33 µV

Common mode range: ±2.5 VDC
DC common mode rejection (CMRR): >140 dB
Maximum input voltage: 16 VDC

A.1.2 Excitation Outputs

Configuration: 3 switched output channels
Excitation range: ±2.5 V
Excitation resolution: 0.67 mV
Excitation accuracy: 0.2% of FSR (0.1% of FSR for 0°C to 40°C)
Output current: 20 mA @ 2.5 VDC, 35 mA @ 2.0 VDC

A.1.3 Pulse Inputs

Configuration: 2 eight or 1 sixteen bit
Maximum count rate: 16KHz for eight bit, 500 kHz for sixteen bit
Maximum input voltage: +/-20 VDC
Modes: Switch closure, high frequency pulse, low level AC

A.1.3 Control Ports
Configuration: 8 digital I/O ports
Input/output resistance: 100kΩ/500Ω, respectively
Input 'high' level: 3.0 V to 5.5 V
Input 'low' level: -0.5 V to 0.8 V
Output 'high' level: 5 V ±0.1 V
Output 'low' level: <0.1 V

A.2 Model 8032 Multiplexer (See the Multiplexer Manual for complete specifications)
Power Requirements: 10-16 VDC (unregulated)
Quiescent Current: 10 μA
Channel Activated Current: 38 mA
Control Line Input Impedance: 10 kΩ
Control Line Input Levels: TTL or RS-232 (±9 VDC)
Transient Protection: 16 VDC Transzorbs
Operating Temperature: –40° to +60° C

A.3 AVW1 Vibrating Wire Interface (See AVW1 Manual for complete specifications)
Power requirements: 5 VDC (12 VDC optional)
Vibrating Wire measurement current: 32 mA
Thermistor measurement current: 0.4 mA
Quiescent current: none

A.4 DSP Digital Signal Processor (See VWDSP Interface Application Note #11)
Power requirements: Nominal 12VDC (6V to 16V)

A.5 AC Adaptors
110VAC: 533 mA @ 18 VDC
220VAC: 800 mA @ 15 VDC

APPENDIX B - MODEL 8032 MULTIPLEXER WIRING

B.1 Model 8032 Mutiplexer Description

Figure 5 depicts the terminal board to which gage connections are made. If the terminal board is equipped with manual switches connectors J3 and J4 will have ribbon cables attached connected to switch boards. J1 and J2 make connections to the multiplexer board installed on the underside.

The components labeled "SA" are optional Tripolar Surge Arrestors. Components labeled "SG" are optional Bipolar Surge Arrestors.

Terminal strips T1 to T4 are for the gage connections.

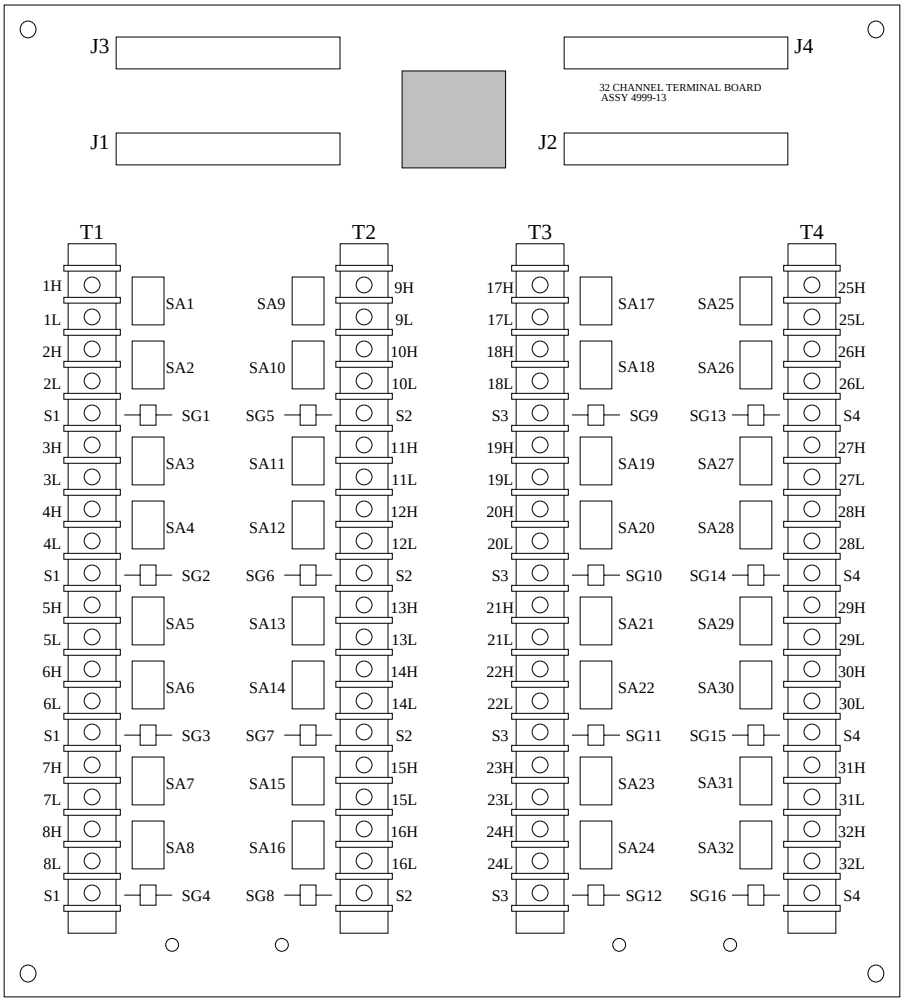

Figure 5 - Plan View of Multiplexer Terminal Board

See the Model 8032 Multiplexer Instruction Manual for additional information.

B.2 Vibrating Wire Gage Wiring

Terminal	16 Channel	32 Channel
1H	VW Sensor #1	VW Sensor #1
1L	VW Sensor #1	VW Sensor #1
2H	Thermistor with VW Sensor #1	VW Sensor #2
2L	Thermistor with VW Sensor #1	VW Sensor #2
S1	Shield Drain Wire from VW Sensor #1	Shield Drain Wires from VW Sensors 1&2
3H	VW Sensor #2	VW Sensor #3
3L	VW Sensor #2	VW Sensor #3
4H	Thermistor with VW Sensor #2	VW Sensor #4
4L	Thermistor with VW Sensor #2	VW Sensor #4
S1	Shield Drain Wire from VW Sensor #2	Shield Drain Wires from VW Sensors 3&4
•	•	•
•	•	•
•	•	•
31H	VW Sensor #16	VW Sensor #31
31L	VW Sensor #16	VW Sensor #31
32H	Thermistor with VW Sensor #16	VW Sensor #32
32L	Thermistor with VW Sensor #16	VW Sensor #32
S4	Shield Drain Wire from VW Sensor #16	Shield Drain Wires from VW Sensors 31&32

Note: Polarity of Vibrating Wire or Thermistor leads is not important.

B.3 Linear Potentiometer Wiring

Terminal	16 Channel	32 Channel
1H	Excitation to Pot #1	Excitation to Pot #1
1L	Wiper Output from Pot #1	Wiper Output from Pot #1
2H	Remote Sense from Pot #1	Excitation to Pot #2
2L	Analog Ground to Pot #1	Wiper Output from Pot #2
S1	Shield Drain Wire from Linear Pot #1	Analog Ground to Pots 1&2 Shield Drain Wires from Pots 1&2
3H	Excitation to Pot #2	Excitation to Pot #3
3L	Wiper Output from Pot #2	Wiper Output from Pot #3
4H	Remote Sense from Pot #2	Excitation to Pot #4
4L	Analog Ground to Pot #2	Wiper Output from Pot #4
S1	Shield Drain Wire from Linear Pot #2	Analog Ground to Pots 3&4 Shield Drain Wires from Pots 3&4
•	•	•
•	•	•
•	•	•
31H	Excitation to Pot #16	Excitation to Pot #31
31L	Wiper Output from Pot #16	Wiper Output from Pot #31
32H	Remote Sense from Pot #16	Excitation to Pot #32
32L	Analog Ground to Pot #16	Wiper Output from Pot #32
S4	Shield Drain Wire from Linear Pot #16	Analog Ground to Pots 31&32 Shield Drain Wires from Pots 31&32

B.4 Tiltmeter (Force Accelerometer) Wiring

Terminal	16 Channel	32 Channel
1H	Output from Tiltmeter #1	Output from Tiltmeter #1
1L	Output Ground from Tiltmeter #1	Output Ground from Tiltmeter #1
2H	Positive Supply to Tiltmeter #1	Output from Tiltmeter #2
2L	Negative Supply to Tiltmeter #1	Output Ground from Tiltmeter #2
S1	Power Ground to Tiltmeter #1 Shield Drain Wire from Tiltmeter #1	Output Ground from Tiltmeters 1&2 Shield Drain Wires from Tiltmeters 1&2
3H	Output from Tiltmeter #2	Output from Tiltmeter #3
3L	Output Ground from Tiltmeter #2	Output Ground from Tiltmeter #3
4H	Positive Supply to Tiltmeter #2	Output from Tiltmeter #4
4L	Negative Supply to Tiltmeter #2	Output Ground from Tiltmeter #4
S1	Power Ground to Tiltmeter #2 Shield Drain Wire from Tiltmeter #2	Output Ground from Tiltmeters 3&4 Shield Drain Wires from Tiltmeters 3&4
•	•	•
•	•	•
•	•	•
31H	Output from Tiltmeter #16	Output from Tiltmeter #31
31L	Output Ground from Tiltmeter #16	Output Ground from Tiltmeter #31
32H	Positive Supply to Tiltmeter #16	Output from Tiltmeter #32
32L	Negative Supply to Tiltmeter #16	Output Ground from Tiltmeter #32
S4	Power Ground to Tiltmeter #16 Shield Drain Wire from Tiltmeter #16	Output Ground from Tiltmeters 31&32 Shield Drain Wires from Tiltmeters 31&32

B.5 Resistance Bridge Wiring

Terminal	16 Channel	32 Channel
1H	Positive Output (S+) from Bridge #1	Positive Output (S+) from Bridge #1
1L	Negative Output (S-) from Bridge #1	Negative Output (S-) from Bridge #1
2H	Excitation (P+) to Bridge #1	Positive Output (S+) from Bridge #2
2L	Excitation Ground (P-) to Bridge #1	Negative Output (S-) from Bridge #2
S1	Shield Drain Wire from Bridge #1	Shield Drain Wires from Bridges 1&2
3H	Positive Output (S+) from Bridge #2	Positive Output (S+) from Bridge #3
3L	Negative Output (S-) from Bridge #2	Negative Output (S-) from Bridge #3
4H	Excitation (P+) to Bridge #2	Positive Output (S+) from Bridge #4
4L	Excitation Ground (P-) to Bridge #2	Negative Output (S-) from Bridge #4
S1	Shield Drain Wire from Bridge #2	Shield Drain Wires from Bridges 3&4
•	•	•
•	•	•
•	•	•
31H	Positive Output (S+) from Bridge #16	Positive Output (S+) from Bridge #31
31L	Negative Output (S-) from Bridge #16	Negative Output (S-) from Bridge #31
32H	Excitation (P+) to Bridge #16	Positive Output (S+) from Bridge #32
32L	Excitation Ground (P-) to Bridge #16	Negative Output (S-) from Bridge #32
S4	Shield Drain Wire from Bridge #16	Shield Drain Wires from Bridges 31&32

B.6 Conductivity Probe Wiring

Terminal	16 Channel	32 Channel
1H	Conductivity Probe #1	Conductivity Probe #1
1L	Conductivity Probe #1	Conductivity Probe #1
2H	Thermistor for Conductivity Probe #1	Conductivity Probe #2
2L	Thermistor for Conductivity Probe #1	Conductivity Probe #2
S1	Shield Drain Wire from Conductivity Probe #1	Shield Drain Wires from Conductivity Probes 1&2
3H	Conductivity Probe #2	Conductivity Probe #3
3L	Conductivity Probe #2	Conductivity Probe #3
4H	Thermistor for Conductivity Probe #2	Conductivity Probe #4
4L	Thermistor for Conductivity Probe #2	Conductivity Probe #4
S1	Shield Drain Wire from Conductivity Probe #2	Shield Drain Wires from Conductivity Probes 3&4
•	•	•
•	•	•
•	•	•
31H	Conductivity Probe #16	Conductivity Probe #31
31L	Conductivity Probe #16	Conductivity Probe #31
32H	Thermistor for Conductivity Probe #16	Conductivity Probe #32
32L	Thermistor for Conductivity Probe #16	Conductivity Probe #32
S4	Shield Drain Wire from Conductivity Probe #16	Shield Drain Wires from Conductivity Probes 31&32

Note: Polarity of Conductivity or Thermistor leads is not important.

B.7 4-20 mA Wiring

Terminal	16 Channel (external power)	32 Channel (loop power)
1H	Positive Output from Device #1	Positive Output from Device #1
1L	Negative Output from Device #1	Negative Output from Device #1
2H	Positive Supply to Device #1	Positive Output from Device #2
2L	Negative Supply (Ground) to Device #1	Negative Output from Device #2
S1	Shield Drain Wire from Device #1	Shield Drain Wires from Devices 1&2
3H	Positive Output from Device #2	Positive Output from Device #3
3L	Negative Output from Device #2	Negative Output from Device #3
4H	Positive Supply to Device #2	Positive Output from Device #4
4L	Negative Supply (Ground) to Device #2	Negative Output from Device #4
S1	Shield Drain Wire from Device #2	Shield Drain Wires from Devices 3&4
•	•	•
•	•	•
•	•	•
31H	Positive Output from Device #16	Positive Output from Device #31
31L	Negative Output from Device #16	Negative Output from Device #31
32H	Positive Supply to Device #16	Positive Output from Device #32
32L	Negative Supply (Ground) to Device #16	Negative Output from Device #32
S4	Shield Drain Wire from Device #16	Shield Drain Wires from Devices 31&32

Note: Nominal supply voltage (Input) is 24 VDC (others available, consult the factory).

B.8 Thermistor Wiring

Terminal	16 Channel	32 Channel
1H	Thermistor #1	Thermistor #1
1L	Thermistor #1	Thermistor #1
2H	Remote Sense from Thermistor #1	Thermistor #2
2L	No Connection	Thermistor #2
S1	Shield Drain Wire from Thermistor #1	Shield Drain Wires from Thermistors 1&2
3H	Thermistor #2	Thermistor #3
3L	Thermistor #2	Thermistor #3
4H	Remote Sense from Thermistor #2	Thermistor #4
4L	No Connection	Thermistor #4
S1	Shield Drain Wire from Thermistor #2	Shield Drain Wires from Thermistors 3&4
•	•	•
•	•	•
•	•	•
31H	Thermistor #16	Thermistor #31
31L	Thermistor #16	Thermistor #31
32H	Remote Sense from Thermistor #16	Thermistor #32
32L	No Connection	Thermistor #32
S4	Shield Drain Wire from Thermistor #16	Shield Drain Wires from Thermistors 31&32

Note: Polarity of Thermistor leads is not important.

B.9 Thermocouple Wiring (Copper-Constantan)

Terminal	16 Channel	32 Channel
1H	Copper Lead from Thermocouple #1	Copper Lead from Thermocouple #1
1L	Constantan Lead from Thermocouple #1	Constantan Lead from Thermocouple #1
2H	Copper Lead from Thermocouple #2	Copper Lead from Thermocouple #2
2L	Constantan Lead from Thermocouple #2	Constantan Lead from Thermocouple #2
S1	No Connection	No Connection
3H	Copper Lead from Thermocouple #3	Copper Lead from Thermocouple #3
3L	Constantan Lead from Thermocouple #3	Constantan Lead from Thermocouple #3
4H	Copper Lead from Thermocouple #4	Copper Lead from Thermocouple #4
4L	Constantan Lead from Thermocouple #4	Constantan Lead from Thermocouple #4
S1	No Connection	No Connection
•	•	•
•	•	•
•	•	•
31H	Copper Lead from Thermocouple #31	Copper Lead from Thermocouple #31
31L	Constantan Lead from Thermocouple #31	Constantan Lead from Thermocouple #31
32H	Copper Lead from Thermocouple #32	Copper Lead from Thermocouple #32
32L	Constantan Lead from Thermocouple #32	Constantan Lead from Thermocouple #32
S4	No Connection	No Connection

Note: Polarity of thermocouple leads IS important.

APPENDIX C - SHIP LIST

C.1 Hardware

The following equipment is included with the system:

- External Power cable
- DB-9 to 10 pin Bendix RS-232 Cable
- 9 pin to 25 pin RS-232 adaptor
- Small regular screwdriver
- Spare slo-blo fuses (5), 0.6 amp and 2 amp
- AC Adaptor (110 VAC or 220 VAC)

The following manuals are included:

- MICRO-10 Instruction Manual
- CR10X Operator's Manual (3-ring binder)
- 8032 Multiplexer Instruction Manual (if multiplexers provided)
- SC32B Optically Isolated RS232 Interface Manual
- AVW1/4 Vibrating Wire Interface Instruction Manual (if datalogger is configured with AVW1/4).
- VWDSP Vibrating Wire Digital Signal Processor Application Note #11 (if datalogger is configured with VWDSP).
- Multisensor Interface Users Guide (if datalogger is configured with Multisensor Interface).

Optional accessories:

- COM210 Landline Phone Modem with manual (access datalogger via phone line)
- COM100 Cellular Phone Modem with manual (access datalogger via cellular phone line)
- Short Haul Modems with manual (current loop communication device)
- CR10KD Keypad Display with manual (handheld display for datalogger)
- MD-9 Multidrop Interface with manual (datalogger networking)
- Solar Panel with mounting hardware, charger, and manuals
- RF Modem with manuals (wireless datalogger communication)

Consult the factory for additional information on any of the optional accessories.

APPENDIX D - INPUT/FINAL STORAGE INFORMATION

The MICRO-10 stores data in three areas, Input Storage, Intermediate Storage, and Final Storage. It is important to understand the difference between these areas as they relate to use of the system. See Section OV2 in the CR10X Operator's Manual for more information on these areas.

The two areas apparent in using the MICRO-10 are Input and Final Storage. Input Storage contains initial measurements or values that are not necessarily stored in Final Storage. For example, all values displayed in the 'Text Monitor' mode of Multilogger are illustrative of Input Storage. The datalogger program has instructions directing certain values in Input Storage to be stored in Final Storage for later retrieval.

Intermediate Storage can be thought of as a scratch area for use between Input and Final Storage. This area is transparent to the user and not accessible.

Final Storage consists of arrays of data that have been stored by the instructions of the datalogger program. An array would consist of all the measurements and other pertinent data (time information, system information, etc.) taken at a particular time. The order of the elements in the array would depend on the order in which they were directed to the Final Storage area by the datalogger program.

The Multilogger software configures the datalogger program in such a way that time and system information are output first, followed by readings. Measurements on multiplexers are output in order of ascendancy, i.e., mux 1, mux 2, and so on. Even if a channel is not configured for an instrument on a mux, a value (0) is still output to Final Storage to occupy the position. Also, if only 16 instruments are being monitored 32 locations are allocated in the array. Hence, the order of the data in the Final Storage array will always be the same. The exception to this would be where the user has installed custom instrumentation that is not read on a multiplexer. In this case the numbers are output at the end of the array.

The following two sections will clarify the position measurements occupy in both the Input and Final Storage areas.

D.1 Default Input Storage Assignment

1:Year	65:Mx1Gage3	129:Mx3Gage3	193:Mx5Gage3
2:JulianDay	66:Mx1Gage4	130:Mx3Gage4	194:Mx5Gage4
3:Time-HHMM	67:Mx1Gage5	131:Mx3Gage5	195:Mx5Gage5
4:Seconds	68:Mx1Gage6	132:Mx3Gage6	196:Mx5Gage6
5:DecimlDay	69:Mx1Gage7	133:Mx3Gage7	197:Mx5Gage7
6:ElapsdHr	70:Mx1Gage8	134:Mx3Gage8	198:Mx5Gage8
7:ElapsdMin	71:Mx1Gage9	135:Mx3Gage9	199:Mx5Gage9
8:ElapsdSec	72:Mx1Gage10	136:Mx3Gage10	200:Mx5Gage10
9:Battery	73:Mx1Gage11	137:Mx3Gage11	201:Mx5Gage11
10:PanelTemp	74:Mx1Gage12	138:Mx3Gage12	202:Mx5Gage12
11:ReadTimer	75:Mx1Gage13	139:Mx3Gage13	203:Mx5Gage13
12:Scratch#1	76:Mx1Gage14	140:Mx3Gage14	204:Mx5Gage14
13:Scratch#2	77:Mx1Gage15	141:Mx3Gage15	205:Mx5Gage15
14:Scratch#3	78:Mx1Gage16	142:Mx3Gage16	206:Mx5Gage16
15:Counter	79:Mx1Gage17	143:Mx3Gage17	207:Mx5Gage17
16:Gagetype	80:Mx1Gage18	144:Mx3Gage18	208:Mx5Gage18
17:GReading	81:Mx1Gage19	145:Mx3Gage19	209:Mx5Gage19
18:CurrIntvl	82:Mx1Gage20	146:Mx3Gage20	210:Mx5Gage20
19:CurrItrtn	83:Mx1Gage21	147:Mx3Gage21	211:Mx5Gage21
20:IntvlLn#1	84:Mx1Gage22	148:Mx3Gage22	212:Mx5Gage22
21:IntvlLn#2	85:Mx1Gage23	149:Mx3Gage23	213:Mx5Gage23
22:IntvlLn#3	86:Mx1Gage24	150:Mx3Gage24	214:Mx5Gage24
23:IntvlLn#4	87:Mx1Gage25	151:Mx3Gage25	215:Mx5Gage25
24:IntvlLn#5	88:Mx1Gage26	152:Mx3Gage26	216:Mx5Gage26
25:IntvlLn#6	89:Mx1Gage27	153:Mx3Gage27	217:Mx5Gage27
26:IntItrn#1	90:Mx1Gage28	154:Mx3Gage28	218:Mx5Gage28
27:IntItrn#2	91:Mx1Gage29	155:Mx3Gage29	219:Mx5Gage29
28:IntItrn#3	92:Mx1Gage30	156:Mx3Gage30	220:Mx5Gage30
29:IntItrn#4	93:Mx1Gage31	157:Mx3Gage31	221:Mx5Gage31
30:IntItrn#5	94:Mx1Gage32	158:Mx3Gage32	222:Mx5Gage32
31:IntItrn#6	95:Mx2Gage1	159:Mx4Gage1	223:Mx6Gage1
32:AdjIntrvl	96:Mx2Gage2	160:Mx4Gage2	224:Mx6Gage2
33:GageType1	97:Mx2Gage3	161:Mx4Gage3	225:Mx6Gage3
34:GageType2	98:Mx2Gage4	162:Mx4Gage4	226:Mx6Gage4
35:GageType3	99:Mx2Gage5	163:Mx4Gage5	227:Mx6Gage5
36:GageType4	100:Mx2Gage6	164:Mx4Gage6	228:Mx6Gage6
37:GageType5	101:Mx2Gage7	165:Mx4Gage7	229:Mx6Gage7
38:GageType6	102:Mx2Gage8	166:Mx4Gage8	230:Mx6Gage8
39:GageType7	103:Mx2Gage9	167:Mx4Gage9	231:Mx6Gage9
40:	104:Mx2Gage10	168:Mx4Gage10	232:Mx6Gage10
41:	105:Mx2Gage11	169:Mx4Gage11	233:Mx6Gage11
42:	106:Mx2Gage12	170:Mx4Gage12	234:Mx6Gage12
43:	107:Mx2Gage13	171:Mx4Gage13	235:Mx6Gage13
44:	108:Mx2Gage14	172:Mx4Gage14	236:Mx6Gage14
45:	109:Mx2Gage15	173:Mx4Gage15	237:Mx6Gage15
46:	110:Mx2Gage16	174:Mx4Gage16	238:Mx6Gage16
47:	111:Mx2Gage17	175:Mx4Gage17	239:Mx6Gage17
48:	112:Mx2Gage18	176:Mx4Gage18	240:Mx6Gage18
49:	113:Mx2Gage19	177:Mx4Gage19	241:Mx6Gage19
50:	114:Mx2Gage20	178:Mx4Gage20	242:Mx6Gage20
51:	115:Mx2Gage21	179:Mx4Gage21	243:Mx6Gage21
52:	116:Mx2Gage22	180:Mx4Gage22	244:Mx6Gage22
53:	117:Mx2Gage23	181:Mx4Gage23	245:Mx6Gage23
54:	118:Mx2Gage24	182:Mx4Gage24	246:Mx6Gage24
55:	119:Mx2Gage25	183:Mx4Gage25	247:Mx6Gage25
56:	120:Mx2Gage26	184:Mx4Gage26	248:Mx6Gage26
57:	121:Mx2Gage27	185:Mx4Gage27	249:Mx6Gage27
58:	122:Mx2Gage28	186:Mx4Gage28	250:Mx6Gage28
59:	123:Mx2Gage29	187:Mx4Gage29	251:Mx6Gage29
60:	124:Mx2Gage30	188:Mx4Gage30	252:Mx6Gage30
61:	125:Mx2Gage31	189:Mx4Gage31	253:Mx6Gage31
62:	126:Mx2Gage32	190:Mx4Gage32	254:Mx6Gage32
63:Mx1Gage1	127:Mx3Gage1	191:Mx5Gage1	
64:Mx1Gage2	128:Mx3Gage2	192:Mx5Gage2	

D.2 Default Final Storage Assignment

```
 1:OutputInst#       12:Mx1Gage1         76:Mx3Gage1         140:Mx5Gage1
 2:Year              13:Mx1Gage2         77:Mx3Gage2         141:Mx5Gage2
 3:JulianDay         14:Mx1Gage3         78:Mx3Gage3         142:Mx5Gage3
 4:Time-HHMM         15:Mx1Gage4         79:Mx3Gage4         143:Mx5Gage4
 5:Seconds           16:Mx1Gage5         80:Mx3Gage5         144:Mx5Gage5
 6:DecimlDay         17:Mx1Gage6         81:Mx3Gage6         145:Mx5Gage6
 7:ElapsdHr          18:Mx1Gage7         82:Mx3Gage7         146:Mx5Gage7
 8:ElapsdMin         19:Mx1Gage8         83:Mx3Gage8         147:Mx5Gage8
 9:ElapsdSec         20:Mx1Gage9         84:Mx3Gage9         148:Mx5Gage9
10:Battery           21:Mx1Gage10        85:Mx3Gage10        149:Mx5Gage10
11:PanelTemp         22:Mx1Gage11        86:Mx3Gage11        150:Mx5Gage11
                     23:Mx1Gage12        87:Mx3Gage12        151:Mx5Gage12
                     24:Mx1Gage13        88:Mx3Gage13        152:Mx5Gage13
                     25:Mx1Gage14        89:Mx3Gage14        153:Mx5Gage14
                     26:Mx1Gage15        90:Mx3Gage15        154:Mx5Gage15
                     27:Mx1Gage16        91:Mx3Gage16        155:Mx5Gage16
                     28:Mx1Gage17        92:Mx3Gage17        156:Mx5Gage17
                     29:Mx1Gage18        93:Mx3Gage18        157:Mx5Gage18
                     30:Mx1Gage19        94:Mx3Gage19        158:Mx5Gage19
                     31:Mx1Gage20        95:Mx3Gage20        159:Mx5Gage20
                     32:Mx1Gage21        96:Mx3Gage21        160:Mx5Gage21
                     33:Mx1Gage22        97:Mx3Gage22        161:Mx5Gage22
                     34:Mx1Gage23        98:Mx3Gage23        162:Mx5Gage23
                     35:Mx1Gage24        99:Mx3Gage24        163:Mx5Gage24
                     36:Mx1Gage25        100:Mx3Gage25       164:Mx5Gage25
                     37:Mx1Gage26        101:Mx3Gage26       165:Mx5Gage26
                     38:Mx1Gage27        102:Mx3Gage27       166:Mx5Gage27
                     39:Mx1Gage28        103:Mx3Gage28       167:Mx5Gage28
                     40:Mx1Gage29        104:Mx3Gage29       168:Mx5Gage29
                     41:Mx1Gage30        105:Mx3Gage30       169:Mx5Gage30
                     42:Mx1Gage31        106:Mx3Gage31       170:Mx5Gage31
                     43:Mx1Gage32        107:Mx3Gage32       171:Mx5Gage32
                     44:Mx2Gage1         108:Mx4Gage1        172:Mx6Gage1
                     45:Mx2Gage2         109:Mx4Gage2        173:Mx6Gage2
                     46:Mx2Gage3         110:Mx4Gage3        174:Mx6Gage3
                     47:Mx2Gage4         111:Mx4Gage4        175:Mx6Gage4
                     48:Mx2Gage5         112:Mx4Gage5        176:Mx6Gage5
                     49:Mx2Gage6         113:Mx4Gage6        177:Mx6Gage6
                     50:Mx2Gage7         114:Mx4Gage7        178:Mx6Gage7
                     51:Mx2Gage8         115:Mx4Gage8        179:Mx6Gage8
                     52:Mx2Gage9         116:Mx4Gage9        180:Mx6Gage9
                     53:Mx2Gage10        117:Mx4Gage10       181:Mx6Gage10
                     54:Mx2Gage11        118:Mx4Gage11       182:Mx6Gage11
                     55:Mx2Gage12        119:Mx4Gage12       183:Mx6Gage12
                     56:Mx2Gage13        120:Mx4Gage13       184:Mx6Gage13
                     57:Mx2Gage14        121:Mx4Gage14       185:Mx6Gage14
                     58:Mx2Gage15        122:Mx4Gage15       186:Mx6Gage15
                     59:Mx2Gage16        123:Mx4Gage16       187:Mx6Gage16
                     60:Mx2Gage17        124:Mx4Gage17       188:Mx6Gage17
                     61:Mx2Gage18        125:Mx4Gage18       189:Mx6Gage18
                     62:Mx2Gage19        126:Mx4Gage19       190:Mx6Gage19
                     63:Mx2Gage20        127:Mx4Gage20       191:Mx6Gage20
                     64:Mx2Gage21        128:Mx4Gage21       192:Mx6Gage21
                     65:Mx2Gage22        129:Mx4Gage22       193:Mx6Gage22
                     66:Mx2Gage23        130:Mx4Gage23       194:Mx6Gage23
                     67:Mx2Gage24        131:Mx4Gage24       195:Mx6Gage24
                     68:Mx2Gage25        132:Mx4Gage25       196:Mx6Gage25
                     69:Mx2Gage26        133:Mx4Gage26       197:Mx6Gage26
                     70:Mx2Gage27        134:Mx4Gage27       198:Mx6Gage27
                     71:Mx2Gage28        135:Mx4Gage28       199:Mx6Gage28
                     72:Mx2Gage29        136:Mx4Gage29       200:Mx6Gage29
                     73:Mx2Gage30        137:Mx4Gage30       201:Mx6Gage30
                     74:Mx2Gage31        138:Mx4Gage31       202:Mx6Gage31
                     75:Mx2Gage32        139:Mx4Gage32       203:Mx6Gage32
```

D.3 Input/Final Storage Assignment Explanation

Following are explanations for the Input/Final Storage location usage;

Input Storage #	Label	Explanation	Final Storage?
None	OutputInst#	Instruction in program that enabled Final Storage	Yes
1	Year	Year when last readings taken	Yes
2	JulianDay	Julian Day (1-365) when last readings taken	Yes
3	Time-HHMM	Time (24 hour) when last readings taken	Yes
4	Seconds	Seconds when last readings taken	Yes
5	DecimlDay	Decimal Day when last readings taken	Yes
6	ElapsdHr	Elapsed Hours from 'Start' (if 'Log' selected as 'Scan Interval')	Yes
7	ElapsdMin	Elapsed Minutes from 'Start' (if'Log' selected as 'Scan Interval')	Yes
8	ElapsdSec	Elapsed Seconds from 'Start' (if 'Log' selected as 'Scan Interval')	Yes
9	Battery	Datalogger battery voltage	Yes
10	PanelTemp	Datalogger panel temperature (°C)	Yes
11	ReadTime	Read timer	No
12-14	Scratch#1-3	Used by time generation routines	No
15	Counter	Readings time length counter	No
16	GageType	Input to gage measurement routines	No
17	GReading	Return from gage measurement routines	No
18	CurrIntrvl	Current Interval (if 'Log' selected)	No
19	CurrItrtn	Current Iterations (if 'Log' selected)	No
20-25	IntvlLn#1-6	Log Intervals (if 'Log' selected)	No
26-31	IntItrn#1-6	Iterations of Log Intervals	No
32	AdjIntrvl	Adjusted Interval Length	No
33-39	GageType1-7	Vibrating Wire Gage Types	No
40-62		User Defined	Depends
63-94	Mx1	Readings from Gages on Mux #1	Yes
95-126	Mx2	Readings from Gages on Mux #2	Yes
127-158	Mx3	Readings from Gages on Mux #3	Yes
159-190	Mx4	Readings from Gages on Mux #4	Yes
191-222	Mx5	Readings from Gages on Mux #5	Yes
223-254	Mx6	Readings from Gages on Mux #6	Yes

D.4 Final Storage Usage Calculation

The CR10X module has a total of 62000 Final Storage Locations available (500,000 for the CR10X-1M and 1,000,000 for CR10X-2M). In 'Low' output resolution each sensor measurement requires 1 of these locations, in 'High' 2 are needed. In addition to sensor data other information are stored. For example, each array contains an output enable instruction number, the current year, Julian day, time (in 24 hour HHMM format), seconds, decimal day, elapsed hours, minutes and seconds, present battery voltage (nominally 12 volts) and panel temperature (total of 11 values). The time and system information are automatically stored in 'High' output resolution format (regardless of the 'Output Resolution' setting).

- **Determine the number of locations required for each array.**

Standard = 11 × 2 ('High' resolution)
Readings = 32 × 'Number of Mux's' × 2 (if 'High' selected)
Total = Standard + Readings

- **Determine number of arrays that can fit into Final Storage (For CR10X-2M)**

Arrays stored = 1,000,000 (locations available) / Total (each array)

- **Based on measurement interval determine length of time before overwriting of oldest data begins.**

Overwrite time = Interval length × Arrays stored

For example, assume a system configured with two 16 channel vibrating wire multiplexers taking readings every hour with 'High' selected as the 'Output Resolution'.

150 (Total) = 22 (Standard, 11 × 2) + 128 (Readings, 32 × 2 × 2)

Each array requires 150 locations from Final Storage.

6666 (Arrays stored, rounded down) = 1,000,000 (locations available) / 150 (Total)

6666 arrays can be stored in memory before overwriting of the oldest data begins.

277 days or 6666 hours (Overwrite time) = 1 (Interval length) × 6666 (Arrays stored)

The system can operate for 277 days before overwriting will occur. Data must be collected AT LEAST THIS FREQUENTLY or some will be lost.

APPENDIX E - SYSTEM WIRING

E.1 Connectors

E.1.1 CR10X 37 pin D-sub (to 8020-40 Distribution Panel)

Pin	Description	Pin	Description
1	+12VDC	20	Ground
2	Input Channel 6L	21	Input Channel 6H
3	Analog Ground	22	Input Channel 5L
4	Input Channel 5H	23	Analog Ground
5	Input Channel 4L	24	Input Channel 4H
6	Analog Ground	25	Input Channel 3L
7	Input Channel 3H	26	Analog Ground
8	Input Channel 2L	27	Input Channel 2H
9	Analog Ground	28	Input Channel 1L
10	Input Channel 1H	29	Analog Ground
11	EX Control 3	30	EX Channel 3
12	EX Control 2	31	EX Channel 2
13	EX Control 1	32	EX Channel 1
14	Analog Ground	33	Pulse Input 2 (P2)
15	Pulse Input 1 (P1)	34	Control Port 8 (C8)
16	Control Port 7 (C7)	35	Control Port 6 (C6)
17	Control Port 5 (C5)	36	Control Port 4 (C4)
18	Control Port 3 (C3)	37	Control Port 2 (C2)
19	Control Port 1 (C1)		

E.1.2 CR10X 9 pin serial I/O

Pin	Designation	Description
1	+5 VDC	Output to power peripherals
2	SG	Signal Ground
3	RING	Signal telecommunications
4	RXD	Receive data line
5	ME	Raised by CR10 to activate modem
6	SDE/PE	Synchronous device/printer enable line
7	CLK/HS	Clock/Handshake for SD's
8	TE	Tape enable
9	TXD	Transmit data line

Note: See Section 6 of the CR10X Operator's Manual for additional information on the serial I/O connections.

E.1.3 10 Pin Bendix for Computer

Pin	Name	Description	From	Wire Color
A	GND	Ground	SC32B Pin 5	Yellow
B	TD	Transmit Data	SC32B Pin 3	Gray
C	RD	Receive Data	SC32B Pin 2	Brown
D	RTS	Request To Send	SC32B Pin 7	Blue
E	CTS	Clear To Send	SC32B Pin 8	Violet
F		No Connection		
G	DTR	Data Terminal Ready	SC32B Pin 4	Orange

E.1.4 3 pin Amphenol for Charger

Pin	Description	Wire Color
A	Charger + (14-22 VDC Input)	Grey
B	Ground	Blue
C	Battery + (12 VDC Output)	Violet

E.1.5 10 Pin Bendix on Multiplexer

Pin	Description	Wire Color 16 Channel	Wire Color 32 Channel
A	Switched 1 - Hi	Yellow (AM32) Brown (8032)	Yellow (AM32) Brown (8032)
B	Switched 1 - Lo	Orange (AM32) Red (8032)	Orange (AM32) Red (8032)
C	Switched 2 - Hi (16 Channel)	Brown (AM32) Orange (8032)	
D	Switched 2 - Lo (16 Channel)	Red (AM32) Yellow (8032)	
E	Shield Plate	White	Brown & Red
F	Mux +12 VDC (12V)	Violet	Violet
G	Mux Ground (GND)	Grey	Grey
H	Mux RESET (RES)	Green	Green
J	Mux CLOCK (CLK)	Blue	Blue
K	No Connection		

E.1.6 3 pin Amphenol for Relay Controller (optional)

Pin	Description	Wire Color
A	Control Port	White
B	Ground	Black
C	Battery + (12 VDC Output)	Red

E.2 Cables

E.2.1 Charger (110VAC/220VAC)

Pin	Description	Condor - Wire Color
A	Charger + (14-22 VDC Input)	Black with White Stripe
B	Ground	Black

E.2.2 External Power Cable

Pin	Description	Wire Color	Clip
A	No Connection		
B	Ground	Black	Black
C	Battery + (12 VDC)	Black w/White Stripe	Red

E.2.4 Mux Cables (Grey, Orange or Tan)

10 Pin Bendix	Description	Grey Belden	Grey & Orange 6 twisted pairs	Tan 5 twisted pairs
A	Switched 1 - Hi	Brown	Brown	White
B	Switched 1 - Lo	Red	Brown's Black	White's Black
C	Switched 2 - Hi (16 Channel)	Orange	Red	Red
D	Switched 2 - Lo (16 Channel)	Yellow	Red's Black	Red's Black
E	AG	Green	Blue & Blue's Black	Blue & Blue's Black
F	+12 VDC	Blue	Yellow	Yellow
G	GND	Violet	Yellow's Black	Yellow's Black
H	RESET	Grey	Green	Green
J	CLOCK	White	Green's Black	Green's Black
K	GND	Shield	Shield Wires from Red and Browns Pair plus Overall	Shield Wires from Red and Whites Pair plus Overall

E.3 Miscellaneous

E.3.1 Vibrating Wire Interface (AVW1)

AVW1	Description	Wire Color	To
T	Thermistor Output	Brown	CR10 - 1L
F	Vibrating Wire Output	Red	CR10 - 1H
EX	Excitation Input	Orange	CR10 - E1
AG	Analog Ground	Yellow	CR10 - AG
+12V	Power Input	Green	CR10 - 5V
G	System Ground	Blue	CR10 - G
T+	Thermistor + Input	Brown (AM32) Orange (8032)	TStrip 1&2 Pos 1 or 3
T-	Thermistor - Input	Red (AM32) Yellow (8032)	TStrip 1&2 Pos 2 or 4
C+	Vibrating Wire + Input	Orange (AM32) Brown (8032)	TStrip 1&2 Pos 3 or 1
C-	Vibrating Wire - Input	Yellow (AM32) Red (8032)	TStrip 1&2 Pos 4 or 2
G	No Connection		
Earth	No Connection		