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Instruction Manual

Model LC-2x16

16 Channel VW Datalogger

(Doc Rev Y, 8/15/22)

Warranty Statement

GEOKON 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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EQUATIONS

1. INTRODUCTION

The Model LC-2x16 16 Channel Datalogger is a low cost, battery powered and easy to use measurement instrument designed to read up to 16 vibrating wire sensors equipped with thermistors.

The 320K standard memory provides storage for 3555 data arrays. Each array consists of an optional datalogger ID string (16 characters maximum), a timestamp consisting of the year, date (Julian day or month/day format), time (hhmm or hours/minutes format) and seconds when the reading was taken. Also included in the data is the internal 3V (or external 12V) battery voltage, the datalogger temperature, the vibrating wire readings, the transducer temperature and the Array number.

Internal math is calculated using 32-bit floating-point notation (IEEE). Math operations on the instrument readings, such as application of zero readings, gauge factors (or calibration factors) and offsets when using a linear conversion technique or polynomial coefficients when using the polynomial conversion, provide outputs directly in engineering units.

The dataloggers internal configuration is defined through communication with a computer using the supplied RS-232 or USB (or optional RS-485) interface cable. The datalogger is configured and monitored using Agent, a GEOKON proprietary Graphic User Interface (GUI) software application. Agent can be downloaded from the GEOKON website. Please refer to the Agent software manual for further information on using the Agent program. (See Appendix I. for the legacy software application, Logview.) The datalogger can also be configured and monitored via text-based commands with any standard terminal emulator software, such as Microsoft Windows HyperTerminal™ (see Appendices J and K).

All data, both readings and configuration, are stored in nonvolatile EEPROM with a typical storage life of 10 years (minimum). The internal temperature compensated real-time clock, used to provide timekeeping and triggering of readings, is accurate to ± 2 minutes/year.

The comma delineated ASCII output format allows for easy importing into popular spreadsheet programs such as Lotus 1-2-3™ or Microsoft Excel™. See Appendix C for sample data files.

2. LC-2 MODEL TYPES

The following three communications options are available for the LC-2x16:

2.1 RS-232 Interface (8002-16-1)

Communication with the LC-2x16 is implemented via the host computer's RS-232 COM port. See Section 3.4.1 for further information.

2.2 USB Interface (8002-16-2)

Communication with the LC-2x16 is implemented via the host computer's USB 2.0 port. When connected to a computer via the USB port, the LC-2x16 appears to the computer as a "virtual" COM port. The LC-2x16 datalogger also receives its operating power from the computer, thus extending the internal 3V (or external 12V) battery life. When disconnected from the USB port, the datalogger automatically switches to the internal 3V (or external 12V) battery pack. See Section 3.4.2 for further information.

2.3 RS-485 Interface (8002-16-3)

Communication with the LC-2x16 is implemented via RS-485. This allows for long communication cables (up to 4000') between the host computer and the LC-2x16. The ability to network two or more LC-2x16 dataloggers together is also available with this communication option. See Section 3.4.3 and Appendix F for further information.

3. GETTING STARTED

The following equipment will arrive with the Model LC-2x16 datalogger:

1. Set of four alkaline 'D' cell batteries.

2. Set of four desiccant packs packaged with the batteries.

3. Accessories:
   8002-16-1: P/N S-8001-6 (DB-9F to 10-pin Bendix Male) RS-232 Communication Cable

   8002-16-2: P/N COM-109 (USB-A to 10-pin Bendix Male) USB Communication Cable

   8002-16-3: Communications Cable dependent on S-8001-5 (RS-232) or S-8002-5 (USB) RS-485 computer interface

4. Model LC-2x16 16 Channel Datalogger Instruction Manual.

If any of these items are missing or damaged contact the factory for replacements. The following are optional accessories:

- RS-485 interface cable.
- S-8001-5 (RS-232) or S-8002-5 (USB) RS-485 computer interface.
- Vibrating Wire Sensor with built-in thermistor (16 maximum).

This section will outline the basic steps needed to install the communications software, establish communication with the Model LC-2x16 and configure the datalogger in the context of water level monitoring using a GEOKON model 4500S Vibrating Wire Pressure Transducer.

3.1 Transducer Installation

Open the LC-2x16 by releasing the two latches on the top of the LC-2x16 enclosure. Install each transducer to the LC-2x16 by threading the transducer’s cable through a bulkhead fitting on the side of the LC-2x16 enclosure and wire the cable’s five conductors into the terminal strip per Table 1. Tighten cable gland around cable.

Channel Number	Terminal Strip Designator	Terminal Strip Position	Description	Cable Wire Color
1	T1	1H	Vibrating Wire +	RED
1	T1	1L	Vibrating Wire -	BLACK
1	T1	2H	Thermistor +	GREEN
1	T1	2L	Thermistor -	WHITE
1	T1	S1	Analog Ground (shield)	BARE WIRE
2	T2	3H	Vibrating Wire +	RED
2	T2	3L	Vibrating Wire -	BLACK
2	T2	4H	Thermistor +	GREEN
2	T2	4L	Thermistor -	WHITE
2	T2	S2	Analog Ground (shield)	BARE WIRE
3	T3	5H	Vibrating Wire +	RED
3	T3	5L	Vibrating Wire -	BLACK
3	T3	6H	Thermistor +	GREEN
3	T3	6L	Thermistor -	WHITE
3	T3	S3	Analog Ground (shield)	BARE WIRE
4	T4	7H	Vibrating Wire +	RED
4	T4	7L	Vibrating Wire -	BLACK
4	T4	8H	Thermistor +	GREEN
4	T4	8L	Thermistor -	WHITE
4	T4	S4	Analog Ground (shield)	BARE WIRE
5	T5	9H	Vibrating Wire +	RED
5	T5	9L	Vibrating Wire -	BLACK
5	T5	10H	Thermistor +	GREEN
5	T5	10L	Thermistor -	WHITE
5	T5	S5	Analog Ground (shield)	BARE WIRE
6	T6	11H	Vibrating Wire +	RED
6	T6	11L	Vibrating Wire -	BLACK
6	T6	12H	Thermistor +	GREEN
6	T6	12L	Thermistor -	WHITE
6	T6	S6	Analog Ground (shield)	BARE WIRE
7	T7	13H	Vibrating Wire +	RED
7	T7	13L	Vibrating Wire -	BLACK
7	T7	14H	Thermistor +	GREEN
7	T7	14L	Thermistor -	WHITE
7	T7	S7	Analog Ground (shield)	BARE WIRE
8	T8	15H	Vibrating Wire +	RED
8	T8	15L	Vibrating Wire -	BLACK
8	T8	16H	Thermistor +	GREEN
8	T8	16L	Thermistor -	WHITE
8	T8	S8	Analog Ground (shield)	BARE WIRE
9	T9	17H	Vibrating Wire +	RED
9	T9	17L	Vibrating Wire -	BLACK
9	T9	18H	Thermistor +	GREEN
9	T9	18L	Thermistor -	WHITE
9	T9	S9	Analog Ground (shield)	BARE WIRE
10	T10	19H	Vibrating Wire +	RED
10	T10	19L	Vibrating Wire -	BLACK
10	T10	20H	Thermistor +	GREEN
10	T10	20L	Thermistor -	WHITE
10	T10	S10	Analog Ground (shield)	BARE WIRE
11	T11	21H	Vibrating Wire +	RED
11	T11	21L	Vibrating Wire -	BLACK
11	T11	22H	Thermistor +	GREEN
11	T11	22L	Thermistor -	WHITE
11	T11	S11	Analog Ground (shield)	BARE WIRE

Channel Number	Terminal Strip Designator	Terminal Strip Position	Description	Cable Wire Color
12	T12	23H	Vibrating Wire +	RED
12	T12	23L	Vibrating Wire -	BLACK
12	T12	24H	Thermistor +	GREEN
12	T12	24L	Thermistor -	WHITE
12	T12	S12	Analog Ground (shield)	BARE WIRE
13	T13	25H	Vibrating Wire +	RED
13	T13	25L	Vibrating Wire -	BLACK
13	T13	26H	Thermistor +	GREEN
13	T13	26L	Thermistor -	WHITE
13	T13	S13	Analog Ground (shield)	BARE WIRE
14	T14	27H	Vibrating Wire +	RED
14	T14	27L	Vibrating Wire -	BLACK
14	T14	28H	Thermistor +	GREEN
14	T14	28L	Thermistor -	WHITE
14	T14	S14	Analog Ground (shield)	BARE WIRE
15	T15	29H	Vibrating Wire +	RED
15	T15	29L	Vibrating Wire -	BLACK
15	T15	30H	Thermistor +	GREEN
15	T15	30L	Thermistor -	WHITE
15	T15	S15	Analog Ground (shield)	BARE WIRE
16	T16	31H	Vibrating Wire +	RED
16	T16	31L	Vibrating Wire -	BLACK
16	T16	32H	Thermistor +	GREEN
16	T16	32L	Thermistor -	WHITE
16	T16	S16	Analog Ground (shield)	BARE WIRE

Table 1 - Transducer Cable Connections

3.2 Battery Installation

Insert four D-cells straight down into the battery holders. Ensure that the polarity of the batteries matches the diagram on the battery holder. Check for secure connection between the battery terminals and holder. If a gap exists, remove batteries and bend the holder sides inward. See Figure 2 below.

Proper Battery Installation

Faulty Battery Installation

Figure 1 - Battery Installation Detail

Note that there is a zip-lock bag containing four desiccant packs shipped along with the batteries. As soon as the batteries are installed, take the desiccant packs out of the zip-lock bag and place them inside the enclosure. Immediately close and reseal the lid. This will help to prevent condensation of moisture within the enclosure.

3.3 Earth Ground Installation

The LC-2x16 provides lightning protection in the form of gas tube surge arrestors. For these components to divert the energy from a lightning strike safely to ground, a good solid electrical connection to earth ground needs to be made. A grounding rod should be driven (or other suitable attachment to earth utilized) to ground the system and provide a path to earth in the event of a lightning strike. A 6' to 8' copper stake with appropriate large gauge wire (12 AWG or larger) connected to the LC-2x16 enclosure is suggested. The stake should be driven as close to the datalogger as possible, and to a depth of at least three feet (one meter). Connect the wire from the grounding rod to the copper grounding lug on the exterior of the enclosure.

3.4 PC Connection

3.4.1 RS-232 Connection (8002-16-1)

Connect the supplied LC-2x16 RS-232 Communications cable (S-8001-6) to the COM port of the LC-2x16 datalogger. The protective cap on the datalogger COM connector is removed by pushing in and turning. Plug the DB-9 end of the RS-232 Communications cable into the host computer’s RS-232 port (either internal or external via a USB to Serial converter).

3.4.2 USB Connection (8002-16-2)

Remove the protective cap from the 10-pin Bendix connector by turning it counterclockwise. (For waterproof models, the 10-pin Bendix connector is located inside the logger, on the bottom of the PCB assembly.) Connect the supplied LC-2x4 USB Communications cable (COM-109) to the USB port of the LC-2 datalogger. Connect the USB-A end of the USB cable into an available USB-2.0 port on the host computer.

NOTE: On certain PCs with operating systems older than XP, Service Pack 3, the LC-2 may require the installation of a driver to properly communicate with the PC. If the PC does not recognize the datalogger’s internal USB to serial converter then the *USB driver for GEOKON devices* may need to be installed from the GEOKON website.

3.4.3 RS-485 Connection (8002-16-3)

Make the COM port connection per Section 3.4.1 (RS-232) or 3.4.2 (USB), and then refer to Appendix F, Networking, to establish communications.

3.5 Software Installation and Setup

Agent software is used to setup, communicate, and download data from the LC-2. Agent can be downloaded from the GEOKON website. Please refer to the Agent Instruction manual for further instructions.

4. MAINTENANCE

While the Model LC-2x16 Datalogger is designed to operate in field environments, nevertheless there are some basic maintenance procedures that should be followed to insure maximum reliability and functionality.

4.1 Cleaning

The outside of the box can be cleaned using a cloth dampened with soap and water. **DO NOT USE ANY TYPES OF SOLVENTS OR SCOURING AGENTS!**

The connector sockets can be cleaned using a small stiff brush (small painters brush) dipped in soap and water. The sockets are water resistant, so the internal electronics will not be adversely affected by them filling with water or other liquids. Be aware however, readings could be affected by shorting or other effects of an improper connection due to fluids being present in the connector. Dry connections thoroughly before use.

4.2 Batteries

When the unit is not in use, especially for extended periods of time, the 'D' cells should be removed to prevent damage due to leakage. **The warranty does not cover damage due to battery leakage.** The table below details the approximate operating times for the various types of D-cell batteries which can be used with the Model LC-2x16.

Battery Chemistry (Four D cells)	Battery Pack Voltage	Battery Capacity	30 Second Scan Rate	1 Minute Scan Rate	1 Hour Scan Rate	1 Day Scan Rate
Lithium	7.2V	34 AHr	32.1 days	63.9 days	6.7 years	16.8 years
Alkaline	3V	26 AHr	10.9 days	21.6 days	1.9 years	4.2 years
Carbon-Zinc	3V	10 Ahr	4.2 days	8.4 days	279.2 days	1.6 years

Table 2 - Approximate Operating Times

The above table assumes a constant temperature environment of 25°C (not field conditions!). Battery life is shortened by temperature extremes. If the datalogger is continuously connected to an active computers USB port, all operating power will be supplied via the USB port. As soon as USB power is lost, the datalogger will immediately switch over to its internal 3V (or external 12V) battery pack.

Batteries should be replaced when the measured voltage drops below 1.8 VDC (internal 3V battery) or 6V (external 12V battery). The datalogger electronics will stop the datalogger from logging and disable RS-485 communications if the battery goes below 1.6 VDC (internal 3V battery) or 5.5V (external 12V battery). In this event, a new set of batteries must be installed (or USB connection must be made) before the datalogger becomes operable again. All data and operating parameters are retained when removing batteries, even for an extended period (years) of time due to non-volatile EEPROM memory. If the datalogger was logging when it stopped itself due to low battery voltage, it will resume logging as soon as new batteries are installed or as soon as it is connected to a USB port.

4.2.1 Battery replacement instructions:

1) Release the 2 clasps on the top of the case and open the cover. Underneath the cover are the 'D' cell battery holders.
2) Remove the four batteries from the holders, being careful not to bend the sides outward. Insert the new batteries straight down into the battery holder. Ensure that the polarity of the batteries matches the diagram on the battery holder. Check for secure connection between the battery terminals and holder. If a gap exists, remove batteries and bend the holder sides inward. See Figure 2 below.

Proper Battery Installation **Faulty Battery Installation**

Figure 2 - Battery Installation Detail

3) Close the cover and lock the clasps. Check datalogger for proper operation.

5. TROUBLESHOOTING

Listed below are a few commonly experienced problems and remedial action. Contact the factory should a problem arise not explained herein or additional information be needed.

5.1 Unit will not respond to communications.

- ✓ Wrong COM port selected.
- ✓ The USB Drivers may not be properly installed. Please download the *USB driver for GEOKON devices* file from the GEOKON website.
- ✓ If RS-232 or RS-485 communications are being used, the internal batteries of the datalogger may be low, dead or have a faulty connection to the holder. Replace/check batteries according to the **"Battery replacement instructions:"** on the previous page.
- ✓ If RS-485 communications is being used, the **<ENTER>,<ENTER>, #,datalogger address**, **<ENTER>** key sequence is not being sent. Refer to Appendix F, Networking, for further information.

5.2 Vibrating wire gauge measurement reads -999999.0

- ✓ Using an ohmmeter, check connections to the vibrating wire gauge leads. Resistance should be between 90 and 180 ohms (pins A&B on the 10-pin connector, see Appendix B). Remember to correct for cable resistance (approximately 14.7 Ω/1000' or 50 Ω/km, double for both directions). If resistance reads less than 100 Ω, the cable is probably shorted. If resistance reads infinite or in the megohms range, the cable is probably cut.
- ✓ Check the datalogger with another known good transducer. If it still reads –999999.0, the datalogger may be malfunctioning.
- ✓ Check that the proper gauge type is selected (see Tables 1&2).
- ✓ Check that the transducer shield wire is not shorted to either the red or black wire.

5.3 Gauge measurement (analog or vibrating wire) reads -999999.9

- ✓ A mathematical overrange has occurred. Check the magnitude of the reading, zero reading, multiplier and offset. The result must be in the range of 1.0×10^{-7} to 1.0×10^{7}.

5.4 Vibrating wire gauge reading is unstable

- ✓ Is there a source of electrical noise nearby? Likely candidates are generators, motors, arc welding equipment, high voltage lines, etc. If possible, move the datalogger and transducer cables away from the power lines or electrical equipment.
- ✓ Check if the proper gauge type is selected (see Tables 1 & 2).

5.5 Thermistor measurement shows -99.9 degrees Celsius

- ✓ Indicates open circuit to thermistor leads. Check connections from datalogger to thermistor leads. If okay, check thermistor with ohmmeter. Appendix D and Appendix E. detail the resistance versus temperature relationship for standard and high temperature thermistors.

APPENDIX A. SPECIFICATIONS

A.1 Measurement Capability

- Vibrating Wire (all types).
- External temperature (thermistor).
- Internal temperature (thermistor).
- Main battery voltage (3V and 12V).
- RTC lithium battery voltage.

A.2 Power

Power supply:	Internal 3 VDC (7.5Vmax) or External 12 VDC (15Vmax)
Processing/communication current:	<100 mA
VW measurement current:	<250 mA
Quiescent current:	<600 µA
RTC battery type:	Panasonic CR2032 3V lithium coin cell: 20mm, 225 mAHr
RTC battery life:	>10 years
Operating temperature range:	–30 to +50° C

A.3 Memory

Data memory:	320K EEPROM
Program memory:	24K EEPROM
Array storage	3555
Data memory type:	ring (oldest overwrite)
Array elements:	ID (optional) Year Julian day (or month,day) Time (hhmm or hh,mm) Seconds Battery voltage Datalogger temperature Channel 1 Transducer reading Channel 2 Transducer reading Channel 3 Transducer reading Channel 4 Transducer reading Channel 5 Transducer reading Channel 6 Transducer reading Channel 7 Transducer reading Channel 8 Transducer reading Channel 9 Transducer reading Channel 10 Transducer reading Channel 11 Transducer reading Channel 12 Transducer reading Channel 13 Transducer reading

Channel 14 Transducer reading
Channel 15 Transducer reading
Channel 16 Transducer reading
Channel 1 Transducer temperature
Channel 2 Transducer temperature
Channel 3 Transducer temperature
Channel 4 Transducer temperature
Channel 5 Transducer temperature
Channel 6 Transducer temperature
Channel 7 Transducer temperature
Channel 8 Transducer temperature
Channel 9 Transducer temperature
Channel 10 Transducer temperature
Channel 11 Transducer temperature
Channel 12 Transducer temperature
Channel 13 Transducer temperature
Channel 14 Transducer temperature
Channel 15 Transducer temperature
Channel 16 Transducer temperature
Array #

A.4 Clock

Features: full calendar
Time format: 12 or 24 hour (selectable)
Date Format: mm,dd or Julian (selectable)
Accuracy: ±2 minutes per year

A.5 Serial Interface (all LC-2x16 models):

Speed: 9600 bps
Parameters: 8 Data bits
1 Stop bit
no Parity
no Flow control
Data output format: ASCII text

A.6 RS-485 Network

Maximum nodes: 256
Maximum cable length: 4000', 1.22 km

A.7 Vibrating Wire Measurement

Excitation sweep range:	400 Hz to 4500 Hz
Frequency Measurement Technique:	Adaptive Multiple Period Averaging
Accuracy:	0.05% F.S.R. (450-4000 Hz)
Resolution:	0.001 digits

A.8 Internal/External Temperature Measurement

Thermistor:	Dale #1C3001-B3 (YSI 44005)	(Standard	0)
	Thermometrics BR55KAKA822J	(High Temp	1)
	U.S. Sensor 103JL1A	(High Temp	2)

Transducer accuracy: ±0.5° C
Measurement accuracy: 0.5% FSR

Resolution:	0.01° C (Internal)
	0.1° C (External)
Linearization error:	0.02% FSR
Temperature range:	–40 to +60° C Standard Thermistor
	0 to +200º C High Temp Thermistor
Overall accuracy:	1.0% FSR (±1°)

A.9 Main Battery Measurement

3V Battery:

Range:	0 to 7.5 VDC
Accuracy:	±1.83mV
Resolution:	0.01 VDC

12V Battery:

Range:	0 to 15 VDC
Accuracy:	±3.662mV
Resolution:	0.01 VDC

A.10. Multiplexer Relay

NAIS TXS2SA-4.5V

Contact resistance:	0.1 ohm (max)
Switching current:	1A (max)

APPENDIX B. CONNECTOR PINOUTS

B.1 Transducer Cable Connections:

Channel Number	Terminal Strip Designator	Terminal Strip Position	Description	Cable Wire Color
1	T1	1H	Vibrating Wire +	RED
1	T1	1L	Vibrating Wire -	BLACK
1	T1	2H	Thermistor +	GREEN
1	T1	2L	Thermistor -	WHITE
1	T1	S1	Analog Ground (shield)	BARE WIRE
2	T2	3H	Vibrating Wire +	RED
2	T2	3L	Vibrating Wire -	BLACK
2	T2	4H	Thermistor +	GREEN
2	T2	4L	Thermistor -	WHITE
2	T2	S2	Analog Ground (shield)	BARE WIRE
3	T3	5H	Vibrating Wire +	RED
3	T3	5L	Vibrating Wire -	BLACK
3	T3	6H	Thermistor +	GREEN
3	T3	6L	Thermistor -	WHITE
3	T3	S3	Analog Ground (shield)	BARE WIRE
4	T4	7H	Vibrating Wire +	RED
4	T4	7L	Vibrating Wire -	BLACK
4	T4	8H	Thermistor +	GREEN
4	T4	8L	Thermistor -	WHITE
4	T4	S4	Analog Ground (shield)	BARE WIRE
5	T5	9H	Vibrating Wire +	RED
5	T5	9L	Vibrating Wire -	BLACK
5	T5	10H	Thermistor +	GREEN
5	T5	10L	Thermistor -	WHITE
5	T5	S5	Analog Ground (shield)	BARE WIRE
6	T6	11H	Vibrating Wire +	RED
6	T6	11L	Vibrating Wire -	BLACK
6	T6	12H	Thermistor +	GREEN
6	T6	12L	Thermistor -	WHITE
6	T6	S6	Analog Ground (shield)	BARE WIRE
7	T7	13H	Vibrating Wire +	RED
7	T7	13L	Vibrating Wire -	BLACK
7	T7	14H	Thermistor +	GREEN
7	T7	14L	Thermistor -	WHITE
7	T7	S7	Analog Ground (shield)	BARE WIRE
8	T8	15H	Vibrating Wire +	RED
8	T8	15L	Vibrating Wire -	BLACK
8	T8	16H	Thermistor +	GREEN
8	T8	16L	Thermistor -	WHITE
8	T8	S8	Analog Ground (shield)	BARE WIRE
9	T9	17H	Vibrating Wire +	RED
9	T9	17L	Vibrating Wire -	BLACK
9	T9	18H	Thermistor +	GREEN
9	T9	18L	Thermistor -	WHITE
9	T9	S9	Analog Ground (shield)	BARE WIRE

Channel Number	Terminal Strip Designator	Terminal Strip Position	Description	Cable Wire Color
10	T10	19H	Vibrating Wire +	RED
10	T10	19L	Vibrating Wire -	BLACK
10	T10	20H	Thermistor +	GREEN
10	T10	20L	Thermistor -	WHITE
10	T10	S10	Analog Ground (shield)	BARE WIRE
11	T11	21H	Vibrating Wire +	RED
11	T11	21L	Vibrating Wire -	BLACK
11	T11	22H	Thermistor +	GREEN
11	T11	22L	Thermistor -	WHITE
11	T11	S11	Analog Ground (shield)	BARE WIRE
12	T12	23H	Vibrating Wire +	RED
12	T12	23L	Vibrating Wire -	BLACK
12	T12	24H	Thermistor +	GREEN
12	T12	24L	Thermistor -	WHITE
12	T12	S12	Analog Ground (shield)	BARE WIRE
13	T13	25H	Vibrating Wire +	RED
13	T13	25L	Vibrating Wire -	BLACK
13	T13	26H	Thermistor +	GREEN
13	T13	26L	Thermistor -	WHITE
13	T13	S13	Analog Ground (shield)	BARE WIRE
14	T14	27H	Vibrating Wire +	RED
14	T14	27L	Vibrating Wire -	BLACK
14	T14	28H	Thermistor +	GREEN
14	T14	28L	Thermistor -	WHITE
14	T14	S14	Analog Ground (shield)	BARE WIRE
15	T15	29H	Vibrating Wire +	RED
15	T15	29L	Vibrating Wire -	BLACK
15	T15	30H	Thermistor +	GREEN
15	T15	30L	Thermistor -	WHITE
15	T15	S15	Analog Ground (shield)	BARE WIRE
16	T16	31H	Vibrating Wire +	RED
16	T16	31L	Vibrating Wire -	BLACK
16	T16	32H	Thermistor +	GREEN
16	T16	32L	Thermistor -	WHITE
16	T16	S16	Analog Ground (shield)	BARE WIRE

Table 3 - Transducer Cable Connections

B.2 RS-232 Connector Pinout (8002-16-1):

The mating 10 pin Bendix plug is part number PT06F-12-10P.

10 Pin Bendix	Internal Wire Color	PCB connector J5 pin	Description
A	Brown	1	Ground
B	Red	2	Tx
C	Orange	3	Rx
D	Yellow	4	RTS
E	Green	5	CTS
F	Blue	6	N/C
G	Violet	7	DTR
H	Grey	8	+5V
J	White	9	N/C
K	Black	10	Ground

Table 4 - RS-232 Connector Pinout

B.3 USB Connector Pinout (8002-16-2):

The mating 10 pin Bendix plug is part number PT06F-12-10P.

10 Pin Bendix	Internal Wire Color	PCB connector J5 pin	Description
A	Brown	1	USB VCC
B	Red	2	USB DM
C	Orange	3	USB DP
D	Yellow	4	Digital Ground
E	Green	5	RS-485 RX
F	Blue	6	RS-485 /RX
G	Violet	7	RS-485 TX
H	Grey	8	RS-485 /TX
J	White	9	RS-485 +12V
K	Black	10	RS-485 Ground

Table 5 - USB Connector Pinout

B.4 RS-485 Connector Pinout (optional, 8002-16-3):

10 Pin Bendix	Internal Wire Color	PCB connector J6 pin	Description
A	Brown	1	No Connection
B	Red	2	No Connection
C	Orange	3	No Connection
D	Yellow	4	Digital Ground
E	Green	5	RS-485 RX
F	Blue	6	RS-485 /RX
G	Violet	7	RS-485 TX
H	Grey	8	RS-485 /TX
J	White	9	RS-485 +12V
K	Black	10	RS-485 Ground

Table 6 - RS-485 Connector Pinout

APPENDIX C. SAMPLE DATA FILE

C.1 Sample Raw Data File

```
Datalogger#1,2007,333,0930,0,2.98,20.27,-9092.555,-9438.785,
-8711.083,-8981.410,-11592.234,-9767.552,-8294.582,-9045.733,
-9499.814,-8729.308,-8818.881,-9740.115,-9023.331,-9299.900,
-8962.831,-7812.252,18.9,19.2,19.4,19.7,19.0,19.3,19.2,19.4,
19.2,19.1,19.3,19.6,19.2,19.1,19.3,19.6,1
```

The comma delineated data above represents the following:

Column 1 represents the datalogger id
Column 2 represents the year when the array was stored.
Column 3 represents the Julian day (or day, month format, see Appendix K.5).
Column 4 represents the time (or hh,mm format, see Appendix K.37).
Column 5 represents the seconds.
Column 6 represents the main battery voltage (alkaline batteries, nominal 3.0 VDC).
Column 7 represents the dataloggers internal temperature in degrees Celsius.
Column 8 represents the Channel 1 vibrating wire reading.
Column 9 represents the Channel 2 vibrating wire reading.
Column 10 represents the Channel 3 vibrating wire reading.
Column 11 represents the Channel 4 vibrating wire reading.
Column 12 represents the Channel 5 vibrating wire reading.
Column 13 represents the Channel 6 vibrating wire reading.
Column 14 represents the Channel 7 vibrating wire reading.
Column 15 represents the Channel 8 vibrating wire reading.
Column 16 represents the Channel 9 vibrating wire reading.
Column 17 represents the Channel 10 vibrating wire reading.
Column 18 represents the Channel 11 vibrating wire reading.
Column 19 represents the Channel 12 vibrating wire reading.
Column 20 represents the Channel 13 vibrating wire reading.
Column 21 represents the Channel 14 vibrating wire reading.
Column 22 represents the Channel 15 vibrating wire reading.
Column 23 represents the Channel 16 vibrating wire reading.
Column 24 represents the Channel 1 external temperature in degrees Celsius.
Column 25 represents the Channel 2 external temperature in degrees Celsius.
Column 26 represents the Channel 3 external temperature in degrees Celsius.
Column 27 represents the Channel 4 external temperature in degrees Celsius.
Column 28 represents the Channel 5 external temperature in degrees Celsius.
Column 29 represents the Channel 6 external temperature in degrees Celsius.
Column 30 represents the Channel 7 external temperature in degrees Celsius.
Column 31 represents the Channel 8 external temperature in degrees Celsius.
Column 32 represents the Channel 9 external temperature in degrees Celsius.
Column 33 represents the Channel 10 external temperature in degrees Celsius.
Column 34 represents the Channel 11 external temperature in degrees Celsius.
Column 35 represents the Channel 12 external temperature in degrees Celsius.
Column 36 represents the Channel 13 external temperature in degrees Celsius.
Column 37 represents the Channel 14 external temperature in degrees Celsius.
Column 38 represents the Channel 15 external temperature in degrees Celsius.
Column 39 represents the Channel 16 external temperature in degrees Celsius.
Column 40 represents the Array #

APPENDIX D. STANDARD THERMISTOR TEMPERATURE DERIVATION

Thermistor Type: YSI 44005, Dale #1C3001-B3, Alpha #13A3001-B3

Resistance to Temperature Equation:

$$T = \frac{1}{A + B(LnR) + C(LnR)^3} - 273.15\ °C$$

Equation 1 - Convert Thermistor Resistance to Temperature

Where: T = Temperature in °C.
LnR = Natural Log of Thermistor Resistance
A = 1.4051×10^{-3} (coefficients calculated over the −50 to +150° C. span)
B = 2.369×10^{-4}
C = 1.019×10^{-7}

Ohms	Temp	Ohms	Temp	Ohms	Temp	Ohms	Temp	Ohms	Temp
201.1K	-50	16.60K	-10	2417	+30	525.4	+70	153.2	+110
187.3K	-49	15.72K	-9	2317	31	507.8	71	149.0	111
174.5K	-48	14.90K	-8	2221	32	490.9	72	145.0	112
162.7K	-47	14.12K	-7	2130	33	474.7	73	141.1	113
151.7K	-46	13.39K	-6	2042	34	459.0	74	137.2	114
141.6K	-45	12.70K	-5	1959	35	444.0	75	133.6	115
132.2K	-44	12.05K	-4	1880	36	429.5	76	130.0	116
123.5K	-43	11.44K	-3	1805	37	415.6	77	126.5	117
115.4K	-42	10.86K	-2	1733	38	402.2	78	123.2	118
107.9K	-41	10.31K	-1	1664	39	389.3	79	119.9	119
101.0K	-40	9796	0	1598	40	376.9	80	116.8	120
94.48K	-39	9310	+1	1535	41	364.9	81	113.8	121
88.46K	-38	8851	2	1475	42	353.4	82	110.8	122
82.87K	-37	8417	3	1418	43	342.2	83	107.9	123
77.66K	-36	8006	4	1363	44	331.5	84	105.2	124
72.81K	-35	7618	5	1310	45	321.2	85	102.5	125
68.30K	-34	7252	6	1260	46	311.3	86	99.9	126
64.09K	-33	6905	7	1212	47	301.7	87	97.3	127
60.17K	-32	6576	8	1167	48	292.4	88	94.9	128
56.51K	-31	6265	9	1123	49	283.5	89	92.5	129
53.10K	-30	5971	10	1081	50	274.9	90	90.2	130
49.91K	-29	5692	11	1040	51	266.6	91	87.9	131
46.94K	-28	5427	12	1002	52	258.6	92	85.7	132
44.16K	-27	5177	13	965.0	53	250.9	93	83.6	133
41.56K	-26	4939	14	929.6	54	243.4	94	81.6	134
39.13K	-25	4714	15	895.8	55	236.2	95	79.6	135
36.86K	-24	4500	16	863.3	56	229.3	96	77.6	136
34.73K	-23	4297	17	832.2	57	222.6	97	75.8	137
32.74K	-22	4105	18	802.3	58	216.1	98	73.9	138
30.87K	-21	3922	19	773.7	59	209.8	99	72.2	139
29.13K	-20	3748	20	746.3	60	203.8	100	70.4	140
27.49K	-19	3583	21	719.9	61	197.9	101	68.8	141
25.95K	-18	3426	22	694.7	62	192.2	102	67.1	142
24.51K	-17	3277	23	670.4	63	186.8	103	65.5	143
23.16K	-16	3135	24	647.1	64	181.5	104	64.0	144
21.89K	-15	**3000**	**25**	624.7	65	176.4	105	62.5	145
20.70K	-14	2872	26	603.3	66	171.4	106	61.1	146
19.58K	-13	2750	27	582.6	67	166.7	107	59.6	147
18.52K	-12	2633	28	562.8	68	162.0	108	58.3	148
17.53K	-11	2523	29	543.7	69	157.6	109	56.8	149
								55.6	150

Table 7 - Standard Thermistor Resistance versus Temperature

APPENDIX E. HIGH TEMPERATURE THERMISTOR TEMPERATURE DERIVATION

Resistance to Temperature Equation for *US Sensor 103JL1A*:

$$T=\frac{1}{A+B(LnR)+C(LnR)^3+D(LnR)^5}-273.15\ °C$$

Equation 2 - High Temperature Resistance to Temperature

Where;

T = Temperature in °C.

LnR = Natural Log of Thermistor Resistance.

$A = 1.127670 \times 10^{-3}$

$B = 2.344442 \times 10^{-4}$

$C = 8.476921 \times 10^{-8}$

$D = 1.175122 \times 10^{-11}$

Note: Coefficients optimized for a curve "J" Thermistor over the temperature range of 0°C to +250°C.

Ohms	Temp	Ohms	Temp	Ohms	Temp	Ohms	Temp	Ohms	Temp	Ohms	Temp	Ohms	Temp	Ohms	Temp
32,650	0	7,402	32	2,157	64	763.5	96	316.6	128	148.4	160	76.5	192	42.8	224
31,029	1	7,098	33	2,083	65	741.2	97	308.7	129	145.1	161	75.0	193	42.1	225
29,498	2	6,808	34	2,011	66	719.6	98	301.0	130	142.0	162	73.6	194	41.4	226
28,052	3	6,531	35	1,942	67	698.7	99	293.5	131	138.9	163	72.2	195	40.7	227
26,685	4	6,267	36	1,876	68	678.6	100	286.3	132	135.9	164	70.8	196	40.0	228
25,392	5	6,015	37	1,813	69	659.1	101	279.2	133	133.0	165	69.5	197	39.3	229
24,170	6	5,775	38	1,752	70	640.3	102	272.4	134	130.1	166	68.2	198	38.7	230
23,013	7	5,545	39	1,693	71	622.2	103	265.8	135	127.3	167	66.9	199	38.0	231
21,918	8	5,326	40	1,637	72	604.6	104	259.3	136	124.6	168	65.7	200	37.4	232
20,882	9	5,117	41	1,582	73	587.6	105	253.1	137	122.0	169	64.4	201	36.8	233
19,901	10	4,917	42	1,530	74	571.2	106	247.0	138	119.4	170	63.3	202	36.2	234
18,971	11	4,725	43	1,480	75	555.3	107	241.1	139	116.9	171	62.1	203	35.6	235
18,090	12	4,543	44	1,432	76	539.9	108	235.3	140	114.5	172	61.0	204	35.1	236
17,255	13	4,368	45	1,385	77	525.0	109	229.7	141	112.1	173	59.9	205	34.5	237
16,463	14	4,201	46	1,340	78	510.6	110	224.3	142	109.8	174	58.8	206	33.9	238
15,712	15	4,041	47	1,297	79	496.7	111	219.0	143	107.5	175	57.7	207	33.4	239
14,999	16	3,888	48	1,255	80	483.2	112	213.9	144	105.3	176	56.7	208	32.9	240
14,323	17	3,742	49	1,215	81	470.1	113	208.9	145	103.2	177	55.7	209	32.3	241
13,681	18	3,602	50	1,177	82	457.5	114	204.1	146	101.1	178	54.7	210	31.8	242
13,072	19	3,468	51	1,140	83	445.3	115	199.4	147	99.0	179	53.7	211	31.3	243
12,493	20	3,340	52	1,104	84	433.4	116	194.8	148	97.0	180	52.7	212	30.8	244
11,942	21	3,217	53	1,070	85	421.9	117	190.3	149	95.1	181	51.8	213	30.4	245
11,419	22	3,099	54	1,037	86	410.8	118	186.1	150	93.2	182	50.9	214	29.9	246
10,922	23	2,986	55	1,005	87	400.0	119	181.9	151	91.3	183	50.0	215	29.4	247
10,450	24	2,878	56	973.8	88	389.6	120	177.7	152	89.5	184	49.1	216	29.0	248
10,000	**25**	2,774	57	944.1	89	379.4	121	173.7	153	87.7	185	48.3	217	28.5	249
9,572	26	2,675	58	915.5	90	369.6	122	169.8	154	86.0	186	47.4	218	28.1	250
9,165	27	2,579	59	887.8	91	360.1	123	166.0	155	84.3	187	46.6	219		
8,777	28	2,488	60	861.2	92	350.9	124	162.3	156	82.7	188	45.8	220		
8,408	29	2,400	61	835.4	93	341.9	125	158.6	157	81.1	189	45.0	221		
8,057	30	2,316	62	810.6	94	333.2	126	155.1	158	79.5	190	44.3	222		
7,722	31	2,235	63	786.6	95	324.8	127	151.7	159	78.0	191	43.5	223		

Table 8 - Thermistor Resistance Versus Temperature for HT Models

APPENDIX F. NETWORKING

F.1 Description

The Model LC-2x16 Datalogger is capable of being networked by way of a single, optically isolated RS-485 communications cable. Utilizing one 8001-5 (RS-232) or 8002-5 (USB) RS-485 interface adapter at the computer (data collection) end, up to 255 Model LC-2x16 Dataloggers* may be networked. Also, the maximum network length* can be up to 4000 feet (1.22 km). RS-485 is chosen as the transmission medium due to its inherent noise immunity and its capability to support a bus type of network architecture. The 8001-5 RS-485 interface adapter is battery powered to allow for collection of data in the field. An AC adapter is also provided if mains power is available. The 8002-5 draws its operating power from the host computer's USB 2.0 port.

Each datalogger appears as a "node" on the RS-485 bus, with its own unique address. In order to communicate with a specific datalogger, the user transmits the address of the datalogger via the #nnn command, where nnn represents the network address of the datalogger. Valid addresses are 1 thru 256.

In a RS-485 system, it is important to locate the "termination" device at the end of the bus. Make sure that circuit board jumper JP1 (located adjacent to J5 – the COM connector cable termination on datalogger the circuit board) is positioned between pins 1 & 2 on the datalogger that is located at the farthest point on the bus from the RS-485 Interface Adapter and data collection computer. Refer to Appendix F.2 for an example of a typical communications session.

Finally, it is helpful to set the datalogger ID# to agree with the network address. This will tend to eliminate any confusion when collecting data.

For further information, refer to Appendix K.10, and K.21 through K.25.

*** The total number of networked dataloggers is limited by the total network cable length. Contact a GEOKON Sales Engineer for further information.**

F.2 Example of a 3 Datalogger Networking Session

1. This session assumes that there are three dataloggers running at 60 second scan intervals.

2. Press <ENTER> <ENTER> to wake the dataloggers from sleep. At this point, each datalogger is "listening" for its network address to be transmitted down the RS-485 bus.

3. To communicate with Datalogger number one and observe a reading type #1<ENTER>. Datalogger 1 returns:

```
Network address: 1
*
Datalogger#1,2007,334,0930,0,2.98,20.27,-9092.555,
-9438.785,-8711.083,-8981.410,-11592.234,-9767.552,
-8294.582,-9045.733,-9499.814,-8729.308,-8818.881,
-9740.115,-9023.331,-9299.900,-8962.831,
-7812.252,18.9,19.2,19.4,19.7,19.0,19.3,19.2,19.4,
19.2,19.1,19.3,19.6,19.2,19.1,19.3,19.6,460
*E
```

Note that the datalogger ID, which is the first entry for each ASCII character string, corresponds to the network address. **This should be set by the user during initial datalogger setup via the ID command**.

Typing E<ENTER> puts the datalogger back to sleep and disconnects it from the RS-485 bus. The datalogger will continue to wake up periodically (scan rate setting) to take a data reading. **The E command must be used to disconnect from the current datalogger and allow connection to the next datalogger**.

4. To communicate with Datalogger number two and observe a reading, type <ENTER> <ENTER> to wake the dataloggers and then type #2<ENTER>. Datalogger two returns:

```
Network address: 2
*
Datalogger#2,2007,334,0931,0,2.95,22.32,-8769.232,-9011.446,-
10005.812,
-8980.122,-8781.123,-9055.027,-11115.978,-8711.610,-9566.233,-
8998.552,
-7879.259,-9700.001,-9023.675,-10006.205,-8882.121,
-7800.223,18.2,18.4,18.4,18.7,18.2,18.3,18.2,18.3,
18.2,18.2,18.1,18.5,18.1,18.2,18.2,18.1,266
*E
```

5. Doing the same for Datalogger number three results in:

```
Network address: 3
*
Datalogger#3,2007,334,0932,0,2.97,22.50,-8880.111,-10010.553,-
10008.335,
-10008.100,-8750.434,-8794.459,-9970.653,-8700.774,-12005.009,-
8888.486,
-7550.447,-7556.002,-9997.558,-10012.223,-8880.100,
-8979.452,18.0,18.0,18.1,18.0,18.0,18.0,18.1,18.2,
18.0,18.4,18.4,18.5,18.4,18.6,18.5,18.4,452
*E
```

APPENDIX G. LITHIUM COIN CELL

G.1 Description:

Under normal operating conditions, the 1.5V ‘D’ cells provide all the power required to operate the LC-2x16 datalogger. To maintain the correct date and time settings for those periods when the ‘D’ cells are removed, the LC-2x16 datalogger incorporates a 3V lithium coin cell (Panasonic CR2032) to supply operating current to the internal Real Time Clock.

Since the power requirements of the Real Time Clock circuit are minimal (3µA max.), the clock will continue to operate for up to 10 years under these conditions.

However, if the lithium cell voltage falls to 2.5V or less, it should be replaced using the following replacement procedure.

G.2 Replacement Procedure:

Materials Required: 1/4” Slotted Screwdriver, 1/8” Slotted Screw driver, CR2032 Lithium Coin Cell (GEOKON P/N BAT-115), Disposable Grounding Wrist Strap (3M P/N 2209 or equivalent)

Procedure:

1) Put on the disposable grounding wrist strap and connect to a good earth ground.

2) Release the two retaining clips and open the LC-2x16 cover.

3) Being careful not to disturb the transducer wiring, use the 1/4” slotted screwdriver to remove the four 3/8” 10x32 screws that mount the LC-2x16 Multiplexer circuit board to the case standoffs.

4) Carefully lift the LC-2x16 Multiplexer circuit board to expose the LC-2 Single Channel Datalogger circuit board mounted underneath.

5) Using the 1/4” slotted screwdriver, remove the four 3/8” 6x32 mounting screws securing the LC-2 Single Channel Datalogger circuit board to the case.

6) Disconnect the two-wire Molex connector from the header labeled “3V” (“12V” if applicable).

7) Lift the LC-2 Single Channel Datalogger printed circuit board up to expose the bottom of the circuit board.

8) Using the 1/8” slotted screwdriver, gently pry the lithium coin cell battery from the battery holder.

9) Insert the replacement lithium coin cell into the battery holder (+ side facing out).

10) Reinstall the LC-2 Single Channel Datalogger printed circuit board back into the case using the four 3/8” 6x32 mounting screws.

11) Reconnect the two-wire Molex connector to the header labeled “3V” (“12V” if applicable).

12) Reposition the LC-2x16 Multiplexer circuit board over the case standoffs and secure using the four 3/8” 10x32 mounting screws.

13) Close and latch the datalogger cover.

Lithium coin cell replacement complete.

APPENDIX H. MODEL 8032-27 AND LOAD CELL WIRING

Connect the "common" VW- conductor from the load cell to the 8032-27 by lifting up on the orange tab located on the opposite side of the six black conductors, inserting the common conductor fully into the 8032-27 (Figure 3), and then pushing down on the orange tab until it snaps into place. Refer to Table 9 to identify which conductor carries the common VW- signal.

Figure 3 - Model 8032-27 Jumper Wire Assembly

10 pin Bendix	Function	3 Gauge VW Load Cell, Purple Cable	4 Gauge VW Load Cell, Purple Cable	6 Gauge VW Load Cell, Orange Cable
H	Common	White's Black*	Green	Blue

Table 9 -Common Conductor Chart

* White's black and Green wires are switched on GEOKON three-gauge VW load cells prior to serial number 3313.

The following wiring chart details the connections between the load cell and 8032-27 with the multiplexer board:

Multiplexer Board	Vibrating Wire with Thermistor
1H	VW Sensor #1
1L	8032-27
2H	Thermistor
2L	Thermistor
S1	Shield Drain Wire
3H	VW Sensor #2
3L	8032-27
4H	-
4L	-
S2	-
5H	VW Sensor #3
5L	8032-27
6H	-
6L	-
S3	-
•	•
•	•
•	•
11H	VW Sensor #6
11L	8032-7
12H	-
12L	-
S6	-

Table 10 - Standard VW Load Cell Wiring When Using 8032-27

APPENDIX I. LOGVIEW SOFTWARE (LEGACY PRODUCT)

LogView is Graphical User Interface (GUI) software is used to communicate with the datalogger using a personal computer running a Microsoft Windows® operating system. Other general-purpose communication programs (i.e. Windows HyperTerminal™) can also be used to communicate with the Model LC-2x16 via text-based commands. LogView and the USB drivers install program can be downloaded at www.GEOKON.com/software.

Perform the following steps to install LogView software for each computer that will connect to an LC-2x16. These instructions are for computers running Windows XP. The installation procedure is very similar for computers running Windows 7, Windows 2000 and Windows 98. This installation procedure needs to be performed just once for each computer that will run LogView to communicate with a LC-2x16 datalogger.

NOTE: The USB drivers are only required for LC-2x16 models 8002-16-2 and the 8002-5 RS-485 Interface

Make sure that the (4) 1.5V D-cell alkaline batteries are installed in the datalogger (See Sections 3.2 and 4.2 for instructions) and that the LC-2x16 datalogger is not connected to the computer at this time.

I.1 LogView Installation

1) Using Windows Explorer, navigate to the extracted downloaded files and double click on the file “start.bat” to start the install process.

2) Click “**Next >**” when the **Welcome** window appears.

3) When the **Choose Install Location** window appears, choose a folder for the LogView installation then click “**Next>**”.

4) When the **Choose Start Menu Folder** window appears, choose an appropriate folder (default is GEOKON) then click “**Install**”.

5) Click “**Next >**” when the **Java Installation Complete** window appears.

6) Click “**Finish**” when the **Completing the LogView Setup Wizard** window appears.

I.2 Launching LogView

Launching LogView can be accomplished two different ways. Double clicking on the desktop icon:

Or via the Windows Start button: "Programs → GEOKON → LogView"

I.3 LogView Workspaces:

When opening LogView for the first time, the user will be prompted to create a workspace name (see Figure 4). The workspace name can be any combination of letters and numbers and, ideally, will be descriptive in nature. See the LogView User's Guide for more information on workspaces.

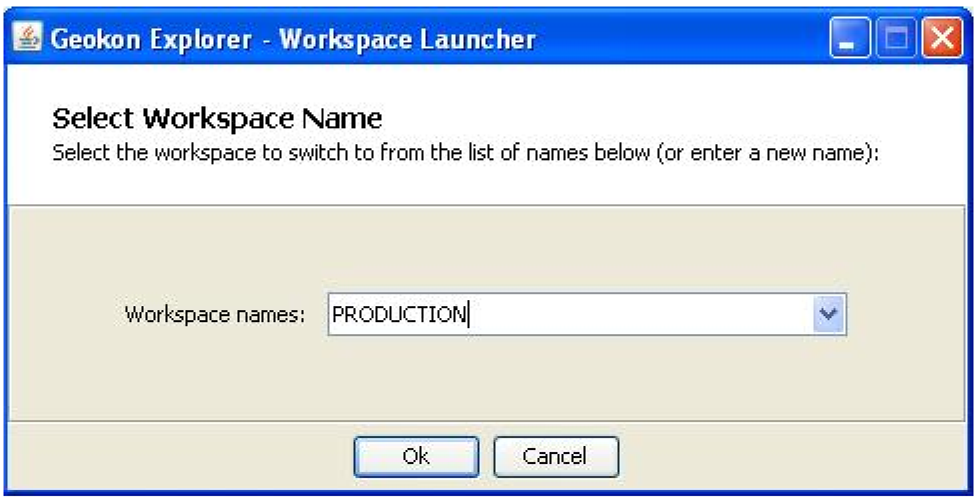

Figure 4 - Select Workspace Name

Once the workspace name has been selected, clicking on "**Ok**" causes LogView to prompt the user to choose or create a folder where all the workspace elements will be stored (see Figure 5). The folder location may be entered directly, i.e., `C:\Workspaces\East Coast` or the **Browse** button may be used to navigate to a folder location or to create a new folder (see Figure 5). This workspace location will be stored in the LogView configuration for subsequent application access. Once workspaces are created, future user access is always by name.

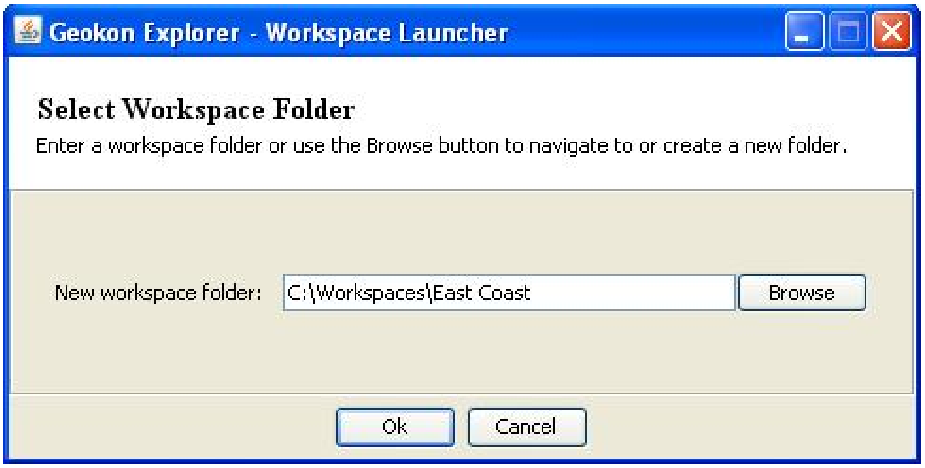

Figure 5 - Select Workspace Folder

If no other is specified, a default folder path is displayed based on the system default workspace path combined with the new workspace name. After the folder path has been specified, either the default or user selected (see Figure 5), clicking on "**Ok**" will display the main window of LogView (see Figure 6). On the left-hand side of the main window is the Project Explorer displaying the newly created workspace. The user can now add new project(s), datalogger(s) and sensor configurations to the workspace by right-clicking on the workspace and using the menu tools.

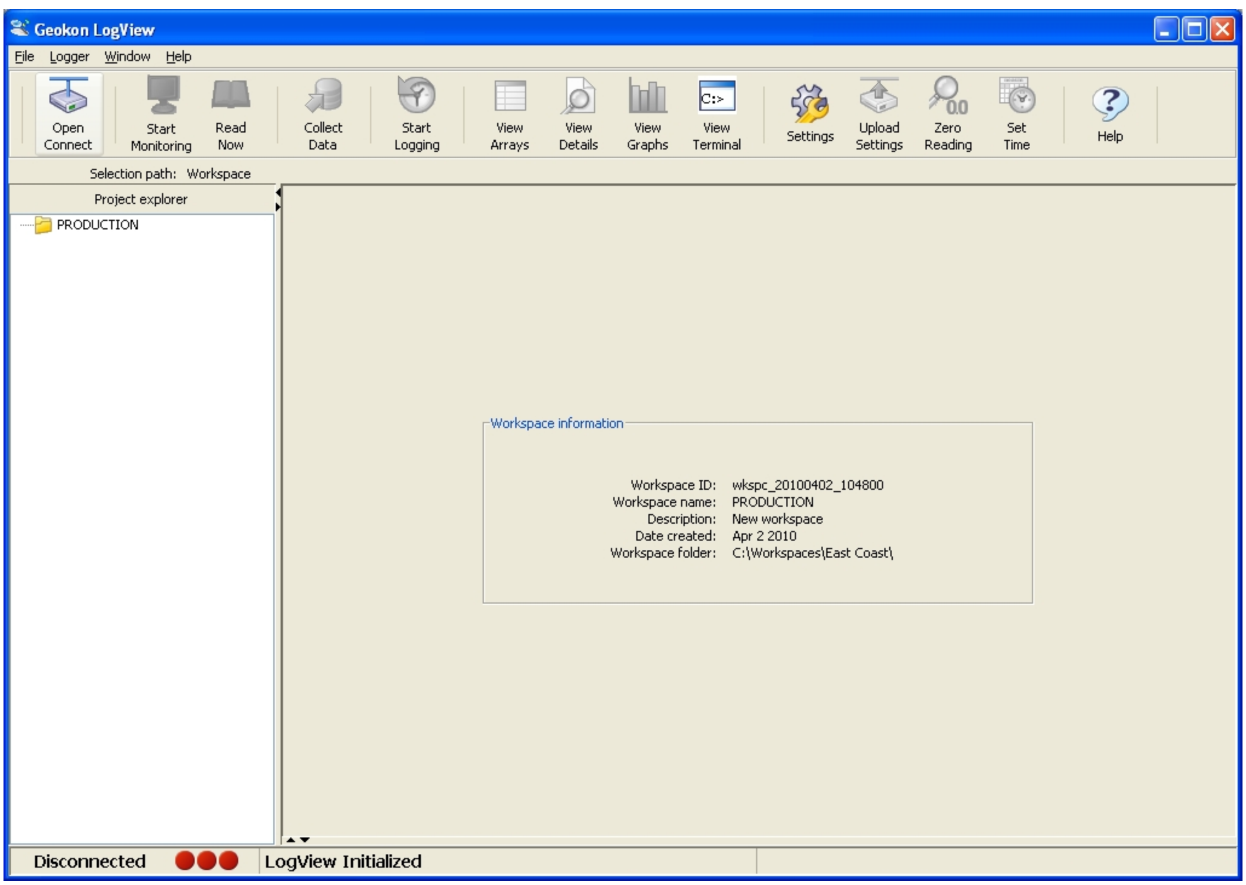

Figure 6 - LogView Main Window

I.4 Adding Projects to LogView Workspaces

Right-clicking on the "**PRODUCTION"** workspace brings up a context sensitive menu that allows the user to add projects to this workspace (using the "**New→Project**" menu selection). Select a name that makes sense for the real-world project this program will be used for. In this example "TestLoggers" was chosen as the project name (see Figure 7 below).

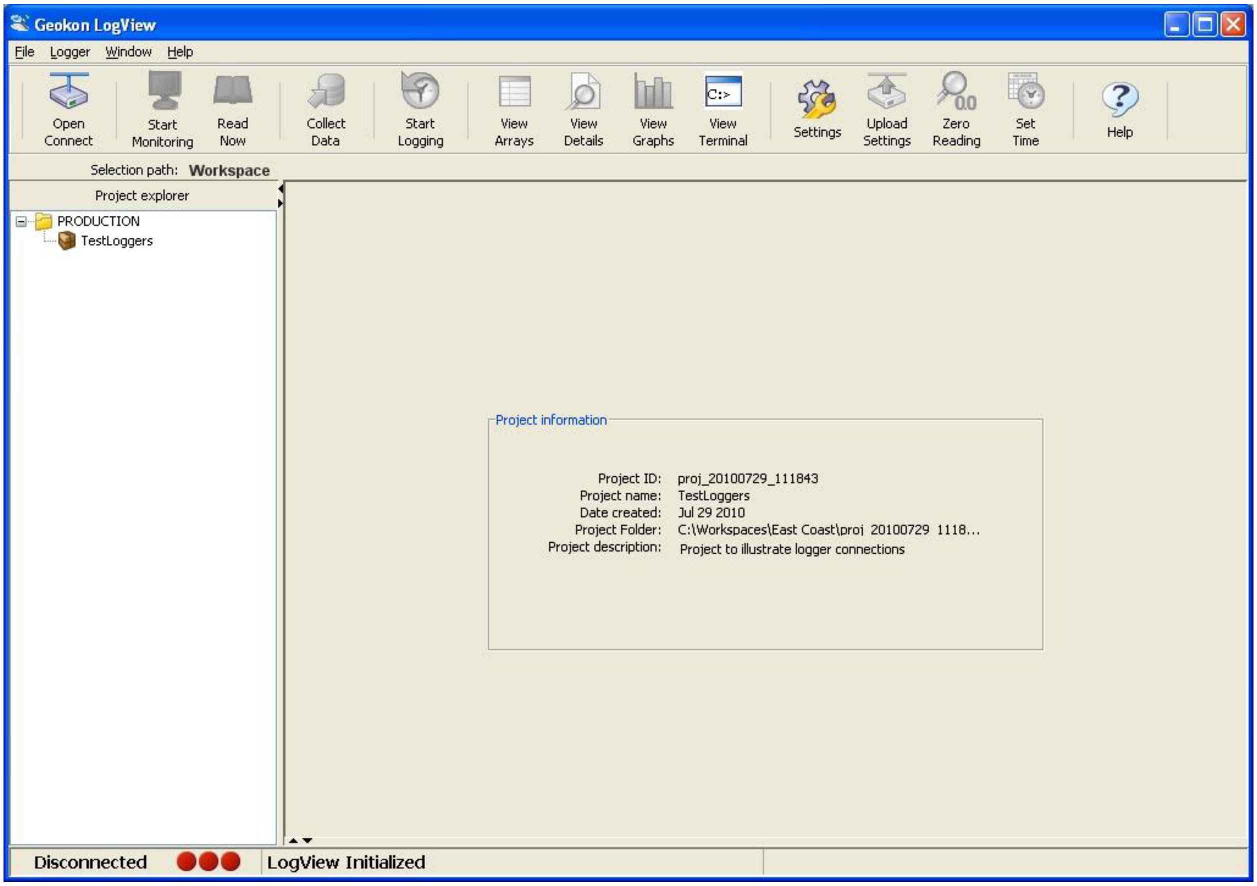

Figure 7 - LogView Main Window with new project

I.5 Adding Dataloggers to LogView Projects

Right-clicking on the "**TestLoggers**" project brings up a context sensitive menu (see Figure 8) that allows users to add dataloggers to their projects. Selecting **New→Logger** from the context menu causes the "**Datalogger Settings**" dialog to be displayed. Like Workspaces and Projects, Dataloggers can be assigned a unique name. For this example, "MyLogger" was chosen for the Datalogger name. For a complete description of all datalogger settings please see the LogView Online Help section on Datalogger Settings. For connection purposes, the relevant tab in this dialog is "**Connection Options**" (see Figure 9).

After physically connecting to a PC, all LC-2x16 dataloggers require a COM port to be identified in the "**Connection Options**". Starting with firmware revision 3.1.X, LC-2x16 dataloggers can communicate at baud rates of 9600 and 115,200. Before this revision the datalogger baud rate was 9600 only so, for these dataloggers, the default setting should not be changed (see Figure 9).

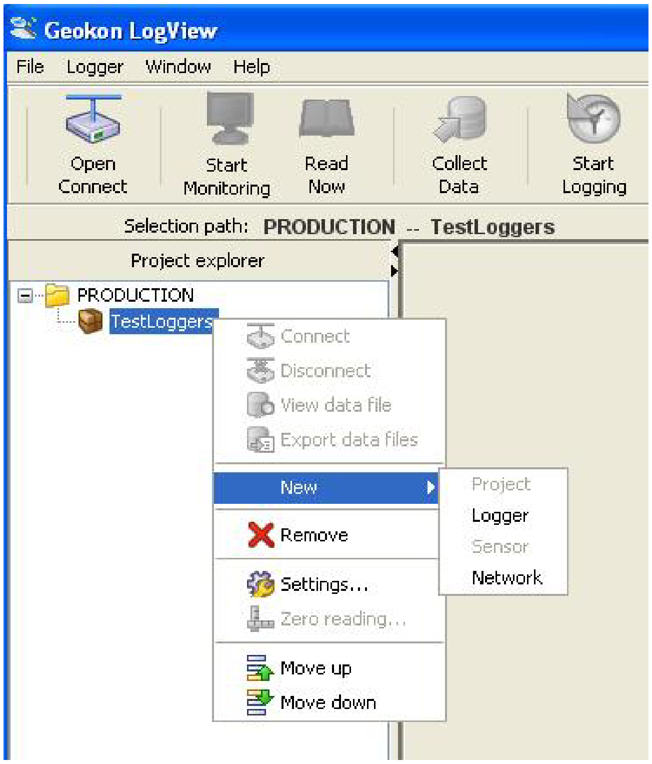

Figure 8 - LogView Context Menu

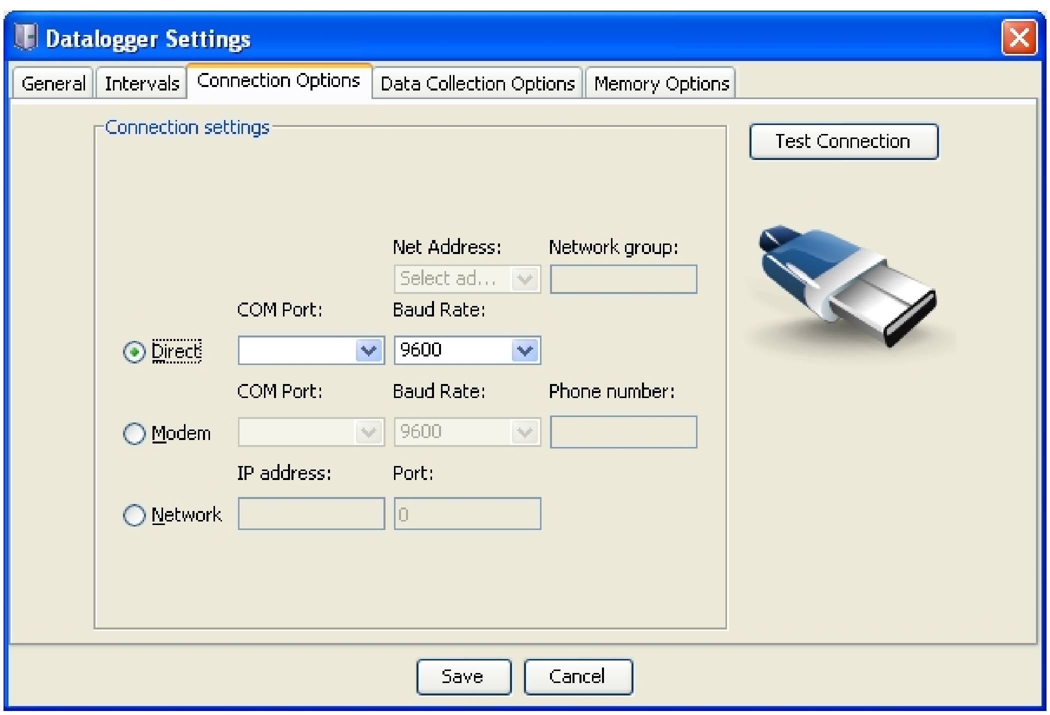

Figure 9 - Datalogger Settings - Connection Options

I.6 LC-2x16 Connection (8002-16-1, RS-232)

Connect the supplied LC-2x16 RS-232 Communications cable (S-8001-6) to the COM port of the LC-2x16 datalogger. The protective cap on the datalogger COM connector is removed by pushing in and turning. Plug the DB-9 end of the RS-232 Communications cable into the host computer's RS-232 port (either internal or external via a USB to Serial converter). Proceed to Appendix I.9, Connecting to a Datalogger with LogView.

I.7 LC-2x16 Connection (8002-16-2, USB)

Connect the supplied LC-2x16 USB Communications cable (COM-109) to the USB port of the LC-2 datalogger. The protective cap on the datalogger USB connector is removed by pushing in and turning. Plug the USB-A end of the USB cable into an available USB-2.0 port on the host computer.

NOTE: On certain PCs with operating systems older than XP, Service Pack 3, the 8002-16-2 may require the installation of a driver to properly communicate with the PC. If the PC does not recognize the datalogger's internal USB to serial converter then the driver may need to be installed by executing the program, CDMv2_xxxx, from the LogView Install folder. Proceed to Appendix I.9, Connecting to a Datalogger with LogView.

I.8 LC-2x16 Connection 8002-16-3 (RS_485)

Make the COM port connection per Appendix I.6 (RS-232) or I.7 (USB), and then refer to Appendix F, Networking, to establish communications.

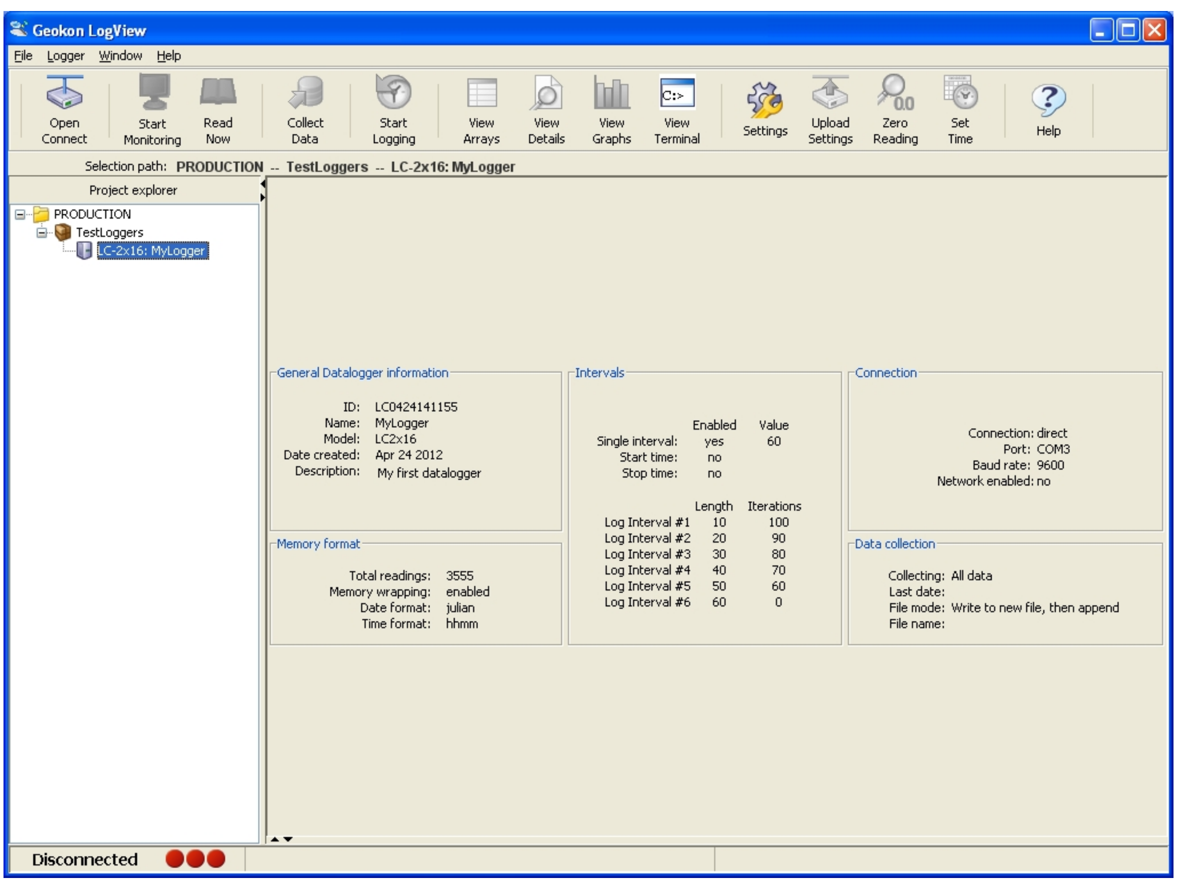

Figure 10 - Datalogger Highlighted - Not Connected

I.9 Connecting to a Datalogger with LogView

1) With a Datalogger profile configured and selected in the Project Explorer (see Figure 10), click on the "**Open Connect**" button on the LogView Toolbar.
2) When connecting to a new Datalogger for the first time, the message below (see Figure 11) may be displayed after a few seconds. This is normal and is only an indication that the datalogger doesn't match the configuration created in the Project Explorer. Click on "Continue" to finish connecting to the datalogger.
3) Click on the "**Upload Settings**" button on the LogView Toolbar to synchronize the datalogger with the LogView configuration (see Figure 12).
4) LogView is now connected and configured correctly for the LC-2x16 datalogger. Sensors can now be added to the datalogger in a similar fashion as adding Dataloggers to Projects. Sensor settings are accessed via the context menu from the Project Explorer.
5) Always upload the new settings to the datalogger after changing its configuration in LogView.

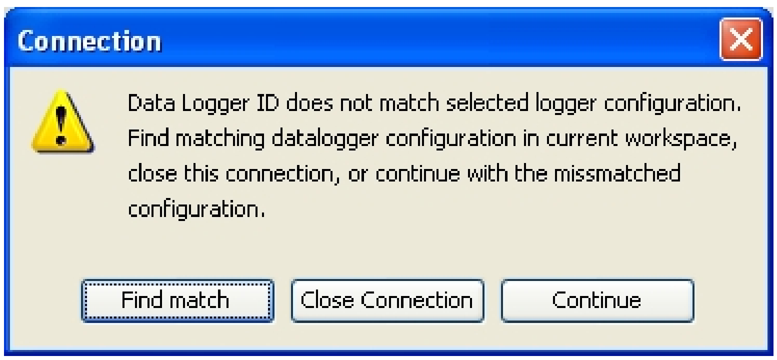

Figure 11 - Datalogger Connection Mismatch

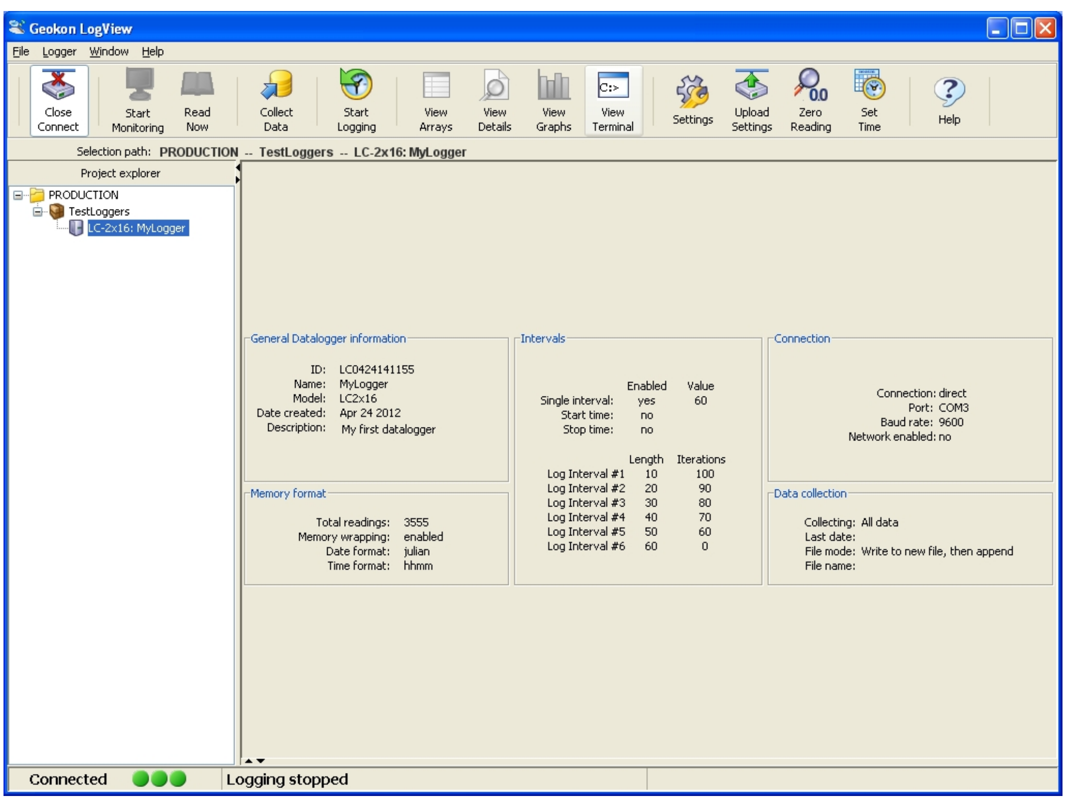

Figure 12 - Datalogger Connected

I.10 Determining COM Port Numbers

When connecting an 8002-16-1 datalogger to a PC with an internal serial port(s) the COM Port number that LogView requires is usually COM1 or COM2 but, occasionally may be COM3 if the PC has more than one internal serial port. Figure 13 below illustrates that the PC has two serial ports, one internal (COM1) and the other via a USB to serial converter (COM13).

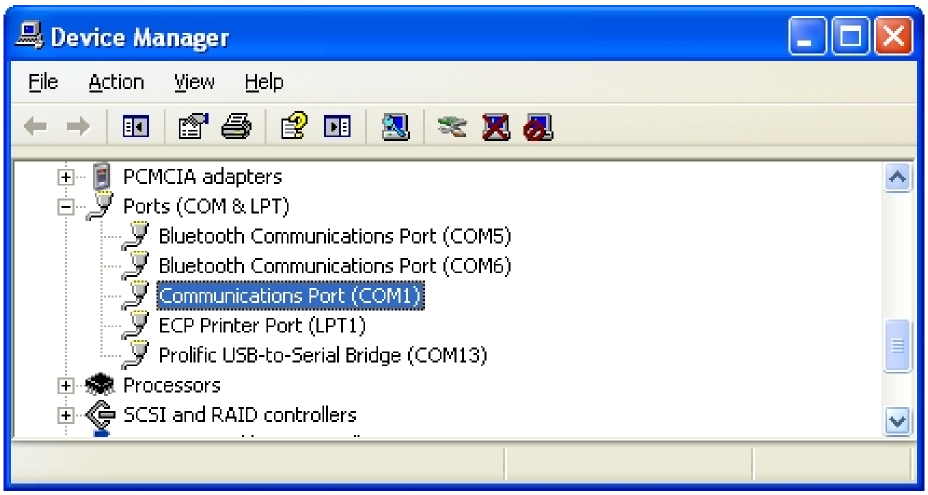

Figure 13 - PC Internal COM Port

When connecting an 8002-16-2 datalogger to a PC the COM Port number that LogView requires can be any number and depends on how many other devices are attached to the PC like, internal serial ports and wireless devices. Figure 14 below illustrates that the PC has three serial ports, one internal (COM1) and the other two via USB to serial converters (COM13 and COM3). One way to determine which COM port an 8002-16-2 datalogger is attached to is to disconnect the cable and see which COM device disappears from the Device Manager Ports list.

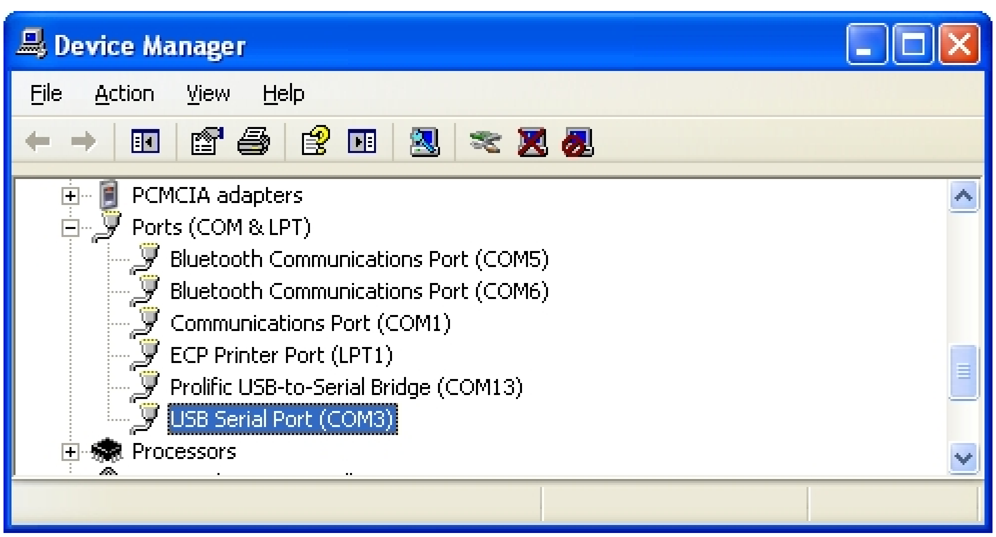

Figure 14 - USB to Serial Converter COM Ports

In this case, COM3 is actually the 8002-16-2 datalogger and not a universally available serial port.

I.11 Downloading Data using LogView

Data can be downloaded to the PC via LogView software (refer to the LogView Online Help). The steps to download the data using LogView are as follows:

Note: The steps below assume that a successful connection has been previously established between LogView and the datalogger. (See Section 3.4 of this manual.)

Click on the Collect Data button from the Main Toolbar. See Figure 15 below:

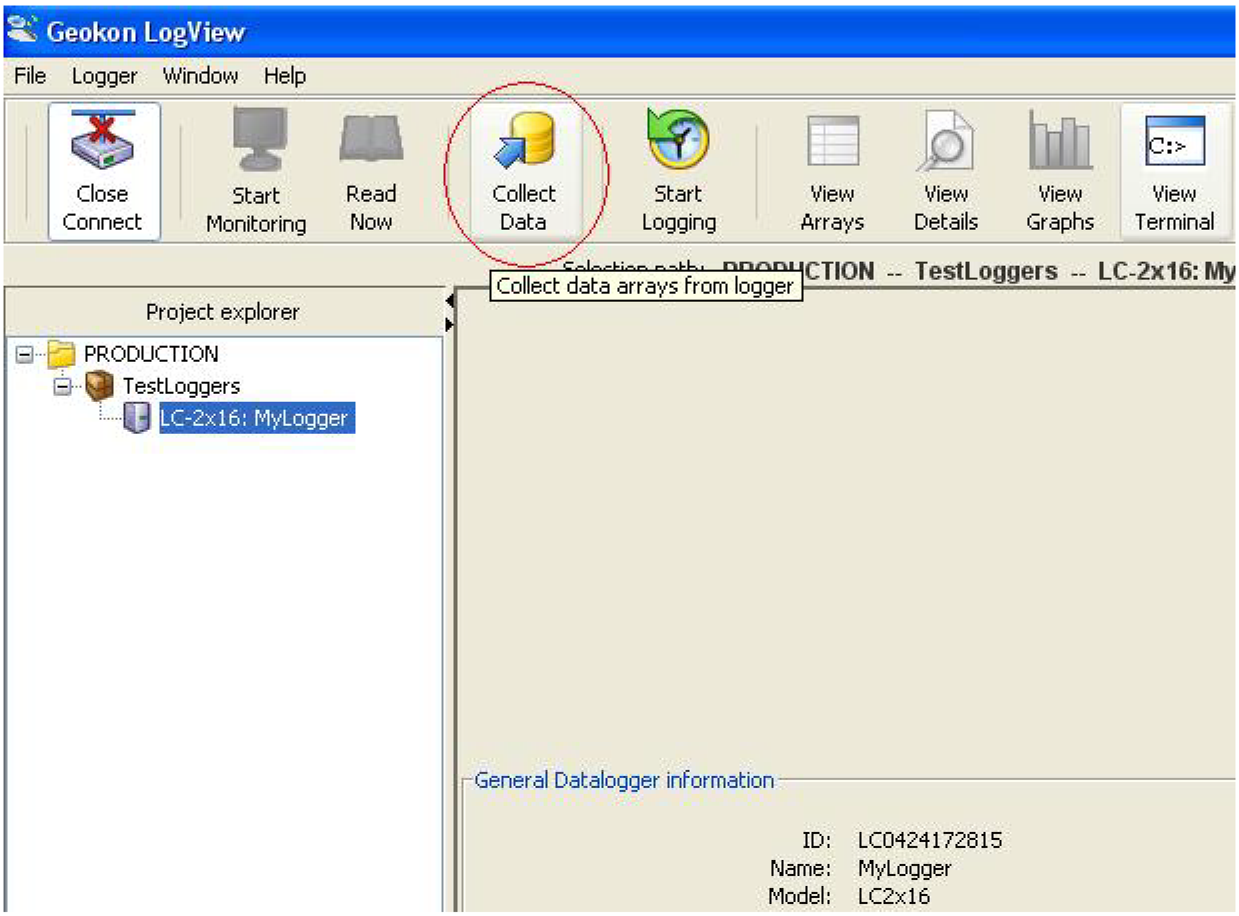

Figure 15 - LogView Collect Data Button

If the datalogger configuration is set for "Collect all data" in "Datalogger Settings→Data Collection Options" (see the LogView online help menu covering datalogger settings) then LogView will issue commands to the datalogger to initiate a download of all arrays logged on the datalogger. If the memory has wrapped then 3555 arrays will be downloaded starting at the current User Pointer (See Appendix K.7 and K.26).

If the datalogger configuration is set for "Collect new data since last download" in "Datalogger Settings→Data Collection Options" then LogView will issue commands to the datalogger to initiate a download of all arrays since the last time data was downloaded.

Once the data collection has been initiated, the following progress bar (see Figure 16) will be displayed until the collection has completed:

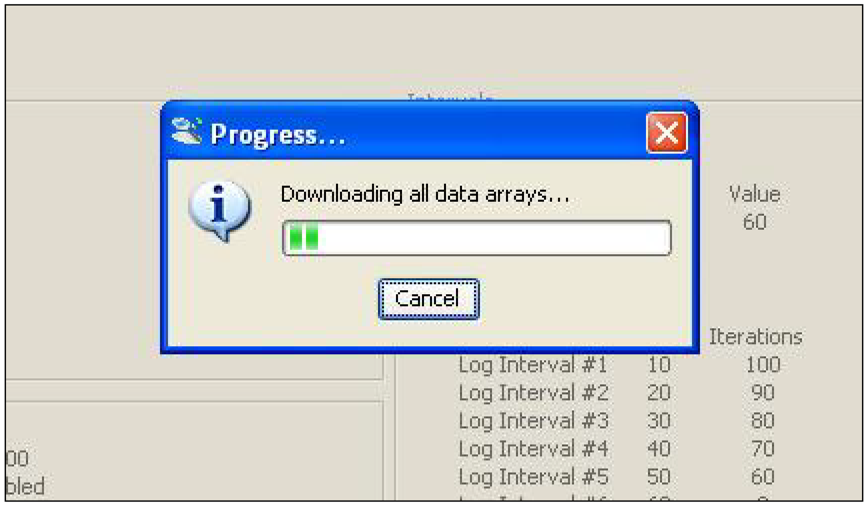

Figure 16 - Data Collection Progress Bar

After a data collection has finished LogView will display the message shown in Figure 17:

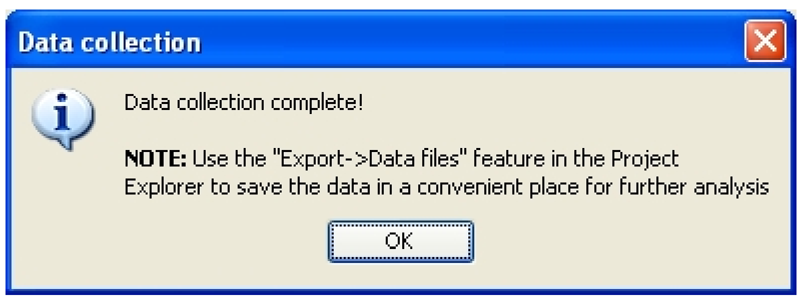

Figure 17 - Data Collection Complete Message

APPENDIX J. EXAMPLE SETUP USING A TERMINAL EMULATOR

If using an 8002-16-2 USB LC-2x16, it is important that the LC-2 first be connected to the computers USB port before running HyperTerminal™ (or other terminal emulator program) so that the LC-2 can be recognized by the computer as a virtual COM port.

Proceed with the following steps to connect with the datalogger using a terminal emulator program such as Microsoft Windows HyperTerminal™.

1. Launch HyperTerminal (Start → All Programs → Accessories → Communications → HyperTerminal).
2. Enter a name for the New Connection and click OK (see Figure 18):

Figure 18 - HyperTerminal Connection Description

3. In the Connect Using window, select the appropriate COM port (see Figure 19):

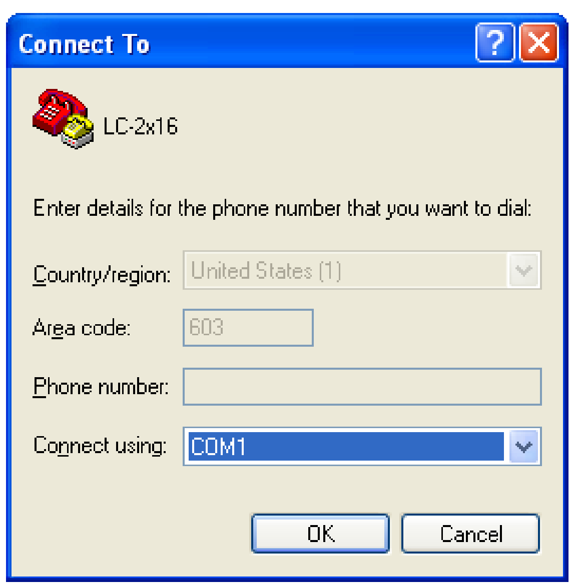

Figure 19 - COM Port Selection

4 In the COM Properties window, configure the COM port (See Figure 20):

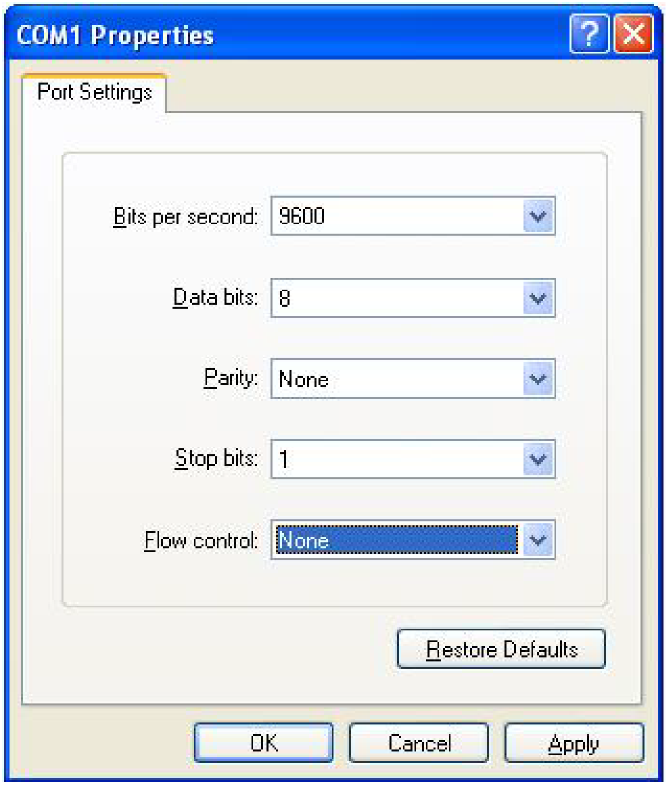

Figure 20 - COM Port Settings

<u>8002-16-1 (RS-232):</u> Configure the COM port (typically COM1 or COM2) as 9600 Bits per second, 8 Data bits, no Parity, 1 Stop bit, no Flow control.

<u>8002-16-2 (USB):</u> Configure the <u>new</u> COM port that is added when the LC-2x16 is connected as 9600 Bits per second, 8 Data bits, no Parity, 1 Stop bit, no Flow control.

5. Click Apply then OK.
6. Press <ENTER> <ENTER> to wake the datalogger from sleep. The datalogger returns the power up prompt;

```
Hello. Press "?" for Help.
*
```

Note: If no characters are received in 15 seconds the datalogger (non-networked) will return to its low power sleep mode. Press <ENTER> <ENTER> to wake it again.

Note: When network commands are enabled and RS-485 is being used, the address must be sent before the respective datalogger will respond. See Appendix K.21 through K.25 for additional information.

7. Type ? <ENTER> to display the Help list. See Appendix K for detailed information on all the commands listed. **All commands must be entered in capital letters!**

```
*?
Command                     Description
-----------------------------------------------
C                           view current Clock
CSmm/dd/yy/hh:mm:ss         Clock Set
DEFAULT                     Load factory DEFAULT gauge settings
DF                          Date Format(0=Julian,1=month,day)
DL                          Display DataLogger type
Dnnnnn                      Display nnnnn arrays from pointer
E                           End communications and go to sleep

Gnn/c/tt/szzzzzz/sffffff/soooooo
or
Gnn/c/tt/saaaaaa/sbbbbbb/scccccc

      Gauge information, where;

                            nn = Channel #
                            c = Conversion Type(L/P)
                            tt = Gauge Type

                            For Linear (L) Conversion:
                                  szzzzzz = zero reading with sign
                                  sffffff = gauge factor with sign
                                  soooooo = offset with sign

                            For Polynomial (P) Conversion:
                                  saaaaaa = polynomial coefficient A with sign
                                  sbbbbbb = polynomial coefficient B with sign
                                  scccccc = polynomial coefficient C with sign

IDdddddddddddddddd          view current ID,set to dddddddddddddddd
Ln/lllll/iii                view Log intervals/change n interval
                                  lllll = length
                                  iii = iterations of interval
LD,LE                       Log intervals Disable, Enable
M,MD,ME                     Monitor status, Disable, Enable
MXS                         Display Multiplexer Setup
MX#                         Select Multiplexer Configuration(4,16)
N                           Display Next time to read
NAddd                       Network Address (1-256)
NS,ND,NE                    Network Status, Disable, Enable
Pnnnnn                      Position array pointer to nnnnn
R                           Reset memory
RESET                       RESET processor
```

S,SS	datalogger Status, System Status
SCnnnnn	view SCan interval/enter nnnnn interval
SPhh:mm	StoP logging, hh:mm = stop time
SR	Synchronize Readings(0=not synch'd,1=synch'd)
SThh:mm	STart logging, hh:mm = start time
SV	Software Version
TEST	System Test
TF	Time Format (0 = hhmm, 1 = hh,mm)
Tnn/t	Thermistor information, where: nn = Channel # t = Thermistor type Thermistor type (0 = standard, 1 = high temp BR55A822J, 2 = high temp 103JL1A)
TR,TR0	display TRap count, zero TRap count
VL	display Lithium cell Voltage
V3	display 3V Battery Voltage
V12	display 12V Battery Voltage
WFn	Wrap Format(0=don't wrap memory,1=wrap memory
X	Single Reading - NOT stored

These commands are executed by typing with the correct syntax and pressing <ENTER>. If the command has not been entered correctly, the datalogger will respond with an asterisk only.

For example:

```
*L7/100/255
*
```

The datalogger will respond to correctly entered commands by displaying the modified values. The purpose and syntax of each of these commands are discussed in the following sections.

J.1 Downloading Data using HyperTerminal (or equivalent)

Data can be downloaded to the PC using Windows HyperTerminal (or other terminal emulator program), which, prior to Windows Vista, was supplied with most personal computers.

The steps to download the data using HyperTerminal are as follows:

Launch HyperTerminal: Start → Programs → Accessories → Communications → HyperTerminal

1. Enter a name for the New Connection – Select OK (see Figure 18, HyperTerminal Connection Description).

2. Change the “Connect using” setting to the appropriate COM port (in this case COM1.) (See Figure 19, HyperTerminal Connection Selection) – Select OK.

3. In the COM Properties Dialog, enter the “Port Settings”. Select Apply. Select OK (Figure 20, HyperTerminal COM Port Settings).

4. With the cursor in the display screen, press the Enter key a few times to verify that communications has been established. The datalogger should return the power up prompt:

```
Hello. Press "?" for Help.
*
```

5. Upon confirmation of communications, select Transfer | Capture Text (see Figure 21):

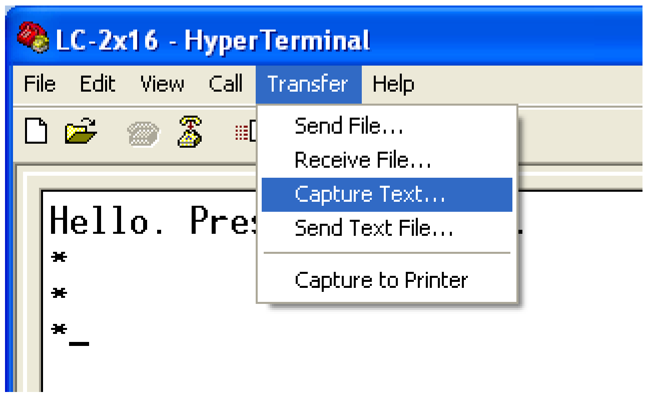

Figure 21 - HyperTerminal Trasnfer Menu

6. Enter the path and name of the file you wish to create, either directly or with the Browse button then click on the Start button (see Figure 22).

Hint: It may be helpful to specify “.CSV” as the file extension to allow for direct formatted entry into a spreadsheet program.

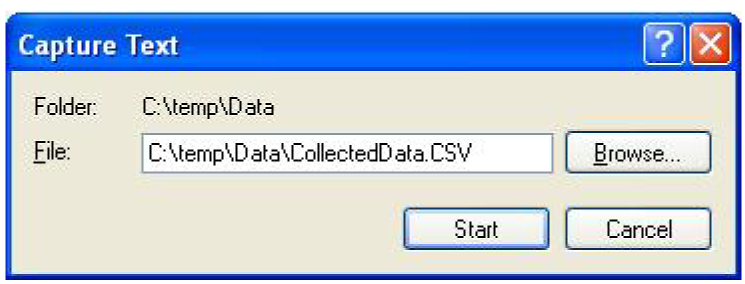

Figure 22 - Specify Data Capture File

7. With the cursor in the display screen, push the Enter key a few times to wake up the datalogger.

Type “S” to get the Status of the datalogger.
Type “P1” to position the data array Pointer at location 1.
Type “D3” to Display the first three readings stored in memory (see Figure 23).
Select Transfer | Capture Text | Stop.

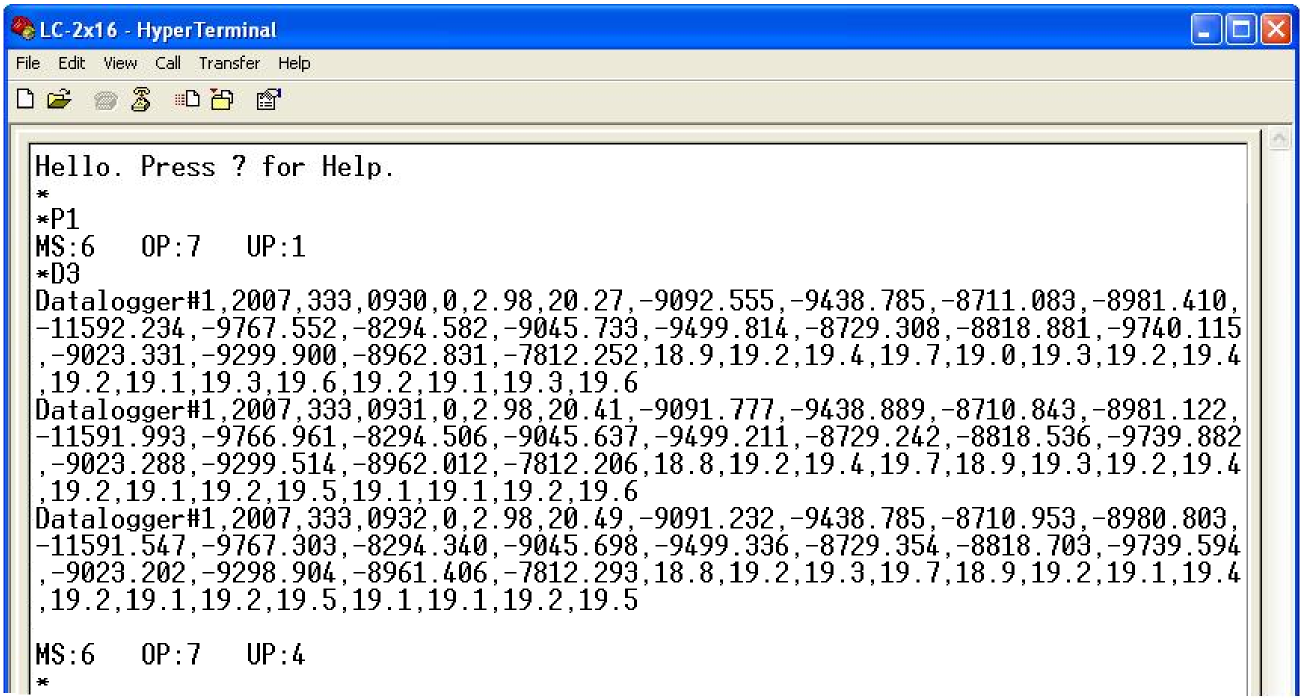

Figure 23 - HyperTerminal/Datalogger Communication

8. The data are now stored in the specified file.

APPENDIX K. TEXT COMMANDS

K.1 "BRnnn"- Set or Display the Current Baud Rate

This command is not displayed in the help text (?<ENTER>). Displays or sets the current baud rate. Valid numbers for "nnn" are 9 (9600 baud) or 115 (115,200 baud). The example below changes the baud rate to 9600 with no confirmation.

```
*BR9
```

K.2 "C" - Display Current Clock Settings

Display the current datalogger real-time clock settings. Appendix K.3 explains how to adjust the clock settings.

```
*C
Date: 02/21/07  Time: 10:43:08
*
```

K.3 "CSmm/dd/yy/hh:mm:ss" - Set the Internal Clock

Set the datalogger's internal real time clock; mm represents the month, dd the day of the month, yy the year, hh the hours, mm the minutes, and ss the seconds. Illegal combinations will be ignored (i.e. CS02/30/07 or CS///12:60). Fields can be left blank to avoid changing (i.e. CS//07 to just change the year).

```
*CS///10:45:00
Date: 02/21/07   Time: 10:45:00
*
```

Note: If logging is currently started and the clock is changed, a restart of the scan interval or log interval table will occur. If the scan interval is fast (e.g., three seconds), logging may need to be stopped and restarted, depending on whether the internal "next time to read" register becomes unsynchronized with the current time.

K.4 "DEFAULT" – Load Factory Default Settings

The DEFAULT command will reload the datalogger's channel and gauge settings to the factory default settings. This results in:

All channels Enabled
All Gauge Types set to 1
All Zero Readings set to 0.00000
All Gauge Factors set to 1.00000
All Gauge Offsets set to 0.00000
Scan interval = 30S
Log Interval Table default values (Appendix K.13 and K.14)
All readings synchronized to the top of the hour
Memory will wrap when full and continue logging
All Thermistors set to standard temperature

***DEFAULT**
This will load all channels with factory default gauge settings!
Are you sure(Y/N)?Y
All channels restored to factory default gauge settings.

K.5 "DF" - Display or Set Date Format

Display or set the date format. This setting determines how the date information will be displayed in the array when the monitor mode is active, or arrays are displayed from memory. Entering DF displays the current date format. Entering DF0 sets the date format to Julian. Entering DF1 sets the date format to month,day. The default date format display is Julian (decimal) day.

```
*DF
Date format is julian.

*DF1
Date format is month,day.

*DF0
Date format is julian.
```

K.6 "DL" – Display Current Mode

Display the current datalogger mode setting.

```
*DL
LC-2x16
```

K.7 "Dnnnn" - Display Arrays Forward from User Position

Use the D command to display arrays forward from the User Position for verification or collection. The updated memory pointers are displayed by this command.

*P1
MS:3146 OP:3147 UP:1
***D5**
2007,11,27,10,00,00,3.10,25.51,9039.950,8054.124,7189.990,9020.111,---,---,---,---,684.250,711.894, 610.020,680.326,---,---,---,---,15.6,15.6,15.4,15.5,---,---,---,---,23.2,23.3,23.2,23.2,---,---,---,---,1

2007,11,27,10,00,30,3.10,25.51,9039.676,8055.002,7189.992,9020.009,---,---,---,---,684.111,711.893, 610.020,680.318,---,---,---,---,15.6,15.6,15.4,15.5,---,---,---,---,23.2,23.3,23.2,23.2,---,---,---,---,2

2007,11,27,10,01,00,3.10,25.51,9039.888,8054.544,7189.990,9020.100,---,---,---,---,684.227,711.894, 610.022,680.325,---,---,---,---,15.6,15.6,15.4,15.5,---,---,---,---,23.2,23.3,23.2,23.2,---,---,---,---,3

2007,11,27,10,01,30,3.10,25.51,9039.939,8054.505,7189.996,9020.112,---,---,---,---, 684.263,711.894, 610.023,680.320,---,---,---,---,15.6,15.6,15.4,15.5,---,---,---,---,23.2, 23.3,23.2,23.2,---,---,---,---,4

2007,11,27,10,02,00,3.10,25.51,9039.944,8054.276,7189.993,9020.108,---,---,---,---, 684.256,711.897, 610.022,680.323,---,---,---,---,15.6,15.6,15.4,15.5,---,---,---,---,23.2, 23.3,23.2,23.2,---,---,---,---,5

MS:3146 OP:3147 UP:6

MS represents the Memory Status of the datalogger. This number indicates how many arrays have been written to memory. In this example, **MS:3146** indicates that 3146 out of 3555 arrays have been written to memory. **OP:3147** indicates that the next memory location to be written to is location 3147. **UP:1** indicates that the memory location currently being pointed to (via the P command) is memory location 1. Use the D command to display arrays forward from the User Position. In this case, **D5** displays the arrays stored at memory locations 1,2,3,4 and 5, and leaves the memory pointer at memory location 6. N

Figure 24 illustrates the ring memory scheme.

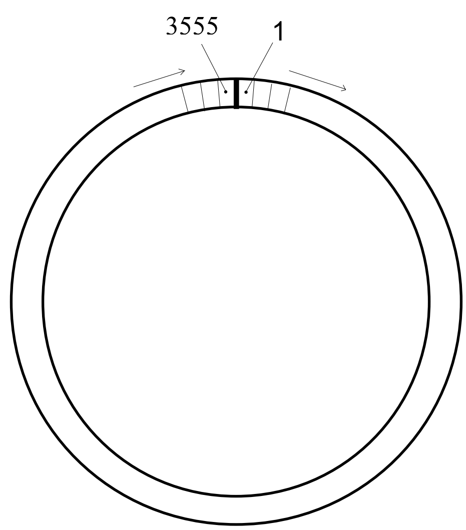

Figure 24 - Order of Array Usage

OP represents the Output Position that the next array will be written to.

UP represents the User Position. This value is updated by D and P commands. The user may display arrays from this position or re-position to another array.

The format is comma delineated ASCII, identical to that displayed when the Monitor mode is active. See Appendix C for a sample data file. See Appendix J.1 in regards using the D command to collect data. When the array display is finished the memory pointers are displayed.

K.8 "E" - Low Power Sleep Mode

Returns the datalogger to its low power sleep mode (readings continue to be logged and displayed in this mode). **This command should always be used when finished communicating with the datalogger to ensure the lowest power consumption.** However, the datalogger (non-networked) will enter sleep mode regardless if no command is received in a period of approximately 15 seconds.

To return from the low power operating mode press <ENTER> <ENTER>. The datalogger responds;

```
Hello. Press "?" for Help.
*
```

Note: When network commands are enabled the address must be sent before the respective datalogger will respond. See the **`NA,ND`** and **`NE`** command sections for additional information.

K.9 "Gnn/c/tt/szzzzzz/sffffff/soooooo or Gnn/c/tt/saaaaaa/sbbbbbb/scccccc" - Gauge Settings

The **G** command is used to set up each of the 16 datalogger channels. All the transducer parameters, including the type of conversion (linear or polynomial) and whether a channel is enabled or disabled are set with this command. Refer to Table 11 and Table 12 for a description of each gauge type.

The syntax for this command is:

<u>Linear Conversion:</u>

Gnn/c/t/szzzzzz/sffffff/soooooo

Where:

nn = Channel # (Valid entries are 1,2,3…16 for the LC-2x16)
c = Conversion Type(L/P) where L=Linear and P=Polynomial
t = Gauge Type:
- 0: Channel Disabled (will display "---")
- 1: VW Gauge Type 1
- 2: VW Gauge Type 2
- 3: VW Gauge Type 3
- 4: VW Gauge Type 4
- 5: VW Gauge Type 5
- 6: VW Gauge Type 6

szzzzzz = zero reading with sign
sffffff = gauge factor with sign
soooooo = offset with sign

Example: To setup Channel 1 as a model 4000 VW Strain Gauge with a Zero Reading of 490 digits, a Gauge Factor of –0.0015 and a Gauge Offset of 0, enter:

G1/L/3/490/-0.0015/0 <ENTER>

The LC-2x16 will return:

CH 1: ENABLED
GT: 3   ZR: 490.0000   GF: -0.00150   GO: 0.00000

***Note**: If selecting Gauge Type 0 to disable the channel, the LC-2x16 will only return '*'. Use the **MXS** command (Appendix K.18) to view the disabled channels.

When using linear conversion (L) of the instrument reading, the G command is used to select the gauge type and enter the gauge zero reading, gauge factor, and gauge offset.

Linear Conversion is described further as follows:
szzzzzz represents the zero reading for the transducer being read, **sffffff** represents the multiplier (calibration or gauge factor) that will be applied to the reading to convert to engineering units and **soooooo** is the offset that will be applied to the gauge reading. The zero reading, gauge factor and offset can be entered with a sign and decimal point. The maximum number of digits, including sign and decimal point is 15. The entered value will display to a maximum of five places to the right of the decimal point.

For vibrating wire instruments (Gauge Types 1-6), manufactured after November 2, 2011 and for all dataloggers (8002-16-X) with a firmware revision of 3.1.X and up, the basic formula for calculation of displayed and stored values is as follows;

$$\text{Display} = ((\text{CurrentReading} - \text{ZeroReading}) \times \text{Multiplier}) + \text{Offset}$$

Equation 3 - Displayed Gauge Reading using Linear Conversion

> **NOTE:** It is possible that a new datalogger might be used with an older sensor or vice versa and because of equation differences the output might be negative. As of LogView version V2.1.1.X, an additional sensor configuration parameter is now required, allowing LogView to compensate for old versus new sensor/datalogger combinations. This new parameter: **Output Calculation**, determines whether the sensor was calibrated using the formula: **G x (R_0 – R_1)** or **G x (R_1 – R_0).** As with the gauge factor, this information is available from the calibration certificate supplied with each sensor. Please see the LogView User's Guide or the online help section, "Sensor Settings" available while running LogView.

NOTE: In Equation 3 (above), the "**CurrentReading**" is frequently referred to as **R_1** while the "**ZeroReading**" is referred to as **R_0**

Polynomial Conversion:

Gnn/c/tt/saaaaaa/sbbbbbb/scccccc

Where:

nn = Channel # (Valid entries are 1,2,3…16 for the LC-2x16)
c = Conversion Type(L/P) where L=Linear and P=Polynomial
t = Gauge Type:
0: Channel Disabled (will display "---")
1: VW Gauge Type 1
2: VW Gauge Type 2
3: VW Gauge Type 3
4: VW Gauge Type 4
5: VW Gauge Type 5
6: VW Gauge Type 6
saaaaaa = polynomial coefficient A with sign
sbbbbbb = polynomial coefficient B with sign
scccccc = polynomial coefficient C with sign

When using polynomial conversion (P), the G command is used to select the gauge type and enter the three polynomial coefficients, A, B and C.

Polynomial Conversion is described further as follows:
saaaa represents polynomial coefficient A, **sbbbb** represents polynomial coefficient B and **scccc** polynomial coefficient C. The polynomial coefficients can be entered with a sign and decimal point. The maximum number of digits, including sign and decimal point is 15. The entered value will display to a maximum of five places to the right of the decimal point.

For the vibrating wire instruments (Gauge Types 1-6), the basic formula for calculation of displayed and stored values is as follows:

$$\text{Display} = (\text{CurrentReading}^2 \times A) + (\text{CurrentReading} \times B) + C$$

Equation 4 - Displayed Gauge Reading using Polynomial Conversion

NOTE: When using the Polynomial conversion method, the default reading units for a vibrating wire instrument is the frequency squared multiplied by 10^{-6}. For example, an instrument reading 3000Hz will output a value of "9.000" when A is entered as "0", B is "1" and C is "0". However, typical calibration units for vibrating wire instruments are frequency squared multiplied by 10^{-3}. To adjust for this discrepancy between LC-2 expected units and calibration units **multiply the A coefficient by 1,000,000 and the B coefficient by 1000. The A and B coefficients can be found on the supplied calibration certificate.** The **C** coefficient should be calculated based on an actual field reading. The above multiplication is **only** necessary if the datalogger is being set up via text commands (see Appendix J) **AND** the gauge conversion is set for polynomial. When using LogView to set up the datalogger configuration, the multiplication is performed by LogView. Refer to the appropriate sensor manual for more information on how to calculate the **C** coefficient.

Geokon Model	Gauge Type	Description
4000	3	Strain Gauge
4100	1	Strain Gauge
4200	3	Strain Gauge
4204	6	Strain Gauge
4202/421X	1	Strain Gauge
4300BX	1	BX Borehole Stressmeter
4300EX	5	EX Borehole Stressmeter
4300NX	1	NX Borehole Stressmeter
4400	1	Embedment Jointmeter
4420	1	Crackmeter
4450	1	Displacement Transducer
4500	1	Piezometer
4600/4651/4675	1	Settlement Systems
4700	1	Temperature Transducer
4800	1	Pressure Cell
4850	1	Low Pressure Piezometer
4900	1	Load Cell
4910/4911/4912	1	Load Bolts

Table 11 - Vibrating Wire Gauge Types

Type	Measurement Type	Description	Output Units	Linear Range	Polynomial Range
0		Channel Disabled			
1	Vibrating Wire	Middle frequency sweep, 1400-3500 Hz	Digits	1960 to 12250	1.960 to 12.250
2	Vibrating Wire	High frequency sweep, 2800-4500 Hz	Digits	7840 to 20250	7.840 to 20.250
3	Vibrating Wire	Very low frequency sweep, 400-1200 Hz	Digits	160 to 1440	0.160 to 1.440
4	Vibrating Wire	Low frequency sweep, 1200-2800 Hz	Digits	1440 to 7840	1.440 to 7.840
5	Vibrating Wire	Very high frequency sweep, 2500-4500 Hz	Digits	6250 to 20250	6.250 to 20.250
6	Vibrating Wire	Low frequency sweep, 800-1600 Hz	Digits	640 to 2560	0.640 to 2.560

Table 12 - Gauge Type Descriptions

The "Digits" calculation for the Vibrating Wire transducer output when using linear conversion is based on this equation:

$$\text{Digits} = \text{frequency}^2 \times 10^{-3}$$

Equation 5 - Digits Calculation using Linear Conversion

The "Digits" calculation for the Vibrating Wire transducer output when using polynomial conversion is based on this equation:

$$\text{Digits} = \text{frequency}^2 \times 10^{-6}$$

Equation 6 - Digits Calculation using Polynomial Conversion

Frequency, in the above equations, represents the resonant frequency of vibration of the wire in the transducer (in Hertz) as determined by the datalogger.

To convert calibration factors (pressure transducers are usually psi per digit) to other engineering units consult the Table 13.

NOTE: In LogView Sensor Settings, when output units are set different than inputs units, a conversion factor (see Table 13) is automatically applied to the gauge factor of each sensor. See the LogView User's Guide for more information on Sensor Settings.

From → To ↓	psi	"H_2O	'H_2O	mm H_20	m H_20	"HG	mm HG	atm	mbar	bar	kPa	MPa
psi	1	.036127	.43275	.0014223	1.4223	.49116	.019337	14.696	.014503	14.5039	.14503	145.03
"H_2O	27.730	1	12	.039372	39.372	13.596	.53525	406.78	.40147	401.47	4.0147	4016.1
'H_2O	2.3108	.08333	1	.003281	3.281	1.133	.044604	33.8983	.033456	33.4558	.3346	334.6
mm H_20	704.32	25.399	304.788	1	1000	345.32	13.595	10332	10.197	10197	101.97	101970
m H_20	.70432	.025399	.304788	.001	1	.34532	.013595	10.332	.010197	10.197	.10197	101.97
"HG	2.036	.073552	.882624	.0028959	2.8959	1	.03937	29.920	.029529	29.529	.2953	295.3
mm HG	51.706	1.8683	22.4196	.073558	73.558	25.4	1	760	.75008	750.08	7.5008	7500.8
atm	.06805	.0024583	.0294996	.0000968	.0968	.03342	.0013158	1	.0009869	.98692	.009869	9.869
mbar	68.947	2.4908	29.8896	.098068	98.068	33.863	1.3332	1013.2	1	1000	10	10000
bar	.068947	.0024908	.0298896	.0000981	.098068	.033863	.001333	1.0132	.001	1	.01	10
kPa	6.8947	.24908	2.98896	.0098068	9.8068	3.3863	.13332	101.320	.1	100	1	1000
MPa	.006895	.000249	.002988	.00000981	.009807	.003386	.000133	.101320	.0001	.1	.001	1

Table 13 - Engineering Units Multiplication Factors

K.10 “IDdddddddddddddddd” - Display or Set Datalogger ID

Displays or sets the datalogger ID. The ID is a 16-character string that can be used to identify a datalogger and the data that is transmitted by it. If an ID is entered it will be transmitted as the first element in each array of data. For example;

```
*ID
Datalogger ID:
*ID
Datalogger ID:
*IDDatalogger#1
Datalogger ID:Datalogger#1
*ST
Logging started.
```

Datalogger#1,2007,11,27,10,00,00,3.10,25.51,9039.950,8054.124,7189.990,9020.111, ---,---,---,---, 684.250,711.894,610.020,680.326,---,---,---,---,15.6,15.6,15.4,15.5,---,---,---, ---,23.2,23.3,23.2,23.2,---,---,---,---,1

Datalogger#1,2007,11,27,10,00,30,3.10,25.51,9039.676,8055.002,7189.992,9020.009, ---,---,---,---, 684.111,711.893,610.020,680.318,---,---,---,---,15.6,15.6,15.4,15.5,---,---,---, ---,23.2,23.3,23.2,23.2,---,---,---,---,2

Datalogger#1,2007,11,27,10,01,00,3.10,25.51,9039.888,8054.544,7189.990,9020.100, ---,---,---,---, 684.227,711.894,610.022,680.325,---,---,---,---,15.6,15.6,15.4,15.5,---,---,---, ---,23.2,23.3,23.2,23.2,---,---,---,---,3

Datalogger#1,2007,11,27,10,01,30,3.10,25.51,9039.939,8054.505,7189.996,9020.112, ---,---,---,---, 684.263,711.894,610.023,680.320,---,---,---,---,15.6,15.6,15.4,15.5,---,---,---, ---,23.2,23.3,23.2,23.2,---,---,---,---,4

Datalogger#1,2007,11,27,10,02,00,3.10,25.51,9039.944,8054.276,7189.993,9020.108, ---,---,---,---, 684.256,711.897,610.022,680.323,---,---,---,---,15.6,15.6,15.4,15.5,---,---,---, ---,23.2,23.3,23.2,23.2,---,---,---,---,5

To clear the ID, enter a <SPACE> character as the ID. When the ID is cleared the arrays from the logger will display beginning with the year. To display the current ID enter `ID` <ENTER>.

K.11 "L" - Display Log Intervals

Display all 6 log intervals.

```
*L
        Log Intervals List
----------------------------------------------

Interval #1  Length: 30     Iterations: 100

Interval #2  Length: 40     Iterations: 90

Interval #3  Length: 50     Iterations: 80

Interval #4  Length: 60     Iterations: 70

Interval #5  Length: 90     Iterations: 60

Interval #6  Length: 120     Iterations: 0

*
```

This command has no effect on the current interval (scan or log). If logging is started and log intervals are enabled the iterations value will be followed by the number of readings left at that interval. For example:

```
*L
            Log Intervals List
----------------------------------------------

Interval #1  Length: 30     Iterations: 100/96

Interval #2  Length: 40     Iterations: 90/90

Interval #3  Length: 50     Iterations: 80/80

Interval #4  Length: 60     Iterations: 70/70

Interval #5  Length: 90     Iterations: 60/60

Interval #6  Length: 120     Iterations: 0/0

    *
```

The above list indicates that there are 96 iterations of interval one left before interval two begins execution. See the **`Ln/lllll/iii`** command section to modify intervals.

K.12 "Ln/lllll/iii" - Define Length and Iteration of Interval

Define the length and iteration of any interval in the list; n refers to the number of the interval (1-6), lllll is the length (3-86400), and iii is the iterations (0-255), or the number of readings that will be taken at that interval. If 0 is entered for the iteration value that interval will execute indefinitely. Illegal entries will be ignored, i.e. `L7/10/100` or `L1/1000/500`. If the entry is correct the modified interval will display.

```
*L1/100/0
Interval #1  Length: 100   Iterations: 0
*
```

If log intervals are enabled and logging was started, any change to the interval list will result in a restart of the table!

Table 14 lists possible logarithmic interval lengths and iterations. Any combination of lengths and iterations is permissible.

Interval	Length	Iterations	Elapsed Time
1	30 seconds	2	1 minute
2	40 seconds	15	10 minutes
3	60 seconds	100	100 minutes
4	300 seconds	200	1000 minutes
5	2400 seconds	250	10000 minutes
6	3600 seconds	0	Endless (hourly)

Table 14 - Logarithmic Intervals List

K.13 "LD" - Disable Log Intervals

Disable use of log intervals. If logging is started (**ST** command) it will continue based on the scan interval entry (**SC** command).

```
*LD
Log intervals disabled.
*Datalogger#1,2007,11,27,10,02,00,3.10,25.51,9039.944,8054.276,7189.993,9020.108,
---,---,---,---, 684.256,711.897,610.022,680.323,---,---,---,---,15.6,15.6,15.4,15.5,---,---,---,
---,23.2,23.3,23.2,23.2,---,---,---,---,311
*
```

K.14 "LE" - Enable Log Intervals

Enable use of log intervals. If logging is started (**ST** command) it will continue based on the interval lengths and iterations of the log list (**SC** command).

```
*LE
Log intervals enabled.
Datalogger#1,2007,11,27,10,02,00,3.10,25.51,9039.944,8054.276,7189.993,9020.108,
---,---,---,---, 684.256,711.897,610.022,680.323,---,---,---,---,15.6,15.6,15.4,15.5,---,---,---,
---,23.2,23.3,23.2,23.2,---,---,---,---,1755
*
```

K.15 "M" - Display Current Monitor Mode Setting

Display the current Monitor mode setting. The monitor mode will display arrays as they are stored in memory during logging. This is useful where a test is being conducted and immediate display of logged values would be helpful. Use the **MD** and **ME** commands (next two sections) to disable or enable the use of the Monitor mode.

```
*M
Monitor mode enabled.
*
```

K.16 "MD" - Disable Monitor Mode

Disable the Monitor mode. Arrays will not be sent to the host computer as they are logged.

```
*MD
Monitor mode disabled.
*
```

K.17 "ME" - Enable Monitor Mode

Enable the Monitor mode. Arrays will be sent to the host computer as they are logged.

```
*ME
Monitor mode enabled.
*
```

K.18 “MXS” – Display Multiplexer Status

Display the Multiplexer Status.

***MXS**

LC-2MUX 16-Channel Multiplexer Setup:

CH 1: ENABLED
GT: 1   ZR: 0.00000   GF: 1.00000   GO: 0.00000   TH: 0

CH 2: ENABLED
GT: 1   ZR: 0.00000   GF: 1.00000   GO: 0.00000   TH: 0

CH 3: ENABLED
GT: 1   ZR: 0.00000   GF: 1.00000   GO: 0.00000   TH: 0

CH 4: ENABLED
GT: 1   ZR: 0.00000   GF: 1.00000   GO: 0.00000   TH: 0

CH 5: ENABLED
GT: 1   ZR: 0.00000   GF: 1.00000   GO: 0.00000   TH: 0

CH 6: ENABLED
GT: 1   ZR: 0.00000   GF: 1.00000   GO: 0.00000   TH: 0

CH 7: ENABLED
GT: 1   ZR: 0.00000   GF: 1.00000   GO: 0.00000   TH: 0

CH 8: ENABLED
GT: 1   ZR: 0.00000   GF: 1.00000   GO: 0.00000   TH: 0

CH 9: ENABLED
GT: 1   ZR: 0.00000   GF: 1.00000   GO: 0.00000   TH: 0

CH 10: ENABLED
GT: 1   ZR: 0.00000   GF: 1.00000   GO: 0.00000   TH: 0

CH 11: ENABLED
GT: 1   ZR: 0.00000   GF: 1.00000   GO: 0.00000   TH: 0

CH 12: ENABLED
GT: 1   ZR: 0.00000   GF: 1.00000   GO: 0.00000   TH: 0

CH 13: ENABLED
GT: 1   ZR: 0.00000   GF: 1.00000   GO: 0.00000   TH: 0

CH 14: ENABLED
GT: 1   ZR: 0.00000   GF: 1.00000   GO: 0.00000   TH: 0

CH 15: ENABLED
GT: 1   ZR: 0.00000   GF: 1.00000   GO: 0.00000   TH: 0

CH 16: ENABLED
GT: 1   ZR: 0.00000   GF: 1.00000   GO: 0.00000   TH: 0

*

K.19 “MXn” – Set the Maximum Number of Channels

Select the maximum number of channels (4 or 16) of the multiplexer. For a LC-2x16, this is 16 by default:

```
*MX16
16 Channel Multiplexer Selected.
*
```

K.20 “N” - Display Next Measurement Cycle

Display the next time the datalogger will initiate a measurement cycle. If the start time (command **ST**) has been set, it will display when logging will begin.

```
*ST12:00
Logging will start at: 12:00:00
*N
Next time to read: 12:00:00
*
```

K.21 “NA” - Display Network Address

Displays the current network address.

```
*NA
Network address: 1
*
```

When network recognition is enabled, this number (preceded by the # character) must be entered for the respective datalogger to respond. The following example illustrates communication with two different dataloggers on the RS-485 network.

```
<ENTER>
<ENTER>
#1<ENTER>
Network address: 1
*NA
Network address: 1
*E

<ENTER>
<ENTER>
#2<ENTER>
Network address: 2
*NA
Network address: 2
*E
```

K.22 "NAddd" - Set Network Address

Sets the current network address to any address between 1 and 256.

```
*NA10
Network address: 10
*
```

When network recognition is enabled, this number (preceded by the # character) must be entered for the respective datalogger to respond. The following example illustrates communication with two different dataloggers on the RS-485 network.

```
<ENTER>
<ENTER>
#1<ENTER>
Network address: 1
*NA
Network address: 1
*E

<ENTER>
<ENTER>
#10<ENTER>
Network address: 10
*NA
Network address: 10
*E
```

NOTE: If connected directly to the datalogger via USB and networking is enabled, the datalogger will respond with the * prompt only. The network address may not be changed while networked. Direct connect to the datalogger via USB to change the network address.

K.23 "ND" - Network Disable

Network **D**isable the datalogger. Disables networking of two or more LC-2x16 dataloggers.

```
*ND
Network recognition disabled.
```

K.24 "NE" - Network Enable

Network **E**nable the datalogger. Enables networking of two or more LC-2x16 dataloggers.

```
*NE
Network recognition enabled.
```

Note: If the LC-2x16 is connected via the USB port, connection to a network enabled datalogger can be made directly without the need to enter the correct datalogger address. This can be helpful if the network address is unknown and the datalogger is network enabled.

K.25 "NS" - Display Network Status

Display the current network status.

```
*NS
Network recognition disabled.
*
```

Or;

```
*NS
Network recognition enabled.
*
```

K.26 "Pnnnn" - Set User Position Memory Pointer

Position the User Position memory pointer. Type **P** and a number between 1 and 3555 to position the pointer. Arrays can then be displayed (**D** command) from the new position. The updated pointers will display after entering a valid position.

```
*P1
MS:3200   OP:1567   UP:1
*
```

K.27 "R" - Reset Memory Pointers

Reset memory pointers to default settings. Gauge and interval settings, as well as the real-time clock settings, are not affected by this command. User will be asked to verify before executing. Press **Y** to continue, any other key to abort.

```
*R
Are you sure(Y/N)?Y
Memory cleared.
*
```

Note: This command does not erase memory. If the need arises to recover data that was previously taken, take one (or more) readings and then position the memory pointers via the **P** and **D** commands to recover previously taken readings.

K.28 "RESET" - Reboot the LC-2 Microprocessor

RESET (reboot) the LC-2 microprocessor. All stored readings and settings, as well as the ID and real-time clock settings are not affected by this command.

***RESET**
Resetting...
RESET COMPLETE
*****

K.29 "S" – Display Status

Display the datalogger Status.

```
*S
MS:1004   OP:1005   UP:1004
16 Channel Multiplexer Selected.
Scan interval: 60 second(s).
Logging stopped.
Log intervals disabled.
Monitor mode enabled.
*
```

Line	Description	Manual Sections
1	Status of memory pointers	K.7, K.26
2	Multiplexer Type	K.18
3	Scan interval setting	K.30
4	Start/Stop status	K.32, K.34
5	Stop time (optional)	K.32
6	Log interval status	K.13, K.14
7	Monitor mode status	K.15, K.16, K.17

Table 15 - S Command Information

K.30 "SCnnnnn" - Set Scan Interval

Enter the SCan interval, in seconds. Range of entry is 3 to 86400. Only whole numbers are accepted. Typing **SC** with no value returns the current setting only

```
*SC
Scan interval: 60 second(s).
*SC300
Scan interval: 300 second(s).

*
```

K.31 "SS" - Display System Status

Display the System Status of the datalogger.

```
*SS
Trap count: 0
Network address: 1
Network recognition disabled.
Time format is hh,mm.
Date format is month,day.
*
```

Line	Description
1	Trap Count (Communications Error counter)
2	Current network address
3	Current network status
4	Current time format configuration.
5	Current date format configuration.

Table 16 - SS Command Information

K.32 "SPhh:mm" - Stop Logging

Sto**P** the datalogger logging values; hh is the hour (24-hour format) of the day to stop and mm the minutes. The time entry is optional.

***SC60**
Scan interval: 60 second(s).
***ST**
Logging started.
Datalogger#1,2007,11,27,10,02,00,3.10,25.51,9039.944,8054.276,7189.993,9020.108, ---,---,---,---, 684.256,711.897,610.022,680.323,---,---,---,---,15.6,15.6,15.4,15.5,---,---,---, ---,23.2,23.3,23.2,23.2,---,---,---,---,1

***SP12:00**
Logging will start at: 15:13:46
Logging will stop at: 12:00:00
*****

Note that when SPhh:mm is issued, the datalogger responds with the time of the next reading along with the time at which logging will stop.

K.33 "SR" - Synchronize Readings

Synchronize **R**eadings to the top of the hour. If enabled (default) via the SR1 command, then all readings after the first reading will synchronize to the top of the hour:

```
*SR1
Readings are synchronized to the top of the hour.
*ST
Logging started.
2008,318,1314,41,3.50,24.45,-8961.077,---,---,-8444.892,
-8823.534,---,---,-10427.004,-9503.859,---,---,-8437.488,
-8954.774,---,---,-10073.441,23.1,---,---,23.9,23.0,---,
---,22.6,23.4,---,---,23.7,23.3,---,---,22.2,1

*2008,318,1314,45,3.50,24.45,-8961.077,---,---,-8444.892,
-8823.534,---,---,-10427.004,-9503.859,---,---,-8437.488,
-8954.774,---,---,-10073.441,23.1,---,---,23.9,23.0,---,
---,22.6,23.4,---,---,23.7,23.3,---,---,22.2,2

2008,318,1315,0,3.50,24.45,-8961.077,---,---,-8444.892,
-8823.534,---,---,-10427.004,-9503.859,---,---,-8437.488,
-8954.774,---,---,-10073.441,23.1,---,---,23.9,23.0,---,
---,22.6,23.4,---,---,23.7,23.3,---,---,22.2,3

*SR0
Readings are not synchronized to the top of the hour.
*ST
Logging started.
2008,318,1314,41,3.50,24.45,-8961.077,---,---,-8444.892,
-8823.534,---,---,-10427.004,-9503.859,---,---,-8437.488,
-8954.774,---,---,-10073.441,23.1,---,---,23.9,23.0,---,
---,22.6,23.4,---,---,23.7,23.3,---,---,22.2,1

*2008,318,1314,56,3.50,24.45,-8961.077,---,---,-8444.892,
-8823.534,---,---,-10427.004,-9503.859,---,---,-8437.488,
-8954.774,---,---,-10073.441,23.1,---,---,23.9,23.0,---,
---,22.6,23.4,---,---,23.7,23.3,---,---,22.2,2

2008,318,1315,11,3.50,24.45,-8961.077,---,---,-8444.892,
-8823.534,---,---,-10427.004,-9503.859,---,---,-8437.488,
-8954.774,---,---,-10073.441,23.1,---,---,23.9,23.0,---,
---,22.6,23.4,---,---,23.7,23.3,---,---,22.2,3
```

K.34 "SThh:mm" - Start Logging

STart the datalogger logging values; hh is the hour of the day (24-hour format) to start and mm the minutes. The time entry is optional. Entry is ignored if logging is already started (unless a time is entered).

```
*ST
Logging already started!
*ST11:00
Logging will start at: 11:00:00
*
```

K.35 "SV" - Display Software Version

Return the **S**oftware **V**ersion of the datalogger's operating system software. Consult the factory to check on latest versions available.

```
*SV
Software version: 3.1.0
*
```

K.36 "TEST" - Perform Internal Self-Tests

TEST is a set of internal self-tests that are performed at the factory during final test.

***TEST**

LC-2MUX TEST MENU:

SELECTION	TEST
0	INTERNAL EEPROM
1	EXTERNAL EEPROM BANK 1
2	EXTERNAL EEPROM BANK 2
3	EXTERNAL EEPROM BANK 3
4	EXTERNAL EEPROM BANK 4
5	EXTERNAL EEPROM BANK 5
6	EXTERNAL EEPROM BANK 6
7	ALL EEPROM
8	+5X_X
9	RTC 32KHz
A	EXTERNAL INPUT (GAUGE TYPE 1)
B	EXTERNAL INPUT (GAUGE TYPE 2)
C	EXTERNAL INPUT (GAUGE TYPE 3)
D	EXTERNAL INPUT (GAUGE TYPE 4)
E	EXTERNAL INPUT (GAUGE TYPE 5)
X	EXIT TEST MENU

ENTER SELECTION:

Selection	Description
0	Test the Configuration memory bank
1	Test Readings 1-592 memory bank
2	Test Readings 593-1184 memory bank
3	Test Readings 1185-1776 memory bank
4	Test Readings 1777-2368 memory bank
5	Test Readings 2369-2960 memory bank
6	Test Readings 2961-3555 memory bank
7	Test all memory banks
8	Turn on System power supplies
9	Test the 32.768 RTC time base
A	External Input with Gauge Type 1 filter configuration
B	External Input with Gauge Type 2 filter configuration
C	External Input with Gauge Type 3 filter configuration
D	External Input with Gauge Type 4 filter configuration
E	External Input with Gauge Type 5 filter configuration
X	Exit and return to normal operations

Table 17 - TEST Menu Information

K.37 "TF" - Display or Set Time Format

Display the current **T**ime **F**ormat display option setting. This setting determines how the time information will be displayed in the array when the Monitor mode is active (see K.15) or arrays are being displayed from memory. Entering TF alone returns the current time format. Entering TF0 sets the time format to hhmm. Entering TF1 sets the time format to hh,mm. The default time format display is hhmm.

```
*TF
Time format is hh,mm.
*TF0
Time format is hhmm.
*TF1
Time format is hh,mm.
*
```

K.38 "Tnn/t" – Set Thermistor Type

Enter the channel's (nn) thermistor type (t). This command allows a specific thermistor to be assigned to each individual channel (generally the external thermistor that is incorporated into the VW gauge). Entering T1/0 sets the external thermistor type of Channel 1 to the standard 3KΩ@25ºC NTC (default). For example, entering T2/1 sets the external thermistor type of Channel 2 to the high temperature BR55KA822J 8.22KΩ@25ºC NTC thermistor. Entering T3/2 sets the external thermistor type of Channel 3 to the high temperature 103JL1A 10KΩ@25ºC NTC thermistor.

```
T1/0:
CH 1: ENABLED
GT: 1   ZR: 0.00000   GF: 1.00000   GO: 0.00000   TH: 0

T2/1:
CH 2: ENABLED
GT: 1   ZR: 0.00000   GF: 1.00000   GO: 0.00000   TH: 1

T3/2:
CH 3: ENABLED
GT: 1   ZR: 0.00000   GF: 1.00000   GO: 0.00000   TH: 2
```

K.39 "TR" - Display Current Trap Count

Display the current **TR**ap Count. The trap counter is a register that keeps track of the number of times that the internal processor has detected a communications error. This is a useful register to check if communication problems are suspected.

K.40 "TR0" - Reset Trap Count

Reset the **TR**ap count register to **0**.

K.41 "VL" – Display Coin Cell Voltage

Display the Lithium Coin Cell Voltage. The internal 3V lithium coin cell is used to supply power to the real-time clock circuit. The 3V lithium coin cell life is rated at 10 years minimum.

***VL**
Lithium Cell Voltage = 2.92V
*****

K.42 "V3" – Display the D Cell Battery Voltage

Display the 3V D-cell battery pack voltage. Replace the batteries when this voltage is less than 1.8V

***V3**
3V Battery Voltage = 2.93V
*****

K.43 “V12” – Display the External Battery Voltage

Display the external 12V battery voltage. Replace or recharge the battery when this voltage is less than 6V

***V12**
12V Battery Voltage = 12.33V
*****

K.44 “WF” - Display Current Wrap Format

Display the current Wrap Format. Memory “wrapping” means that once the memory has filled, the datalogger will continue taking readings and overwrite the stored values in a circular fashion (see Appendix K.7, Dnnnnn).

When the wrap format is set to 0, logging will stop once the memory becomes full. This is useful if critical data is stored and it must not be inadvertently overwritten and lost.

When the wrap format is set to 1, logging will continue when the memory becomes full and the original stored values will be overwritten. With this setting, logging will continue indefinitely until told to stop with the SP command, or the programmed stop time has been reached.

```
*WF
Logging will not stop when memory is full
*WF0
Logging will stop when memory is full
*WF1
Logging will not stop when memory is full
*
```

K.45 “X” - Take Immediate Reading

Take and display one reading, but do not store this reading in memory. Useful if interested in obtaining a reading at the moment, without interrupting or affecting the current logging schedule.

***D**

MS:3 OP:4 UP:3
***X**
Datalogger#1,2007,11,27,12,32,07,3.10,25.51,9038.122,8055.655,7187.985,9018.434,
---,---,---,---, 685.209,712.577,611.013,683.002,---,---,---,---,15.7,15.7,15.6,15.6,---,---,
---,---,24.8,24.8,24.9,24.8,---,---,---,---

***D**

MS:3 OP:4 UP:3
*****

Note: In this example, channels 5,6,7,8 and 13,14,15,16 are disabled.