DATARADIO DL-3400 APPLICATION NOTE

Prepared by:
The Sutron Corporation
21300 Ridgetop Circle
Sterling, VA 20166

Rev. B

12/10/07

TABLE OF CONTENTS

1. Overview

Sutron's standard loggers can be interfaced to analog radios which are ideal for telephone line replacement. The radio discussed in this particular note is the Dataradio DL-3400. This radio could be easily adapted to Bell 202 and other FSK style modems.

2. Specifications

2.1 DL3400 FEATURES

- Meets United States FCC Reframing efficiency standards
- Available in UHF, VHF, and 900 MAS frequency bands
- Designed for data:
  - Superior frequency stability
  - Low group delay
  - Fast attack synthesizer
  - Minimal key up/down sideband noise
- Adjustable 1 to 5 watt power output
- Two power minimization features:
  - Sleep mode
  - Cold start
- 8 channel operation
- Customer PC programmable
- Front panel LEDs

2.2 DL3400 SPECIFICATIONS

2.2.1 General

Frequency Range	132-174 MHz, 380-512 MHz, 928-960 MHz
Frequency Control	Synthesized
Channel Bandwidth	12.5 or 25 kHz
Operating Voltage	10-16 VDC
Operating Temperature	-30°C to +60°C
Data Interface	RS-232 DB9

2.2.2 Receiver

RF Input Impedance	50 ohms
Frequency Stability	2.5 ppm
Receiver Attack Time	<7 msec
Carrier Detect	high/low programmable TTL levels
Selectivity	70 dB @ 25 kHz; 60 dB @ 12.5 kHz
Intermodulation	70 dB
Spurious and Image Rejection	70 dB
FM Hum and Noise	-45 dB @ 25 kHz; -40 dB @ 12.5 kHz (psophometrically weighted)
Sensitivity	<0.35 µV @ 12 dB SINAD
Current Drain	100 mA maximum
Data Output	De-emphasis or flat
Data Output Level	Adjustable
Wideband Output Level	150 mV RMS, adjustable down
Narrowband Output Level	707 mV RMS, adjustable up or down
Audio Response	Audio, FSK, sideband AC coupled - inverted or noninverted; wideband DC coupled - noninverted only

2.2.3 Transmitter

Bandwidth Without Tuning	132-150: 18 MHz; 150-174 24 MHz
RF Output Power	1-5 watts adjustable
RF Output Impedance	50 ohms
Duty Cycle	50% @ 5 watts, 30 seconds max transmit
Attack Time	<7 msec
Frequency Tolerance	2.5 ppm
Spurous and Harmonic Emission	-37 dBm (-74 dBc)
FM Hum and Noise	
Current Drain	2000 mA @ 5 watts at 13.3 VDC
Modulation Distortion	<5%
Data Input	Pre-emphasis or flat
Data Input Level	200-800 mV RMS, factory set to 400 mV RMS

2.3 DL3282 EXTERNAL MODEM FEATURES

The Dataradio DL-3282 external modem is designed for SCADA markets that utilize standard modes, such as Bell 202. It is FCC refarming compliant when paired with the RNet JSLM or the DL-3400 Series analog telemetry radios. This transparent modem eliminates dribble bits, making it capable of sending Modbus Protocol messages.

- User programmable to operate at 1200 or 300 bps
- Selectable operating modes:
  - Bell 202
  - Bell 103
- RS-232 compatible with standard RTS/CTS handshaking
- Eliminates dribble bits, Modbus compatible
- Small, compact size permits easy installation
- Internal LED aids troubleshooting
- Two-year limited factory warranty

2.4 9210-XLITE SPECIFICATIONS

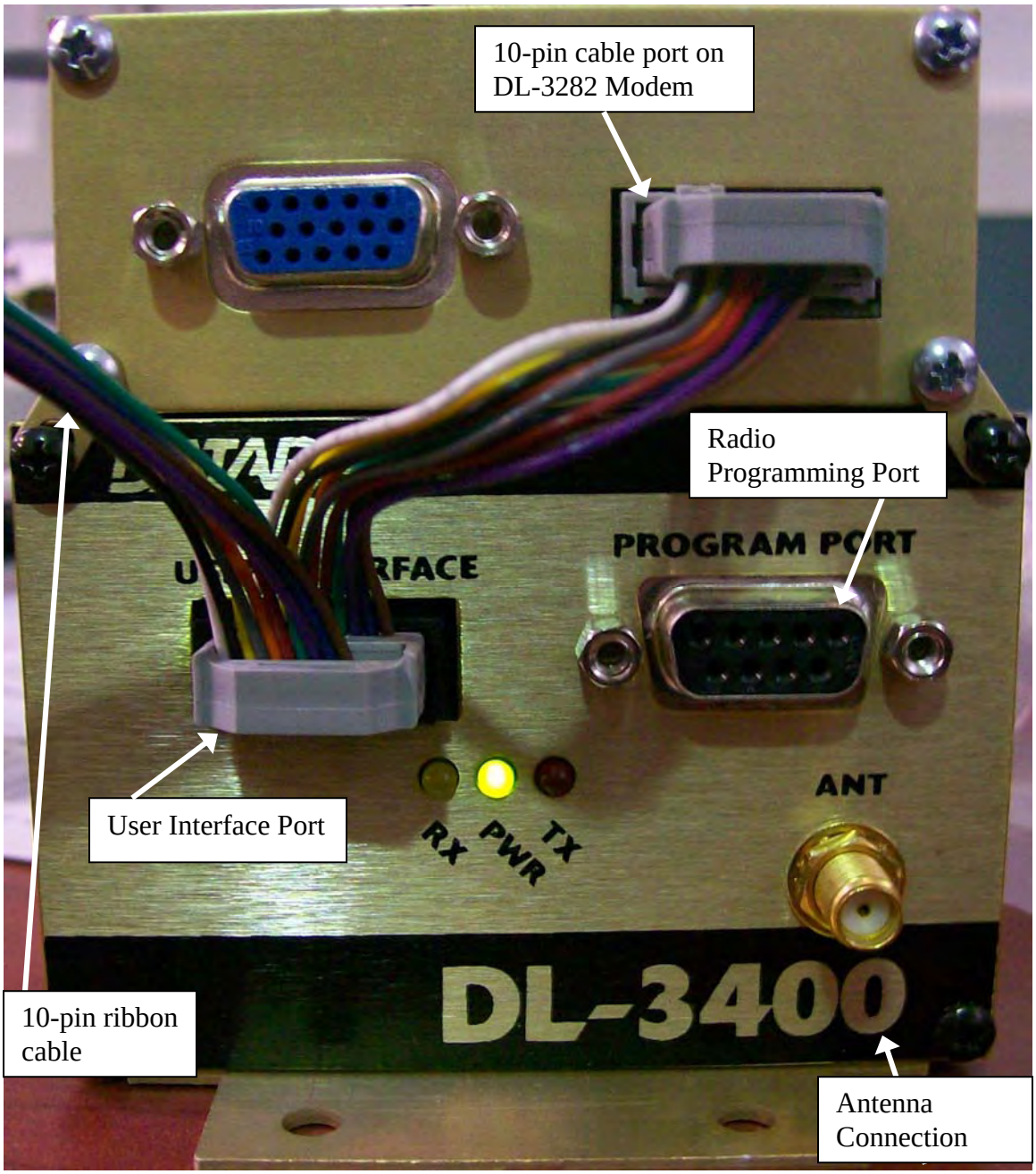
Sutron's robust XLite datalogger is the heart of the remote monitoring network. The 9210 is highly modular in design and scalable to handle simple to complex requirements.

- Intuitive graphical block-oriented setup
- Unlimited I/O expansion
- Software extensibility with DLL libraries
- 2x20 Backlit LCD Display
- Menu and Data keys
- 8 Channel Digital I/O, RS485, SDI-12
- 10 Channel Analog Input, DC Power Connection
- 3 RS-232 Ports, I2C Bus to I/O Modules, Optional PCMCIA
- Windows CE Operating System with a 486 Processor & C++ Programming!
- Low power consumption – sleep modes with low quiescent power (<2mA), low operating power.
- Battery operated – each module operates off of 10 to 15 VDC.
- Wide temperature operation – -40 to +60C.
- High reliability and robust – no fuses, fault tolerant, lightning protection.
- Flash memory expansion cards are available.
- Multiple telemetry – Telephone, LOS Radio, METEOSAT telemetry (up to 3).
- Plug-n-play ease of setup – the system is setup with ease. Install a new module, and the system automatically detects it and allows it to be configured for operation.
- Flexible measuring and recording – The setup allows separate measuring schedules for data as well as individual recording intervals.
- Open design – the system will operate with sensors and modules manufactured by others
- Takes measurements from low cost sensors.
- **High-speed data transfers – data downloads to PC at 115k baud**

3. Wiring Radio & Modem

First, connect the DL-3400 radio to the DL-3282 modem using the 10-pin ribbon connector. One of the connectors should be plugged into the "User Interface" connection on the DL-3400 radio, the other should be plugged into the fitting connector slot on the front of the DL-3282 modem. The other end of this ribbon cable should have bare leads, the red (+12VDC) and black (GND) cable should be used to power the radio and modem.

The front of the DL-3400 radio has a 9-pin RS-232 port which should be used when programming the radio using the programming software specific for the DL-3400 (available from the DataRadio website).



F*igure 1: DL3282 Modem mounted on and connected to DL3400 Radio*

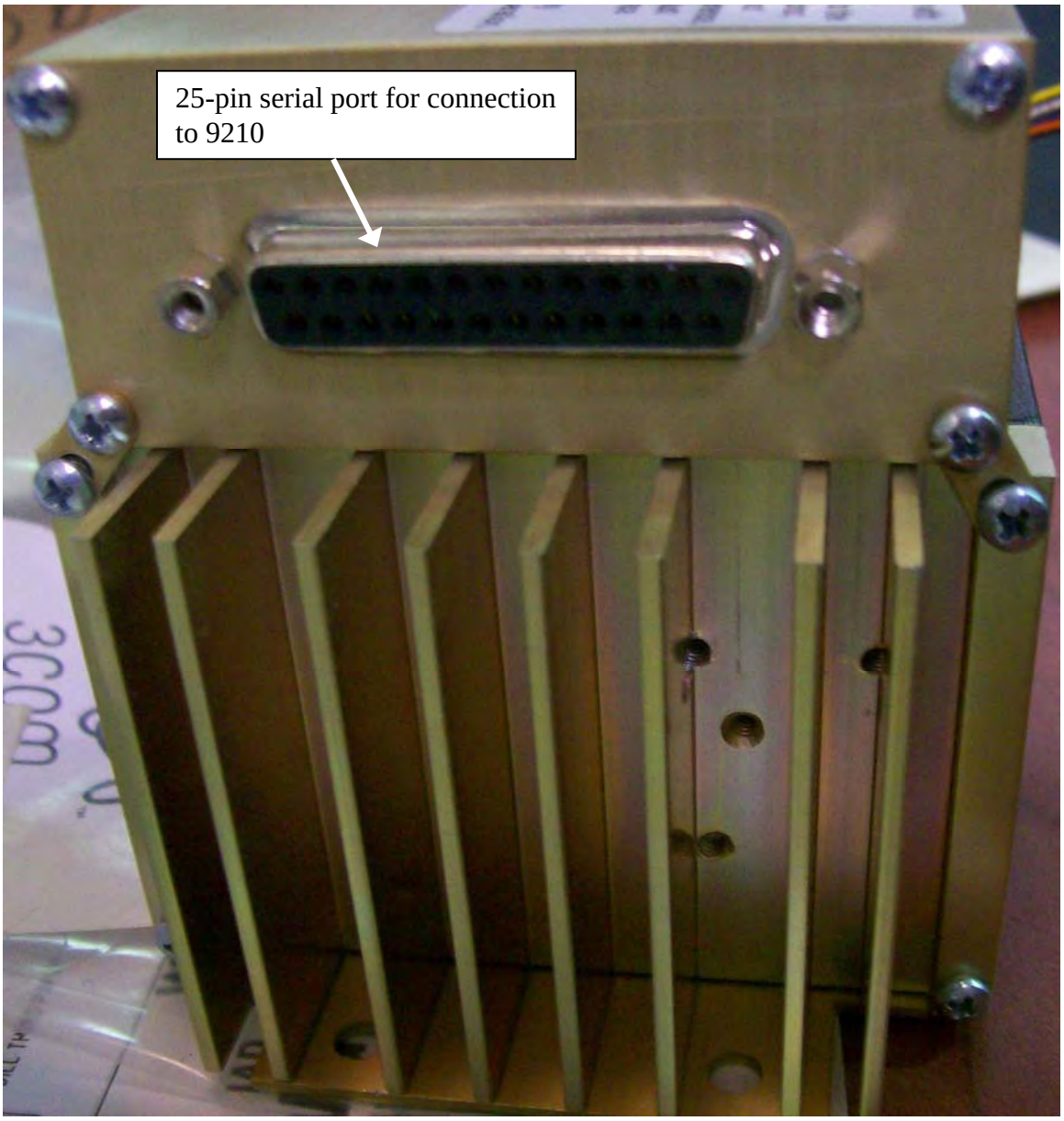


Figure 2: Back of DL3282 Modem showing 25-pin Serial Port

To connect to the 9210, you will need a DB-25 to DB-9 serial cable. Connect the 25-pin connector to the port on the back on the DL-3282 modem and the 9-pin connector to an available port on the 9210.

4. Programming the Radio

Download the programming software from the following link.
http://www.dataradio.com/4_2.html

Proceed with the following steps to program the radio

a. Connect the power connector on the Radio. Also, connect the 5W load resistor and rubber duck antenna to the RF port of the Radio.

b. Connect the red & black wire of the power connector to the +12 Volt & GND of power supply, respectively.

c. Connect the 9-15 pin setup cable from computer's COM port to the Data Port of the Radio.

d. Start the DL-3400 Program on your PC. The following screen will appear.

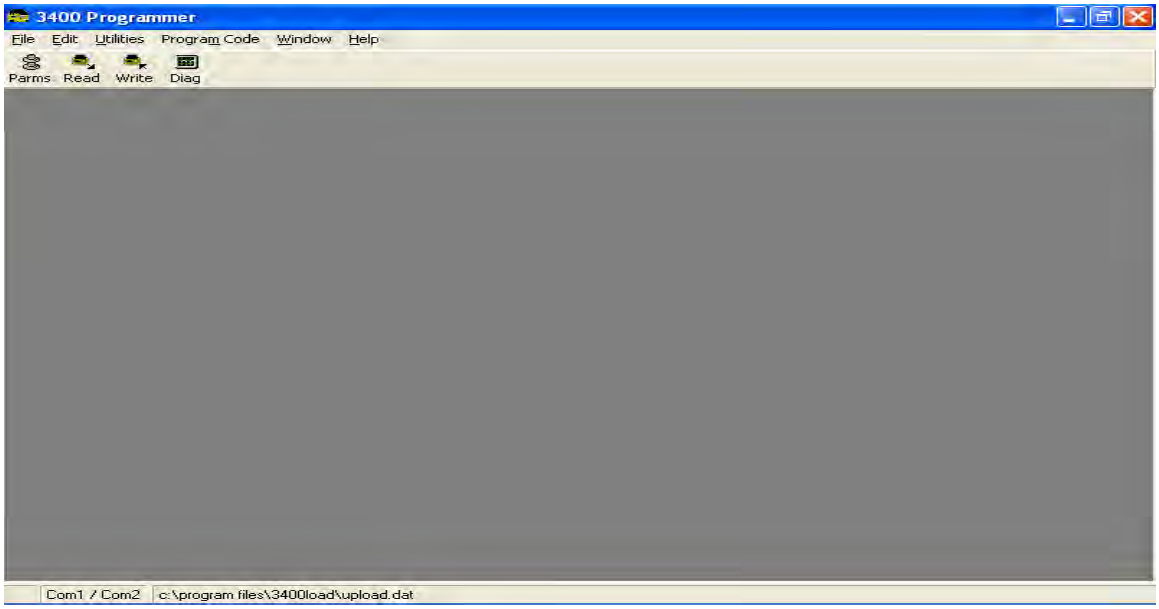


Figure 3: DL3300 Load Main Menu

e. Click on the Parms toolbar button on the screen.

f. Click on the Read toolbar button on the screen. This step will update the program with the latest settings from the radio.

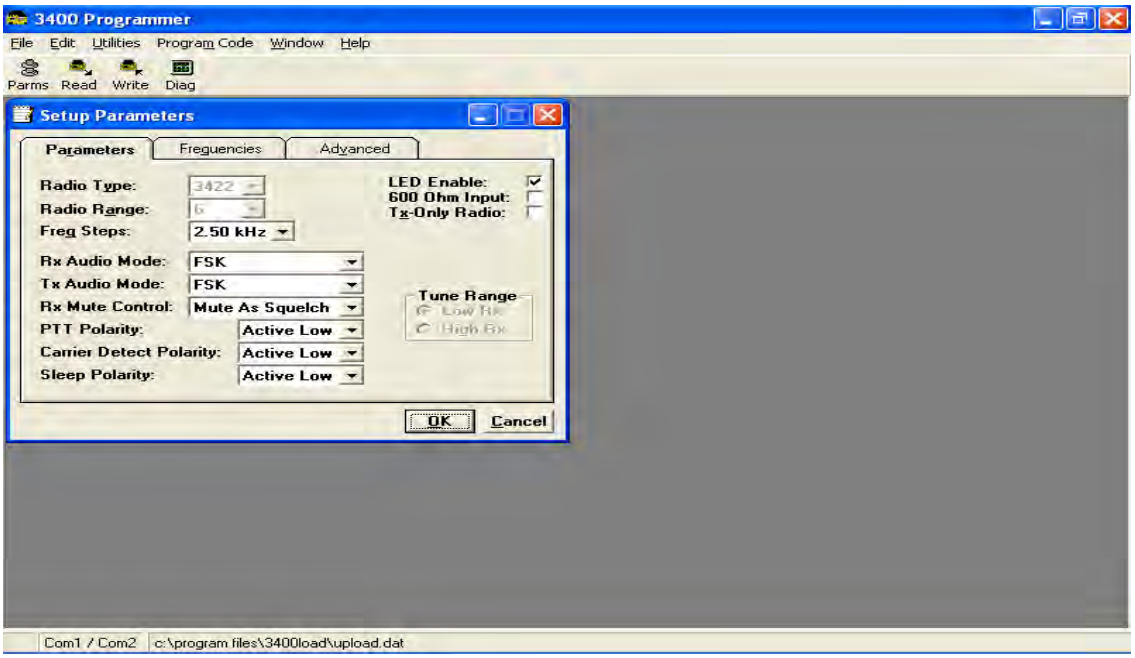


Figure 4: Setup Parameters

f. Next, click on the Frequencies tab to program the frequency.

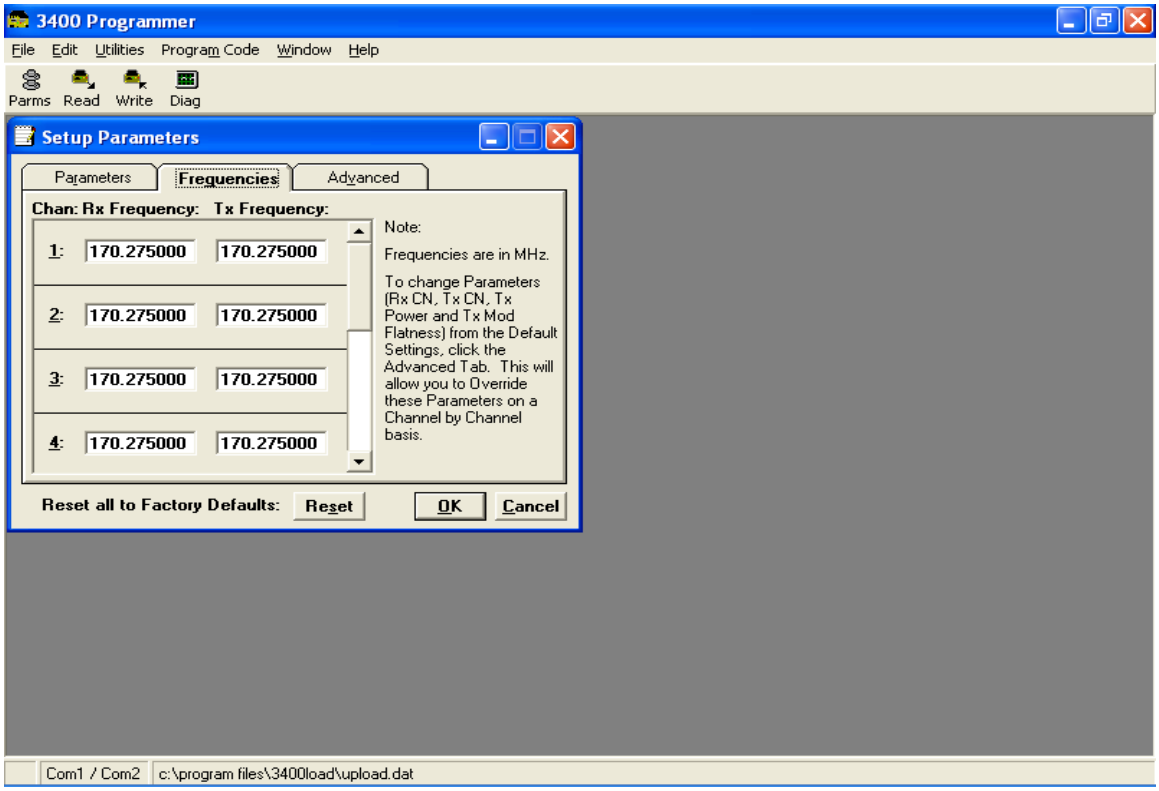


Figure 5: Programming the Frequencies

g. Click Write toolbar button in the main window to write all the settings to the radio.

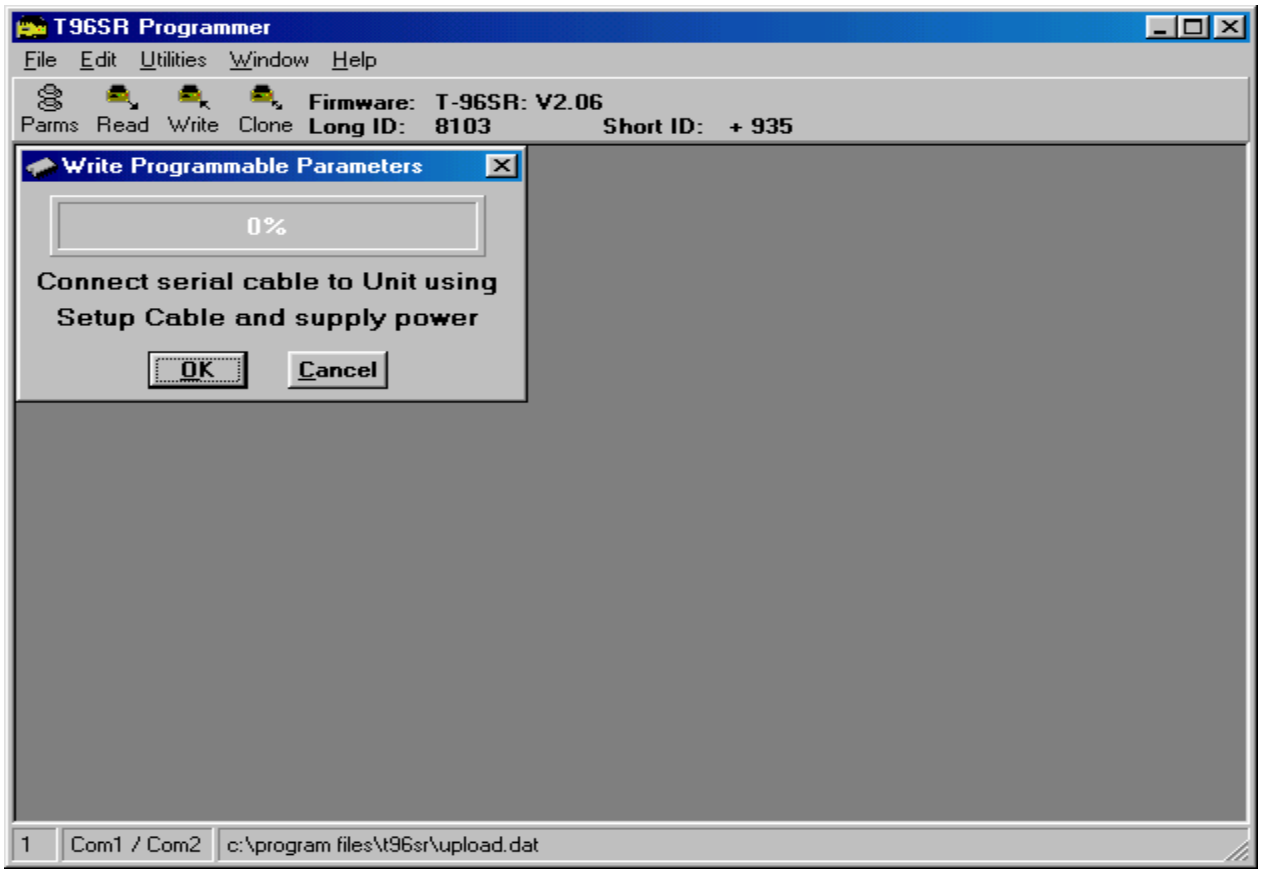


Figure 6: Transferring the Settings to the Radio

h. After the programming is done the window will go blank and Figure 5 will appear. The programming is complete.

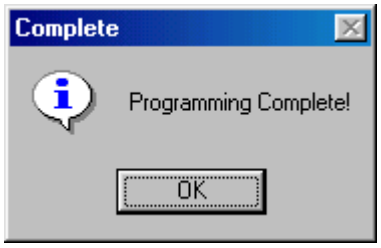


Figure 7: Programming Complete Message

5. 9210 to Radio Interface

5.1 9210 COM PORTS PIN OUT

9210	Com 2 &3	
	DTE Male	
DTE	**Signal Name**	**Direction**
1	CD	IN
2	RD	IN
3	TX	OUT
4	DTR	OUT
5	GND	
6	DSR	In
7	RTS	IN
8	CTS	OUT
9	Set by jumpers to RI, +5V 0r +12V	IN

5.2 DL3282 TO 9210 COM PORT CABLE

DB-25 Male	DB-9 Female
3 TXD	2 RD
2 RX	3 TX
4 RTS	7 RTS
5 CTS	8 CTS
6 DSR	6 DSR
7 GND	5 GND
8 DCD	1 CD
22<->20	9

5.3 DL3282 TO DL3400 CONNECTION CABLE

Use the 10 pin ribbon cable to connect the DL3282 to the DL3400 (use either connector for the radio). The red (+12V) and black (GND) bare leads on the other end of this cable are used to provide power to the radio and modem. For more information about the use of the other leads on this cable, please see the DL3400 Manual.

6. Operation details

The 9210-Xlite will serve as the controller for the application. The Sutron XLite/9210 Data Recorder is the functional foundation of the Hydromet Station. A unique feature of the XLite design is its block-oriented setup. Blocks of various types are connected together to graphically represent data flow from all sensors, with data flowing from left to right. The diagram gives a good overall picture of what the XLite is measuring and how it is processing the data from each of the sensors. More detail is revealed by using the Zoom button or by viewing the property window for a specific block.

When connected to Xlite via **Xterm** the user can modify the setup, thus add or remove sensors in a very simple way. Every sensor or category is represented by a block. Blocks are interconnected to perform an operation. When the user enters the setup bracket of Xterm a blank window will pop open; here the user can add blocks from the following categories: input, processing, logging , telemetry, miscellaneous, and outputs. PLEASE REFER TO 9210 PRODUCT MANUAL FOR DETAILS ON HOW TO PROGRAM IT.