Guardian™ and DL3282 Modem Interface
Technical Service Application Note

OVERVIEW

The following document is designed to provide information for the implementation of the Guardian Wireless Modem/Analog Radio and the DL3282 Bell 202/103 modem.

PRODUCT

Guardian-X00 Wireless Modem/Analog Radio, DL3282 Bell 202/103 Modem

APPLICATION

The Guardian wireless modem/analog radio can operate at VHF, 200 MHz, UHF and 900 MHz frequencies. The radio will operate at 25 KHz or 12.5 KHz of bandwidth. The Guardian will operate as a modem or analog radio. The user can select the operating mode by using the Guardian FPS (Field Programming Software) and selecting the proper bandwidth and mode of operation; reference User Manual 001-5006-000 for additional information on Guardian frequency ranges and modes of operation.

The DL3282 is an analog modem that can be set to operate in Bell 202 or Bell 103 standards format. Bell 202 is a 1200 Baud FSK data format. Bell 103 is a 300 Baud FSK data format.

HARDWARE

The Guardian uses the following connections:

- Antenna Connector
  - TNC Female connector
  - Full Duplex version
    - TNC female connector for Transmit
    - SMA female connector for Receive

- Power Connection
  - Guardian uses a 4 pin power connector
  - Power cable is included with the radio
    - Power cable part number 897-5008-010
  - 3 wire connection for power
    - Red – B+
    - Black – Ground
    - White – B+ (must be connected to B+)
    - Power Input: 10-30 VDC @ 60 Watts maximum

- Interface Connection
  - Guardian uses an 8 pin 'User' interface connector
    - Connector PN# 415-1001-208
    - Contacts are opened with small screwdriver
    - Contacts can be opened with insertion tool PN# 250-5006-001

The DL3282 modem uses the following connections:

- User Interface
  - 10 Pin 3M ribbon style connector
  - 25 Pin DB25 female RS232 serial data connector
  - DE15 high density serial connector – special purpose connection

- Power Connection
  - Power is applied to the DL3282 through the 10 pin ribbon cable connection
  - Power input: 7-16 VDC @ 50 mA (max)
  - Use cable PN# 023-3410-109 for power and interface to the Guardian

PROGRAMMING AND SETUP

Programming the Guardian is done using the Guardian FPS. Programming software is available on the CalAmp Corp. website at: http://www.calamp.com/support/download-library

When the Guardian is being interfaced with an existing DL3400/DL3282 radio modem system the Guardian must be programmed to match the settings of the DL3400 analog radios. Information for programming a Guardian into a DL3400 system is available on Technical Service Application Note (TSAN) 009-5006-002 and is available for download at the CalAmp Corp. website at: http://www.calamp.com/support/support-bulletins/319-guardian-and-dl-3400-interoperability

This TSAN will provide programming information to set the Guardian for the same parameters as the DL3400 analog radios.

Programming for the Guardian is also covered in the Guardian Technical Manual PN# 001-5006-000.

The following programming steps will provide much of the information required to operate a Guardian in an analog data system:

Setting Guardian Parameters

Once the parameters for the existing DL3400 system are logged, connect the Guardian to proper power supply voltage (10-30 VDC 60 Watt maximum at 10 watt RF power). Connect antenna port to 50 ohm termination. Connect DB-9 to DB-9 data cable (PN# 697-4008-408 or equivalent) to Guardian "Setup" port.

- Note: Guardian FPS is defaulted to COM 1. Change if necessary.
- Programming parameters are 57,600 8, N, 1, DTR – None
- Handshaking should be set to "Buffered with no HS"

With the Guardian connected to proper power source, antenna terminated and programming cable connected to the "Setup" port of the radio/modem go to the upper left corner of the programming screen and select "Config" (Fig. 1).

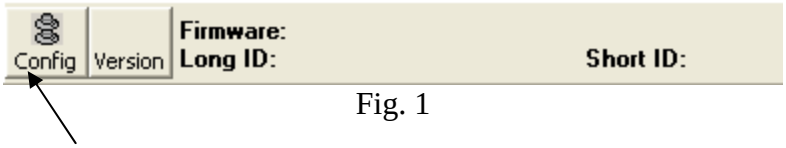

Fig. 1

The Guardian FPS will read and display the current configuration of the radio/modem connected to the computer. (Fig. 2). Selection of "Loader" mode will change the configuration screen to allow analog radio settings.

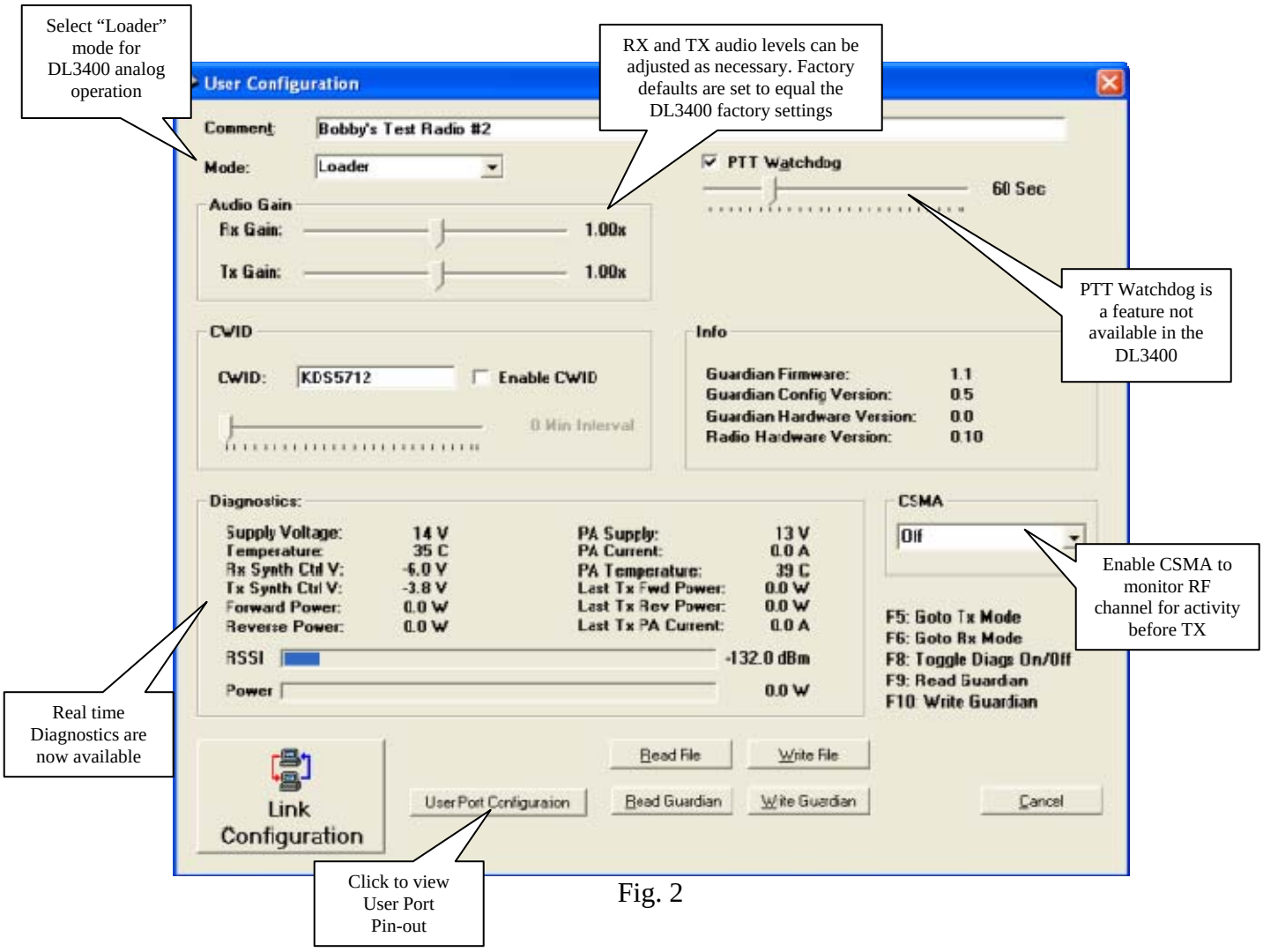

Fig. 2

- The "PTT Watchdog" performs same function as in the T-96SR. This can be adjusted or left at factory default. Note: This feature is not available in the DL3400 transceiver.
- Information and real time diagnostics are available on this screen.
- CWID is a new feature not available on the DL3400. Station /License call signs can be transmitted at selected intervals. This feature is used when the analog system shares a 'Voice Channel' with another system and is required to identify itself using Morse code. (Fig. 5)
- The Guardian RX and TX audio levels are preset to match the DL3400 factory levels. These can be adjusted as necessary for the User's application. See manual 001-5006-000 for additional information. (Fig. 5)

- CSMA (Carrier Sense Multiple Access) is a feature added to the Guardian that is not available on the DL3400.
    - This feature allows the radio to monitor the RF channel for activity
    - There are two modes to select from when CSMA mode is enabled:
        - No TX when the radio/modem is receiving valid user data

- No TX when the radio/modem is receiving an RF carrier
- See Fig. 5

- There is a new feature added to the Guardian that allows the radio to be used as a modem (T-96SR compatible) or to be used as an analog radio (DL3400 compatible). For this application only the 'Loader' mode will be used. (Fig. 5)

Link Configuration:

Click the "Link Configuration" button to advance to the modem settings. This is the screen that sets the RF channel frequencies and Loader settings. See Fig. 3.

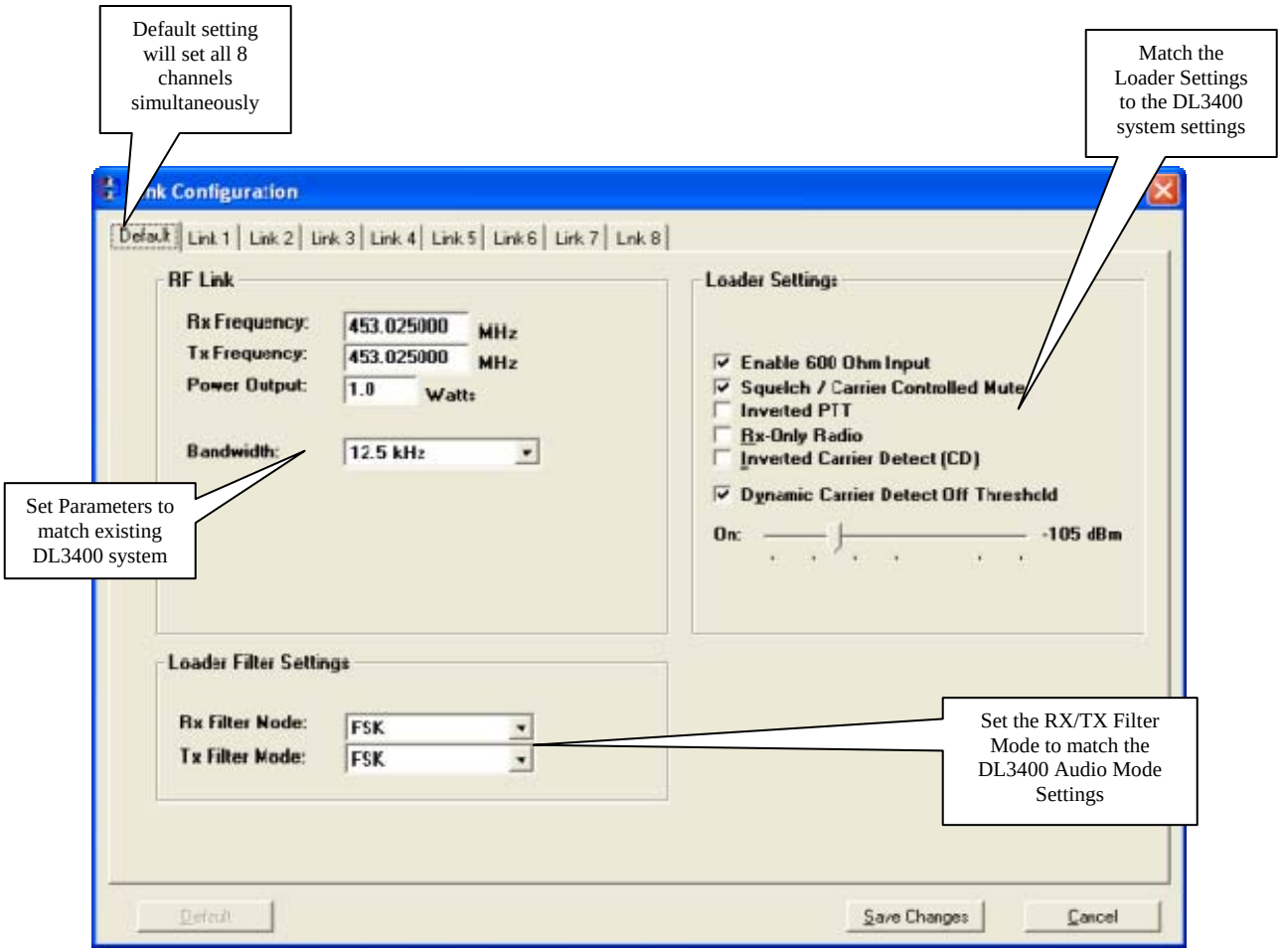

Fig. 3

Unlike the DL3400 where all 8 channels were programmed one channel at a time, the Guardian has a "Default" setting that will set all 8 channels simultaneously. (Fig. 3)

- Using the information gathered from the DL3400 programming set the RF Link information to match the system parameters.
- Channel bandwidth is now selectable for either 25 KHz or 12.5 KHz
- Set TX Output Power to desired power level; 1-10Watts

- Select the RX and TX Filter Mode to match the DL3400 RX/TX Audio Mode (Fig. 3)

Refer to the parameters gathered from the DL3400 programming to set the “Loader Settings”. Set Squelch, PTT Polarity, RX/TX audio impedance to match the DL3400 system settings. (Fig. 3)

Dynamic Carrier Detect acts the same as in the T-96SR. The Carrier Sense level is set by selecting the “On” level. This is the RSSI (Receive Signal Strength Indication) or signal strength required to open the squelch setting in the receiver. The Carrier Sense “Off” level is set automatically to 5 dBm below the “On” level. (Fig. 3)

When all parameters are selected and verified to be correct, click “Save Changes” at the bottom of the Link Configuration screen. The Link Configuration screen will close.

The User Port pin-out configuration can be displayed by clicking the “User Port Configuration” button on the User Configuration screen. (Fig. 2)

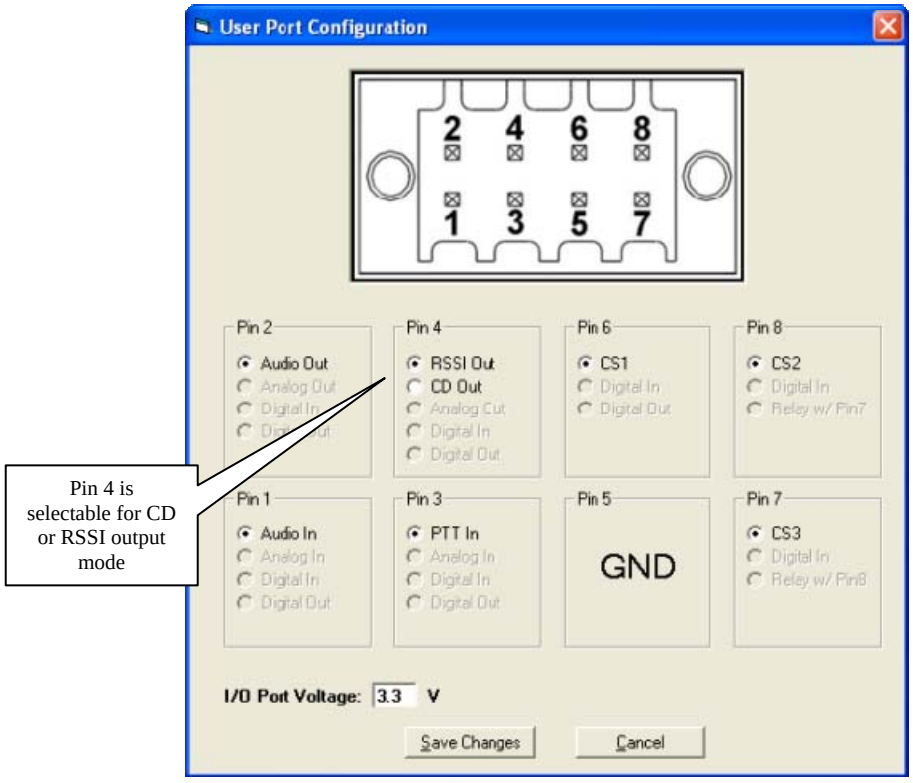

Fig. 4

In ‘Loader’ mode the User Port controls the analog radio functions. Pin 4 can be programmed to provide a Carrier Detect (CD) output; 0-5 VDC or 5-0 VDC. Pin 4 can also be programmed to output the receiver RSSI level as a DC voltage allowing it to be used for system monitoring and control. (Fig. 4) **NOTE**: For this modem application Pin 4 should be set for CD output. CD polarity should not be inverted as the DL3282 modem is expecting to see a 0-5 VDC change when an RF signal is present.

The following lists the User Interface pin functions in reference to the DL3400 wiring and 023-3410-109 cable color code:

Guardian	**DL3400**
Pin 1 Audio In (TX)	Pin 8 – TX Audio – Yellow Wire
Pin 2 Audio Out (RX)	Pin 10 – RX Audio – White Wire
Pin 3 PTT In	Pin 6 – TX PTT – Orange Wire
Pin 4 CD/RSSI Out	Pin 7 – CD Output – Gray Wire
Pin 5 Ground	Pin 9 – DC Ground – Black Wire
Pin 6 CS1 (Channel Select)	Pin 3 – Freq. Select – Violet Wire
Pin 7 CS3	N/A
Pin 8 CS2	N/A

Note: The Guardian provides for 8 channel selection on the User Interface connector. The DL3400 allows selection of Channel 1 or 2 on the 10 pin User Interface connector. The remaining channel selection is done using 3 pins on the DB-9 programming connector of the DL3400.

Programming

There are two options for programming the Guardian. There is a “Write Guardian” button used for programming. The other option is to press F10 on the computer keyboard. See Fig. 5.

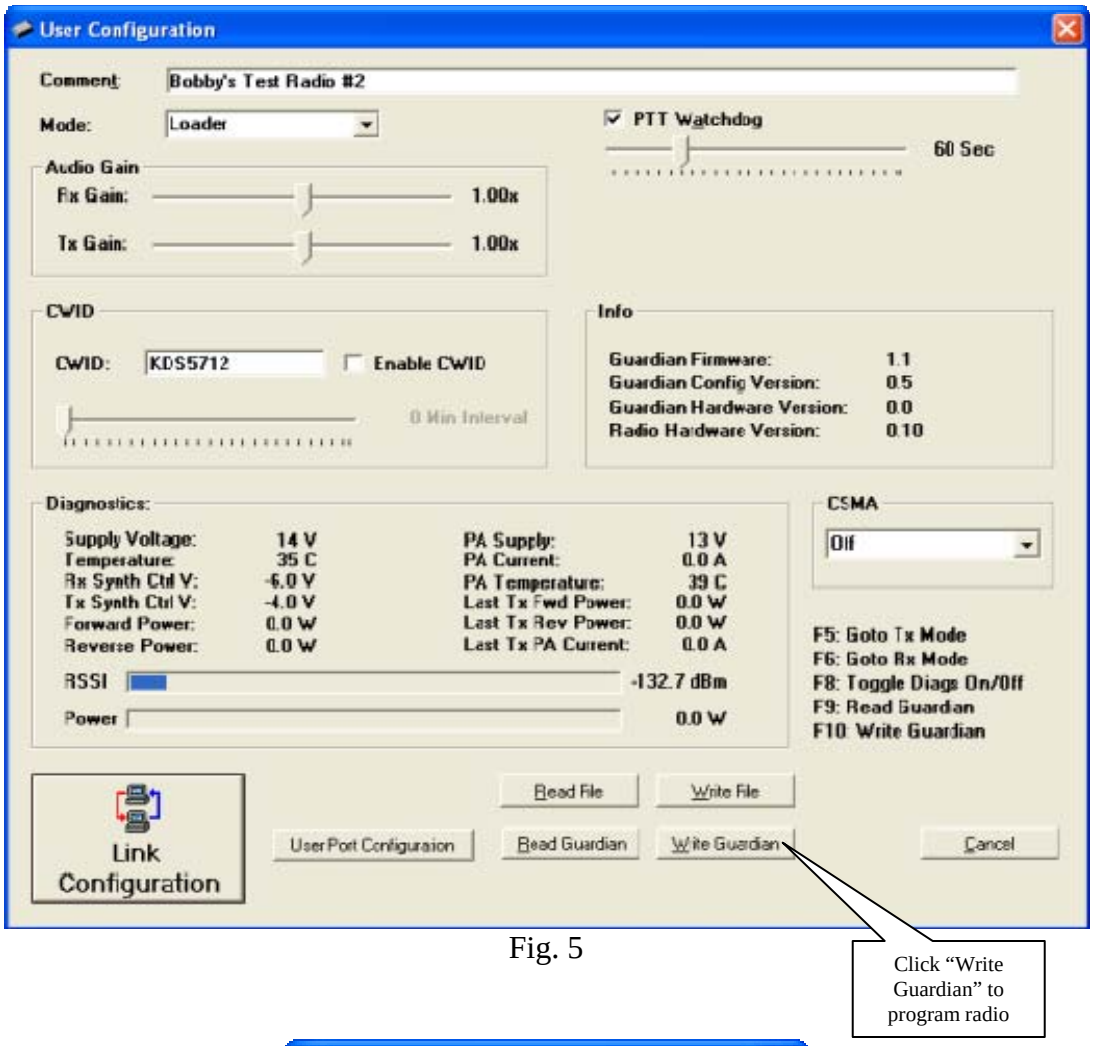

Fig. 5

Fig. 6

Programming of the Guardian is very fast. When complete, click "OK" as shown in Fig. 6 The Guardian has now been configured and is ready for connection to the DL3282 modem.

DL3282 INTERFACE TO GUARDIAN

The DL3282 modem is connected to the Guardian using the 10 pin ribbon cable connection J102. See Fig. 7

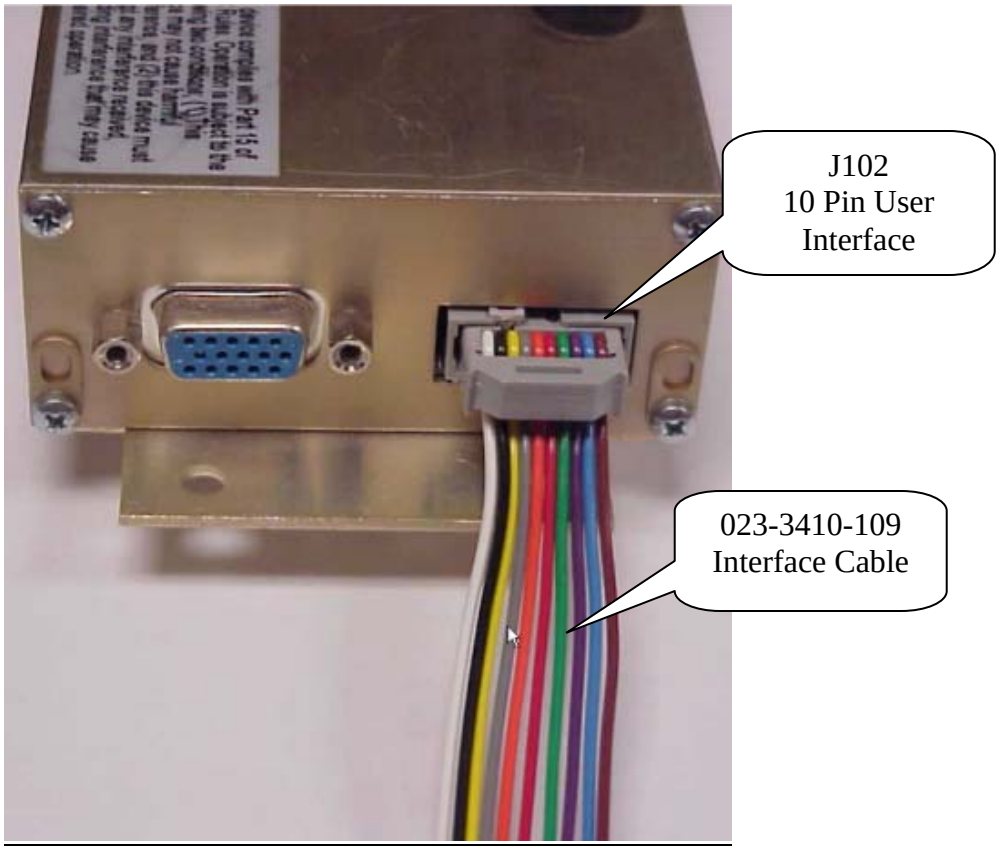

Fig. 7

Interface wiring from the DL3282 modem to the Guardian is accomplished by connecting the 023-3410-109 cable to the Guardian 'User Interface' connector as shown in Fig. 8. Fig. 9 shows the 'User Interface' connector pin locations as viewed from the front of the radio. Cable length is determined by application. Fig. 8 is not to scale and is for reference only.

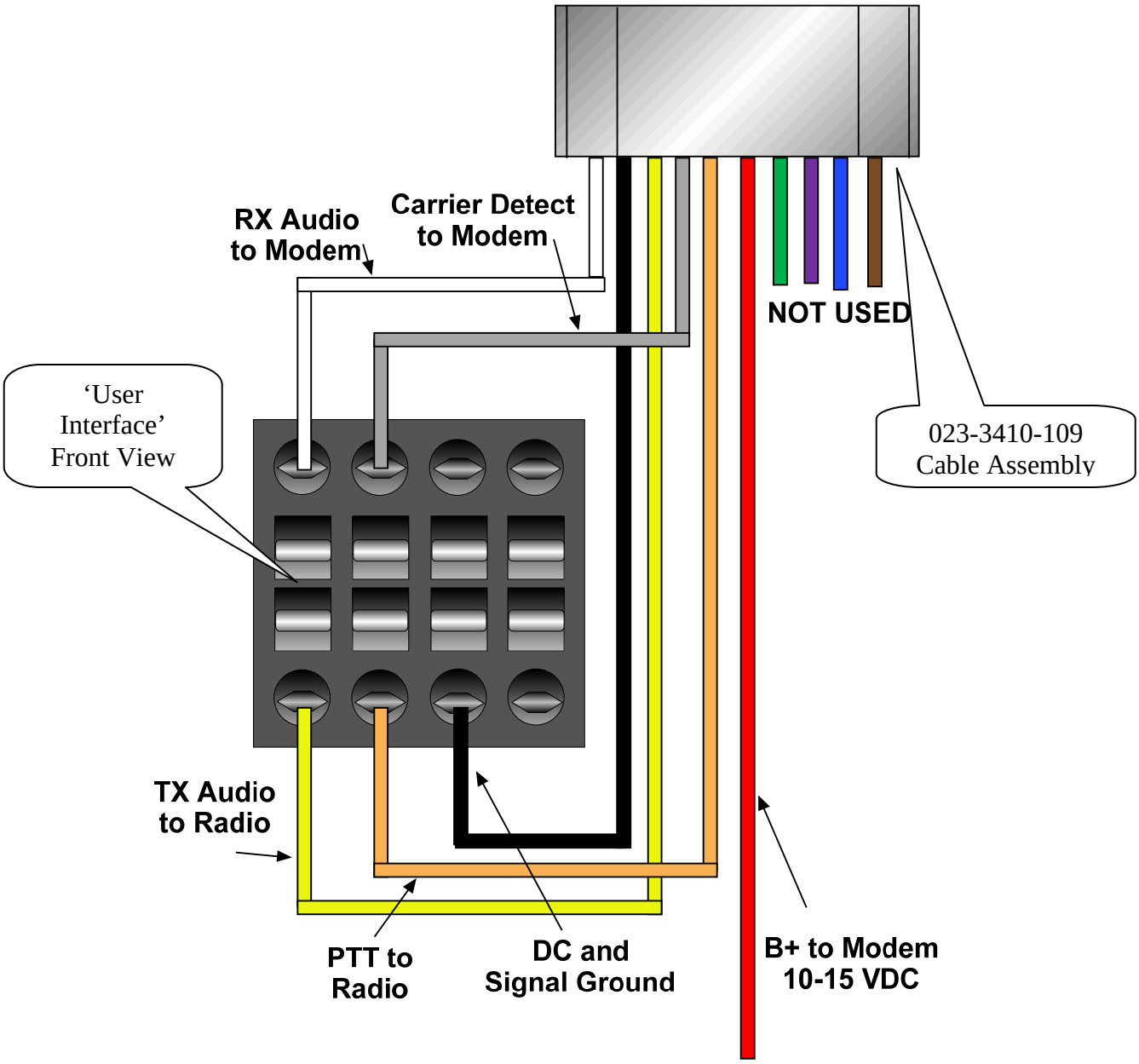
RX Audio
to Modem
Carrier Detect
to Modem
NOT USED
'User
Interface'
Front View
023-3410-109
Cable Assembly
TX Audio
to Radio
PTT to
Radio
DC and
Signal Ground
B+ to Modem
10-15 VDC

Fig. 8

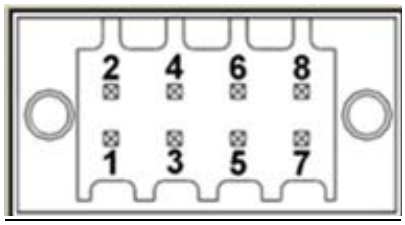
2
4
6
8
1
3
5
7

Fig. 9

Fig. 10 shows the DL3282 modem connected to the Guardian. The cable length and power connection is shown for reference only. Actual cable length and modem location will vary by application. The modem is shown screwed to the top of the Guardian using a 6-32 x3/8" screw. This shows one possible way to mount the modem to the radio.

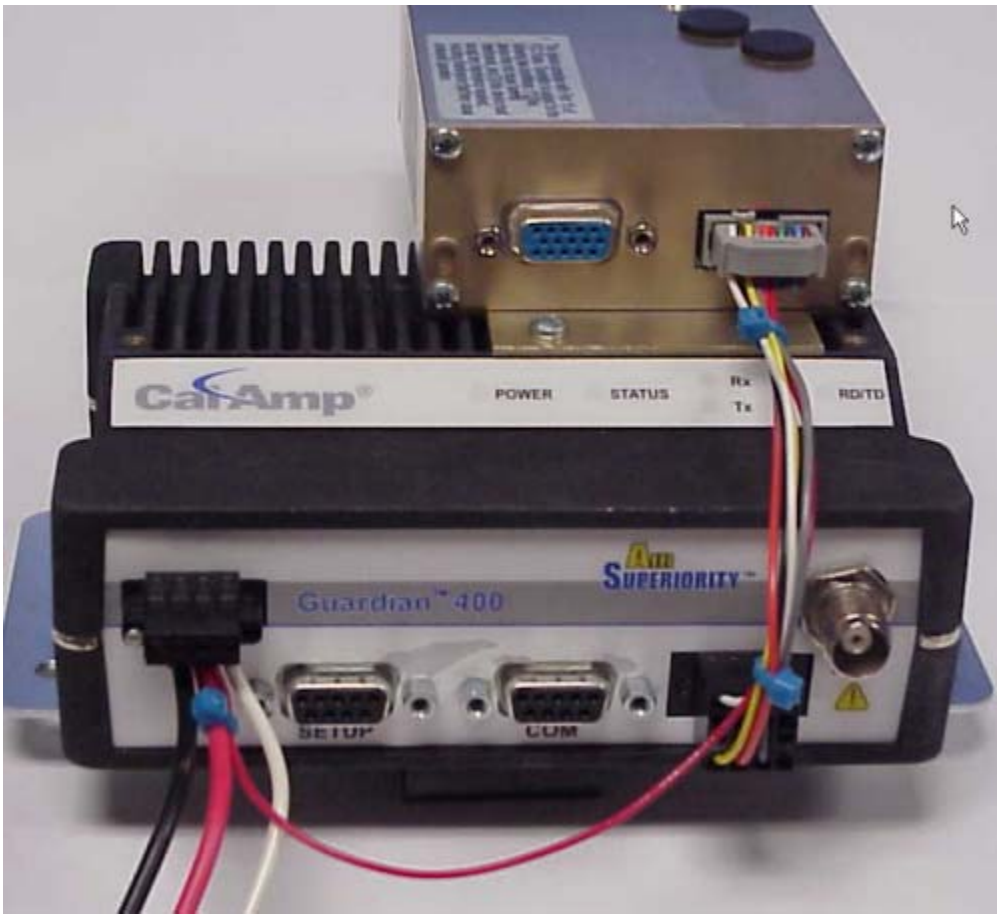

Fig. 10

PROGRAMMING and OPERATIONAL HINTS

- Normally the Guardian will be programmed for 'FSK' mode since this mode provides a flat audio response for data applications.
- When interfacing into an existing DL3400/DL3282 radio modem system always verify the DL3400 programmable parameters and program the Guardian accordingly.
- Information on the DL3282 modem is available in the technical manual PN# 001-3282-003. Contact wngsupport@calamp.com for manual availability.
- The DL3282 modem is programmed using a series of DIP switches located inside the modem. Default settings are Bell 202 w/Equalizer, CD – Active High, Normal mode – On, RTS/CTS delay – 240 mSec.
- Guardian CD polarity should be set for 'Active High' which is the default setting of the Guardian CD parameter.

- Ensure that Pin 4 of the ‘User Interface’ is set for CD output.
- NOTE: The Guardian can operate from **10-30 VDC**. The DL3282 modem can operate from **7-16 VDC**. Care must be taken to prevent overvoltage damage to the DL3282 modem.

SUMMARY

For technical assistance please contact CalAmp Technical Services at:

wngsupport@calamp.com

Or call 1-507-833-6701 Option 1 for Fixed and Legacy products.

Please visit our website at:

www.calamp.com