Moog Components Group, Halifax Operations
Focal Technologies Corporation
77 Frazee Avenue
Dartmouth, Nova Scotia, Canada B3B 1Z4
Tel: 1-902-468-2263 • Fax: 1-902-468-2249
Email: focal@moog.com • www.moog.com

Model 903
Video/Data Multiplexer
Software Manual

Part No. 903-0611-00 B
February 22, 2006

REVISION HISTORY

Revision	Date	By Whom
A	2001-04-04	IBM
B	2006-02-22	IBM

Revision	Revision Notes
A	Preliminary Issue
B	Converted to Moog format and new Focal address, cover
	Minor formatting changes (correction of fonts, typos, etc.)
	Addition of revision history page
	Temperature reading info corrected, p. 4

TABLE OF CONTENTS

LIST OF FIGURES

ACRONYMS AND ABBREVIATIONS

AIB	**Analogue (Adaptable) Interface Board**
APD	**Avalanche Photodiode**
DIB	**Data Interface Board**
ECL	**Emitter Coupled Logic**
EIA	**Electronic Industries Association**
EIB	**Ethernet Interface Board**
ESD	**Electrostatic Discharge**
FORJ	**Fiber Optic Rotary Joint**
FMB	**Fiber (Optic) Multiplexer Board**
ITU	**International Telecommunications Union**
LED	**Light Emitting Diode**
NTSC	**National Television System Committee (Composite Video Standard)**
PAL	**Phase Alternation Line (Composite Video Standard)**
PCBA	**Printed Circuit Board Assembly**
PIN	**P-Intrinsic-N (Standard Photodiode)**
RGB	**Red-Green-Blue (Component Video)**
ROV	**Remotely Operated Vehicle**
SERDES	**Serializer-Deserializer (N:1, 1:N Multiplexer IC)**
SMT	**Surface Mount Technology**
TDM	**Time Division Multiplexing**
TTL	**Transistor-Transistor Logic**
VIB-RX	**Video Interface Board (Console Module)**
VIB-TX	**Video Interface Board (Remote Module)**
WDM	**Wavelength Division Multiplexer**
Y/C	**Luminance/Chrominance (Component Video)**

1.0 INTRODUCTION

The Model 903 diagnostics software is a powerful, user-friendly PC program that monitors the operation of the Model 903 multiplexer system through a serial connection to the DB-9 jack on the console fiber multiplexer board (FMB-VRX) module. Displayed parameters include the power supply voltages at both the remote and console modules, the temperature inside each module, and the status of the optical uplink and downlink between the modules. The diagnostics program also checks for the presence of sync pulses on the video channels — four on each video board — at both the console and remote ends of the system. All key parameters may be logged to file for later inspection and monitoring of long term performance.

2.0 INSTALLATION AND SET-UP

The Model 903 diagnostics program runs under Windows 95, 98, NT, or 2000 from the file *VDM_0406X.exe* for software part number 903-0406-00, where the *X* is the revision, e.g., *VDM_0406D.exe* for revision D. Two floppy disks are provided with setup software to properly configure the VDM program to run on the target system. Each multiplexer system is provided with an RS-232 serial cable with a nine pin male connector on one end, connected to the console module, and a nine pin female connector at the other end, connected to one of the PC serial ports.

To install the VDM Diagnostics Program on a PC, run the *setup.exe* program on the first 3.5" floppy disk and follow the on-screen instructions. These instructions ask for a target directory for the program files and a target directory for installing the LabWindows Run-Time Engine, if it is not already installed. Once the directories are specified, the setup program places the required files in the program folder. To remove the program, run the *uninst.exe* file.

The software can also be installed from a hard drive by copying the three files from the diskettes (setup.exe, VDM.001, and VDM.002) to a clean directory and running the setup.exe program.

A configuration file, *VDM.cfg*, stores the calibration and configuration data for the specific telemetry system. During installation, a default copy is placed in the same directory as the executable file. Configuration file backups are automatically created immediately following any change in calibration or configuration, but the files themselves are not overwritten until the program is closed. Configuration files may also be backed up by copying them to a different directory. If any of the cards (FMBs) with optical transmitters or receivers are changed, the corresponding configuration file must be updated by recalibrating the software per section 3.5.

2.1 System Requirements

The recommended system for operating the VDM diagnostics software is as follows:

Pentium 166 MHz or faster with at least one available COM: port
Windows 95 or higher, or Windows NT version 4.0 or higher
Video resolution set for 800 x 600 or higher

3.0 USING VDM DIAGNOSTICS

3.1 Start Up

An initial ID pop-up panel displays the version number of the software as well as contact information for Focal Technologies, as shown in Figure 1 below. Clicking on the "Continue" button causes the ID pop-up panel to disappear and the main program to begin. An RS-232 serial cable must be connected between the console module and the PC with both the console and remote modules powered.

When the main program begins, a master display screen opens corresponding to the diagnostics data streams from the remote and console modules. The following sections describe the displays and controls of the master display and associated pop-up windows.

Figure 1 - *ID Pop-up Panel*

3.2 Confirming Optical Links

The initial screen format is as shown in Figure 2. Most of the screen is broken into two halves, the left half readings corresponding to the remote module and the right half readings corresponding to the console module. A strip chart display of optical insertion loss applies to the entire system and thus spans both halves of the screen.

If the remote and console units are connected properly and are both powered up, the following controls and indicators should appear on the console and remote halves of the screen to indicate that the FMB uplink and downlink are functioning.

Remote Module:

The Downlink RX Ready LED should be green.
The Downlink RX Errors LED should be off and the display box should read 0.
The remote Temperature reading should be between 0°C and +60°C.
The LED to the right of the "Voltage Levels On/Off" button should be green.
The LED to the right of the "Video Syncs On/Off" button should be green.
The data activity LED in the upper right hand corner of the remote half screen should be flashing green, indicating diagnostics data transmission between the remote and console modules.
Downlink RX Power and Uplink TX Power should be within specifications.

If there are no diagnostics readings received by the console module from the remote module, the remote side of the screen will be greyed out.

Console Module:

The Uplink RX Ready LED should be green.
The Uplink RX Errors LED should be off and the display box should read 0.
The console Temperature reading should be between 0°C and +60°C.
The LED to the right of the "Voltage Levels On/Off" button should be green.
The LED to the right of the "Video Syncs On/Off" button should be green.

3.3 Screen Description

The main program window is divided into separate halves for the remote (left side) and console (right side) modules, as shown below in Figure 2.

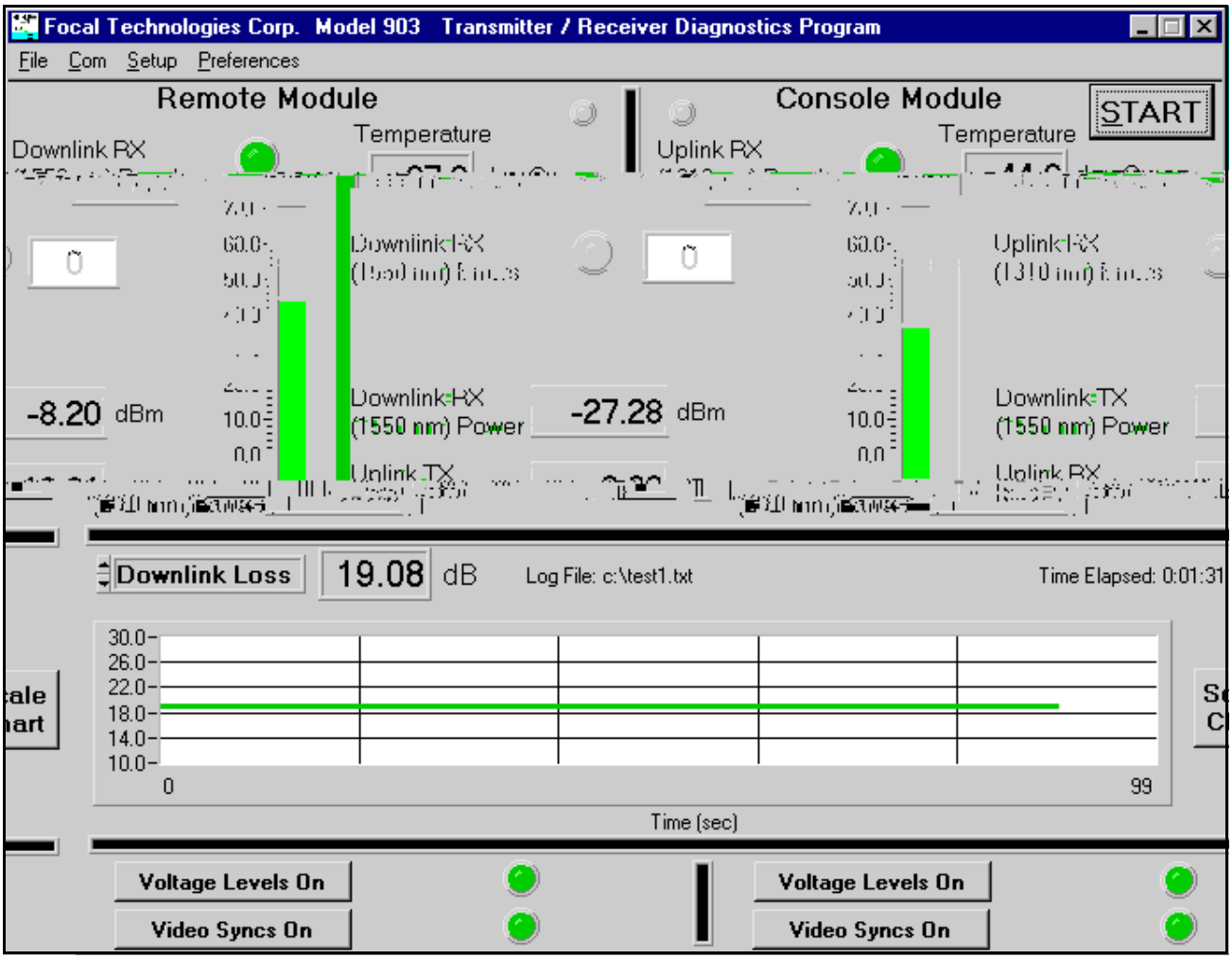


Figure 2 - *Initial Display Screen*

3.3.1 Remote Module

Temperature:

Temperature of the remote FMB-VTX card is monitored with a small IC sensor located near the high speed multiplexing ICs. The temperature reading for the remote FMB is displayed in a numerical output box and a graphical thermometer as degrees Celsius. The color of the thermometer is blue for temperatures below +5°C, green for temperatures between +5°C and +45°C, yellow for temperatures between +45°C and +50°C, and red for temperatures greater than +50°C. Typical accuracy is better than +/- 3.0°C. FMB modules are normally rated to +60°C ambient with on-board temperatures typically 10 to15°C higher than ambient. A red thermometer indicates the unit is running at the hot end of the scale, not necessarily in a failing or dangerous mode. Module cooling and air flow should be investigated and possibly corrected for diagnostics temperature readings that are consistently above +70°C.

Link Parameters:

The Downlink RX Ready LED turns green to indicate that the optical FMB downlink is synchronized and that valid data frames are being received. This LED turns red if synchronization is lost.

The Downlink RX Errors LED turns red when a frame of FMB downlink data was received which did not conform to proper frame encoding. The number of errors displayed is incremented by one or two for each half-second period in which one or more bad frames of data were received. This LED is clear when there are no frame errors.

The Uplink TX Power is given in dBm and is calibrated to indicate the FMB uplink laser power present at the FMB-VTX front panel fiber bushing of the remote module. Calibration is accessible via the Setup pull-down menu. The uplink wavelength is typically 1310 nm.

The FMB Downlink RX Power is given in dBm and is calibrated to indicate the FMB downlink laser power present at the FMB-VTX front panel fiber bushing of the remote module. Calibration is accessible via the Setup pull-down menu.

Voltage Levels:

As long as the remote primary rail voltages are within 10% of their nominal values, the LED next to the "Voltage Levels On" button will be green. While any one of the rail voltages differs more than 10% from its nominal value, the LED turns red. Measured voltages are accurate to within +/-0.1 V.

Pressing the "Voltage Levels On" command button produces a pop-up window as shown in Figure 3 with the measurements of the remote unit primary power supply voltages: +5V, -5V, +12V, and -12V. While the pop-up window is open, the "Voltage Levels On" button name changes to "Voltage Levels Off". Pressing the button again removes the power supply voltages pop-up window and restores the name of the button to "Voltage Levels On".

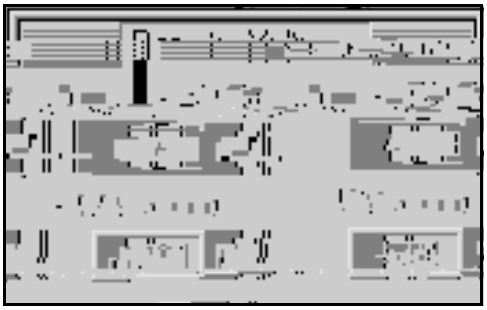


Figure 3 - *Remote Voltage Rails Pop-Up Window*

Video Sync Parameters:

The diagnostics software monitors the remote video board channels for sync pulses, indicating the presence of composite video signals. If a video signal on any channel loses sync for the duration of a sampling interval (default 1 second), the LED next to the "Video Syncs On" button will turn red. Otherwise, the LED should remain green.

Pressing the "Video Syncs On" button produces a pop-up window, as shown in Figure 4, listing the sync status on all 8 video channels and the number of syncs lost on each channel. The "Loss of Sync" counter for each channel is reset when the "START" button (top right portion of the diagnostics window) is pressed. The sync pulse check occurs for only 100 μs per channel per half-second sampling interval, and therefore it is possible that brief synchronization losses (less than 0.5 sec) associated with intermittent video signals will not be detected. The name of the "Video Syncs On" button changes to "Video Syncs Off" when the video syncs pop-up window is displayed. Pressing the button again restores its name to "Video Syncs On" and removes the pop-up window.

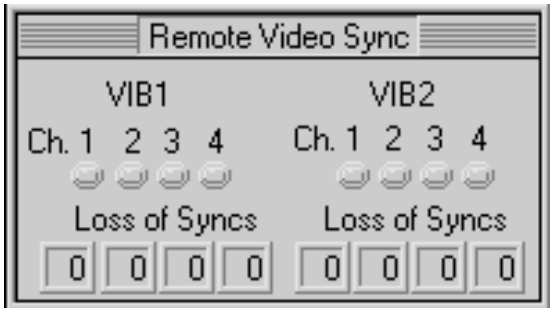


Figure 4 - *Remote Video Syncs Pop-Up Window*

3.3.2 Console Module

Temperature of the console FMB-VRX card is monitored with a small IC sensor located near the high speed multiplexing ICs. The temperature reading for the console FMB is displayed as per the remote FMB with a numerical output box and a graphical thermometer in degrees Celsius. (See section 3.3.1.)

Link Parameters:

The Uplink RX Ready LED turns green to indicate that the optical FMB uplink is synchronized and that valid data frames are being received. This LED turns red if synchronization is lost.

The Uplink RX Errors LED turns red when a frame of FMB uplink data was received which did not conform to proper frame encoding. The number of errors displayed is incremented by one or two for each half-second period in which one or more bad frames of data were received. This LED is clear when there are no frame errors.

The Downlink TX Power is given in dBm and is calibrated to indicate the FMB downlink laser power present at the FMB-VRX front panel fiber bushing of the console module. Calibration is accessible via the Setup pull-down menu.

The Uplink RX Power is given in dBm and is calibrated to indicate the FMB uplink laser power present at the FMB-VRX front panel fiber bushing of the console module. Calibration is accessible via the Setup pull-down menu.

Voltage Levels:

As per the remote module, but for the console primary rail voltages. The LED will be green as long as the rails are within 10% of their nominal values.

Pressing the "Voltage Levels On" command button produces a pop-up window as shown in Figure 5 with the measurements of the console unit primary power supply voltages: +5V, +12V, and -12V. While the pop-up window is open, the "Voltage Levels On" button name changes to "Voltage Levels Off". Pressing the button again removes the power supply voltages pop-up window and restores the name of the button to "Voltage Levels On".

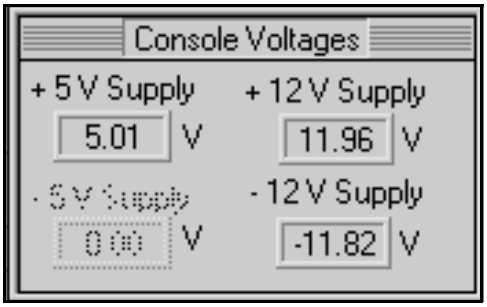


Figure 5 - *Console Voltage Rails Pop-Up Window*

Video Sync Parameters:

Sync pulses on the console video board channels are monitored in the same manner as for the remote video boards. Operation of the console video sync button and indicators are identical to those described above for the remote unit.

3.4 Downlink Loss Display

Insertion loss between the front panel bushings of the remote and console modules is displayed in the middle of the screen. The link monitored may be selected with the up/down arrows from Downlink (1550 nm), Uplink (1310 nm), or Average of Uplink and Downlink. Insertion loss is calculated as the FMB front panel transmit power at one end minus the FMB front panel receive power at the opposite end of the system. Insertion loss includes the loss of all external optical components, such as fiber cable, FORJs, and connectors. It does not include losses from internal connectors, WDMs, splitters, fiber switches, or other integrated optical components, hence the full optical power budget is available to the external cable system. Measured loss readings for a calibrated FMB are typically within +/- 1.0 dB when in the operational range of the system.

Pressing the "Scale Chart" button produces pop-up windows for changing the minimum and maximum loss (dB) of the vertical axis. The horizontal axis is fixed at 100 sample periods, the default period being one second as configured in the Log Preferences window.

If the diagnostics program is currently logging to a file, the file's name appears above the strip chart. Another reading at the right corner of the chart indicates elapsed time since the program was last started with valid data received from the console module. Pressing the "START" button resets the elapsed time.

3.5 Menus and Options

Pull-down menus are available from the main menu bar for functions under the headings of File, Com, Setup, and Preferences.

File

Open Log File: Displays a pop-up panel, shown below, which prompts entry of the name of a text log file for storing monitoring data. A file is then opened under the selected name and data is recorded into the log file in a text format as described in section 4.0. Only those parameters selected from the Log Preferences window, under the Preferences pull-down, are stored. For more information on setting up the format of a log file, see the Choose Log Preferences menu item below.

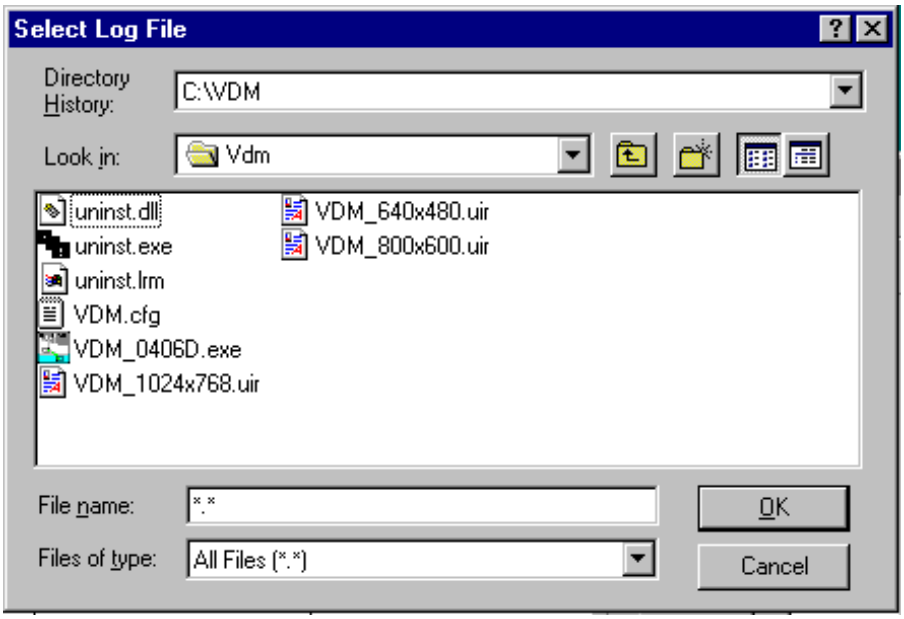


Figure 6 - *Log File Selection Window*

Playback Log File: Displays a pop-up panel, shown below, which prompts entry of the name of a previously recorded text log file. Once selected, the data in the file is replayed as if it were live data with the same main screen display as shown in Figure 2. Data missing from the recorded file, as set in the Log Preferences window, will not be displayed. An additional small window appearing during replay acts like a tape recorder control, indicated in Figure 8 below.

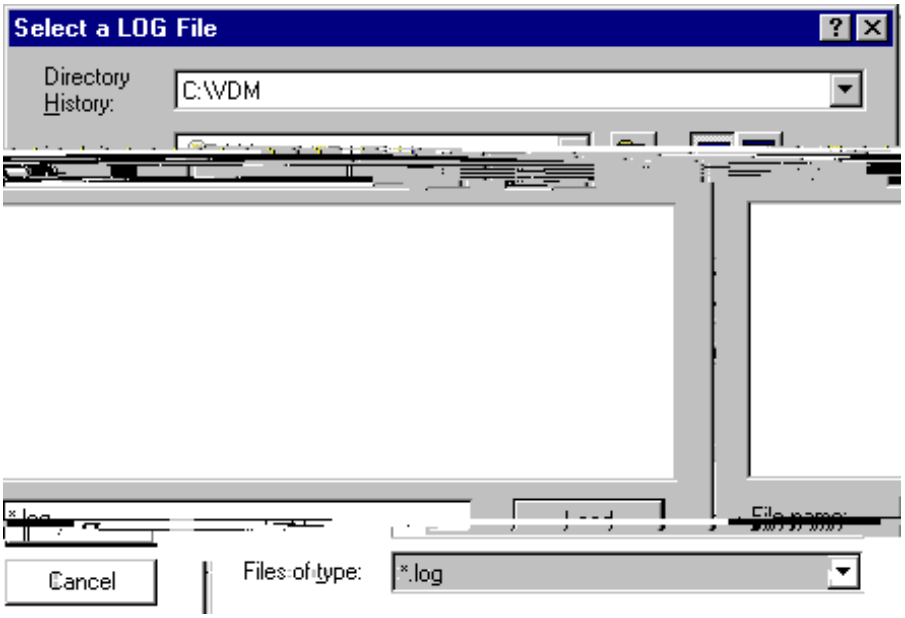


Figure 7 - *Playback File Selection Window*

An additional small window, below, appears during replay, acting like a tape recorder control. The square button stops/pauses the file replay. The right arrow button plays the data. The double arrow buttons are fast forward and rewind controls. Using a mouse, the time marker may be dragged to the desired location in the file. Start and stop times in minutes are shown at the ends of the time.

Figure 8 - *Playback Control Window*

Close Log File: Closes the log file if one was previously opened.

Exit: Exits the program. Any open log file is automatically closed. Clicking on the close window button of the display window also exits the program for both telemetry systems.

Com

Choose COM Ports: Displays a dialog panel, as shown in Figure 6, which allows configuration of COM ports (1-32) for receiving data from the console FMB. All input COM ports are fixed at 9600 baud. An output COM port (1-32) and baud rate may also be set for copying the input data out to another PC if "Log to COM Port" is enabled.

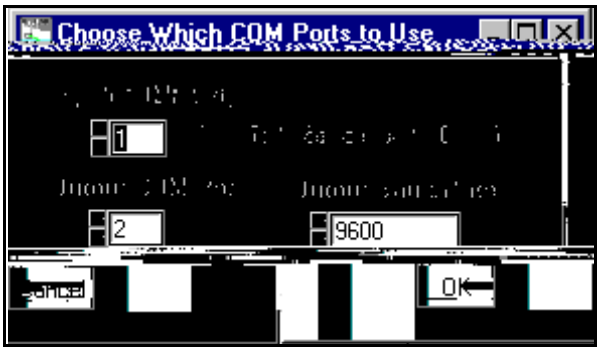


Figure 9 - *COM Port Select Window*

Log To COM Port: Selecting this option copies the incoming raw data streams to another COM port, selected above, in the same ASCII format as logged data described in section 4.0.

Setup

Selecting any of the calibration options first triggers a window that warns the configuration file will be modified and asks for verification to continue. If confirmed, a calibration window appears with the currently measured optical power for the given transmitter or receiver. All powers are measured at the actual laser (back facet monitor) or receiver (photocurrent) but referenced to the power measured at the front panels of the FMB cards, where calibration measurements are typically made. Thus a laser with +6 dBm at its pigtail but +3 dBm at the FMB front panel should display as +3 dBm in the diagnostics software.

The current optical power reading may be corrected by entering the actual power measured with an optical power meter calibrated at the wavelength of interest. (Ensure only one wavelength is present during the measurement.) For a laser transmitter calibration, enter the actual measured transmitted power in the lower numeric box labeled "Enter Actual Power," shown in Figure 10.

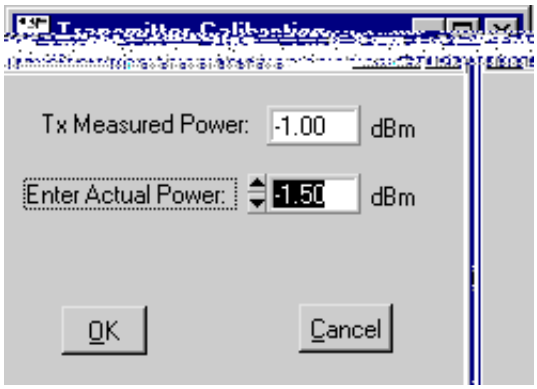


Figure 10 - *Transmitter Calibration Window*

For a receiver, two calibration points are required. The first calibration point window is as shown in Figure 11 A second calibration with an insertion loss at least 10-15 dB different than the first point is required, as indicated in Figure 12.

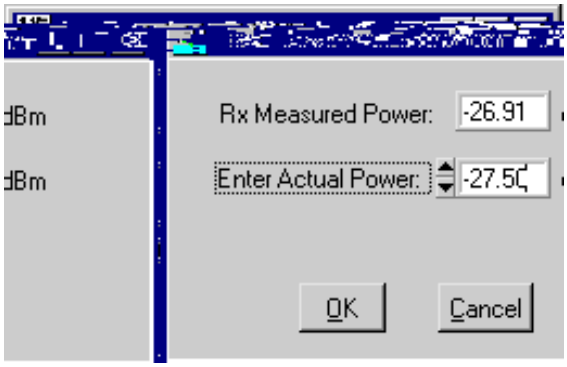


Figure 11 - *Receiver Calibration Window (1st Point)*

The software uses a linear curve fit between the two calibration points. If one of the points is at too low a receive power level, the accuracy of the calibration may be poor over the full range or erratic fluctuations in optical power may appear.

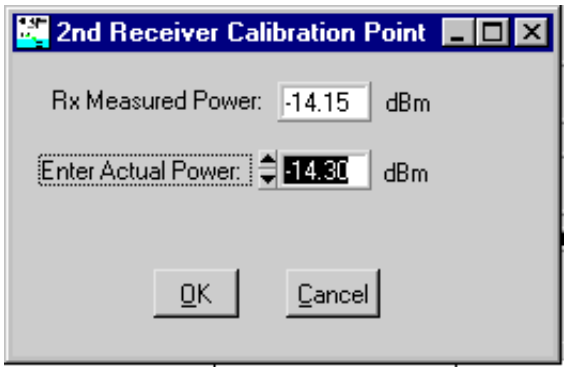


Figure 12 - *Receiver Calibration Window (2nd Point)*

Calibrate Downlink Receiver: A dialog window displays the currently measured FMB downlink receiver power at the front panel bushing of the remote FMB.

Calibrate Downlink Transmitter: A dialog window displays the currently measured FMB downlink transmitter power at the front panel bushing of the console FMB.

Calibrate Uplink Receiver: A dialog window displays the currently measured FMB uplink receiver power at the front panel bushing of the console FMB.

Calibrate Uplink Transmitter: A dialog window displays the currently measured FMB uplink transmitter power at the front panel bushing of the remote FMB.

Fiber Select: On units provided with automatic fiber switching, selecting this option generates a pop-up window, shown below, with two buttons for the two corresponding fibers, #1 and #2. (The window may be minimized when not in use.) If the console FMB is configured for manual switching, the two buttons will be greyed out and "MANUAL" will appear in the pop-up window. In this mode, the software cannot be used to control the switching.

If the console module FMB is configured for automatic switching, the button corresponding to the active fiber will be green. To force the switch to the other fiber, click on the other button with the mouse. This feature is primarily intended to allow periodic checking of the loss on both fibers — it does not disable the automatic switching algorithm in the FMB microcontroller. Customer software may be used to control the switching by sending an ASCII lowercase 's' with 9600-N-8-1 protocol. Such software may use a switching algorithm based on different conditions than the FMB microcontroller, such as received uplink power level.

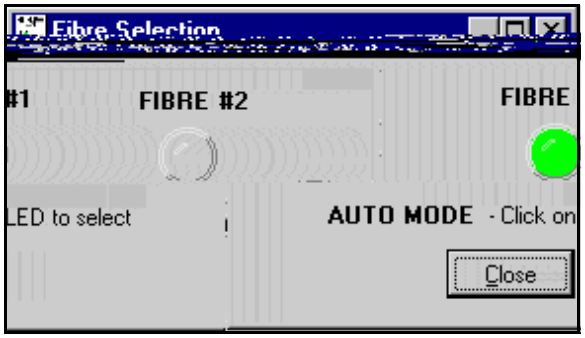


Figure 13 - *Fiber Selection Window*

Preferences

Choose Log Preferences: Displays a dialog window, as shown in Figure 14, to select which parameters will be saved to the log file previously selected using the File menu. The dialog window includes options to include or exclude video sync information in the log file (by default video sync information is not included), whether or not to include a simple one-line message header at the top of the file (by default this is not included), whether to use space (default) or comma separated values, and the sampling rate in samples per minute, where the default is 60, but can be set between 0.1 and 60.

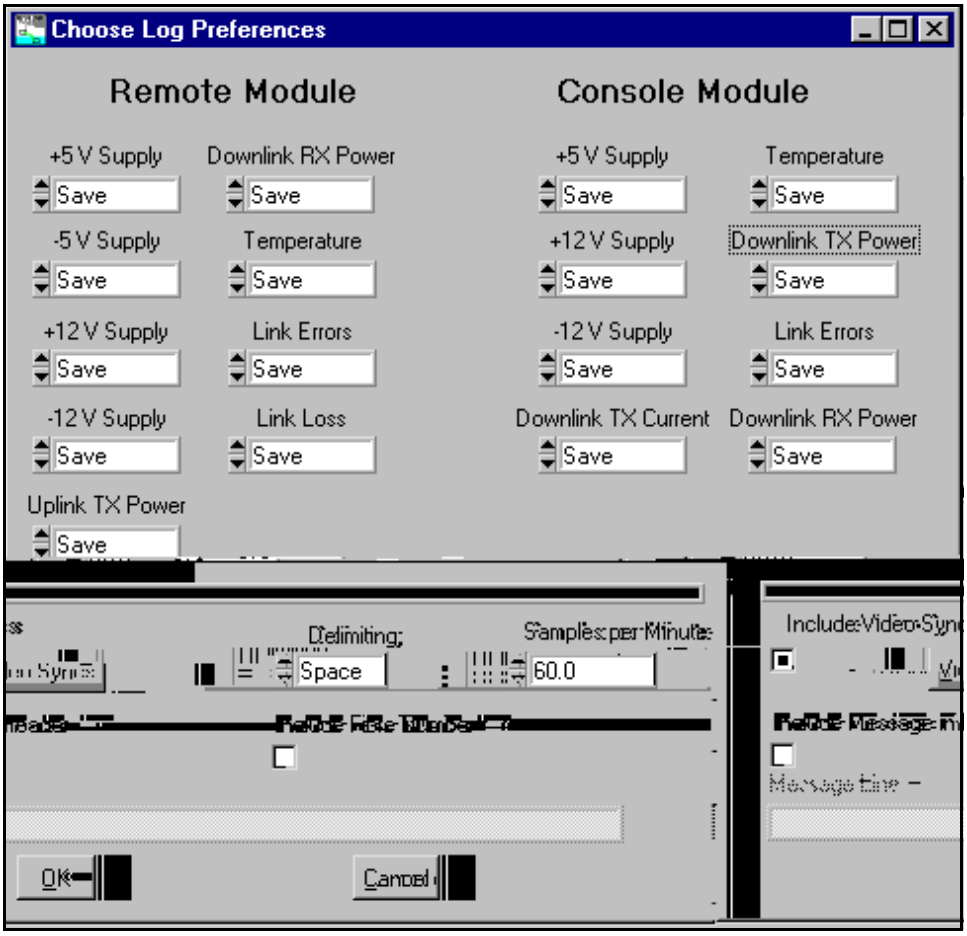


Figure 14 - *Log Preferences Window*

Selecting "No Save" for unused parameters will reduce the size of log files.

Clicking on the Video Syncs button triggers two pop-up windows, one for the remote and one for the console, to set which video channels are active. By default, all video channels are assumed to be active. If a video channel is not used, it should be disabled here to avoid false triggering of loss of sync indicators.

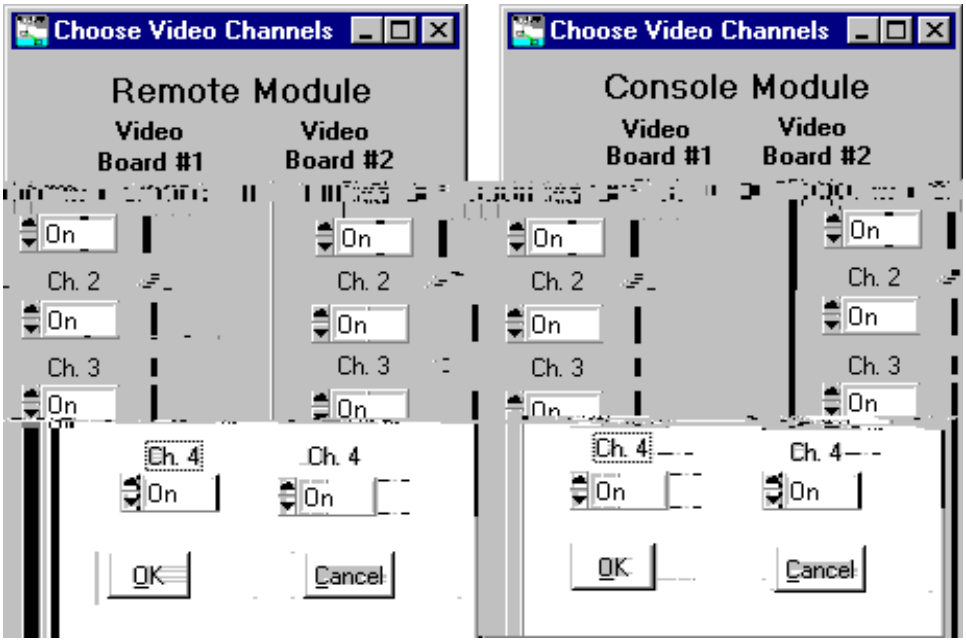


Figure 15 - *Video Enable Windows*

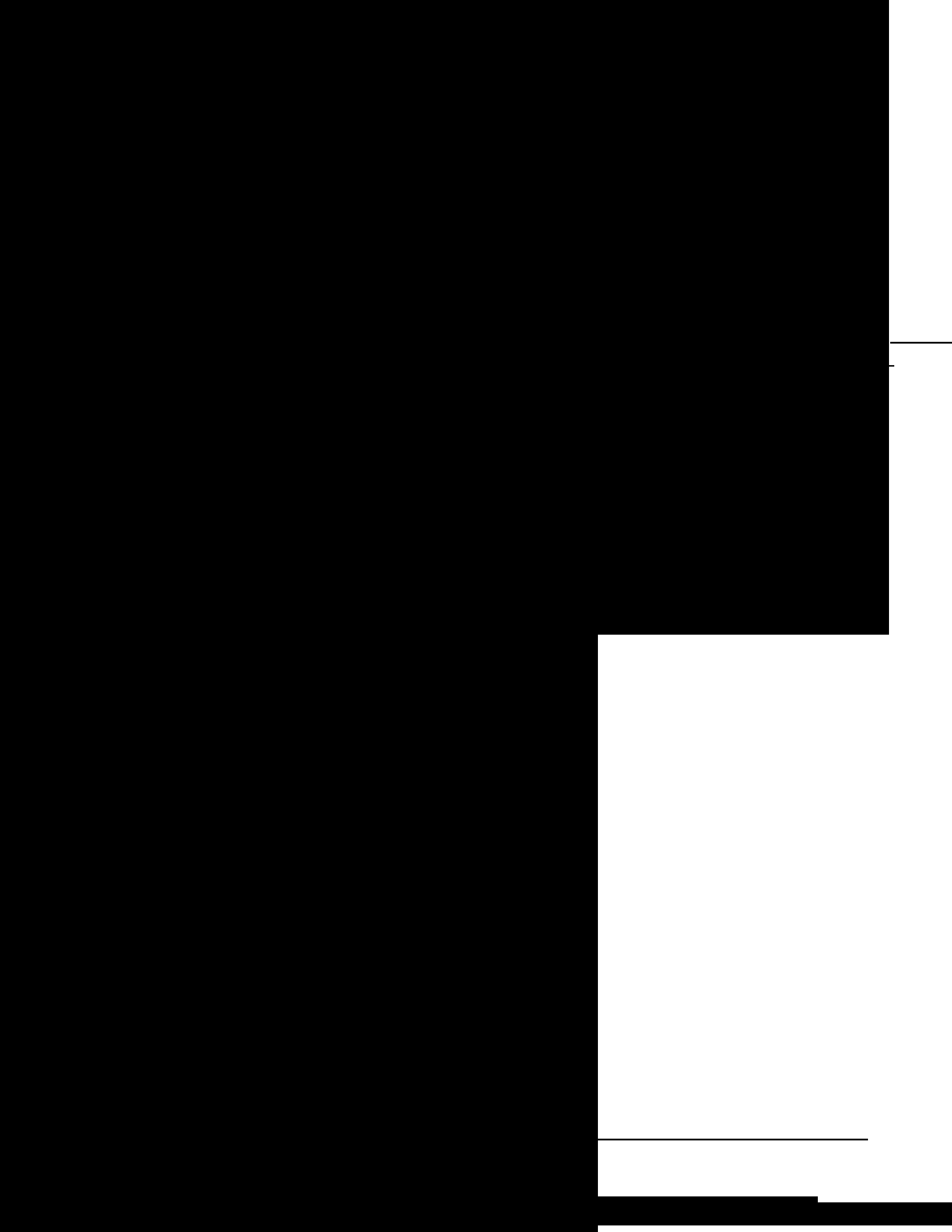
4.0 RAW DATA FORMAT

All diagnostics data is transmitted in ASCII format from the console FMB. Each reading is separated by a comma and the full set of readings is terminated by a carriage return (ASCII code 13) followed by a line feed (ASCII code 10). Output sample rate is fixed at 2 Hz, though software may choose to subsample the readings. Details on the diagnostic port hardware are given in the console FMB section of the user guide. This section describes the format of the data for firmware part number 903-1023-00.

The format for the RS-232 connection is as follows:

Baud rate	9600
Parity	none
Number of data bits	8
Number of stop bits	1

$$V = \frac{DDDD \times 5}{4095}$$



After an initial header with date and time, a row of column headers is written with the following items:

1. Transmitting optical power of console 1550 nm transmitter
2. Laser Current of console 1550 nm transmitter
3. +5V console supply voltage level
4. +12V console supply voltage level
5. -12V console supply voltage level
6. Console temperature

5.0 LOGGED DATA FORMAT

The log file format consists of columns of data as selected in the Log Preferences windows, and is stored in space or comma-delimited ASCII strings. The VDM software outputs the data in engineering units based on the calibration information contained in the VDM configuration files. Only data readings selected in the Log Preferences window will be included in the log file. Rows of readings are stored at the time interval set in the Log Preferences window.

A typical output file is shown below, where optical powers are given in dBm, voltages in volts, and temperatures in degrees Celsius.

Time: 09:37:57

Date: 03-06-2001

Con_TXPow	Con_RXPow	Con_+5V	Con_+12V	Con_-12V	Con_Tmp	Con_Lnk_Err	Rem_RXPow	Rem_TXPow	Rem_+5V	Rem_-5V	Rem_+12V	Rem_-12V	Rem_Tmp	Rem_Lnk_Err	Link_Loss	Time_Elapsed_(min)
-7.26	-21.49	4.96	12.04	-11.86	55.35	0	-28.28	-4.33	4.93	-4.99	12.17	-12.00	55.35	0	21.02	0.92
-7.26	-21.49	4.96	12.04	-11.86	55.87	0	-28.46	-4.33	4.93	-4.99	12.17	-12.00	55.87	0	21.21	0.93
-7.26	-21.49	4.96	12.04	-11.86	55.87	0	-28.46	-4.33	4.93	-4.99	12.17	-12.00	55.87	0	21.21	0.95
-7.26	-21.49	4.96	12.04	-11.86	55.87	0	-28.28	-4.33	4.93	-4.99	12.17	-12.00	55.87	0	21.02	0.97
-7.26	-21.49	4.96	12.04	-11.86	55.87	0	-28.46	-4.33	4.93	-4.99	12.17	-12.00	55.87	0	21.21	0.98
-7.26	-21.49	4.96	12.04	-11.86	55.87	0	-28.46	-4.33	4.93	-4.99	12.17	-12.00	55.87	0	21.21	1.00
-7.26	-21.49	4.96	12.04	-11.86	55.87	0	-28.46	-4.33	4.93	-4.99	12.17	-12.00	56.13	0	21.21	1.02
-7.26	-21.49	4.96	12.04	-11.86	55.87	0	-28.28	-4.33	4.93	-4.99	12.17	-12.00	55.87	0	21.02	1.03
-7.26	-21.49	4.96	12.04	-11.86	55.87	0	-28.46	-4.33	4.93	-4.99	12.17	-12.00	56.13	0	21.21	1.05
-7.26	-21.49	4.96	12.04	-11.86	55.87	0	-28.28	-4.33	4.93	-4.99	12.17	-12.00	56.13	0	21.02	1.07
-7.26	-21.49	4.96	12.04	-11.86	56.13	0	-28.28	-4.33	4.93	-4.99	12.17	-12.00	56.13	0	21.02	1.08
-7.26	-21.49	4.96	12.04	-11.86	56.13	0	-28.46	-4.33	4.93	-4.99	12.17	-12.00	56.13	0	21.21	1.10
-7.26	-21.49	4.96	12.04	-11.86	56.13	0	-28.28	-4.33	4.93	-4.99	12.17	-12.00	56.13	0	21.02	1.12
-7.26	-21.49	4.96	12.04	-11.86	56.13	0	-28.28	-4.33	4.93	-4.99	12.17	-12.00	56.13	0	21.02	1.13
-7.26	-21.49	4.96	12.04	-11.86	56.13	0	-28.46	-4.33	4.93	-4.99	12.17	-12.00	56.13	0	21.21	1.15
-7.26	-21.49	4.96	12.04	-11.86	56.13	0	-28.46	-4.33	4.93	-4.99	12.17	-12.00	56.13	0	21.21	1.17
-7.26	-21.49	4.96	12.04	-11.86	56.13	0	-28.28	-4.33	4.93	-4.99	12.17	-12.00	56.13	0	21.02	1.18
-7.26	-21.49	4.96	12.04	-11.86	56.13	0	-28.46	-4.33	4.93	-4.99	12.17	-12.00	56.13	0	21.21	1.20
-7.26	-21.49	4.96	12.04	-11.86	56.13	0	-28.46	-4.33	4.93	-4.99	12.17	-12.00	56.13	0	21.21	1.22
-7.26	-21.49	4.96	12.04	-11.86	56.13	0	-28.46	-4.33	4.93	-4.99	12.17	-12.00	56.13	0	21.21	1.23
-7.26	-21.49	4.96	12.04	-11.86	56.13	0	-28.46	-4.33	4.93	-4.99	12.17	-12.00	56.13	0	21.21	1.25
-7.26	-21.49	4.96	12.04	-11.86	56.13	0	-28.28	-4.33	4.93	-4.99	12.17	-12.00	56.13	0	21.02	1.27
-7.26	-21.49	4.96	12.04	-11.86	56.13	0	-28.46	-4.33	4.93	-4.99	12.17	-12.00	56.13	0	21.21	1.28
-7.26	-21.49	4.96	12.04	-11.86	56.13	0	-28.46	-4.33	4.93	-4.99	12.17	-12.00	56.13	0	21.21	1.30
-7.26	-21.49	4.96	12.04	-11.86	56.13	0	-28.28	-4.33	4.93	-4.99	12.17	-12.00	56.13	0	21.02	1.32
-7.26	-21.49	4.96	12.04	-11.86	56.13	0	-28.28	-4.33	4.93	-4.99	12.17	-12.00	56.13	0	21.02	1.33
-7.26	-21.49	4.96	12.04	-11.86	56.13	0	-28.46	-4.33	4.93	-4.99	12.17	-12.00	56.13	0	21.21	1.35