# Force Two System
## Vibroseis Control System
## Universal Encoder


# User's Manual

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**DSP ver 2.18**
**Source Control ver 2.19**

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# 1 Introduction Force Two System

## 1.1 Force Two System Description

The **Force Two Vibrator Control System** consists of one **Universal Encoder** and usually several **Force Two Vibrator Decoder Units**. The **Universal Encoder** is interfaced to seismic recording system and an IBM compatible computer. The **Source Control** software on the computer is used to control the operation of the Force Two System. The Source Control Program can load and store parameters for all vibrators, display and store all PSS reports, and perform analysis of vibrator similarity data. The **GPSview** software on the Computer is used to track and store position of the vibrator sources.

**Force Two Universal Encoder** – synchronizes operation of the recording system and the Source Control Unit. The Universal Encoder can control Vibroseis, Dynamite and Weight Drop Source Control Units. The Force Two Universal Encoder will control the following units:

- Seismic Source Co. Force Two Vibrator Control Units
- Seismic Source Co. Boom Box – Dynamite Blaster units
- Pelton Vib Pro Vibrator Control Units
- Pelton Shot Pro – Dynamite Blaster Unit
- Pelton Shot Pro II – Dynamite Blaster Unit
- Seismic Source Co – Weight Drop Control units

**Source Control** software – Universal control software allows observer to easily switch between seismic sources, i.e. vibrators, dynamite, weight drop. Single software program allows the following operation:

- Receives Vibrator PSS information
- Receives Blaster's PFS information
- Receives GPS position from Source control units
- Receives Shot Status information from Weight Drop Control Unit
- Receives and Analyzes Radio Similarities
- Sends and Receives Force Two control parameters
- Sends and Receives Force Two sweep information
- Sends and Receives Recording Truck information to ARAM, I-O, Sercel, Ascend, VibTech, Geometrics, and other recording systems.

**Force Two Vibrator Decoder Units** – receive and synchronize radio signals from the Universal Encoder. The Decoder units provide complete control of the Servo Hydraulic Vibrator. The system controls the phase and force of the Vibrator within the user selectable limits.

The **Force Two** radio interface and control system allows direct replacement of Pelton Vib Pro units.

- Force Two control units can operate in same vibrator group as Pelton Vib Pro unit
- Force Two generates same sweep as Pelton Vib Pro Units
- Force Two unit uses same Start Code and PSS type as Pelton Vib Pro Unit
- Force Two has same PSS data as the Pelton Vib Pro Unit ( PSS type 12) and (PSS type 15 VSR status)
- Force Two uses same Vibrator Wiring as Pelton Vib Pro unit
- Force Two can also use Advance II Start code for more reliable telemetry

**Master/Slave** operation of the Force Two system can be enabled by adding a **RTM** (Radio Trigger Module) to the Master UE system. The RTM unit receives the "master" start signal and transmits a Master Start code. The Slave UE units receive the "master" start code information from the RTM units and verifies that the "crew number code" matches. All of the recording systems can be synchronized using "delay entries" in the RTM and UE units.

## 1.2 Force Two Operation

The recording system usually starts the Universal Encoder. The Encoder then sends out radio start codes to the Vibrator Control Units. The Encoder then issues a "Time Break" signal to the recorder at exactly the time that the sweeps from the Encoder and all of the vibrators begin. The start time accuracy of the system is 25 microseconds. Four different "Start Codes" can be selected. These four different start codes are used to prevent interference to other crews working in the same area on the same radio frequency.

Many different kinds of sweeps are available including the following:

- Linear
- DB/octave
- DB/Hz
- T-Power
- Pulse Type
- Pause Mode
- Flash Mode
- Random
- Link Mode (Sweeps 17 through 32)

The sweep entry also allows for any initial phase settings.

The Universal Encoder has 5 BNC outputs on the Front Panel

1. **True Reference** – (Pilot Signal) – This signal should be connected to the Recording System and used as the correlation operator for the Seismic Plots. This signal will be in phase with the unfiltered accelerometer signal on the Vibrator unit. The True Reference starts at "Time Break", and can be used when connecting to Vibrator Quality Control System like the SSC Bird Dog II unit.
2. **Wireline Reference** – This signal is a delayed True Reference Signal. It is used when performing Wireline Similarities. The delay allows this signal to be compared directly to the Vibrator Output signal on the Vibrator.
3. **Radio Reference**- This signal is a delayed Wireline Reference signal. The Delay is the same as the one way radio delay for modulating and demodulating the radio Similarity Signal.
4. **Radio Sim** – This signal is the selected Vibrator radio similarity signal that has been transmitted back via radio from the Vibrator Decoder Unit. Normally this signal is the **Sim Ground Force Signal** from the selected Vibrator.
5. **Time Break signal** – This signal occurs when the Sweep starts. It can be used to trigger an oscilloscope or another recording system

The Vibrator Control Decoder Unit generates the selected sweep, controls the phase and amplitude output of the vibrator. User selectable settings determine the exact control type and control limits of the Vibrator. Two dual accelerometers are mounted on the vibrator; one is mounted on the vibrator's Base Plate and one is mounted on the

vibrator's Reaction Mass. These accelerometers are used by the vibrator's control electronics to compute Vibrator Force output and phase error. One set of accelerometers (Loop Accelerometers) is used for control system and the other set (Sim Accelerometers) is used to independently monitor the vibrator output.

During each sweep, one vibrator may be selected for testing by means of radio similarity. The output of the selected vibrator is transmitted over the radio link to the Universal Encoder. The Encoder receives the signal and vibrator output signal is digitized to produce the Radio Vibrator signal. The Radio Vibrator signal and the Radio Reference signal are uploaded to the Source Control program on the computer. The Source Control programs can display and store the following data:

- Signal traces
- Phase, amplitude, and fundamental component of the vibrator output signal (usually the weighted sum force signal) verses time.
- Phase and amplitude of vibrator output verses frequency.
- Cross correlation of vibrator output and reference sweep, and its envelope.
- Harmonic distortion, shows total distortion.

Wire line similarities may also be used to test all vibrators simultaneously. When performing Wireline similarities; the Wireline Reference signals from Encoder, the Wireline Signal from the Decoder, and the SV (Similarity Vibrator) output from the Decoder units are used for comparison. These signals should all be recorded on the main Seismic Acquisition System.

The Vibrator Output for Similarity is user selectable. The Loop or Sim accelerometer can be used for this signal. Normally for complete testing of the vibrator system, the Sim accelerometers should be used for the similarity. However, the Force Two also allows the selection of the Loop Accelerometers for similarities for testing purposes only.

During each sweep the Vibrator Control Units perform several "Quality Control Tests". These tests and the Quality Control Report are commonly called "**PSS**". At the end of each sweep all Vibrator Control Units report the results of these tests to the Universal Encoder by transmitting in digital form the following data:

- Maximum and average phase error (Loop Accelerometers)
- Maximum and average fundamental force (Loop Accelerometers
- Average total harmonic distortion (Loop Accelerometers)
- GPS position
- Cross correlation wavelet of vibrator reference sweep and vibrator force signal (Sim Accelerometers)

The results of the "Quality Control Tests" are displayed and stored by the **Source Control** program running on the computer connected to the Universal Encoder. The results are also compared to pre-established limits and, if any limits are exceeded, an error is indicated.

The **Source Control** program uses the PSS cross correlation wavelet data to compute and display amplitude and phase plots for each vibrator. These reports reduce the need for frequent vibrator similarity tests. The cross correlation wavelet uses the "similarity" accelerometers. The other digital PSS data uses the "loop" accelerometers

The Vibrator Control Units monitor torque motor current, valve spool displacement, and force during each sweep, compares them to pre-established limits, and reduce drive as necessary to prevent these limits from being exceeded. If one of these limits is reached, then a "limits reached" message is shown on the Decoder Display and the PSS reports. This limits reached is typical for most vibroseis operation. This is not an error in operation, but allows the trained vibroseis operator to determine what limit is being reached .

Sweep parameters and other set-up data can be entered with the **Source Control** program on the computer and downloaded to the Universal Encoder. Sweep parameters and vibrator parameters are entered into the computer and downloaded to the Universal Encoder, which transfers them to the Vibrator Control Units via radio link. Parameters may also be entered into to Vibrator Control Unit locally by means of its keypad and display. Parameters may also be loaded to the Vibrator Control Units by connecting the computer's serial port directly to the Control Unit with the **Source Control** program.

An automatic calibration procedure is used by the Vibrator Control Unit to optimize the performance of the Vibrator. This calibration routine also finds and corrects (if possible) hydraulic and wiring errors on the vibrator.

An optional external GPS receiver may be connected to the Vibrator Control Unit to enable position reporting. The GPS data can be viewed with the GPSview program on the computer connected to the Universal Encoder.

**Recording System Interface (RTI)** – The Universal Encoder system also allows connection to the recording system via a RS232 interface. This interface is standard with most recording systems. The standard RTI interface allows the Recording System to receive the "Ready message with GPS" from the Source Control unit; this ready message can then be used by the Recording system to automatically select the correct seismic spread from a preloaded script. The recording system then commands which source or source group to shake. After the sweep is finished the Recording system stores the PSS and GPS data for that source point.

**Board interchangeability**
Boards from the Encoder and the Vibrator Decoder units can be interchanged.
The Encoder uses 3 boards

- Radio/Communication Board
- DSP Board
- Power Supply Board

These three boards can be swapped between the Encoder and the Vibrator Decoder units without any other modification. Be sure that the jumpers on the Radio/Communication

Modem are set the same. These jumpers determine the interface to the recording system and are generally not used in the Vibrator units.
The Radio/Communication card also has digitally controlled selections for timing and polarity. The parameters are stored internally in the Radio Communication card. After changing cards, the correct parameters must be loaded into the new Radio Communication Card. These parameters should be stored on the computer for each project.
**Note**: When using the Vibrator Signature recording systems in the vibrators, the Time Break settings may need to change for proper operation. See appendix for more information on jumper settings.

# 2 Description of Universal Encoder Controls

An image of the front panel of the Universal Encoder Unit is shown below.


1. **POWER** Switch, located on the Front of the panel. .
2. **SWEEP** Button and Indicator – The button can be used for manual sweep start.
3. **FUSE**
4. **Radio/Power Connector (10 pin) –** is located on the side of the unit. It is used to connect
    a. **POWER** Connection – Acceptable voltage range is 11 – 36 VDC
    b. **Radio** Connection. Usually used to connect to VHF radio. See Radio Requirement chapter for details.
5. **Recording Truck Connector (25 pin) –** is located on the side of the unit, and it is used to connect to the recording system.
6. **Computer Connector (USB) -** This connector is located on the side of the unit, and is used to connect to the computer running the Source Control software.
7. **True Reference (BNC)** – (Pilot Signal) – This signal should be connected to the Recording System and used as the correlation operator for the Seismic Plots. This signal will be in phase with the unfiltered accelerometer signal on the Vibrator unit. The True Reference starts at "Time Break", and can used when connecting to Vibrator Quality Control System like the SSC Bird Dog II unit.
8. **Wireline Reference (BNC)** – This signal is a delayed True Reference Signal. It is used when performing Wireline Similarities. The delay allows this signal to be compared directly to the Vibrator Output signal on the Vibrator.
9. **Radio Reference (BNC)**- This signal is a delayed Wireline Reference signal. The Delay is the same as the one way radio delay for modulating and demodulating the radio Similarity Signal.

10. **Radio Sim (BNC)** – This signal is the selected Vibrator radio similarity signal that has been transmitted back via radio from the Vibrator Decoder Unit. Normally this signal is the **Sim Ground Force Signal** from the selected Vibrator.
11. **Time Break Signal (BNC)** – This signal occurs when the Sweep starts. It can be used to trigger an oscilloscope or another recording system

# 3 Pilot Installation

## 3.1 General Information

Mechanical:
The Force Two Universal Encoder should be mounted on a wall.

The location for the Universal Encoder is not critical, since all of the unit functionality is controlled with a computer. Operator should have an access to the unit front panel in order to reach Power switch. Most of the attention should be paid to the unit cable routing in order to avoid cable damage during transportation and production work.

Electrical:
The Universal Encoder must be wired to the following devices:

- DC Voltage Supply (11-36 volts DC). Usually there is a DC bus under the operator's desk.
- VHF Radio
- Seismic Recording System.
- Windows Computer
- Chassis of Universal Encoder should be connected to a good Ground. This is usually the same ground as used for the Radio

### 3.2 Connector Wiring

**RECORDING SYSTEM** Connector wiring: (25pin D-sub)
Note: All signals referenced to the Universal Encoder Unit.

- Pin 1 **Start Active** input signal. The signal is part of the circuit to start sweep by Universal Encoder. Pins 1 and 2 are connected to the Recording system. The recording system produces a pulse which will start the Universal Encoder. . Jumpers on the Radio interface board can select if this signal is a pulse or a switch closure
- Pin 14 **Start Return** input signal. The signal is part of the circuit to start sweep by Universal Encoder.
- Pin 2, 5, 6,16, 20 DCOM or Digital Common signal.
- Pin 15 **Time Break** Active output signal. The signal is part of the circuit to provide Time Break to recording system. Pin 15 produces a "Time Break" pulse when the sweep begins. This signal is wired to the recording system to initiate the Recording. Software Selection on the Radio/Communication board can select if this signal is a pulse or a switch closure. The polarity of this signal is software selectable, use the Source Control software to set the polarity and type.
- Pin 3 **Time Break** Return output signal. The signal is part of the circuit to provide Time Break to recording system.
- Pin 4 **Recorder Start** signal Active. This signal is used to start the recording system. This signal is a switch closure (Opto-Isolated Output)
- Pin 17 **Recorder Start** signal Return. This signal is part of the Recorder Start circuit.
- Pin 12 **+5 Volts DC**. This pin can be used with an external 390 ohm resistor in series to pull-up the **Recorder Start** signal.
- Pin 18 Reference Pulses – used in Boom Box mode – Not used – Reference Pulse are available on the Radio Reference line
- Pin 19 Recording Truck Interface transmit signal. This signal is wired to the RS232 Recording Truck interface on the recording system. **The internal RTI in the Universal Encoder has not been completed, do not wire this signal to the Recorder.** The Recording system interface can also be done with the Source Control software program.
- Pin 7 Recording Truck Interface receive signal. This signal is wired to the RS232 Recording Truck interface on the recording system. This signal should be wired to both the Universal Encoder and the RTI com port on the computer running the Source Control software program.

Radio Similarity. – (Radio similarity from Vibrator)

- Pin 22,23,24 ACOM or Analog Common signal. This signal is used as a return for the Analog signals produced by pins 13 and 14
- Pin 8 **True Reference** output. The range is 10 volts peak-to-peak.

- Pin 9 **Radio Reference** output. The range is 10 volts peak to peak. This reference is used to compare with the radio vibrator signal. This signal is also used for reference marks for the uphole data from the shooting system
- Pin 10 **Radio Sim**-Radio Vibrator output. The range is 10 volts peak to peak. This signal will show the vibrator output when a radio similarity is requested. This signal also shows the uphole data, and CTB data from the shooting system
- Pin 11 **Wireline Reference** output. This is a delayed True Reference signal to match the filtered SV (Similarity Vibrator) outputs of the Vibrator Control units.

**RADIO and Power Connector** wiring (10 pin):
Note: All signals referenced to the Universal Encoder Unit.

- Pin 1 Battery + (DC input voltage 11 – 36 volts)
- Pin 3 Speaker Active input signal.
- Pin 4 Speaker Return input signal.
- Pin 6 Microphone output signal.
- Pin 5 PTT output signal.
- Pin 7 Radio Return signal.
- Pin 6-9 Not connected.
- Pin 10 Battery – ( Battery ground)

**COMPUTER** Connector wiring: Standard USB connector

See **Appendix** information about setting jumpers on the Radio interface module. These jumpers are used to select voltage or switch closure signals on the recorder interface lines.

### 3.3 Boom Box / Shot Pro Operation

The Universal Encoder is designed to operate with the following Dynamite Synchronization Decoder units:

- **Boom Box**
- **Shot Pro 1**
- **Shot Pro 2**

### 3.3.1 Boom Box Operation

The Boom Box Decoder units are capable of receiving three different types of Start Codes. (Boom Box, Advance II, and Advance III)

**Boom Box Protocol**

When using only Boom Box Decoders, it is recommended to use the Boom Box radio protocol. Set the Boom Box decoders to BB ready message. With the Boom Box mode selected, additional features are available with the UE system. These features include:

- Boom Box parameter Download and verification
- Enhanced Ready Message
- Last PFS message request

The UE can control both Vibrators and Dynamite units on the same crew. To align the start times accurately with the **Boom Box** protocol, the speaker polarity in the Boom Box decoders must be **reversed** from the Vibrator units.

The Source Control Program allows control of most of the Boom Box parameters.

BBview_UE program that can be used instead of the Source Control program. MultiCom must be running on the computer before starting BBview_UE. This version of BBview selects the USB port at 57.6 K baud. This program allows full control of the Boom Box parameters.

**Advance II protocol – Shot Pro/Boom Box SP mode**

The Boom Box units will receive the Advance II start codes and transmit back the Advance II PFS information.
TheUE will not receive the Advance II PFS format

**Advance III protocol – Shot Pro/Boom Box VP mode**

The Boom Box units will receive the Advance III start codes and transmit back the Advance III (Vib Pro) PFS information. This is similar to the VP mode in the Shot Pro Units.

The UE can control both Vibrators and Dynamite units on the same crew. To align the start times accurately with the **ShotPro/Boom Box VP mode** protocol, the speaker polarity in the Boom Box decoders must be the **same** as the Vibrator units.

### 3.3.2 Shot Pro Operation

The Shot Pro Decoder units are capable of three different types of Radio protocols. (Boom Box, Advance II, and Advance III)

**Advance II protocol**

The Shot Pro units will receive the Advance II start codes and transmit back the Advance II PFS information. The UE will not receive PFS information in this mode**. Do Not Use.**

**Shot Pro Protocol - Shot Pro/Boom Box SP mode**

Shot Pro protocol receives Advance II Start Codes and sends back Advance III PFS information. With some radios, the Advance II start codes may be more reliable than the Advance III start codes.

When using Advance II start codes the following convention applies:

Similarity Vibrator Number is used to Select Shot Pro Unit ID (Sim vib number =15 selects all units)

UE Sweep number is used to select Shot Pro crew number. These numbers must match for the Decoder to fire. Suggest entering 15 for both

**Advance III protocol - Shot Pro/Boom Box VP mode**

The Shot Pro units will receive the Advance III start codes and transmit back the Advance III (Vib Pro) PFS information. Set the Shot Pro to VP mode.

The UE can control both Vibrators and Dynamite units on the same crew. To align the start times accurately with the **Shot Pro/Boom Box SP mode** protocol, the speaker polarity in the Shot Pro decoders must be the **same** as the Vibrator units.

### 3.4.1 Advance II version 5 Decoders

The Universal Encoder will start the Advance II decoder units when the Advance II start codes are selected.

The Keyboards Sweeps on the Advance II version 5 will not match the Universal Encoder (UE) sweeps.

Must use Stored Values mode to match UE's sweep generation. Suggest loading same Stored Values sweep in Advance II and in FLASH mode in UE.

Advance II PSS data will not be received by the UE.

Start Time should be adjusted to align the True Reference of the Advance II with the True Reference of the UE.

Because of the similarity filters used in Advance II version 5, the Radio Sims will show phase error when sweeps are correct.

It is recommended to not use Advance II version 5 units with UE, unless for short job like a VSP survey.

### 3.4.2 Advance II version 6 Decoders

The Universal Encoder will start the Advance II decoder units when the Advance II start codes are selected.

The Keyboards Sweeps on the Advance II version 6 will match the Universal Encoder (UE) sweeps. (**note: Do not use the Db/Hz sweeps**)

Advance II PSS data will not be received by the UE.

Start Time should be adjusted to align the True Reference of the Advance II with the True Reference of the UE

Align zero Radio Reference Delay to adjust the Radio similarities.

Wirelines sweeps will not match UE system

### 3.4.3 Vib Pro Decoders

The Universal Encoder will start the Vib Pro decoder units when the Vib Pro start codes are selected.

The Keyboards Sweeps on the Vib Pro unit will match the Universal Encoder (UE) sweeps

Vib Pro PSS type 12 and type 15 data will be received by the UE.

Start Time should be adjusted to align the True Reference of the Advance II with the True Reference of the UE

Wireline sweeps will match with the UE's Wireline Reference Signal

Align zero Radio Reference Delay to adjust the Radio similarities

The Parameter load of the Vib Pro Decoder units can be done using the Universal Encoder and the Pelton VPKOP program. A special "Com4all.dll" program provided by Seismic Source is required. This special program allows the Pelton KOP program to communicate via the USB port to the Universal Encoder.

- First run the "Source Control" Program
- Start the Pelton VPKOP program with the correct SSC "Com4all.dll"
- Source Control with Multicom must be running for the VPKOP program to run correctly
- Load and store parameters to the Vib Pro Decoders via radio using the VPKOP program

The sweep and operation parameters on the Vib Pro unit can also be entered via the Vib Pro Decoder's keyboard.

#### 3.4.3.1 Vib Pro Radio Polarity

The Radio Polarity on the Vib Pro and Force Two units are not identical
Speaker Polarity = Same
Microphone Polarity = Reversed

Example: For Force Two crew set to Mic and Speaker 'Normal Polarity", The Vib Pro unit must be set to Speaker Normal and Microphone Reversed for same operation.

## 3.5 Weight Drop Operation

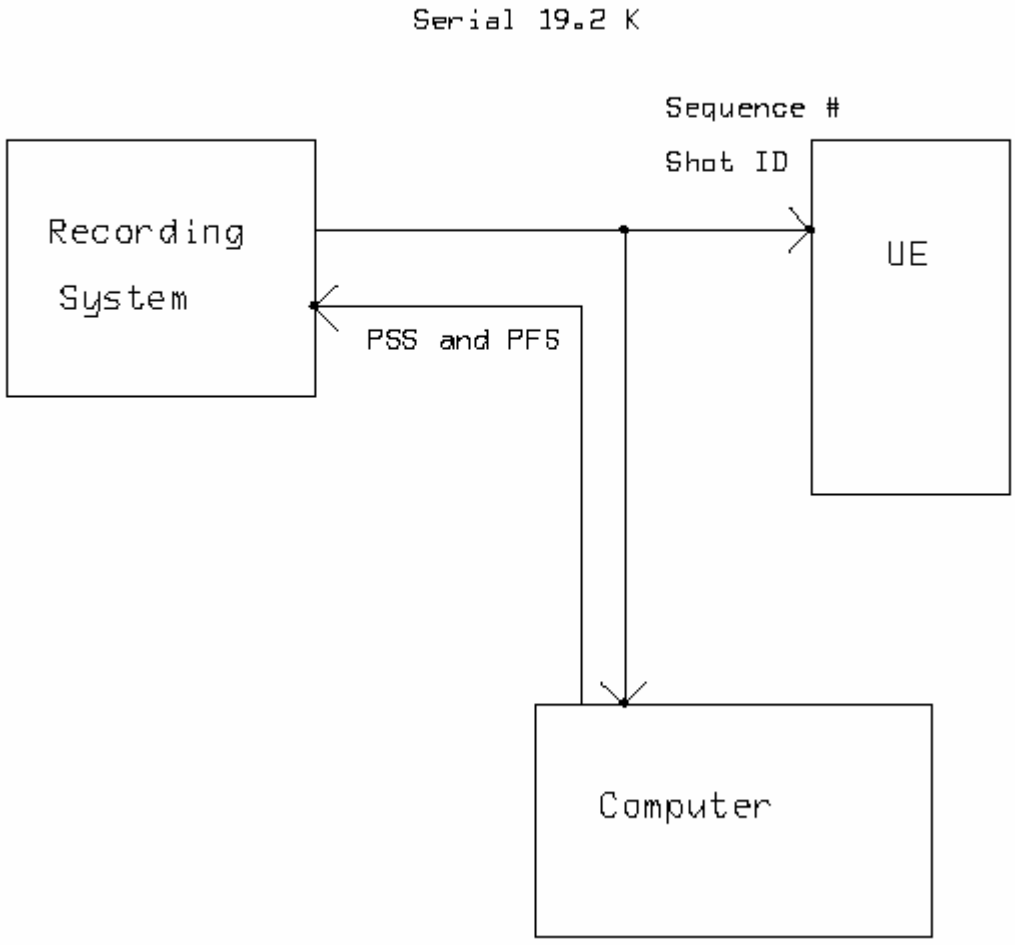
The Universal Encoder is designed to operate with the Seismic Source Weight Drop units.
The Sequence Table in the Source Control allows for selection of different source types. Select “Weight Drop” as the source when using the Weight Drop unit.

### 3.6 Recording Truck Interface

The Universal Encoder is designed to operate with various Recording systems. An advanced digital communication protocol is available with most of the new Recording systems. The interface is referred to as RTI (Recording Truck Interface)

#### 3.6.1 Standard Serial RTI

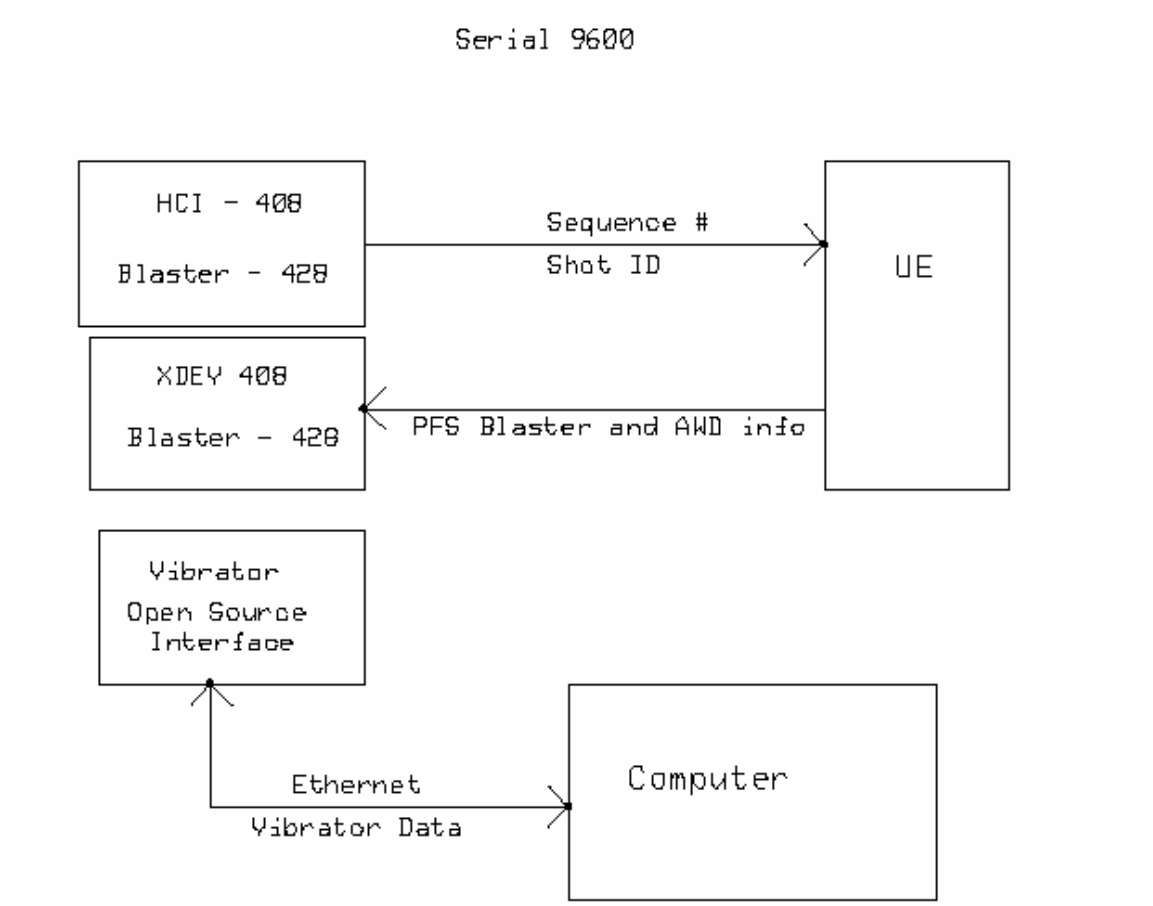
The UE receives the standard RTI messages from most recording systems at 19.2 K baud. The Computer running source Control sends the PSS, GPS and PFS data from the source control units to the Recording System. Because there are slight differences in the serial messages with different recording systems, be sure to select the correct recording system type on the UE and Source Control program.



### 3.6.2 Sercel RTI

The UE has a special RTI mode for the Sercel Recording System. The UE receives Sequence # and Shot ID data serially from the Sercel Recording System at 9600 baud. The UE also sends the GPS and PFS data from the source control units to the Recording System serially at 9600 baud.

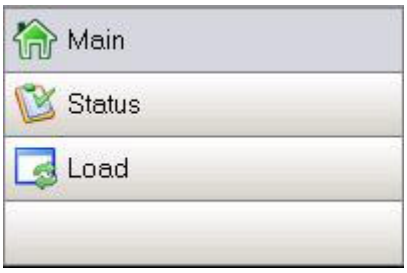
The Source Control program has a special Ethernet communication to the Sercel 428 recorder. This communication is used in Vibroseis mode.



# 4 Source Control Program Operation

## 4.1 Program Information

The Source Control program provides full control of the Force Two system. The program features following main screen of operation:



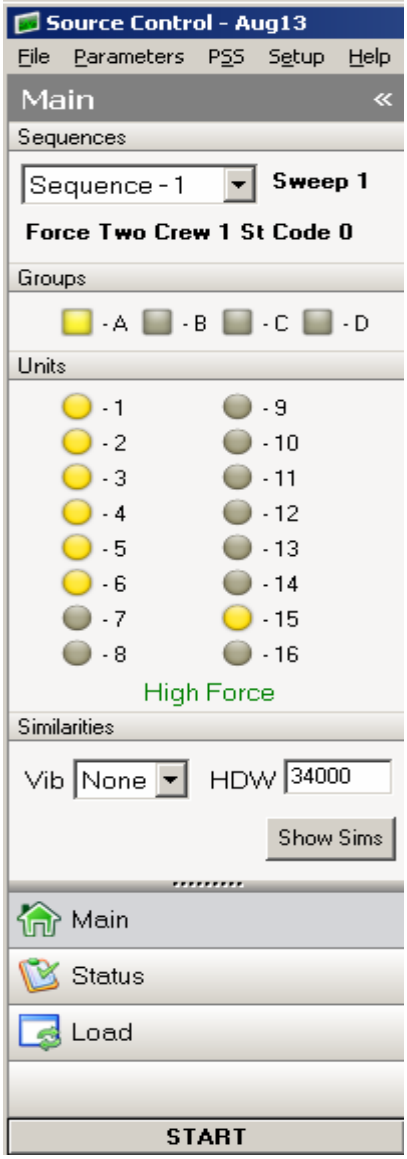

- **Main Window**-
  - Sequence Selection
  - Radio Similarity Selection
  - Viewing of Sweep number to be used
  - Viewing of Vibrator Group to be used
  - Viewing of PSS data
  - Viewing of Radio Similarities
- **Load Window**
  - Sweep Table-
  - Vibrator parameters
  - Encoder Parameters.
  - Sequence Parameters
  - Display Last Sweep Used
- **Status Window**
  - Request and print Vibrator Decoder Status information
  - Request GPS position information
  - Setting and Renaming Vibrator # and crew # - **Note this function can only be done in the Status menu**

## 4.2 Main Window

The Main window allows the user to select or view the following

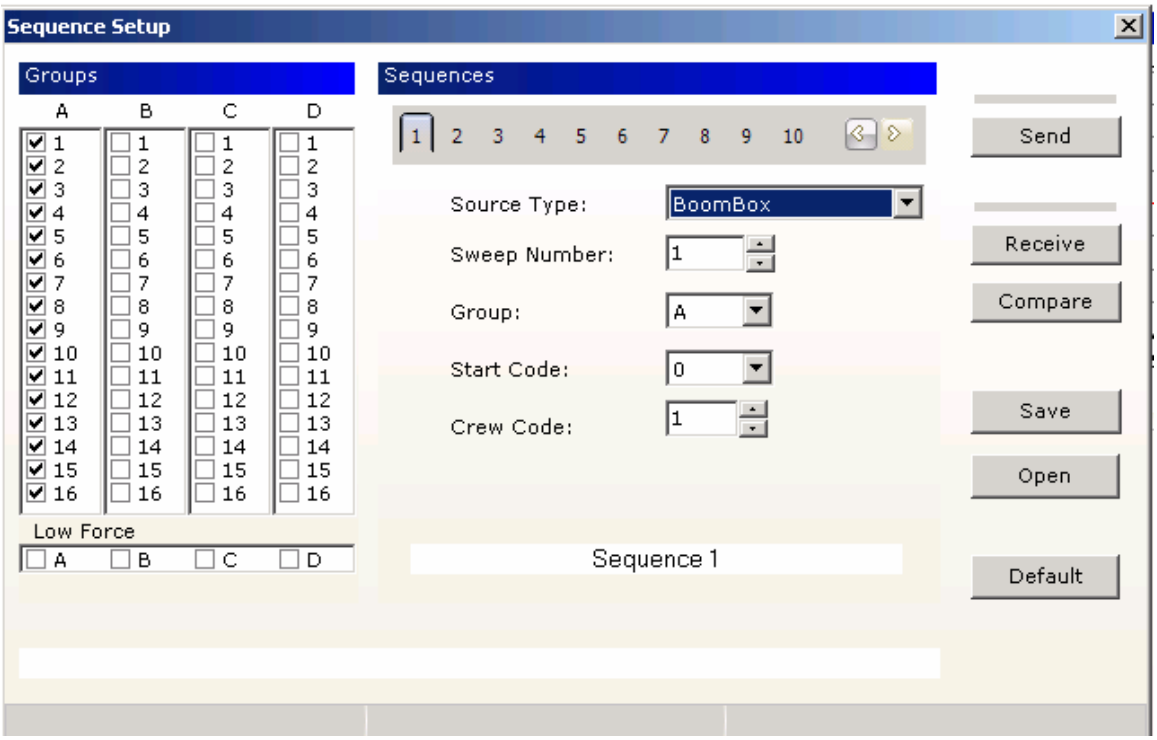
- the sequence number to be run
- select the vibrator to be used for similarities
- displays the Sweep number used for the selected sequence
- displays the vibrator group that is selected.
- Start the Pilot

The Recording Truck interface can be used to select the sequence numbers automatically; in this case the main window is only used to view the sequence result of the sweep that was initiated by the recording system.



### 4.2.1 Sequence Table Selection

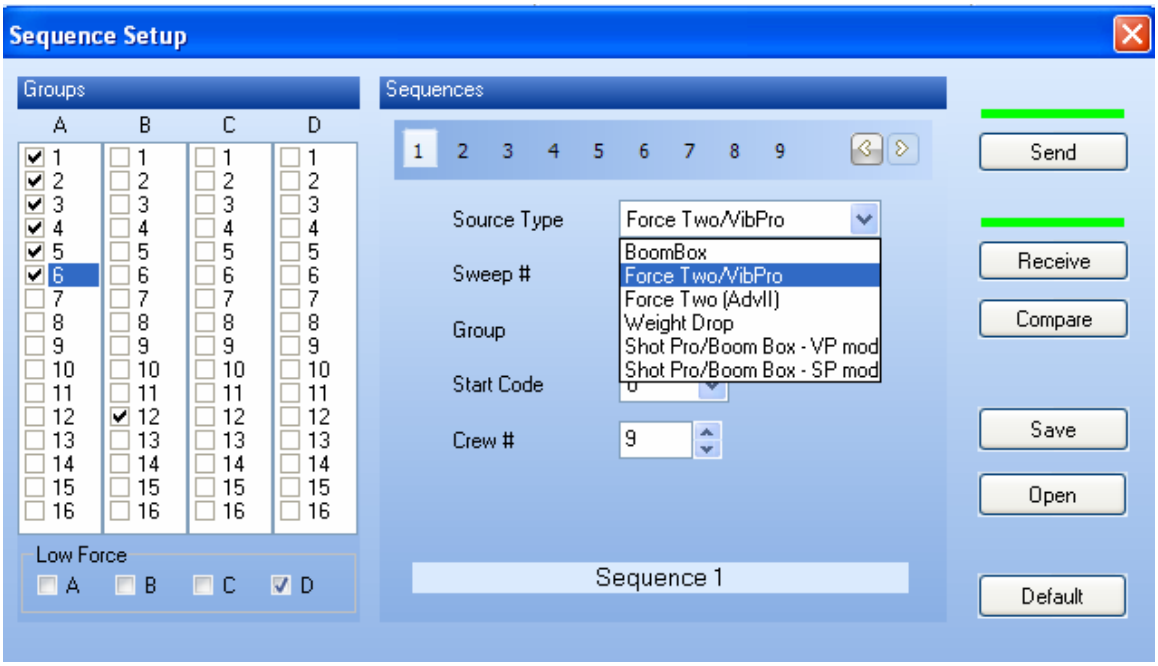
Before starting a vibrator unit, weight drop unit, or firing dynamite it is necessary to select what operation is to be performed. This setup is done in the Sequence Selection Parameters.
Go to the Parameter – Sequence Table menu. Or just click on the Groups or Units in the Main Window.




Each Sequence in the Sequence Table defines only one Encoder Start Command.

For each sequence number the following must be setup:

1. Source Type
    a. Boom Box – Select Boom Box mode when firing Boom Box units. This selects Boom Box Start Codes
    b. Force Two – Vib Pro Mode – Use this mode when firing Force Two vibrator units, Vib Pro Vibrator units, Shot Pro dynamite Units. This selects Vib Pro Start Codes
    c. Force Two – Advance II Mode – This option selects the Advance II start codes. This can be used to start the Force Two units, Shot Pro units, Boom Box units in Advance II mode.
    d. Weight Drop – Use this selection when operating with the Weight Drop Unit – RTM style decoders
    e. Shot Pro/Boom Box – VP mode - This selects Vib Pro type start codes
    f. ShotPro/Boom Box –SP mode – This selects Advance II type start codes

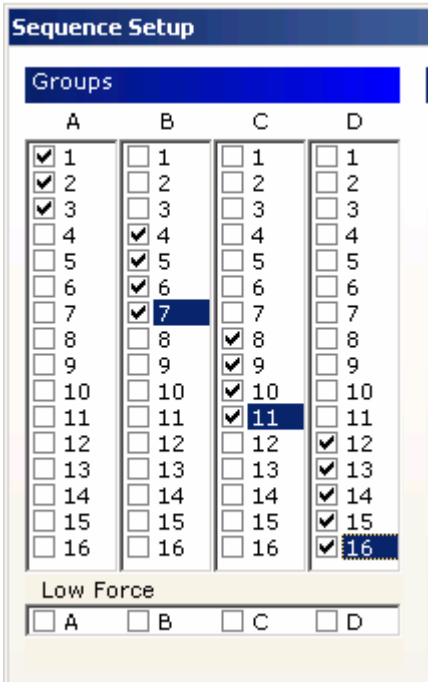



2. Sweep Number – The sweep number defines which sweep will be used when starting the vibrator group
3. Group – Selects which vibrator group will be started. The vibrator numbers must first be selected in the correct group. The Id number of the decoder must be enabled in the group for the decoder to start.
4. Start Code – Select the same start code as used in the Decoders. The Start code number must match for the decoder units to start.
5. Crew Code – Select the same crew number as used in the Decoders. The Crew code must match for the decoder units to start.

### 4.2.2 Vibrator Groups

The Vibrator groups must be selected before the decoders will start. The Vibrator Groups are selected in the Sequence Table menu.

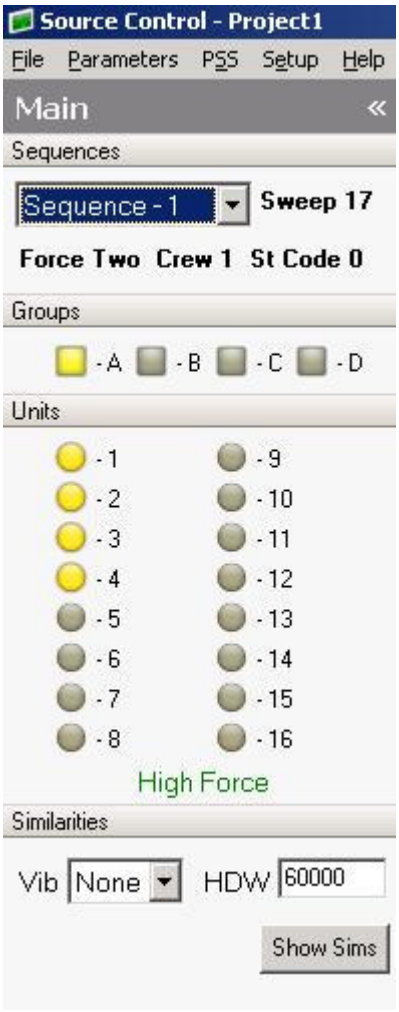
Go to the Parameter – Sequence Table menu. to setup the Vibrator Groups




To enable a decoder in a specific group, simply check the Decoder unit number under the Group letter. The above example shows Decoder units 1, 2 and 3 in Group A.

When starting vibrator units, Low Force can be selected by checking the Low Force box at the bottom of each group.

### 4.2.3 Main Start Window:



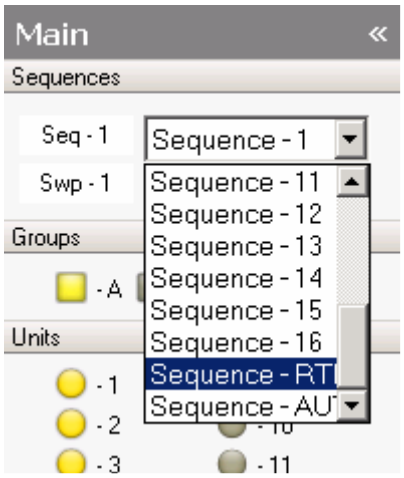

The main start window shows the following:

1. Sequence # Selected
2. Sweep # Selected by the Sequence Table information
3. Source Type: Force Two, Boom Box, etc..
4. Crew #
5. Start Code #
6. Vibrator Group information. To edit group information click on Groups and the edit Vibrator Group Window will appear.
7. Force Level setting. To edit Force Level selection, click on groups or units and the edit Vibrator Groups window will appear..
8. Vibrator Number for Similarity- Select the vibrator number to perform a vibrator similarity.
9. Press Show Sims to open Similarity Window to load stored similarity record from file.
10. HDW is hold down weight. This entry is used to scale the Force output plots of the similarities. Enter the correct HDW (Hold Down Weight) entry in this field before acquiring similarity.

After setting up and selecting the correct sequence table Press the “Start” button to manually start the sweep.

### 4.2.4 Start Sequence Selection

To Start a sweep first select the Sequence Table to be used.




For many jobs, a single sequence number can be assigned and used for the entire job.

Sequence RTI selection allows the Recording Truck Interface serial port to control which sequence to run. Select “Sequence RTI” to enable the RTI function.

When “Sequence Auto” is not currently implemented.

A single Sequence can also be selected. The start parameters in this sequence will be used until a new sequence is manually selected.

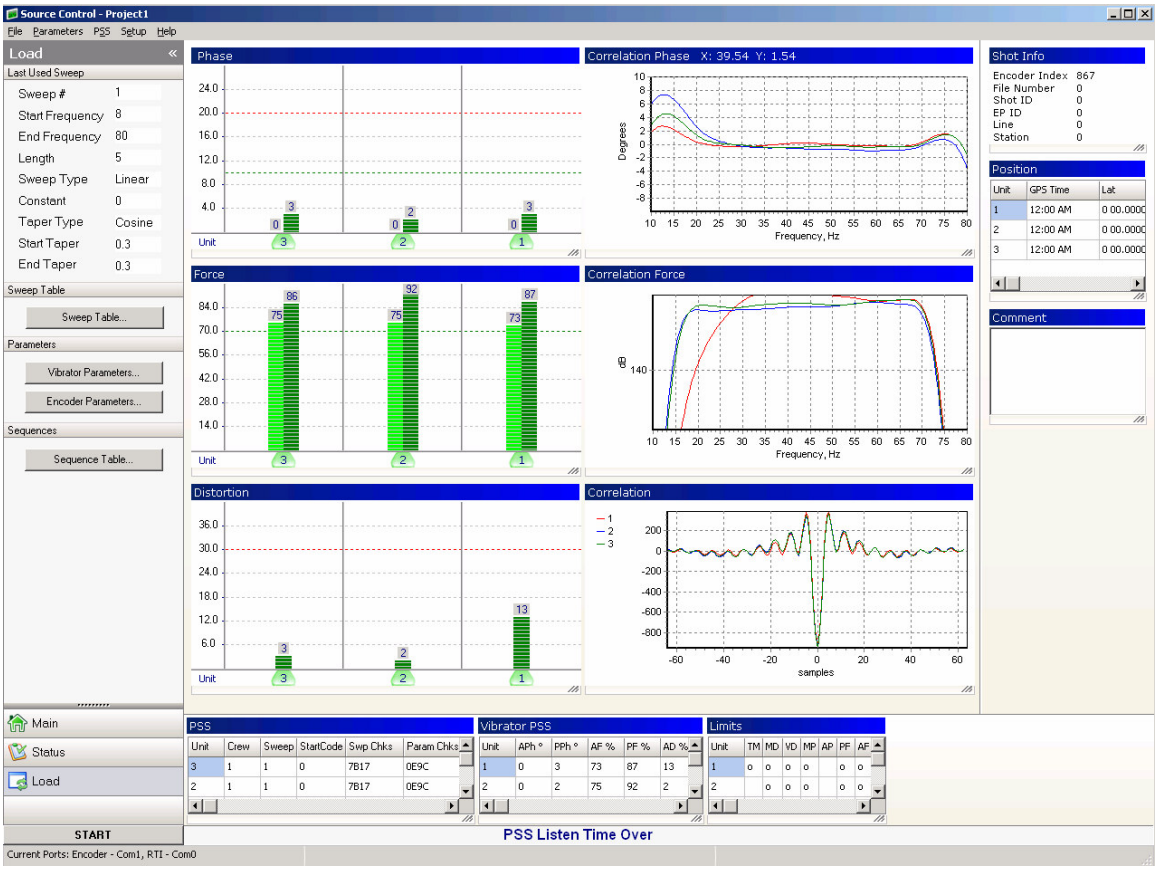
### 4.2.5 PSS Data

After each sweep, the Vibrator Decoder units send back quality control data to the Encoder. This quality control data is called **PSS**. The PSS data includes the following from the control system:

- Peak and average Phase Error
- Peak and average Force output
- Average distortion
- GPS position

In addition, cross correlation wavelet from the similarity system is sent back from each decoder.

The data from all active vibrators are overlaid on the graphs. To change a graph scale, right click inside of the graph select axis and enter upper and lower limits.

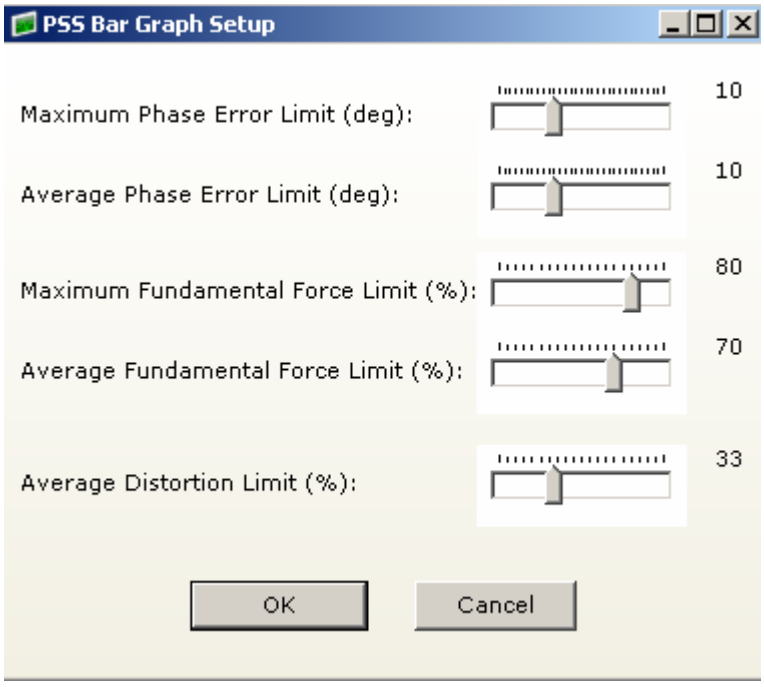


### 4.2.5.1 PSS Graph Error Limits

Right clicking the bar graphs or going to the PSS-Options menu will bring up the PSS Bar Graph Setup. This menu is used to setup the scaling of the bar graphs and the error limits.

An error will be shown if one of the following occurs:

- Actual Phase error exceeds the set Limit
- Actual Force Output is less than the set Limit
- Actual Harmonic Distortion is more than the set limit



### 4.2.5.2 PSS Limits and Error window

The Source Control Program can display errors and limits seen by the Force Two Decoder unit.

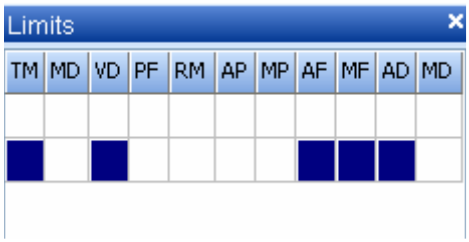
For the limits reached and phase and force errors a Limits window is displayed. For each limit that is reached, a blue mark is shown in the square.

**Each Decoder unit sets these Limits;**

**TM** = Torque Motor Current Reached
**MD** = Reaction Mass Displacement Reached
**VD**= Valve Displacement Limit reached
**PF** = Peak Force Limit reached
**RM** – Reaction Mass Force Reached
**AP** = Average Phase Error Reached – average phase error exceeded limit set in the Decoder
**MP** = Maximum Phase Error Reached – average phase exceeded limit set in the Decoder
**AF**= Average Force level not reached – Average Force did not reach entry in the Decoder Limit entries.
**MF**= Maximum Force Level not reached - Maximum Force did not reach entry in the Decoder Limit entries.
**AD** = average Distortion level exceeded - average distortion exceeded limit set in the Decoder
**MD** = Maximum distortion Level exceeded – Maximum distortion exceeded limit set in the Decoder

See figure below shows Limits reached for TM, VD, AF, MF, AD.

.



#### 4.2.5.3 Accelerometer Errors and Voltage Errors

The Source Control Program will display voltage and accelerometer errors detected by the Decoder units.

Every Sweep the Decoder units compare the phase and amplitude of the Loop and Sim Accelerometers. If the unit detects more than 10 degrees difference in phase or a 10 % difference in amplitude an error message is shown.

Do a radio similarity to verify the problem. If the radio similarity using the sim accelerometers is good, then everything is OK, and the accelerometer error is probably occurring during the tapers and should be ignored.

Sometimes the ground condition or sweep can cause this error, and the accelerometers are OK.

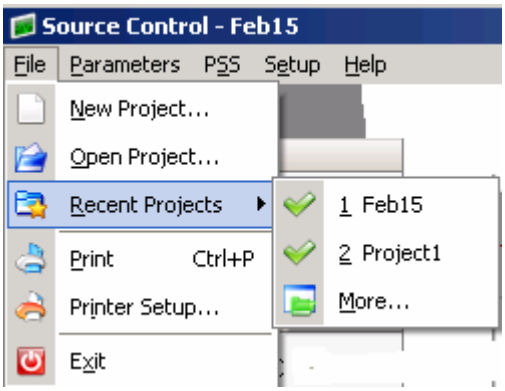
The Decoder units also monitor voltage readings; if any of the voltages go out of range an error message will appear.

### 4.2.5.4 Creating and Saving PSS data

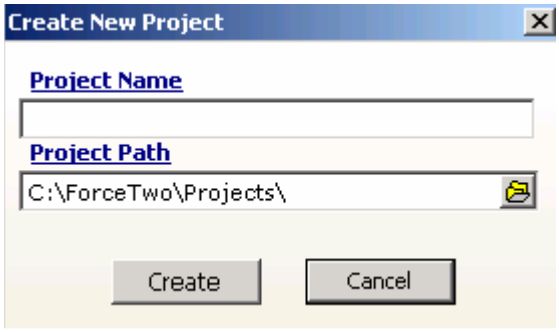
All PSS data is automatically saved to a file.

New PSS Files can be created by selecting New Project in the File Menu selections.

The ability to open Projects or view recent projects can also be selected in this menu.




After selecting New Project, a window appears which allows the user to select the name and path of the new project.




It is recommended to create a new PSS file at the start of each day or each new project.

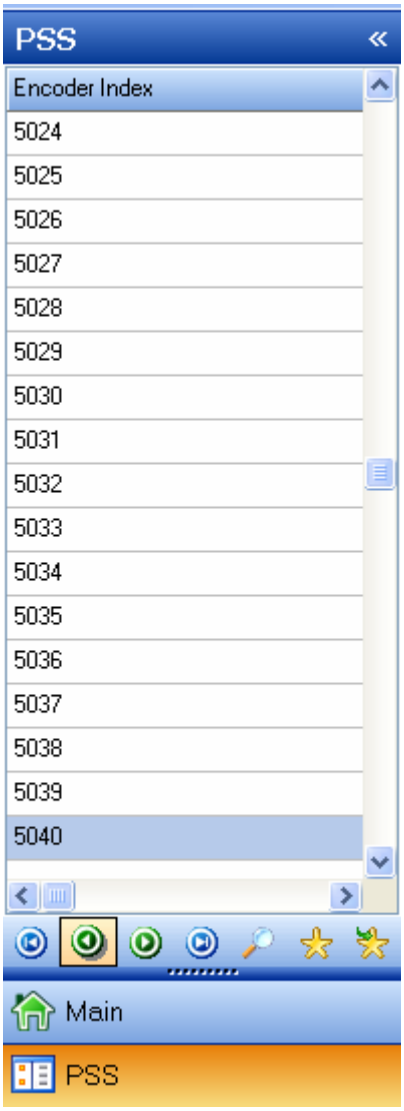
**Opening PSS records**

When program first starts, it automatically opens the last used project. To Open previously recorded data, select the File menu – Open Project or Recent Project to select the stored PSS file to be opened.

### 4.2.5.5 Viewing Saved PSS data

The saved PSS data can be viewed using the Source Control Program.

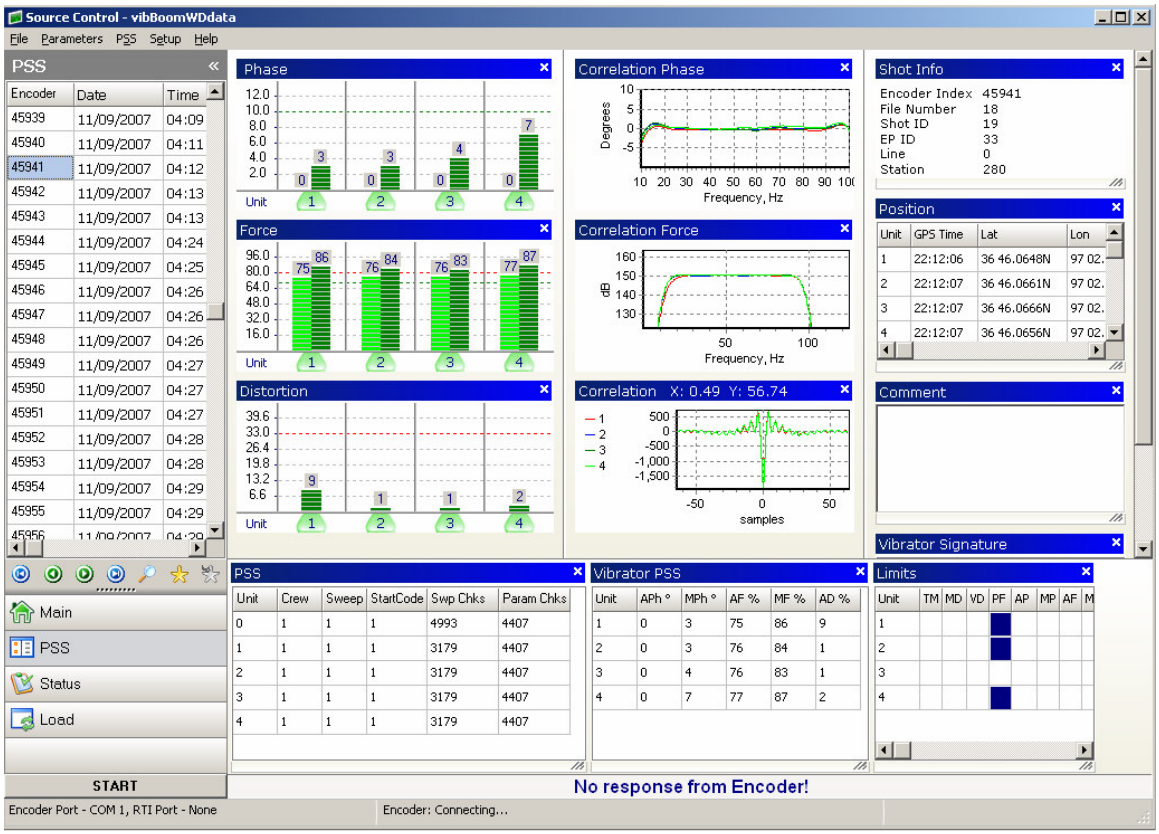
Press the “PSS Window Button” and a PSS explorer menu appears.




The “PSS Tool Bar” allows to do the following operations

- Go to the First Record
- Go back One Record
- Go Forward One Record
- Go to Last Record
- Go to specific Encoder Index
- Mark a Record as a “Bookmark”
- Go to “Bookmarked” record

Clicking on Encoder Index will display the data from the current index number

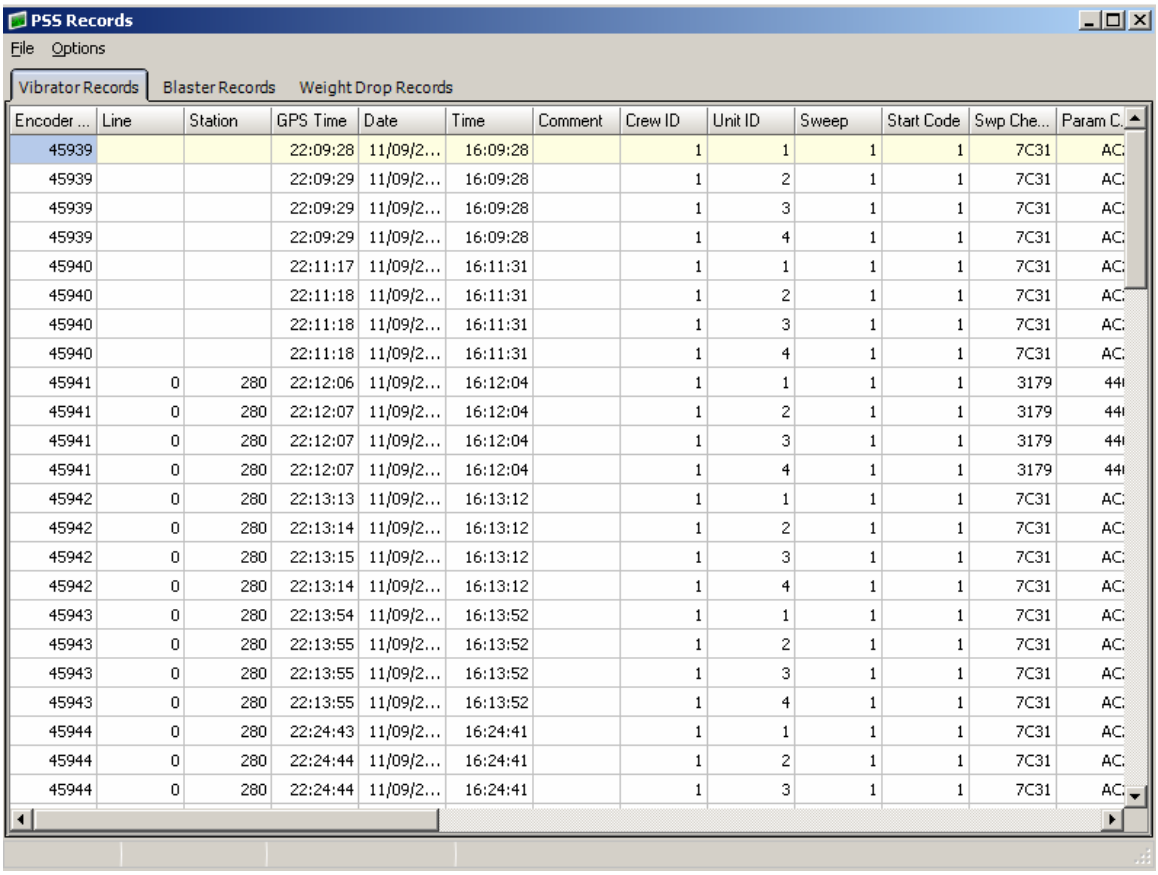


### 4.2.6 PSS report

Go to the PSS – PSS Report menu to enter the PSS Report Menu.

The PSS records will be shown. The records will automatically be sorted by source type

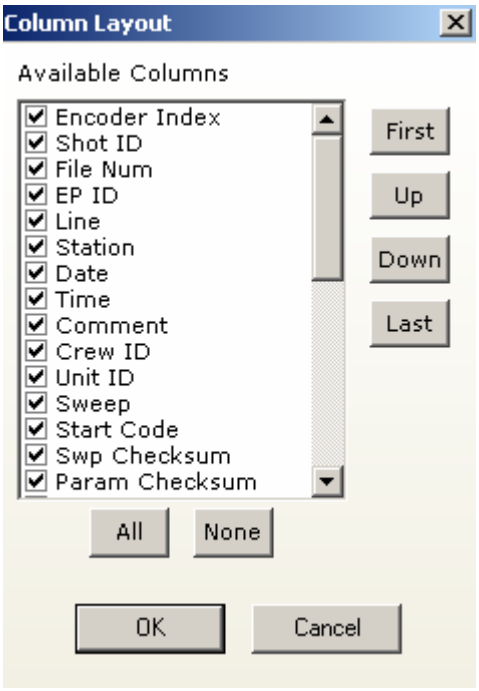
- Vibrator Records
- Blaster Records
- Weight Drop Records




| Encoder ... | Line | Station | GPS Time | Date | Time | Comment | Crew ID | Unit ID | Sweep | Start Code | Swp Che... | Param C... |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 45939 | | | 22:09:28 | 11/09/2... | 16:09:28 | | 1 | 1 | 1 | 1 | 7C31 | AC: |
| 45939 | | | 22:09:29 | 11/09/2... | 16:09:28 | | 1 | 2 | 1 | 1 | 7C31 | AC: |
| 45939 | | | 22:09:29 | 11/09/2... | 16:09:28 | | 1 | 3 | 1 | 1 | 7C31 | AC: |
| 45939 | | | 22:09:29 | 11/09/2... | 16:09:28 | | 1 | 4 | 1 | 1 | 7C31 | AC: |
| 45940 | | | 22:11:17 | 11/09/2... | 16:11:31 | | 1 | 1 | 1 | 1 | 7C31 | AC: |
| 45940 | | | 22:11:18 | 11/09/2... | 16:11:31 | | 1 | 2 | 1 | 1 | 7C31 | AC: |
| 45940 | | | 22:11:18 | 11/09/2... | 16:11:31 | | 1 | 3 | 1 | 1 | 7C31 | AC: |
| 45940 | | | 22:11:18 | 11/09/2... | 16:11:31 | | 1 | 4 | 1 | 1 | 7C31 | AC: |
| 45941 | 0 | 280 | 22:12:06 | 11/09/2... | 16:12:04 | | 1 | 1 | 1 | 1 | 3179 | 44I |
| 45941 | 0 | 280 | 22:12:07 | 11/09/2... | 16:12:04 | | 1 | 2 | 1 | 1 | 3179 | 44I |
| 45941 | 0 | 280 | 22:12:07 | 11/09/2... | 16:12:04 | | 1 | 3 | 1 | 1 | 3179 | 44I |
| 45941 | 0 | 280 | 22:12:07 | 11/09/2... | 16:12:04 | | 1 | 4 | 1 | 1 | 3179 | 44I |
| 45942 | 0 | 280 | 22:13:13 | 11/09/2... | 16:13:12 | | 1 | 1 | 1 | 1 | 7C31 | AC: |
| 45942 | 0 | 280 | 22:13:14 | 11/09/2... | 16:13:12 | | 1 | 2 | 1 | 1 | 7C31 | AC: |
| 45942 | 0 | 280 | 22:13:15 | 11/09/2... | 16:13:12 | | 1 | 3 | 1 | 1 | 7C31 | AC: |
| 45942 | 0 | 280 | 22:13:14 | 11/09/2... | 16:13:12 | | 1 | 4 | 1 | 1 | 7C31 | AC: |
| 45943 | 0 | 280 | 22:13:54 | 11/09/2... | 16:13:52 | | 1 | 1 | 1 | 1 | 7C31 | AC: |
| 45943 | 0 | 280 | 22:13:55 | 11/09/2... | 16:13:52 | | 1 | 2 | 1 | 1 | 7C31 | AC: |
| 45943 | 0 | 280 | 22:13:55 | 11/09/2... | 16:13:52 | | 1 | 3 | 1 | 1 | 7C31 | AC: |
| 45943 | 0 | 280 | 22:13:55 | 11/09/2... | 16:13:52 | | 1 | 4 | 1 | 1 | 7C31 | AC: |
| 45944 | 0 | 280 | 22:24:43 | 11/09/2... | 16:24:41 | | 1 | 1 | 1 | 1 | 7C31 | AC: |
| 45944 | 0 | 280 | 22:24:44 | 11/09/2... | 16:24:41 | | 1 | 2 | 1 | 1 | 7C31 | AC: |
| 45944 | 0 | 280 | 22:24:44 | 11/09/2... | 16:24:41 | | 1 | 3 | 1 | 1 | 7C31 | AC: |

### 4.2.6.1 Options – Column Settings

Options – Column Settings menu is used to select the data to be shown and exported to a file. The order of the columns can be moved with the First, Up, Down, and Last buttons. The order of the columns can also be moved by Left clicking and dragging the column in the PSS records menu




### 4.2.6.2 Options – Reset Columns

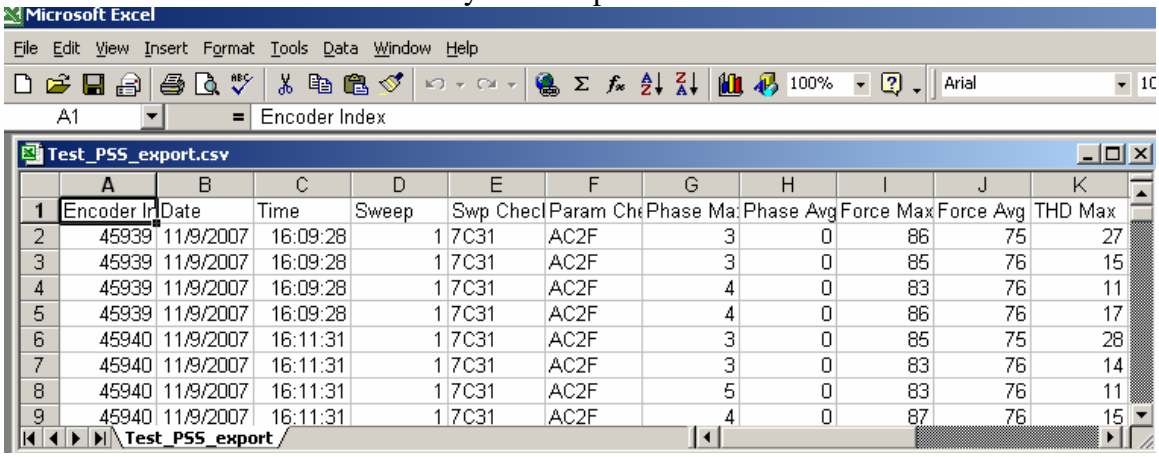
Options – Reset Columns is used to reset the columns settings to the default parameters.

### 4.2.6.3 PSS Export

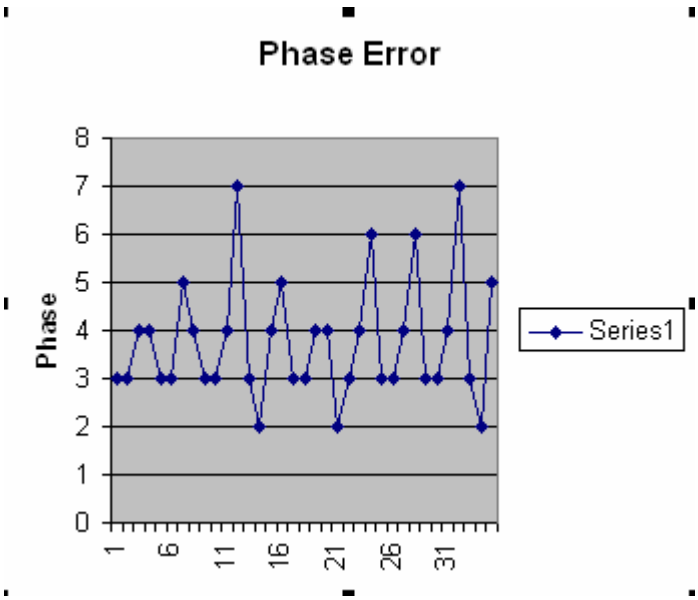
Go the File – PSS export menu to export the data to a *.CSV file

The columns selected will be exported to the file name selected.

Microsoft Excel can be used to analyze the exported data file




| | A | B | C | D | E | F | G | H | I | J | K |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Encoder In | Date | Time | Sweep | Swp Chec | Param Che | Phase Ma | Phase Avg | Force Max | Force Avg | THD Max |
| 2 | 45939 | 11/9/2007 | 16:09:28 | 1 | 7C31 | AC2F | 3 | 0 | 86 | 75 | 27 |
| 3 | 45939 | 11/9/2007 | 16:09:28 | 1 | 7C31 | AC2F | 3 | 0 | 85 | 76 | 15 |
| 4 | 45939 | 11/9/2007 | 16:09:28 | 1 | 7C31 | AC2F | 4 | 0 | 83 | 76 | 11 |
| 5 | 45939 | 11/9/2007 | 16:09:28 | 1 | 7C31 | AC2F | 4 | 0 | 86 | 76 | 17 |
| 6 | 45940 | 11/9/2007 | 16:11:31 | 1 | 7C31 | AC2F | 3 | 0 | 85 | 75 | 28 |
| 7 | 45940 | 11/9/2007 | 16:11:31 | 1 | 7C31 | AC2F | 3 | 0 | 83 | 76 | 14 |
| 8 | 45940 | 11/9/2007 | 16:11:31 | 1 | 7C31 | AC2F | 5 | 0 | 83 | 76 | 11 |
| 9 | 45940 | 11/9/2007 | 16:11:31 | 1 | 7C31 | AC2F | 4 | 0 | 87 | 76 | 15 |



### 4.2.7 Radio Similarities

To enable Radio Similarities select the Vibrator number for the Radio Similarities.

Enter the correct HDW entry (Hold Down Weight) .

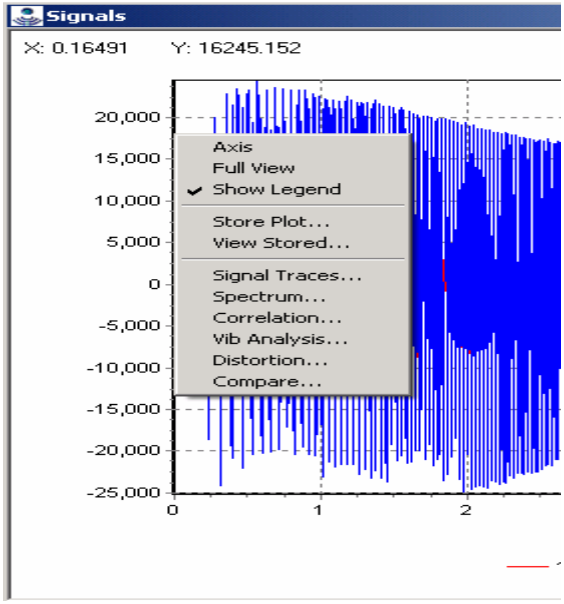
The similarity window will automatically open when similarity is selected and the sweep starts.

To load stored similarity data from a file, first press the "**Show Sims**" button to view the similarity window then open the file menu and load the stored similarity data.

Right click inside of graph selects pop-up menu. The menu options provide several options for different graphs, as well as scale limits for each graph.

An example of similarity screen is shown below.
Right clicking on the graph brings up the "Graph Menu"

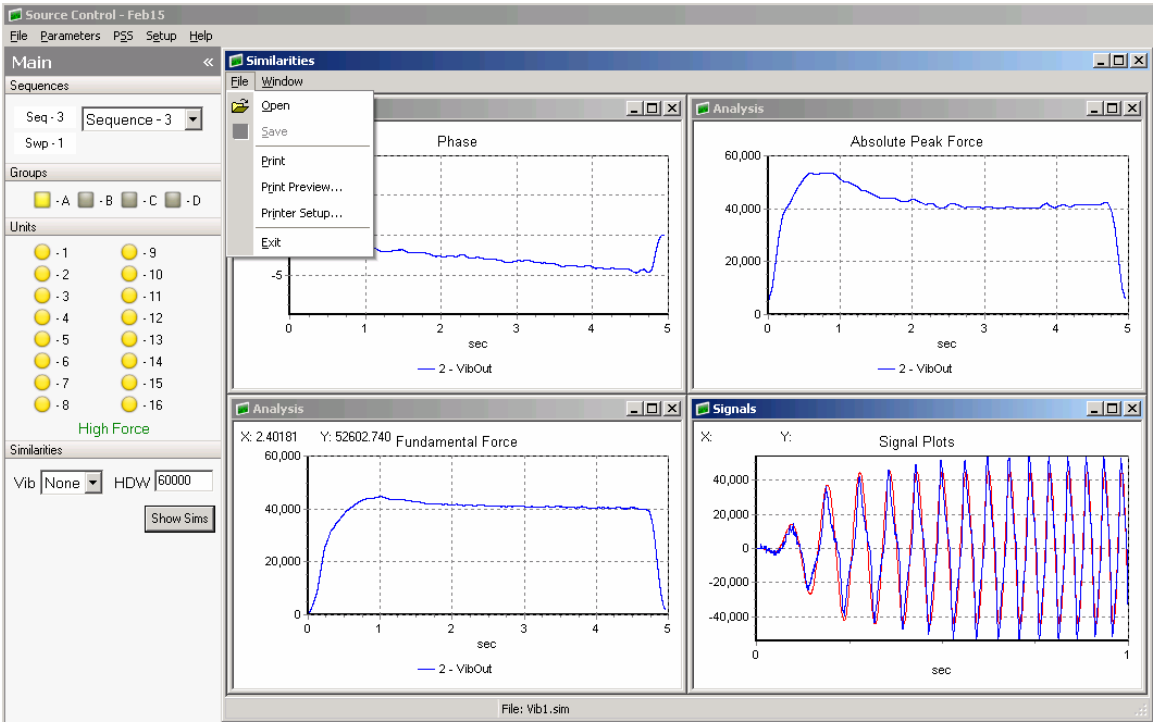
Axis selection allows changing the X and Y axis scaling



### 4.2.7.1 Radio Similarity Analysis

Each Graph can have a different view of the similarity signal.
Use Window – New Plot to open a new graph and select one of the many options:

1. Signal traces shows the signals in the Time Domain
2. Spectrum shows the signals in the Frequency domain
3. Correlation in the time domain; and phase and amplitude in the frequency domain.
4. Vib Analysis Plots for :
    1. Phase comparison plot
    2. Fundamental Force
    3. Peak Force
    4. Time vs. Frequency



These selections are available in the plot popup menu. On any plot press the right mouse button to bring up the plot menu.


Figure 4.2.7.2 Plot Popup Menu

Axis allows changing of the x and y axis of the plot.

Full view or ctrl +F zooms out completely to show all of plot.

Show Legend –enables and disables the text legend at the bottom of the plot.

### 4.2.7.2 Similarity Overlays - Store Plot Menu

**Store Plot** – allows the current plot to be saved to memory and viewed later as an overlay to another signal. The first trace in a plot will be stored. The color and name of each stored plot can be changed in the Store Plot Menu. The stored plot data can be saved and later loaded from disk with the Save and Load buttons in the Save Plot menu. The store plot menu is used to compare data using the same sample rate. Data acquired using different sample rates will not be displayed correctly.

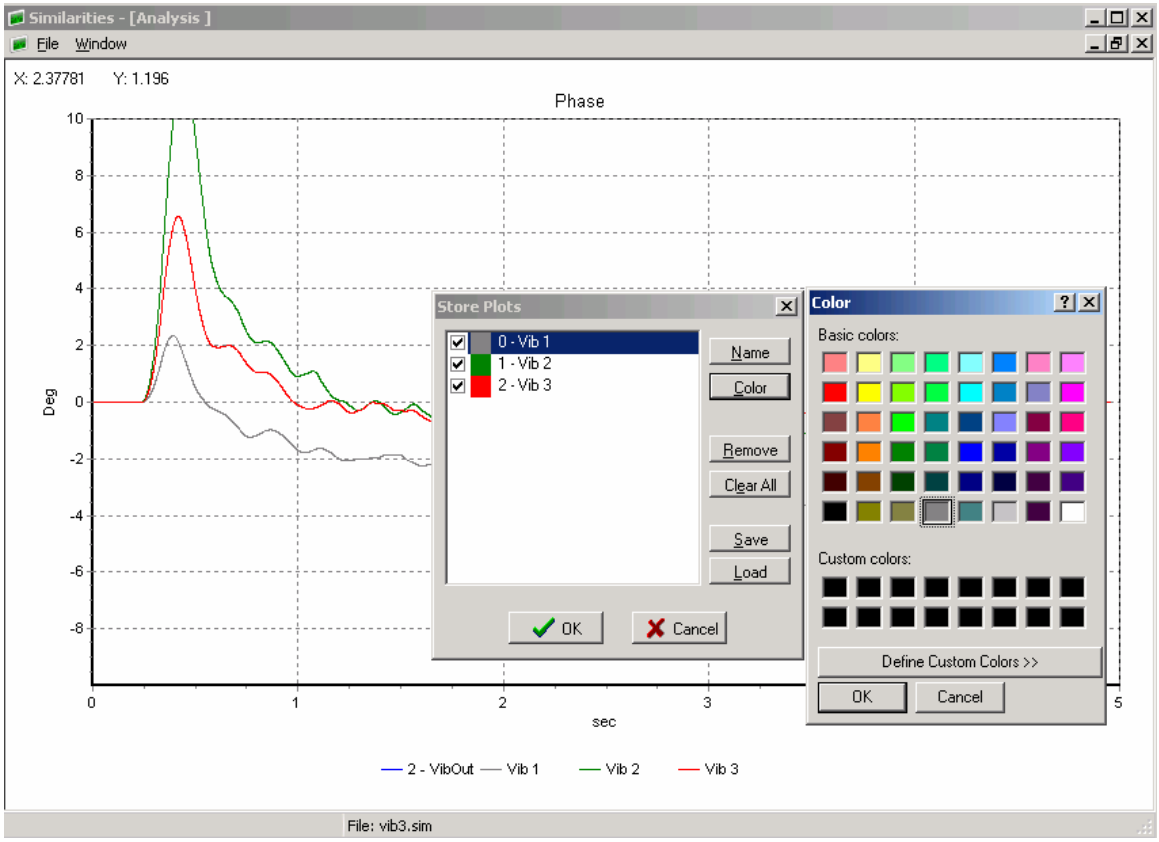


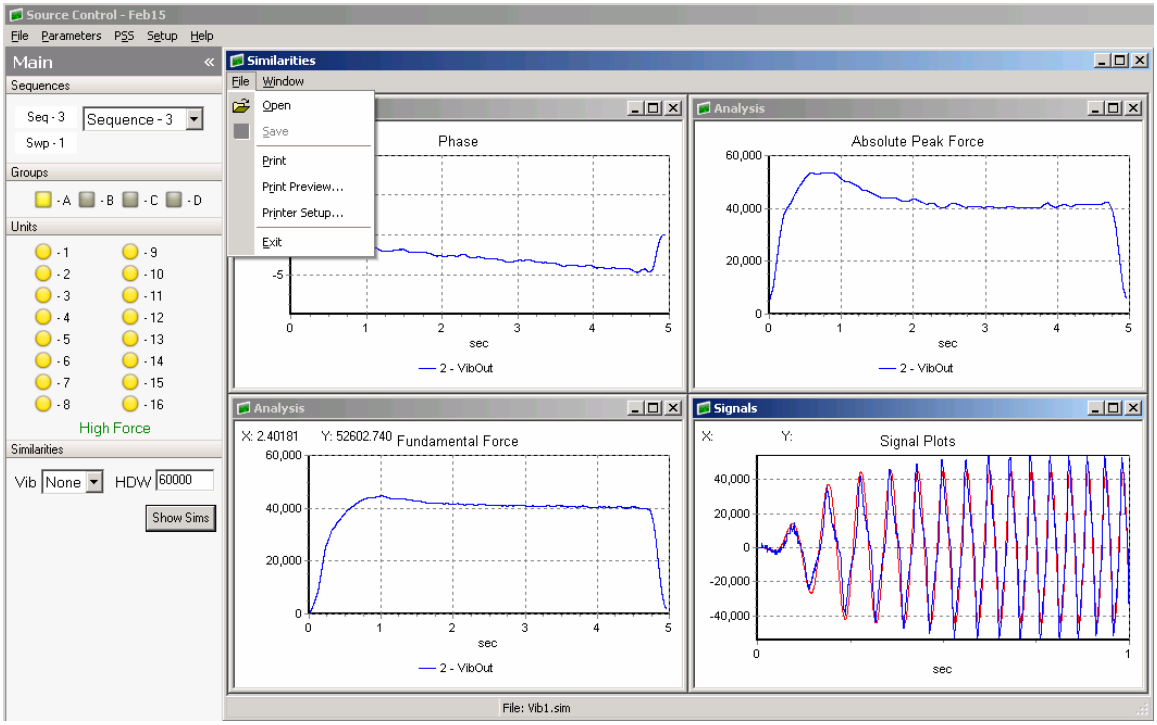

Figure 4.2.7.2 Store Plot Menu

**View Stored** – used to change settings of overlaid plots and to save or retrieve data from file.

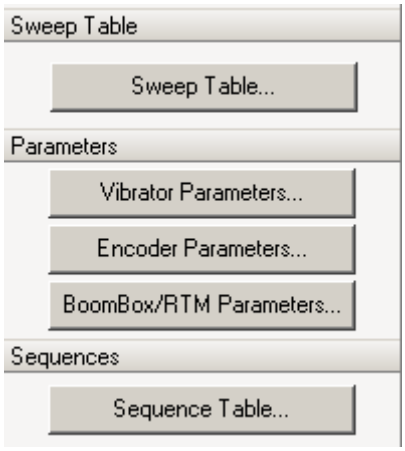
### 4.2.7.3 Loading and Saving Similarity Data

To Save and Load Similarity data select the File Menu- in the similarity Window. This allows the similarity data to stored to disk or loaded from disk for later analysis.

Press the "**Show Sims**" button to view the similarity window



## 4.3 Load Menu




The **Load Menu** allows to setup the vibrator and encoder electronics. The following load menus are available:

- **Sweep Table** – Load, save, and compare the sweep parameters of the Vibrator and Encoder units
- **Vibrator Parameters** – Load, save and compare the Vibrator control parameters
- **Encoder Parameters** – Load, save and compare the Encoder parameters.
- **Boom Box/RTM Parameters** – Load, save and compare Boom Box or RTM parameters
- **Sequence Table** – Load, save and compare the Sequence Table parameters. See Section 4.2.1 Sequence Table. Sequence Table Parameters include:
    - Vibrator Group Selection and control
    - Sweep number selection
    - Source Type – Vibrator, Dynamite, or Weight Drop
    - Start code

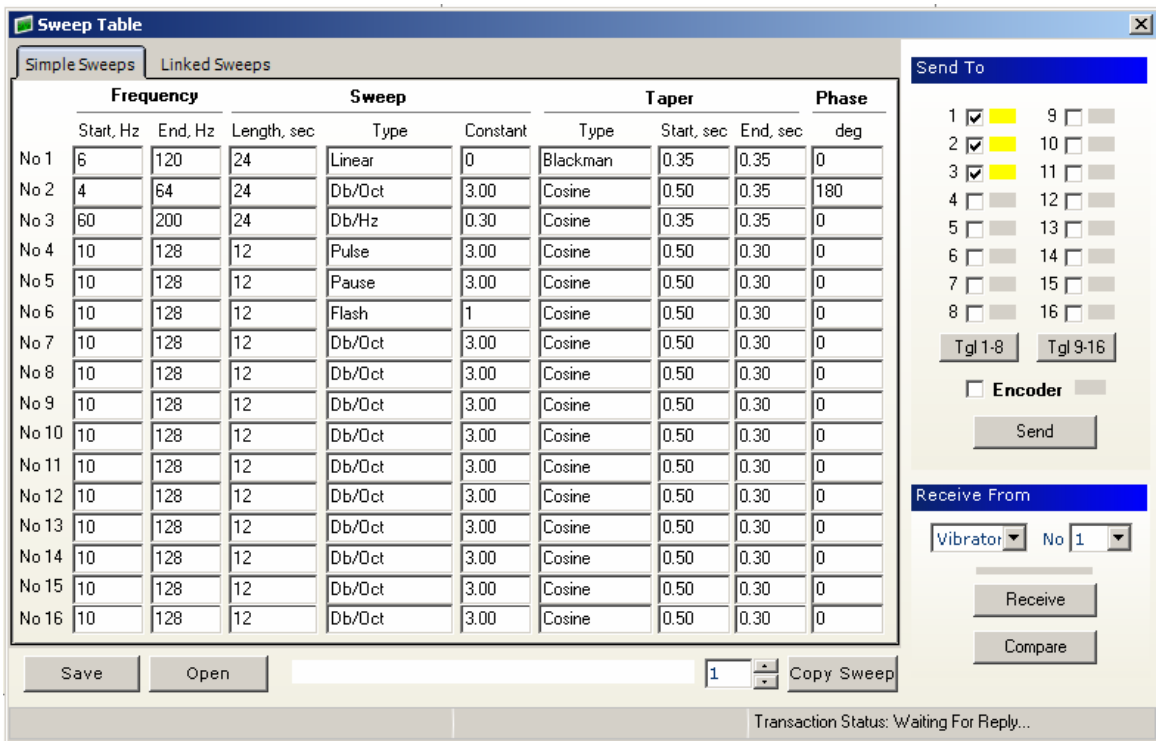
Each Load Menu allows the user to:

- Edit Entries
- Save Entries to file
- Compare Entries
- Send Entries via radio or direct connection
- Receive Entries via radio or direct connection

**The Vibrator Electronics Require that the following important entries be manually entered (See Loading Vibrator Parameter section of manual):**

- Valve Feedback
- Mass Feedback
- Mass Position (Mass Offset)

### 4.3.1 Sweep Table




16 different sweeps can be defined in the standard sweep library. Each sweep parameter range limit is displayed when it is active (being selected) just below the table of sweeps.

There are six sweep types defined: Linear, Pulse, T-Power, Pause, dB/Oct and dB/Hz. For each sweep type a constant value can be entered. For example: to enter a 5-120 Hz 6 second 3 dB/Octave sweep. Select Sweep Type = Db/oct and Constant = 3.00.

After defining the sweeps, the following actions can be performed

1. Send sweeps to Encoder and Vibrator Electronics
2. Receive sweep table form Encoder or Vibrator Electronics
3. Compare Sweeps from Encoder or Vibrator Electronics
4. Save or Open Sweep table to file

#### 4.3.1.1 Flash Sweeps – Stored Sweeps

Special Custom sweeps can be designed and stored on Compact Flash Cards.

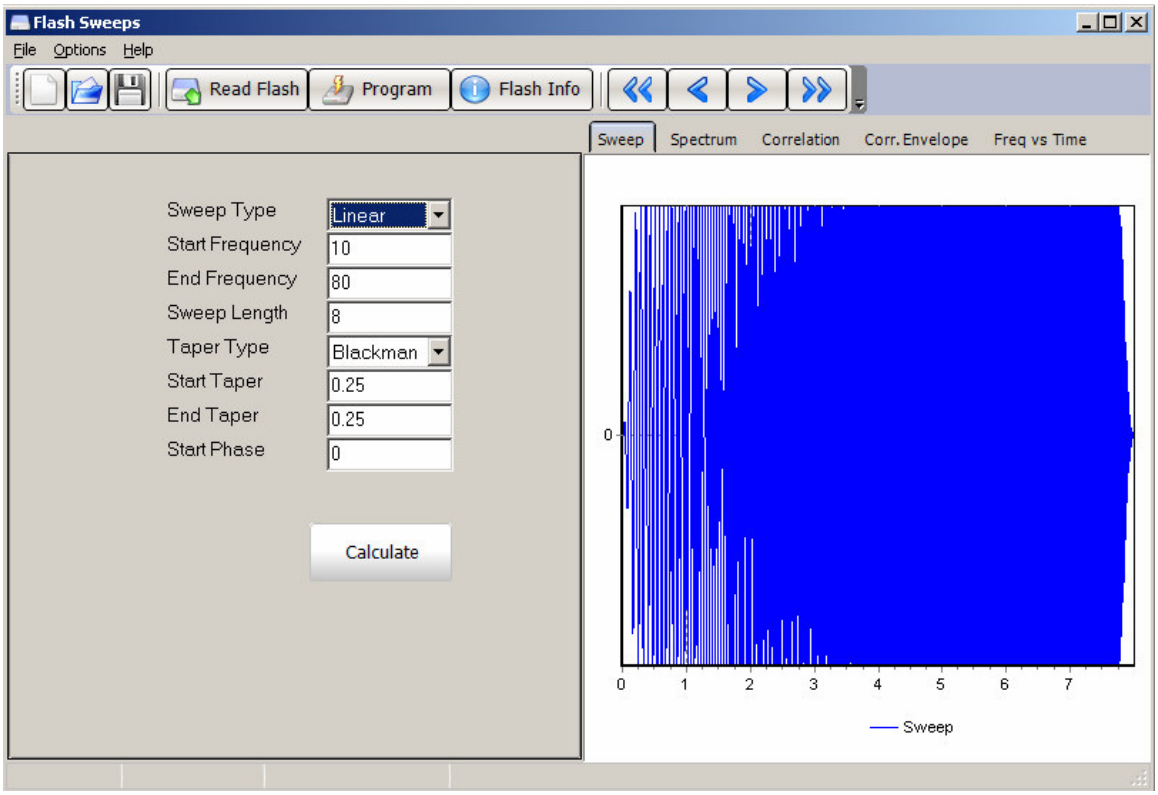
These Compact Flash Cards can be programmed using a PC computer and the “Flash Sweep” software program.

The programmed Compact Flash Cards are inserted into the DSP cards in each of the Vibrator Electronics and the Universal Encoder.

Select Sweep Type “Flash” to select the Flash sweeps.

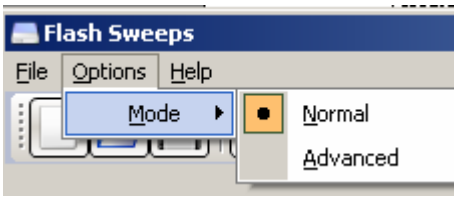
The “constant” entry determines which Sweep number stored on the compact flash will be used

Start the Flash Sweep Program

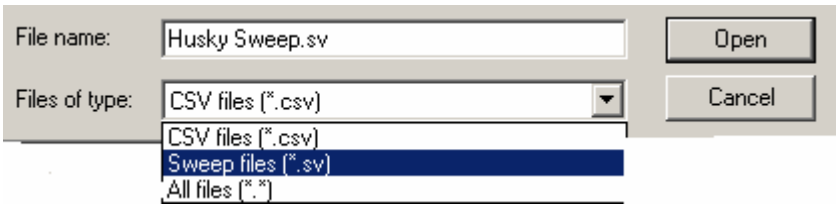



The Flash Sweep program has two modes of operation

- Normal – Allows entry of a single segment
- Advanced – Allows entry of multiple segment sweeps

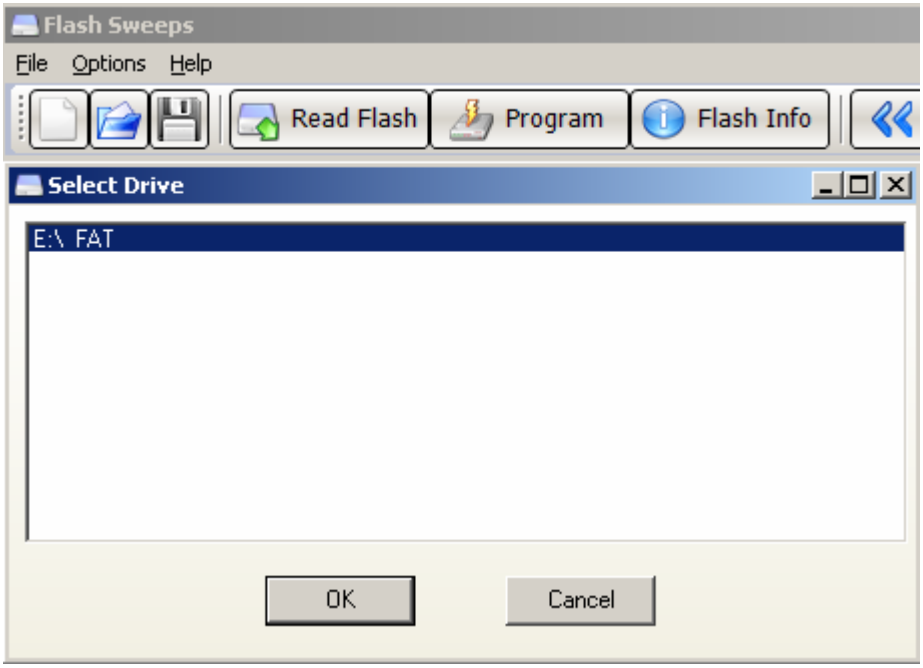



The Flash Sweep program can read the *.sv file designed for the Pelton Advance II vibrator electronics



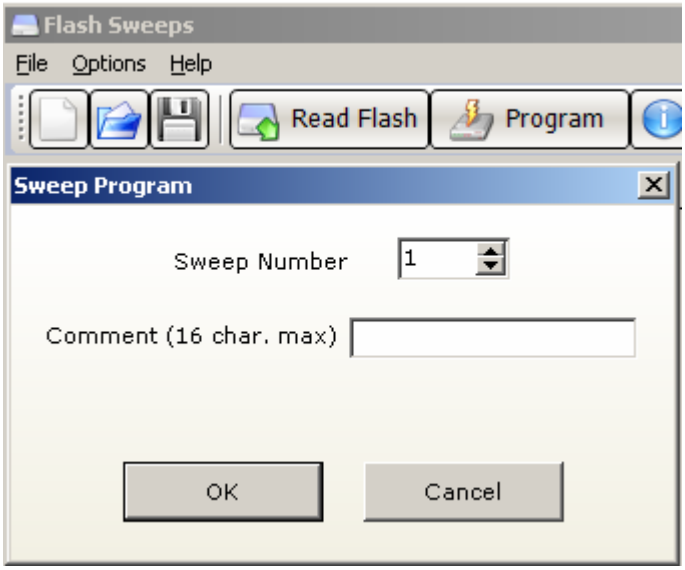

After designing the sweep and verifying the design with the multiple plot options, the sweep should be stored to the Flash Card.

Insert the Flash Card into the computer. Press the Program button on the screen and select the Flash Card to be programmed.




Select OK

Then Select the Sweep number to program into the Flash Card, and the comment for the Sweep Design




Other sweeps can be programmed on the card.

After programming all of the sweeps remove the Flash card from the computer and install in the DSP card in each of the Force Two Decoders and the Universal Encoder.

### 4.3.1.2 Linked Sweeps

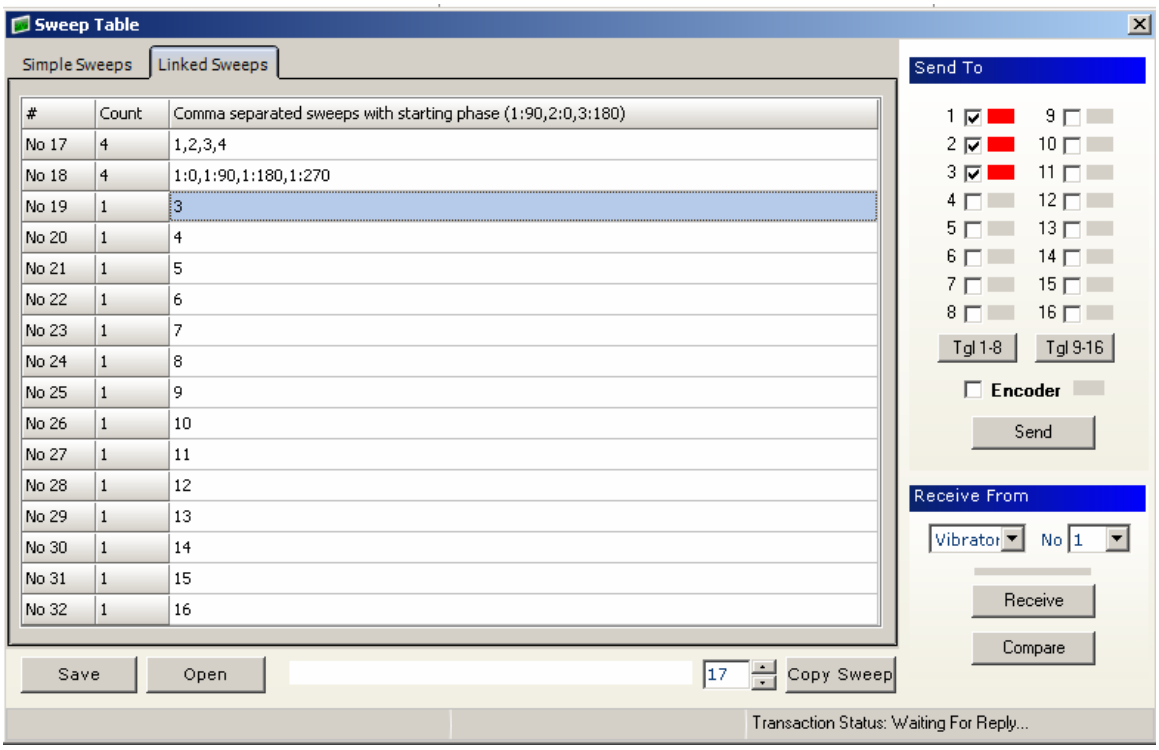
Sweep numbers 17 through 32 are reserved for the special “Linked Sweeps”.

The 16 defined sweeps in sweep number 1 through 16 can be used to define a complex multi- sweep combination using the Linked Sweep mode.

Different sweep numbers with different starting phases can be entered in the Linked Sweep definition

Sweep 17 shown below, has an entry of 1,2,3,4. This will run a 4 sweep linked sweep, first sweep is sweep 1, then sweep 2, then sweep 3, then sweep 4. All sweeps will have 0 starting phase.

Sweep 18 shown below, has an entry of 1:0,1:90,1:180,1:270. This will run a 4 sweep linked sweep, the first sweep will be sweep 1 with 0 degrees starting phase, the second segment will be sweep 1 with 90 degrees starting phase, the third segment will be sweep 1 with 180 degrees starting phase, the fourth segment will be sweep 1 with 270 degrees starting phase.



### 4.3.2 Vibrator Parameters

The Vibrator Parameters edit dialog divides parameters into six groups: Vibrator Characteristics, Controls, Servo, Radio, Advanced and Limits & Errors.

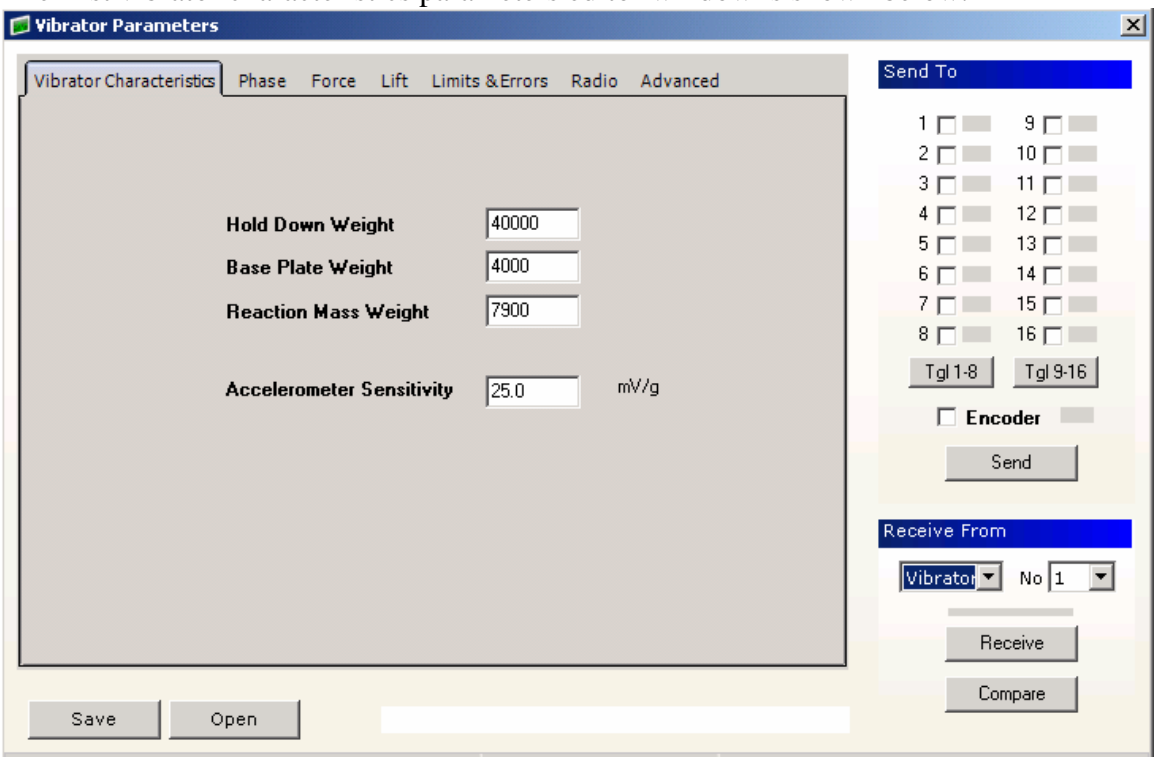
All the Vibrators Parameters groups are sent or received with a single request.

**The Critical Parameters in the Radio parameter group will only be received by the Vibrator Decoder units if the Vibrator and crew numbers match in the:**
**Critical parameters**
**Send to units**
**Vibrator Decoder ID entry**.

The Vibrator Parameters can be saved or loaded from a file completely independently from the Sweep Parameters.

### 4.3.2.1 Vibrator Characteristics

The first vibrator characteristics parameters editor window is shown below.




**All weight parameters can be entered in pounds or in kg. All weights must entered in the same units.**

**Accelerometer sensitivity**, mV/g- Sensitivity of system accelerometers in millivolts per g of acceleration. Allowable range is 1 to 99.9 mV/g. Seismic Source accelerometers are 25 mV/g.

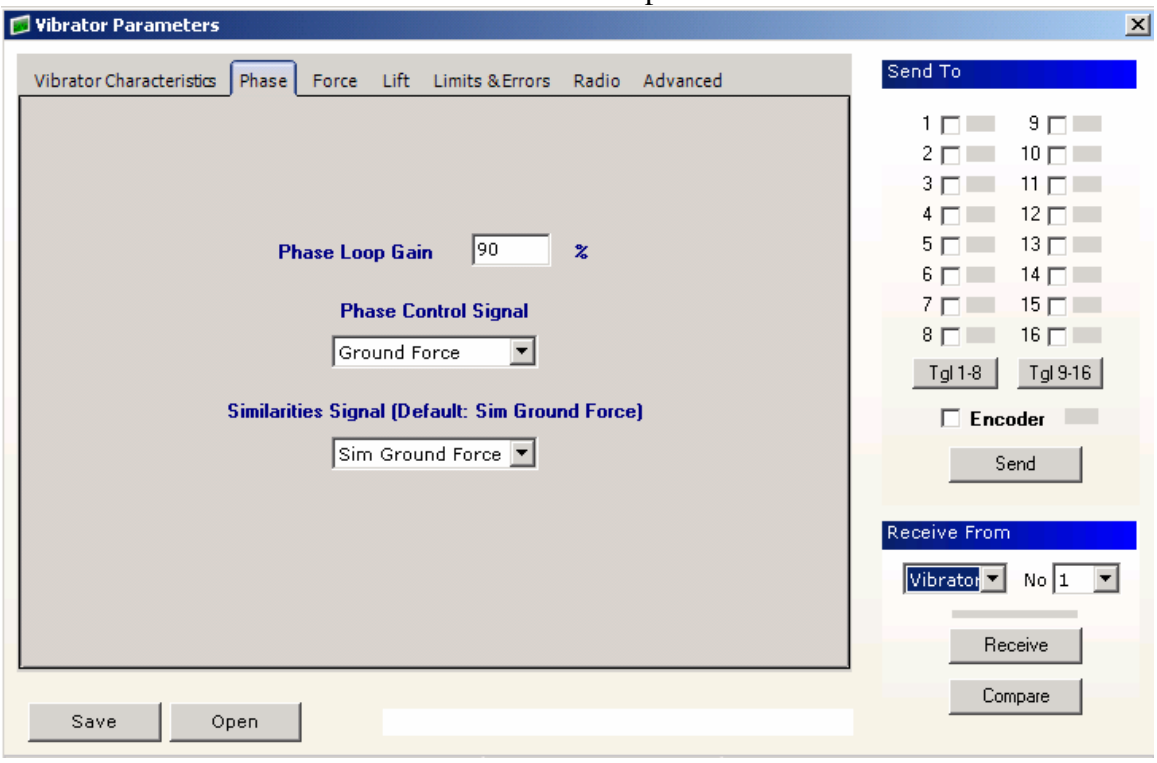
**HD Weight - Hold Down Weight,** - Force of static hold down on the base plate in thousand pounds or kilograms Allowable range in Vibrator entry is 0 to 99.9. Allowable Range in Source Control Program is 0 to 655000.

**BP Weight**, - Base plate weight in pounds or kilograms. Allowable range in Vibrator entry is 0 to 9.99. Allowable Range in Source Control Program is 0 to 65500.

**RMass Weight**, - Reaction mass weight in pounds or kilograms. Allowable range in Vibrator entry is 0 to 9.99. Allowable Range in Source Control Program is 0 to 65500.

### 4.3.2.2 Phase Controls

The vibrator control loop setup window is shown below. Please refer to the Force Two Vibroseis Control manual for more detailed description.




**Phase Loop Gain**- Sets sensitivity of phase correction system. Allowable range is 0 to 99%, where 0 is system disabled and 99 is maximum sensitivity.
**Normal entry is 80**

**Phase control Signal**- Selects signal to be phase controlled-

0- earth force (Ground Force (GF))
1- base plate acceleration
2- reaction mass acceleration
3- reference signal
**Normal Entry is 0**

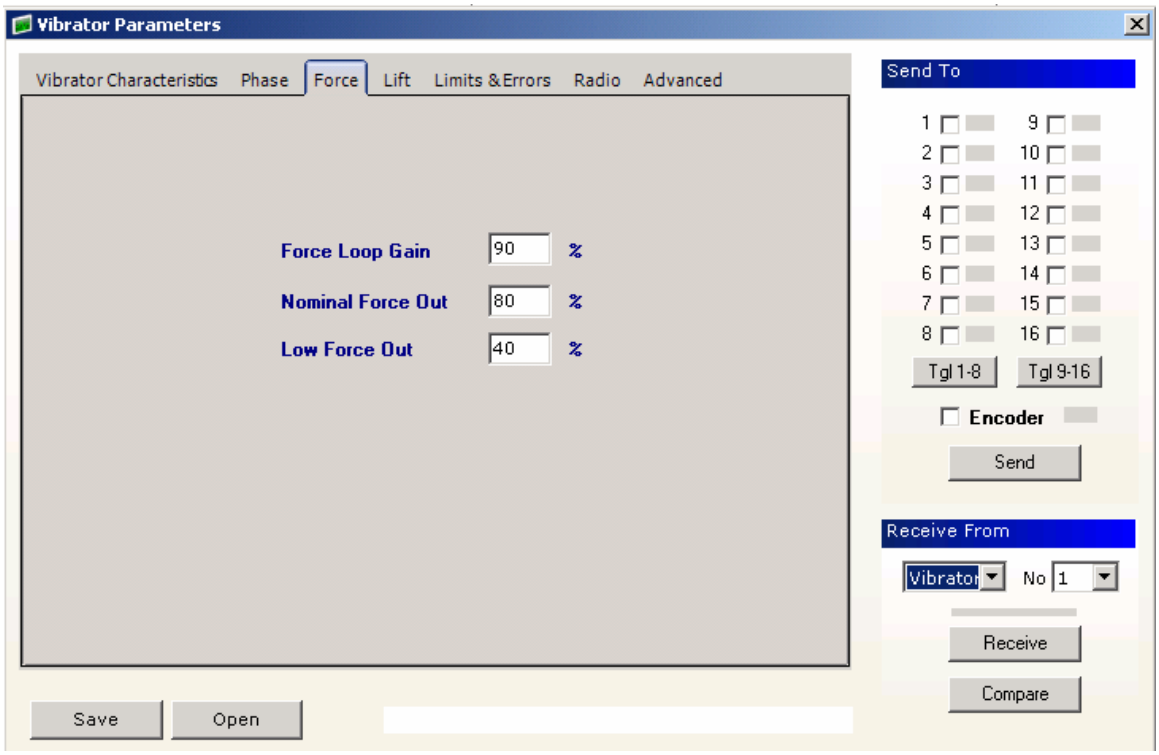
**Similarity Signal**- Selects signal to be transmitted to Universal Encoder-

0- Sim GF - Uses Similarity accelerometers to compute Ground Force)
1- Sim BP - Uses Similarity Base Plate accelerometers
2- Sim RM - Uses Similarity Reaction Mass accelerometers
3- Reference signal
4- Loop GF - Uses Loop accelerometers to compute Ground Force)
5- Loop BP - Uses Loop Base Plate accelerometers
6- Loop RM - Uses Loop Reaction Mass accelerometers

**Normal entry is 0**

### 4.3.2.3 Force Controls

The vibrator control loop setup window is shown below. Please refer to the Force Two Vibroseis Control manual for more detailed description.



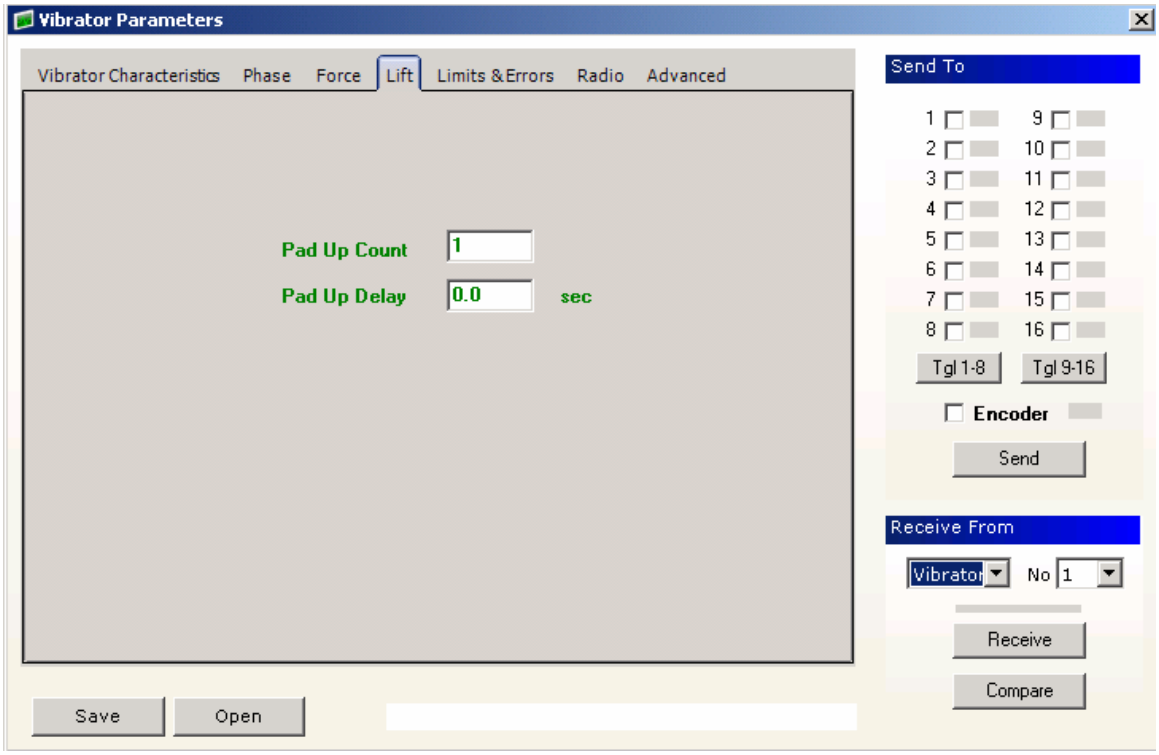

**Force Loop Gain**- Sets sensitivity of force control system. Allowable values are 1 to 100%. Enter 0% to disable the force control system.
**Normal entry =80**

**Nominal Force Output**- Sets High Force target value of fundamental vibrator force, expressed as a percentage of Hold Down Weight.
**Normal entry = 070**

**Low Force Out**- Sets Low Force target value of fundamental vibrator force, expressed as a percentage of Hold Down Weight.
**Normal entry =040**

### 4.3.2.4 Lift System Parameters

The vibrator servo system parameters setup dialog is shown below.

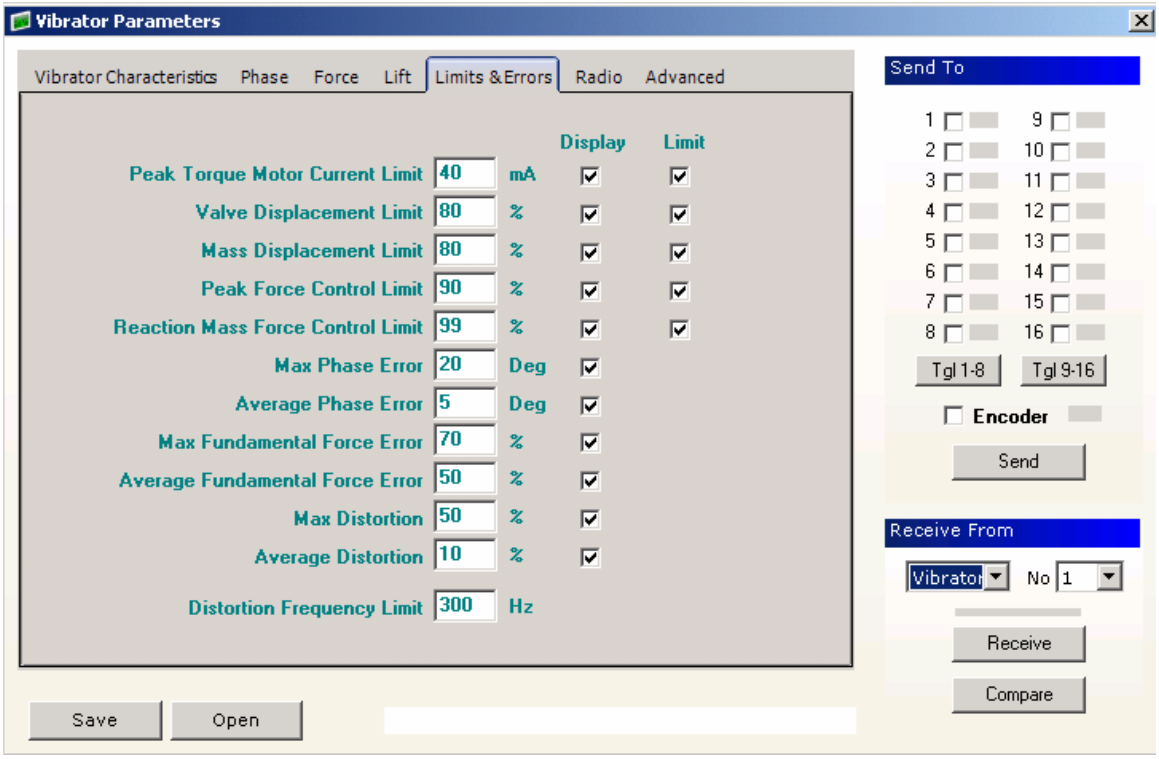



**Pad Up Count** parameter sets up number of sweeps count before the Base Plate is automatically raised.

**Pad Up Delay** sets the time delay for the Base Plate to go up after the last sweep.

### 4.3.2.5 Vibrator Limits and Error Parameters

The Limits setup parameters used by the vibrator electronics control loop and have direct impact on the vibrator performance.
Enabling the display does not affect vibrator performance, but determine if an error message occurs on the Vibrator Decoders display.
This entry will also determine if the "Limits" display in the Source Control program will display the limit reached.
If the limit check box is shown, then the value will be used has a Limit control
If the parameter is checked as Display, then it will be shown on the LCD display of the Force Two instrument.




**Peak Torque Motor Current Limit –** The Peak Torque Motor current must be limited to 40 milliamps peak to prevent damage to the Torque Motor. The Hardware in the Force Two provides this limit. In addition, the software can reduce this limit. When this limit is enabled, the Force Control circuit will reduce the drive level to prevent from exceeding the entered limit. If the Display is enabled, the Display will show a "T" after the "L" limit. Typical entry = 40

**Valve Displacement Limit –** The Valve Displacement Limit can be set to prevent overdriving the Main stage valve. When this limit is enabled, the Force Control circuit will reduce the drive level to prevent from exceeding the entered limit. If the Display is enabled, the Display will show a "V" after the "L" limit. Typical entry is 80%

**Mass Displacement Limit –** The Mass Displacement Limit can be set to prevent overdriving the Reaction Mass. This is usually only important when doing a very low frequency sweep. When this limit is enabled, the Force Control circuit will reduce the drive level to prevent from exceeding the entered limit. If the Display is enabled, the Display will show a "M" after the "L" limit. Typical entry is 80%

**Peak Force Control Limit –** The Peak Force Control Limit can be set to prevent overdriving the Ground Force Signal. Normally the "Peak Force" should not exceed the "Hold Down Weight" of the vibrator. When this occurs, decoupling of the vibrator occurs and increased distortion into the ground. When this limit is enabled, the Force Control circuit will reduce the drive level to prevent from exceeding the entered limit. If the Display is enabled, the Display will show a "F" after the "L" limit. Typical entry is 90%

**NOTE**: Sometimes it is required by the client to control to Peak Force and not Fundamental Force. To enable "**Peak Force" Control**, set the "Nominal Force Output" to 99% (maximum setting). Then set the Peak Force Control Limit to your desired set point. Typically 90%

**Reaction Mass Force Control Limit –** The Reaction Mass Force Control Limit can be set to prevent overdriving the Vibrator. When this limit is enabled, the Force Control circuit will reduce the drive level to prevent from exceeding the entered limit. The Reaction Mass Force is proportional to the hydraulic output of the vibrator. Example, a 40,000 lb peak force vibrator will have a peak Reaction Mass Force of about 40,000 lbs. In some cases, the Ground Force signal may be small when the vibrator's Reaction Mass Force is very large. To prevent overdriving the vibrator this limit can be used. If the Display is enabled, the Display will show a "V" after the "L" limit. Typical entry is 99%

**Maximum Phase Error** – This entry is used to set the maximum allowable peak phase error before an error indication occurs. Typical entry =30

**Average Phase Error** – This entry is used to set the maximum allowable average phase error before an error indication occurs. Typical entry =5

**Maximum Fundamental Force Error** – This entry is used to set the minimum allowable Fundamental Force before an error indication occurs. Typical entry =10% less than target ( 70 %)

**Maximum Average Fundamental Force Error** – This entry is used to set the minimum allowable Average Fundamental Force before an error indication occurs. Typical entry =30% less than target ( 50 %)

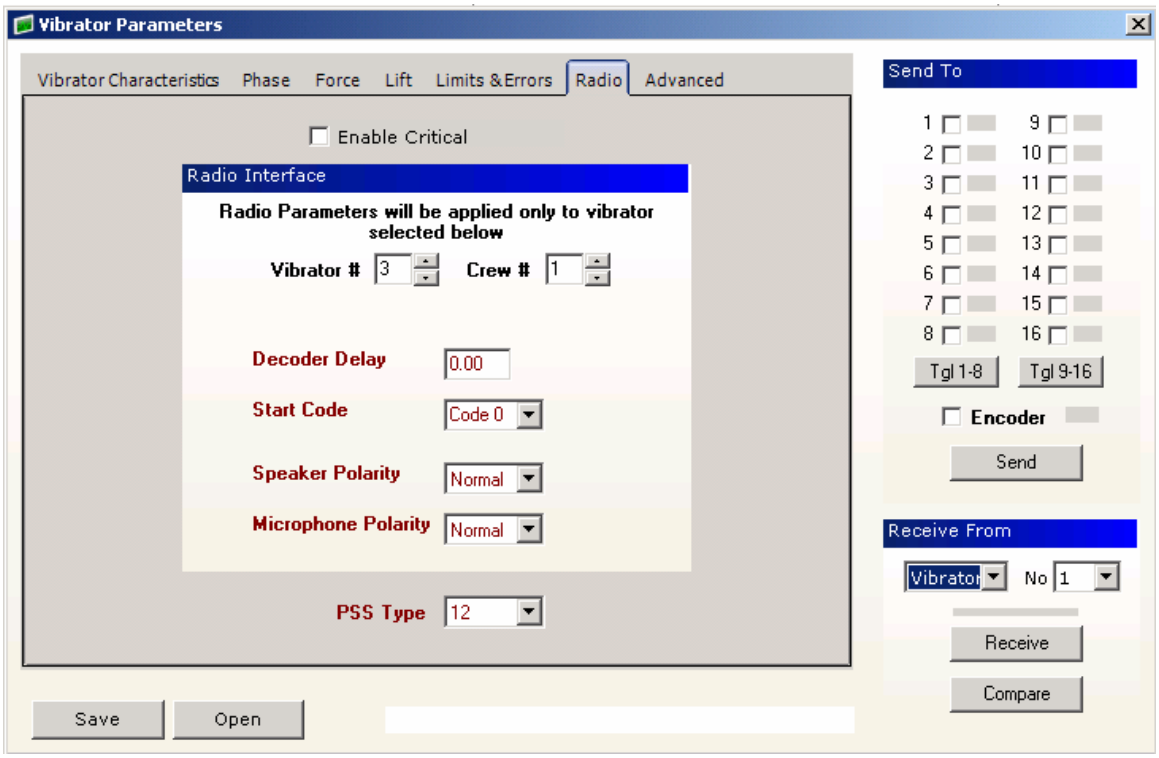
**Maximum Distortion** – This entry is used to set the maximum allowable Distortion % before an error indication occurs. Typical entry =70

**Maximum Average Distortion** – This entry is used to set the maximum allowable average Distortion % before an error indication occurs. Typical entry =40

**Distortion Frequency Limit** – This entry is used to determine the Distortion percentage. This entry sets the high frequency limit for the distortion calculations. All frequencies greater than this entry are ignored for the % Distortion computations. Typical entry is 200 Hz for 2 msec sample rate recording.

### 4.3.2.6 Vibrator Radio Parameters

The Radio setup dialog includes parameters shown below.




**To change these parameters, the "Enable Critical Parameter" box must be checked.**

**To Change Vibrator Settings, both the Vibrator number in the box on the right and the left must have the same vibrator number enabled. These settings can only be changed one vibrator number at a time.**

**Decoder Delay** this values will delay the start of the decoder unit. This value should only be used by advanced users, it allows to adjust the start delay when different radio types are used. This value should normally be set at 0.00.

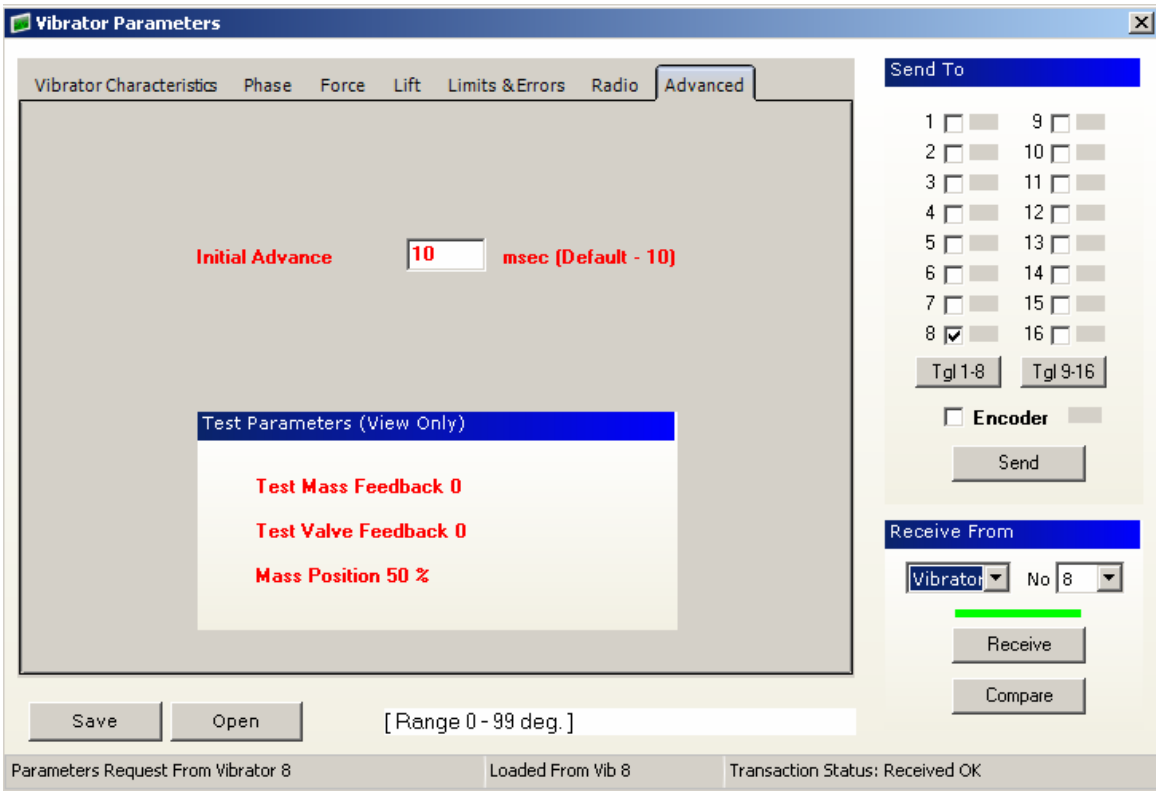
**Speaker Polarity –** This selection allows the speaker circuit to be reversed. This is used when setting up the radio interface. All speaker polarities on a crew should be set the same. This setting in the Vibrator will affect the start time.

**Microphone Polarity -**This selection allows the microphone circuit to be reversed. This is used when setting up the radio interface. All microphone polarities on a crew should be set the same. This setting in the Encoder will affect the start time.

**PSS Type**- Selects PSS type 12 or 15. PSS type 15 is required when using the VSS (Vibrator Signature system). All units must have same PSS type for proper operation

### 4.3.2.7 Advanced Parameters

The Advanced parameters setup dialog is shown below.



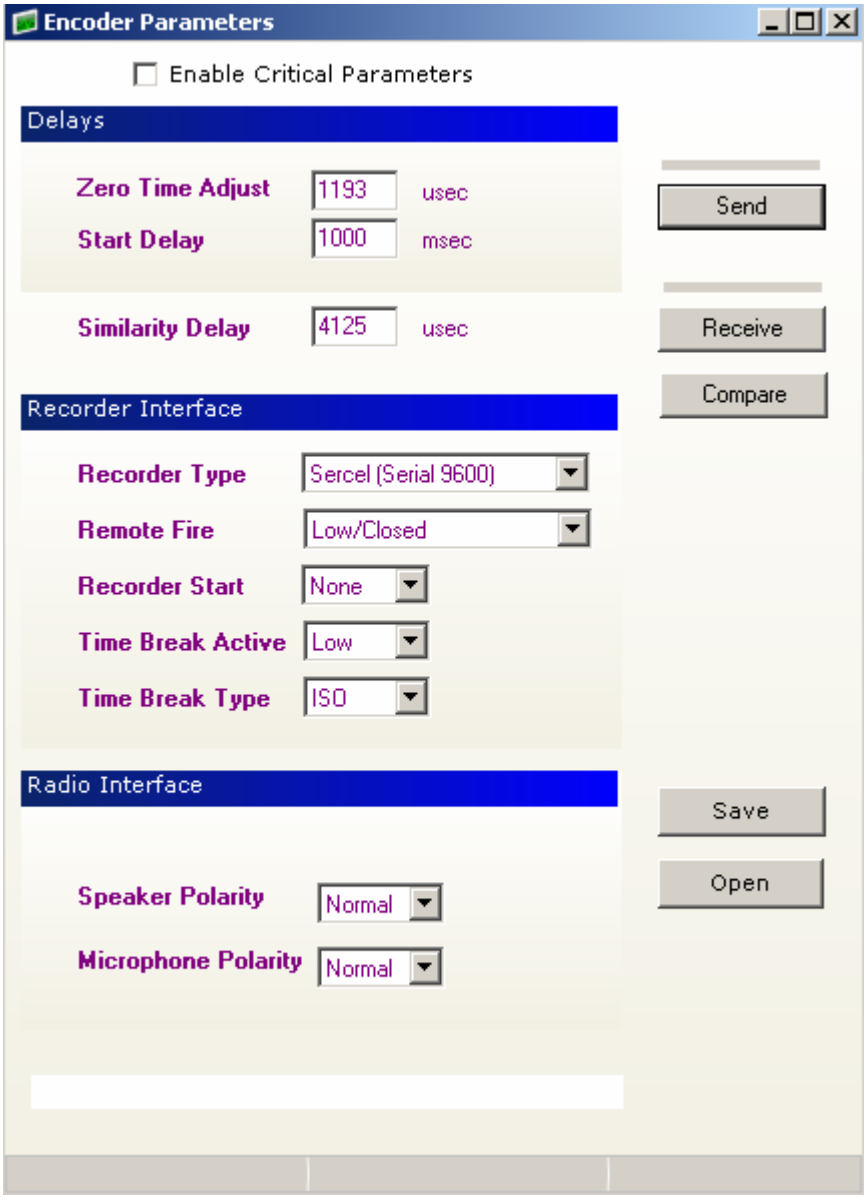

**Initial Advance** value defines timing constant for the vibrator control to compensate for the vibrator servo system delay. Normal entry is 10 msec

**Test Parameters (View Only).** After Downloading the parameters from a vibrator, the Test Parameters show the values of the Advanced entries in the Vibrator. These values can only be changed via the keyboard entry in the vibrator.

## 4.4 Encoder Parameters

The Encoder Parameters setup the Recording Truck and Radio Interface. These parameters are usually setup only once and should not be changed.

**To change these parameters, the "Enable Critical Parameter" box must be checked.**



**Zero Time Adjust** is used to adjust vibrator start time to match Universal Encoder start time. This entry is used to compensate for the radio delay. Typical value is 1700 microseconds.

**Start Delay** sets the time between when the "Pilot Start" signal is received from the Recording system and the "Time Break" is issued. Normally set to the minimum =1.00

**Similarity Delay**, This entry controls the delay of the Radio Reference signal in the Universal Encoder. This entry is used to compensate for the radio delay when doing the radio similarities. Typical value is 3000 microseconds. See Start Time Setup section of manual for more information.

The Following Entries must be set to match the **Recording System Interface**.

- **Recorder Type**, This entry selects the Recording Truck interface protocol to be used. This selection sets up the data protocol that is transmitted over the serial port to the recording system.

- **Remote Fire**, This entry sets up the polarity of the signal which starts the Encoder.

- **Recorder Start**, this entry sets up the polarity of the signal which starts the recorder from the Encoder. This signal is normally used in Weight Drop Mode and in Master/Slave operation.

- **Time Break Active**, This entry sets up the polarity of the Time Break signal from the Encoder to the Recording system.

- **Time Break Type**, This entry sets up the Time Break signal interface. Isolated or non-isolated interface can be selected.

The following entries setup the **Radio Interface**

- **Source Type Entry** in the Sequence Table Selection control the **Radio Mode** used by the Communication/Radio board

- **Speaker Polarity**, this entry allows reversal of speaker polarity to optimize radio communication

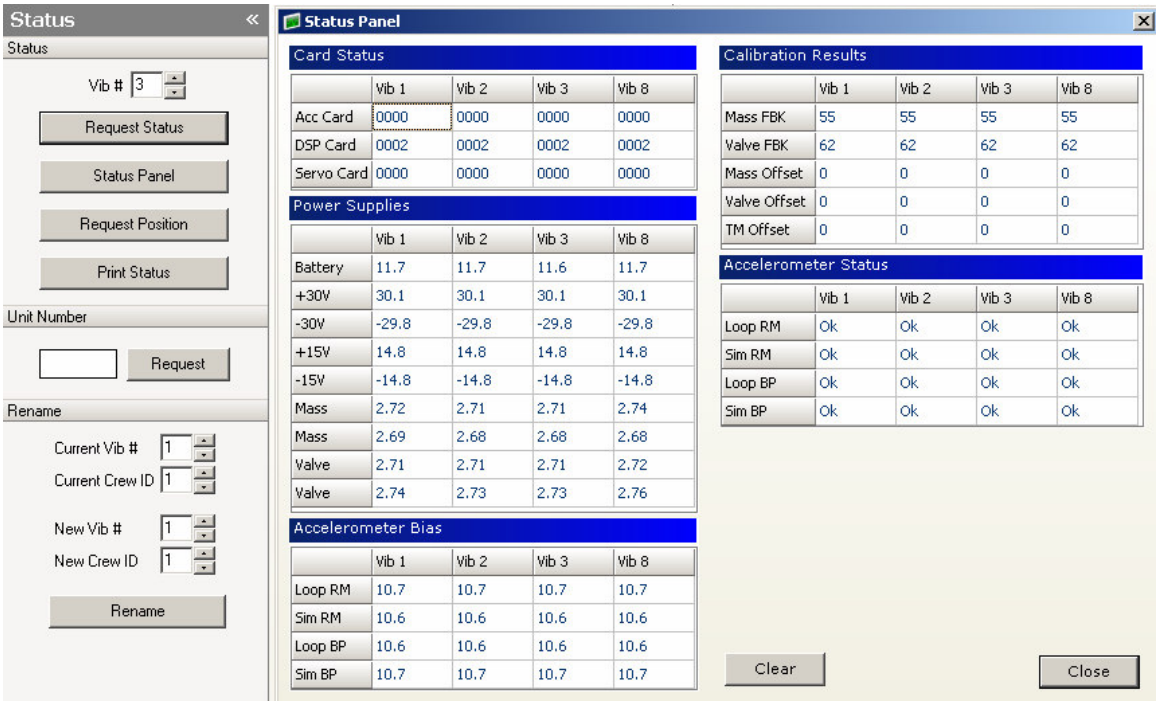
- **Microphone Polarity**, this entry allows reversal of the microphone polarity to optimize radio communication

## 4.5 Force Two Status Panel

To check the status of the Force Two vibrator instruments, Accelerometer Bias voltages, Performance during the last sweep and to see results of calibration, the Status dialog should be used to request this information from the particular vibrator.

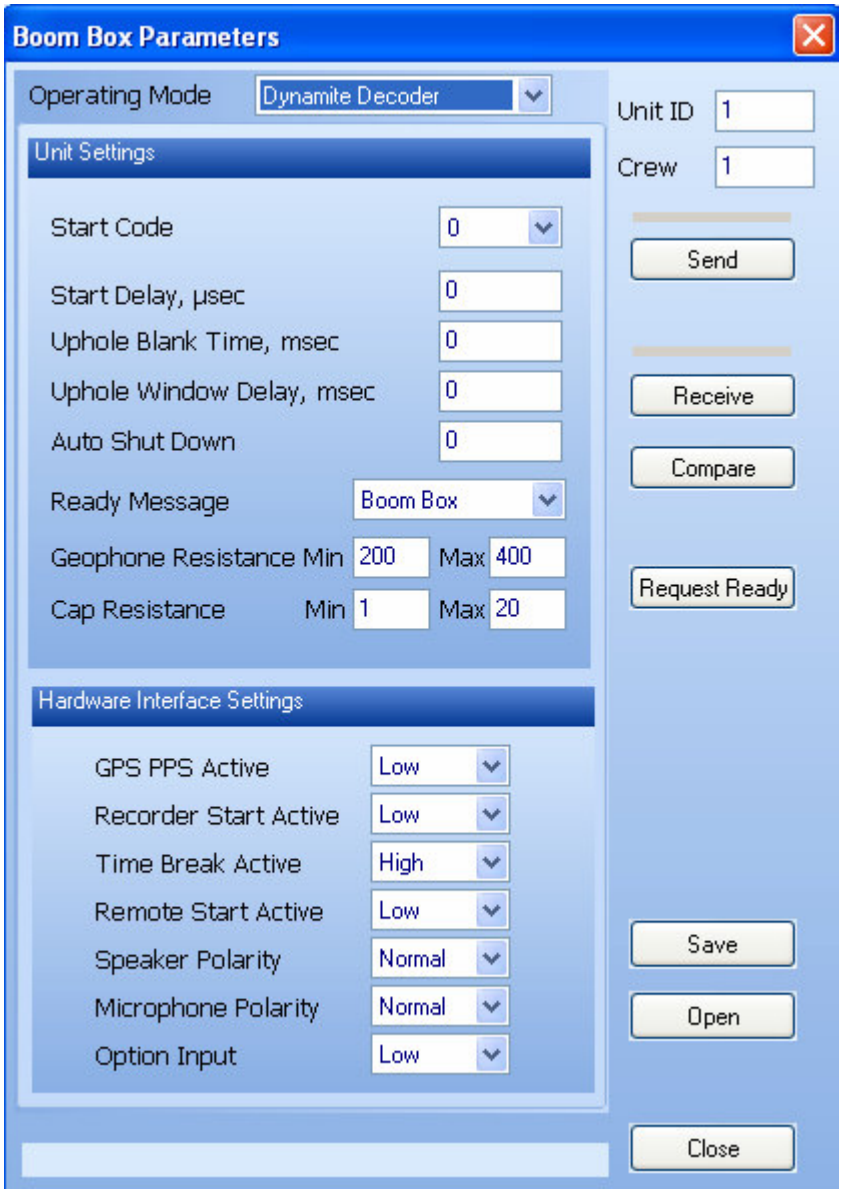
Results from Multiple Vibrators can be shown

The example of the Status request response from vibrator is shown below:



## 4.6 Boom Box Parameters

The Source Control Program can control the Boom Box Decoder Parameters. The Boom Box parameter load via the radio only works if the Boom Box mode is selected in the Sequence Table.



### 4.5.1 Vibrator Number and Crew Number Setup

Each Decoder uses the Vibrator Number , Crew Number and Start Code (0,1,2,3) to provide a unique identity for each unit.

The Vibrators are numbered 1 through 16.

The Crew Number is numbered 0 through 250

# 5 Start Time Setup

The Force Two System typically uses a voice radio link to communicate from the Encoder unit in the Recording Truck to the Decoder Units in the Vibroseis Trucks. The Start time between the Encoder and the Decoder units is very precise and repeatable. However different voice radios require different delay entries to fine-tune this synchronization.

There are three entries used to adjust the system for the radio delay.

1. **Zero Time Delay** - The zero time delay entry is set at the Encoder to compensate for the Start Codes one way radio delay. This entry is used to align the start of the Decoder and the Encoder. Normally True Reference from the Encoder and the Decoders are compared, and the Zero Time Delay is adjusted so that there is zero phase error between the two References. Typical value for this entry is 1700 microseconds..
2. **Similarity Delay** - The Similarity Delay is used to delay the radio reference in the Encoder to match the delay of the Radio similarity. The Similarity Delay Entry is only used by the Encoder unit. Typical value for this entry is 3000 microseconds.
3. **Decoder Delay** – This entry allows each Decoder unit to have its own delay. This entry is for advanced users. (Vibrator Parameter – Radio) Typical value for this entry is 000.

## 5.1 Set up procedure

First set Zero Time Delay then set up Similarity Delay

## 5.2 Setting Zero Time Delay

Zero Time Delay must be entered into the Universal Encoder

There are multiple ways to set Zero Time Delay. Any of the following methods can be used. An oscilloscope or a vibrator QC system like the BirdDog II should be used to view the signals.

- **True Reference** comparison – The True Reference from the Encoder and the True Reference from the Decoder must be compared. Start the sweep via radio (Press the Start button on the front of the Encoder). Adjust “Zero Time Delay Entry” until the two signals have a zero phase error.

- **Time Break** – Compare the Time Break from the Encoder and the Decoder units. Start the sweep via the standard radio link. Adjust the two signals so that two Time Break signals occur at the same time.

- **Wireline Reference** – The Wireline Reference Signals from the Vibrator and Encoder can also be used to adjust the "Zero Time Delay Entry". The Wireline Reference signal is a delayed True Reference signal. The Wireline Reference signal have been delayed exactly 1.7 msec from the True Reference Signals. The Wireline reference signal is used to compare to the SV (Similarity Vibrator) signal from the Vibrator.

## 5.3 Setting Similarity Delay

After Setting Zero Time Delay in the Encoder, the similarity delay in the Encoder unit can be set.

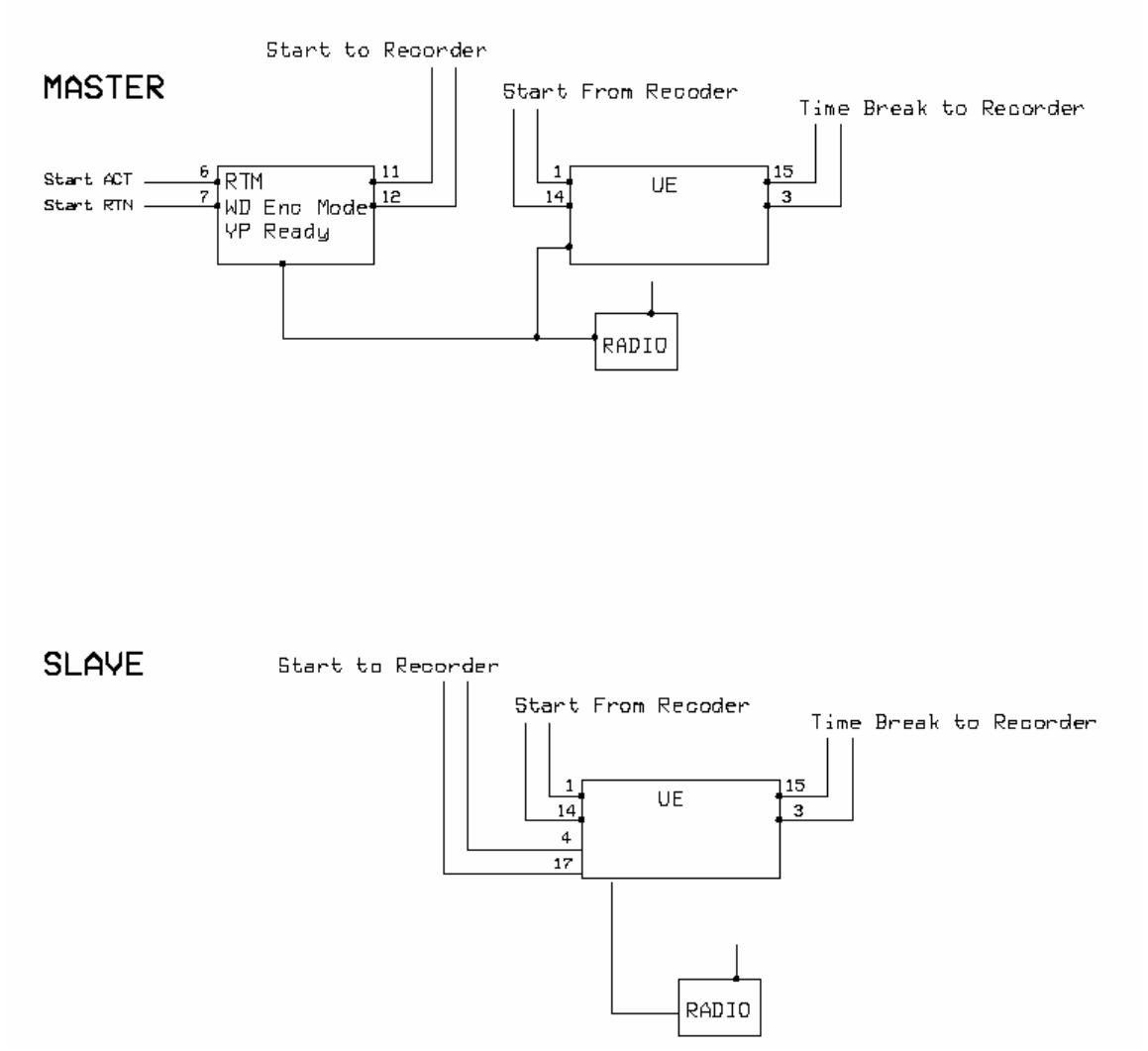
Select Reference for the similarity signal.

Perform a radio similarity. Adjust Similarity delay in the Encoder to obtain a 0 degree error.

After setting Similarity delay, set the similarity signal to the same signal used for controlling the vibrator. This is normally the "Sim Ground Force" Signal.

# 6.0 Master Slave

**Master/Slave** operation of the Force Two system can be enabled by adding a **RTM** (Radio Trigger Module) to the Master UE system. The RTM unit receives the "master" start signal and transmits a Master Start code. The Slave UE units receive the "master" start code information from the RTM units and verifies that the "crew number code" matches. All of the recording systems can be synchronized using "delay entries" in the RTM and UE units.

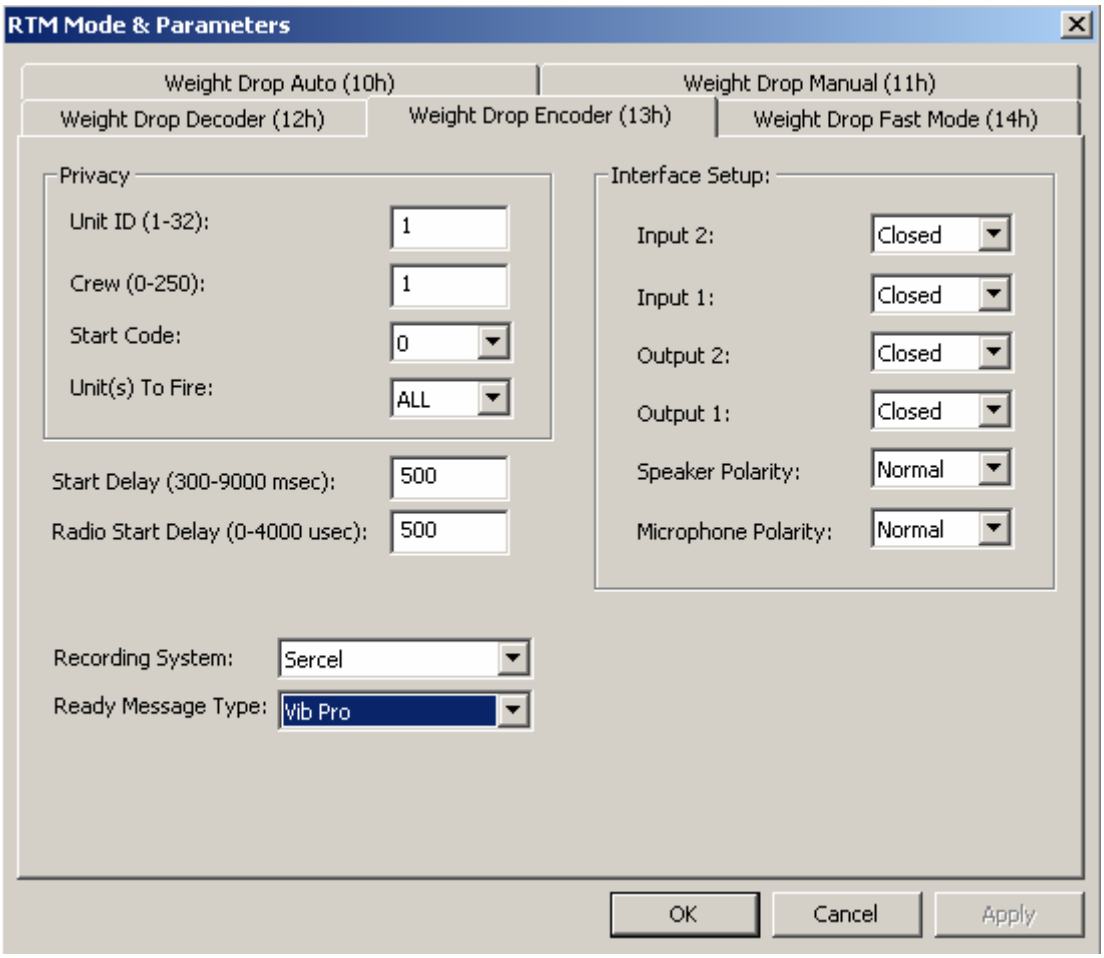


## 6.1 RTM setup

The RTM module must be setup in “Weight Drop Encoder Mode (13H)”. The Ready message needs to be set for “Vib Pro ready” message.

Input 2 is used to start the RTM. This can either be connected to a switch to initiate the sequence or it may be connected to the Master Recording System to start the sequence.

Output 2 is used to start the Master Recording System and/or the Universal Encoder. This signal is activated after the “Master Codes” have been sent. This signal can be adjusted using the “Radio Start Delay” entry.



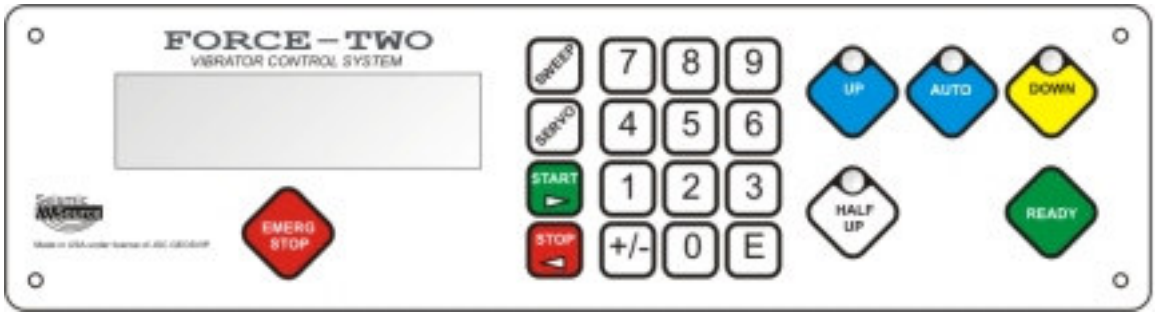
The **RTM/UE master slave** mode requires the following:

**RTM:**
WD Encoder Mode (13h)
Ready Message type – VP
Crew ID must match UE Crew ID to work.
Radio Start Delay synchronizes the Pre-Start lines from the RTM (Output 2, 11&12) and UE.
Start with Input 2, 6&7.
Firmware 22b or later.

**UE:**
Force Two Encoder Mode (Vibrator Encoder)
UE receives special “Master Start Code” message and toggles Recorder Start Line.
Radio Modem Firmware 2.9a or later.

# 7 Decoder System - Force Two Vibroseis Control System

## 8. Decoder Description of System Controls




**READY key**- Pressing this key causes a tone signal to be transmitted over the radio link to the Universal Encoder, indicating that the vibrator is ready to receive a sweep start command.

**SWEEP key**- Calls up a menu for displaying and editing sweep parameters.

**SERVO key**- Calls up a menu for displaying and editing vibrator parameters.

**START key**- Starts sweep manually. In parameter display and editing modes, moves display cursor to the right.

**STOP key**- Stops a sweep in progress. In parameter display and editing modes, moves display back one field. Also used to exit menus

**ENTER key**- Used to access menus and load parameters.

**NUMERICAL (0-9) keys**- Used to enter parameter values.

**DOWN key**- Lowers the base plate to the ground and applies hold down weight to airbags.

**UP key**- Raises the base plate off the ground.

**HALF UP key**- Alternately turns HALF UP light ON and OFF.

- When ON, base plate raises partway, to a position determined by the physical location of a switch in the lift cable.
- When OFF, raises the base plate fully to the limit of travel of the lift cylinders.

**AUTO key**- Alternately turns AUTO light ON and OFF.

- When ON, automatically raises the base plate after the number of sweeps determined by the setting of the PAD UPCOUNT parameter.
- When OFF, the base plate remains down until the UP key is pressed.

**EMERGENCY STOP key**- Stops sweeps and lowers Reaction Mass to bottom.
**Use this button before pressuring down the vibrator.**

**POWER switch**- Switches unit power on and off.

- Switch OFF before starting vibrator engine.
- Switch ON before pressuring up.
- Do not switch OFF during normal operation.
- May be switched OFF in emergency situation, such as loss of servo valve feedback.
- Do not turn power switch ON with the vibrator pressured up.

## Interface Connectors – See appendix for pin out information

**9 Pin Female D-sub Connector**- GPS connector connects to optional GPS receiver or Vibrator Signature Recorder

**9 Pin Male D-Sub Connector**- Computer Connector. Located next to the 15 pin Test connector. Connects to portable PC to load parameters directly to the unit. Some of the older Force Two units do not have the serial connection on the side, on these units the GPS connector can be used.

**15 Pin Connector**- Connects to external testing device, such as BirdDog II unit running the Vscope software.

**41 Pin Connector** - Connect to Connector Panel Cable for power, lift, servo valve, mass LVDT, and accelerometers.

**6 Amp Fuse**- Replace only with 6 amp fuse.

# 9 Decoder Operation

Insure that the vibrator hydraulic engine is operating, electrical power is being supplied to Vibrator Control Unit, and hydraulic pressure is normal. The vibrator should be "Pressured Down" when turning the vibrator electronics on.

**The vibrator should only be pressured up when the Force Two vibrator electronics shows the "Pressure Up, BP down" message.**

**All Parameters must be correctly entered into the electronics before pressuring up the vibrator**. With new electronics, be sure to go to edit mode first to load all parameters. Most parameters can be loaded via the Source Control Program on the external PC, but the following parameters must be entered via the keyboard.

- Valve Feedback – set to 000
- Mass Feedback – set to 000
- Mass Position – set to 050
- Start Sweep Number

1) **Switch POWER switch ON**. The initial messages show the status and version number of the firmware installed in the electronics. The status should show 0000 for each message.
   a. "Force Two Ver X.XX" message shows the status and version number of the System Control Card.
   b. DSP message shows status and version number of DSP card. **Note**: **It is very important that the DSP message is shown.** If not power down, wait 10 seconds, and turn the instruments back on.
   c. Acc message shows status and version number of ACC card
   d. Radio Modem message shows status and version number of Radio Modem Card

**2)** After the initial tests and messages are shown, the following message is displayed

**Operate >Start Cal>7**
**Test Setup>Stop GPS>2**

Press Start or 8 – For Normal Operation
Press 7 – To Calibrate Force Two instruments
Press Stop – for Setup – loading parameters, Zero Time etc..

**Setup**. Sometimes there is a requirement to perform tasks without the vibrator being pressured up. The following task can be performed without pressuring up the vibrator.

a) Press **Stop** to run **Zero Time Tests** with Vibrator Pressured Down. Pressing Stop allows the system to go the Main Operating Display without

pressuring up the vibrator. Radio Loads, Keyboard entry and Start Time tests can be preformed when the Normal Operating Display is shown.

b) Press **Stop** – to **Radio load Parameters**
   1) To load parameters by radio link, press **Stop**.
   2) In this mode sweep parameters and vibrator parameters may be loaded by radio link from the computer connected to the Universal Encoder.
   3) Vibrator status may be transmitted to the computer.
c) Press **Stop** – to **Edit Parameters -** To load parameters manually, press key **Stop**. Do not load parameters unless vibrator is pressured down
d) Press 2 – to check GPS operation. To view GPS data, press 2. To exit GPS menu press "3"

To **calibrate** the Vibrator Control Unit to the characteristics of its vibrator, press key 7. Follow the instructions displayed during calibration.

**Calibration** should be performed if

a) New installation
b) When any vibrator hydraulic component has been changed
   a. Mass LVDT
   b. Valve LVDT
   c. Torque Motor
   d. Servo Valve
   e. Accelerometer
   f. External Cable
   g. Connector Panel
   h. Etc.
c) To perform a complete test of the vibrator's operation. Calibration performs test that can isolate problems with the vibrator's operation.

.

## 9.1 Normal Operation

To enter the normal operation mode, press key Start or 8. **Do not enter normal operation mode unless parameters have been entered and calibration has been done at least once on this vibrator. Calibration is only required when new vibrator electronics are installed or vibrator hydraulic components have been replaced**.

When the "Start" key is pressed for Normal operation. The following messages will appear.

1) Servo Card status and version message. Shows firmware version of Servo Card. Status message should show 0000 for no errors.
2) Power Supply Voltages. All major power supplies are checked and the voltages errors are displayed.
3) Servo Amplifiers are checked
4) LVDT's are checked and voltages errors displayed.

Before Pressuring up the vibrator, the Lift position must be checked.

a) Press HALF UP key until HALF UP light is off.

b) Observe position of base plate. If base plate is down, press DOWN key. If base plate is UP, press UP key.

After the initial messages and voltage checks are performed. The following is displayed.

**Pressure Up, BP Down**
**Done ? Press Start.**

**Insure that all personnel are well clear of the vibrator**, **before pressuring up the vibrator and moving the baseplate.**

It is now safe to pressure up the vibrator

1) Pressure Up the vibrator.
2) If Baseplate is up, then open the stiff legs and move the baseplate down.

After the vibrator is pressured up and the baseplate is down, then Press "Start" on the control panel.

The Vibrator's Reaction Mass should center and the normal operating display will be shown.

If the electronics is unable to center the Reaction Mass, then the display will not appear and calibration must be run to correct the problem.

## 9.2 Normal Operating Display

Display should show:

| | | |
|---|---|---|
| Vib aa | Crew bb | Swp cc |
| GCnt=ZZZZZZ | | LCnt=VV |

aa- is the Vibrator number

bb- is the Crew number

cc- is the number of the previous sweep. There is a library of 16 sweeps for each sweep type. Sweep number indicates which library sweep was used.

**ZZZZZZ** is the total sweep counter. It shows the total number of sweeps generated since it was last reset.

**VV** is a sweep counter which resets each time the base plate is automatically raised.

## 9.3 Start Sweep

To start a sweep manually, press the START key.

Display should show:

```
Ph-###0### + D-########
F-########## L ab-cd-ef
```

1) During a sweep, the track to the right of **Ph-** shows **instantaneous phase error**, with negative error to the left of 0 and positive error to the right of 0. Each bar represents 1 degree of phase error.
2) The track to the right of **D**- shows instantaneous **total harmonic distortion**. Each bar represents 5 % distortion.
3) The track to the right of **F**- shows **instantaneous fundamental earth force** amplitude. Each bar represents 10% of hold down weight.
4) The numbers to the right of L show whether or not limits have been exceeded at any point during the sweep. If X is 0, the corresponding limit has not been exceeded. If X is 1, the corresponding limit has been exceeded.
5) L for Limits reached, shows if the following Force Control Limits have been reached
    a. Torque Motor Current – "T" will be displayed
    b. Valve Displacement Limit – "V" will be displayed
    c. ReactionMass Displacement limit – "M" will be displayed
    d. Maximum Peak Force limit – "F" will be displayed
    e. Maximum Reaction Mass Force – "R" will be displayed

## 9.4 PSS data

Press "E" on the keyboard to display the PSS data from the last sweep.

APh= 1 AF = 60% AD= 10%
Mph= 10 MF = 70% MD= 70%

Where
APh is average phase reading from last sweep
Mph is maximum phase reading from last sweep
AF is average Fundamental Force from last sweep
MF is maximum Fundamental Force from last sweep
AD is average Distortion from last sweep
MD is maximum Distortion from last sweep

Press "Stop" to return to Main menu

## 9.5 High/Low Force Selections

Press the “+/-“ key on the keyboard. The system will ask if you want to change form “high to “low “force.

Press “4” to switch

This entry only affects sweeps that are started locally by the “Start” button. Sweeps commanded by the UE in the recorder will automatically select High or Low force.

## 9.6 Auto Lift

To enable the automatic lift function, press the AUTO key until the AUTO light is ON. The base plate will automatically go up after the number of sweeps set by the “Pad up count” parameter. The time delay before lifting is set by the “Pad Up Delay” parameter.

The base plate is lowered again by pressing the REMOTE DOWN switch (this switch is connected by a cable to the 2 pin connector), or by pressing the DOWN key.

Pressing the AUTO key disables the automatic lift function.

Remote Down works in both “Auto” and “Manual” Modes.

## 9.7 Half Up Full Up switch

To reduce the time required for the base plate to go up, press the HALF UP key until the HALF UP light is on. Now the base plate will go up only enough to provide minimal ground clearance, rather than to the limit of lift cylinder travel. Note that the safety stiff legs cannot be used in the half up mode. The base plate must be lifted fully up and the stiff legs must be closed to hold the shaker assembly up when the vibrator is pressured down.

## 9.8 GPS data

Press “2” to show GPS data on screen.
Press “3” to exit GPS display and return to Normal Operating Display.

.

## 9.9 End of the Day – Pressuring Down the Vibrator

1) Press Emergency Stop- This will slowly ramp the Reaction Mass to the bottom.
2) After the Reaction Mass is at the bottom, before pressuring down the Vibrator make sure the Baseplate is Up and in the Stiff Legs before pressuring down for the end of the day.
3) Always pressure down vibrator before turning power switch off, unless in an Emergency condition like loss of Valve Feedback.
4) Always turn the Decoder power off before turning off the engine
5) Never start up or turn off the engine with the Vibrator Control Unit POWER switch ON.

# 10 Calibration

Insure that the vibrator hydraulic engine is operating, electrical power is being supplied to Vibrator Control Unit, and hydraulic pressure is normal. The vibrator should be "Pressured Down" when turning the vibrator electronics on.

**The vibrator should only be pressured up when the Force One vibrator electronics shows the "Pressure Up, BP down" message.**

1) **Switch POWER switch ON**. Wait for initial DISPLAY message. The initial messages show the status and version number of the firmware installed in the electronics. The status should show 0000 for each message.
    a. "Force One Ver X.XX" message shows the status and version number of the System Control Card.
    b. DSP message shows status and version number of DSP card. **Note**: It is very important that the DSP message is shown. If not power down and turn the instruments back on.
    c. Acc message shows status and version number of ACC card
    d. Radio Modem message shows status and version number of Radio Modem Card

**3)** After the initial tests and messages are shown, the following message is displayed

**Operate >Start Cal>7**
**Test Setup>Stop GPS>2**

To **calibrate** the Vibrator Control Unit to the characteristics of its vibrator, press key 7. Follow the instructions displayed during calibration.

**Calibration** should be performed if

d) New installation
e) When any vibrator hydraulic component has been changed. These components include:
    a. Mass LVDT
    b. Valve LVDT
    c. Torque Motor
    d. Servo Valve
    e. Accelerometer
    f. Etc.
f) To perform a complete test of the vibrator's operation. Calibration performs test that can isolate problems with the vibrator's operation.

**Press key 7. The display shows the message "Calibration Start".**

- The system automatically checks memory integrity, power supply voltages, servo amplifier integrity, and LVDT primary circuit integrity. Any problems detected are shown on the display, along with recommended operator action.

- If no problems are detected, calibration continues. A display message instructs the operator to pressure up the vibrator and to move the base plate to the DOWN position.

- The base plate hold down pressure sensor is checked. If it is not activated, the display shows the message "Lift Error".

- The system automatically checks LVDT output voltages, then asks if the mass is down. The operator answers this question by pressing the appropriate key.

- The system then sets optimum values of valve and mass loop gains and checks LVDT offsets. If offsets are excessive, a display message instructs the operator to adjust the LVDT's.

- The system tests all accelerometers and reports any errors on the display.

- All parameters determined by the calibration process are stored in memory. When calibration is completed, the unit is ready for normal operation.

# 11 Loading Parameters

## 11.1 Parameters via Keyboard

Parameters may be loaded into the Vibrator Control Unit either by radio from the **Source Control** program connected to the Universal Encoder, by connecting the computer directly to the Vibrator Control Unit, or manually entering the data using the keyboard and display.

Most of the parameters in the vibrator control require a password to change.

When editing use the following keys:

"**E**" to enter parameter and move to next entry

"**Stop**" can be used to exit the edit mode and return to the main menu.

"**Start**" key used to move to next item in menu

"+/-" key used to move to previous item in menu

The "**Stop**" button will exit out of most menus. Typically pressing the "Stop" button a few times will return to the "Main Menu"

Some of the entries do not require a password.

The following are some of the entries that most Vibrator operators can change without a password.

### 11.1.1 Start Sweep Number

Start Sweep Number changes the sweep number that starts when the “Start” button is pressed.

To change “Start Sweep number”

Press “Sweep” button

**SWEEP PARAMETERS**
**START > +/- <STOP –EXIT**

Press “Start” button once to go to the following menu

**START SWEEP NUMBER**
**START > +/- <STOP –EXIT**

Press “E” to enter new Sweep number

SWEEP NUMBER  01

Enter number between 1 and 32 to select sweep 1 to 32

After entering correct Sweep number, press “Stop” to return to main menu.

### 11.1.2 Resetting Presets – Force and Phase

Use this feature to Reset all of the Force and Phase Presets. This is sometimes required after doing Zero Time tests with the Vibrator pressured down.

To Reset Force and Phase Presets for all of the Sweeps

Press “Servo” button

**SERVO PARAMETERS**
**START > +/- <STOP –EXIT**

Press “Start” button once to go to the following menu

**RESET PRESETS**
**START > +/- <STOP –EXIT**

Press “E” to perform RESET PRESETS

Press “Stop” to return to main menu.

### 11.1.3 Global Counter Clear

To Clear the Global Counter that is displayed on the main screen, perform the following.

Press “Servo” button

**SERVO PARAMETERS**
**START > +/- <STOP –EXIT**

Press “Start” button five times to go to the following menu

**GLOBAL COUNTER CLEAR**
**START > +/- <STOP –EXIT**

Press “E” to enter to select Global Counter Clear function.

Press “1” to clear

Press “Stop” to return to main menu.

### 11.1.4 Password for Keyboard Entry

To Edit  the other Servo or Sweep parameters a password must be entered

A Password is 4 digits which add to 17

Example: **4,5,6, 2 is a valid Password**

## 11.2 Sweep Parameters via Keyboard

Sweep parameters may be loaded into the Vibrator Control Unit either by radio from the **Source Control** program connected to the Universal Encoder, by connecting the computer directly to the Vibrator Control Unit, or manually entering the data using the keyboard and display.

**The following is a description of manual entry.**

Complete items 1-4 of "Normal Operation".

Press SWEEP key. (If unit is already in normal operating mode, just press SWEEP key.)

**SWEEP PARAMETERS**
**START > +/- <STOP –EXIT**

**Press "E**" will bring up the following menu

**View Sweep – press 0**
**Edit Sweep – press 1**

Press 0 to view Sweeps or Press 1 to Edit Sweeps

When editing use the following keys:

"E" to enter parameter and move to next entry

"Stop" can be used to exit the edit mode and return to the main menu.

"Start" key used to move to next item in menu

"+/-" key used to move to previous item in menu

### 11.2.1 Edit Sweeps

To Edit Sweeps a password must be entered
A Password is 4 digits which add to 17
Example: **4,5,6, 2 is a valid Password**

Using the +/- key, select one of the following items:

- Sweep Parameters
- Start Sweep Number
- EXIT

And press "E" for enter.

**Sweep Parameters**-

First Enter Sweep #. This is a number between 1 and 16. (Enter 01 for 1)
The Sweep Parameters for this sweep number will be shown.

Example for Sweep # 01

Sweep#01: 010/100/10
Linear /Cs/0.50_0.50

This shows that sweep #01 is a 010 Hz to 100 Hz , 10 second upsweep. Linear mode with 0.50 seconds up and down cosine tapers.

To change these parameters

Press "E" to move to the next field

Press "Stop" to move to the previous field

Press "+/-" key to change Sweep Type

- Linear
- DO – Db/octave – Dwell (-9.99 to +9.99)
- DH- Db/Hertz (-0.49 to +0.49)
- TP – T – power sweep (+/- 0.30 to +/- 3.00)
- Pulse
- Pause

.
Enter Dwell for the non-linear sweeps if selected

Enter Taper Type

- Cs is the taper type (cosine).
- Bl  is the taper type (Blackman).

X.XX is the taper up time in seconds.
Y.YY is the taper down time in seconds

### 11.2.2 Start Sweep Number

Start Sweep number selects the sweep number that the electronics will use when a manual sweep is started.

Usually this is the same number used for production. Other sweep numbers can be selected and run at the vibrator with this selection.

## 11.3 Loading Vibrator Parameters

Vibrator parameters may be loaded via radio by using the "Source Control program" on the computer connected to the Universal Encoder or manually by the local keyboard.

Press the SERVO key, to enter Vibrator parameters

**SERVO PARAMETERS**
**START > +/- <STOP –EXIT**

**Press "E**" will bring up the following menu

**View Sweep – press 0**
**Edit Sweep – press 1**

Press 0 to view Sweeps or Press 1 to Edit Sweeps

When editing use the following keys:

"E" to enter parameter and move to next entry

"Stop" can be used to exit the edit mode and return to the main menu.

"Start" key used to move to next item in the menu

"+/-" key used to move to previous item in the menu

To enter parameters, press 1. A correct password must be entered to proceed.
**Password** must be entered to continue:

Password is 4 digits which add to 17
Example: **4,5,6, 2 is a valid Password**

Using the +/- key, select one of the following modes:

- SERVO PARAMETERS
  - Vib Characteristics
    - Acc Sensitivity MV/G
    - HD Weight
    - Bplate Weight
    - RM Weight
  - Phase Control
    - Phase Loop Gain
    - Predic Phase Gain
    - Phase Control Signal
    - Similarity Signal
  - Force Control
    - Force Loop Gain
    - Predic Force Gain
    - High Force %
    - Low Force %
  - Lift Control
    - Pad Up Count
    - Pad Up Delay
  - Limits & Errors
    - TM Current, MA
    - Valve Disp %
    - Mass Disp %
    - Peak Force %
    - Peak Mass Force %
    - Max Fund Force %
    - Avg Fund Force %
    - Max Phase Error %
    - Avg Phase Error %
    - Max Distortion %
    - Avg Distortion %
    - Dist Freq Limit
  - Radio Control
    - Vibrator ID
    - Crew ID
    - Start Code
    - PSS Type
    - Spk 0-norm 1-rev
    - Mic 0-norm 1-rev
    - Decoder Delay

    - Advanced
        - **Test Mass Fbk – Keyboard Entry Only – Normal 000**
        - **Test Valve Fbk –Key board Entry Only – Normal 000**
        - **Mass Position – Keyboard Entry Only – Normal 050**
        - Initial Advance, ms
        - Phase Preset
        - Force Preset
        - Phase Control Type
        - Force Control Type
    - Exit
- Calibration Data
    - MFBK=xxx  VFBK=xxx
    - M_OF=+xx  V_OF=+xx
    - TM_OF=xx  Acc=XXXX
- GLOBAL COUNTER CLEAR
    - Shows total number of sweeps since last reset
    - Press 1 to clear counter
- SERVICE & SUPPORT
    - Phone 1-800-762-8233
    - SeismicSource.com
- DISPLAY
    - **Display Contrast**- Use START and STOP keys to optimize display contrast
- EXIT
- RESET PRESETS – Resets all Phase and Force presets for all sweeps

### 11.3.1 Servo Parameters

Select Servo parameters and press the “E” key.

To exit without saving changes press the “Stop” button.

**To save changes the “E” key must be pressed when the “Exit menu” is shown**.

Use the “E” key to move between parameters

Uses the “Start“ key to move forward one menu.

Uses the “+/-“ key to move back one parameter

Use the “Stop” key to exit menu

By pressing the “+/-“ key or the START keys, the following menus may be selected:

- VIB CHARACTERISTICS
- PHASE CONTROL
- FORCE CONTROL
- Lift CONTROL
- LIMITS & ERROR
- RADIO CONTROL
- ADVANCED CONTROL
- EXIT

To select any displayed menu, press the “E” key.

To exit press the “Stop” key until the main menu is shown

### 11.3.2 Vib Characteristics

**Vibrator Weights can be entered in any units. All entries must be entered in same units. Example: If pounds (lbs) are used for Hold Down Weight, then Max peak Force, BP Weight, and RM Weight must also be entered in pounds.**

- Vib Characteristics
  - Acc Sensitivity MV/G
  - HD Weight
  - Bplate Weight
  - RM Weight

**Accelerometer sensitivity**, mV/g- Sensitivity of system accelerometers in millivolts per g of acceleration. Allowable range is 1 to 99.9 mV/g. Seismic Source accelerometers are 25 mV/g.

**HD Weight - Hold Down Weight,** - Force of static hold down on the base plate in thousand pounds or kilograms. This value will be used for all Ground Force Calculations. Force Output settings will be based on this entry. Allowable range is 0 to 99.9.

**BP Weight**, - Base plate weight in pounds or kilograms. Allowable range is 0 to 9.99.

**RMass Weight**, - Reaction mass weight in pounds or kilograms. Allowable range is 0 to 9.99.

### 11.3.3 Phase Control

- Phase Control
  - Phase Loop Gain
  - Predic Phase Gain
  - Phase Control Signal
  - Similarity Signal

**Phase Loop Gain**- Sets sensitivity of phase correction system. Allowable range is 0 to 99%, where 0 is system disabled and 99 is maximum sensitivity.
**Normal entry is 80**

**Predictive Phase Loop Gain**-. **NOT USED**-***Manual Entry Only.*** **Normal Entry = 00%**

**Phase control Signal**- Selects signal to be phase controlled-

0- earth force (Ground Force (GF))
1- base plate acceleration
2- reaction mass acceleration
3- reference signal
**Normal Entry is 0**

**Similarity Signal**- Selects signal to be transmitted to Universal Encoder-

0- Sim GF - Uses Similarity accelerometers to compute Ground Force)
1- Sim BP - Uses Similarity Base Plate accelerometers
2- Sim RM - Uses Similarity Reaction Mass accelerometers
3- Reference signal
4- Loop GF - Uses Loop accelerometers to compute Ground Force)
5- Loop BP - Uses Loop Base Plate accelerometers
6- Loop RM - Uses Loop Reaction Mass accelerometers

**Normal entry is 0**

### 11.3.4 Force Control

- Force Control
  - Force Loop Gain
  - Predic Force Gain
  - High Force %
  - Low Force %

**Force Loop Gain**- Sets sensitivity of force control system. Allowable values are 1 to 100%. Enter 0% to disable the force control system.
**Normal entry =80**

**Predictive Force Gain**- **NOT USED**-***Manual Entry Only.*** **Normal Entry = 00%**

**High Force Output**- Sets High Force target value of fundamental vibrator force, expressed as a percentage of Hold Down Weight.
**Normal entry = 070**

**Low Force Out**- Sets Low Force target value of fundamental vibrator force, expressed as a percentage of Hold Down Weight.
**Normal entry =040**

### 11.3.5 Lift Control

- Lift Control
  - Pad Up Count
  - Pad Up Delay

**Pad Up Count**- Number of sweeps to be taken in one pad location. Used to autolift baseplate if AUTO light is ON. Allowable range is 1 to 99.

**Pad Up Delay**- Delay between end of sweep and automatic base plate lifting. Allowable range is 0 to 99 seconds. Typical entry = 1

### 11.3.6 Limits and Errors

- Limits & Errors
  - TM Current, MA
  - Valve Disp %
  - Mass Disp %
  - Peak Force %
  - Peak Mass Force %
  - Max Fund Force %
  - Avg Fund Force %
  - Max Phase Error %
  - Avg Phase Error %
  - Max Distortion %
  - Avg Distortion %
  - Dist Freq Limit

All the "Limits and Errors" entries start with "m0"
This is a changeable entry where:-
0 = No Limit/Error display or control
1 = Limit/Error displayed
3 = Limit/Error displayed and controlled
Recommended entry is "m3" for all parameters

**TM Current**- Sets maximum allowable peak torque motor current. Allowable range is 0 to 40 milliamperes. Example: If 40 mA is selected, then torque motor current will be limited to +/- 40 mA.
**Typical entry = 040**

**Valve Disp**- Sets a limit of servo valve spool stroke, as a percentage of full stroke. Allowable range is 0 to 99%. **Typical entry =080**

**Mass Disp**- Sets a limit of reaction mass displacement, as a percentage of full travel. Allowable range is 0 to 99%. **Typical entry = 080**

**Peak Force**- Sets a limit of peak Ground Force, as a percentage of holddown weight. Allowable range is 0 to 199%. **Typical entry =90**

**Peak Reaction Mass Force**- Sets a limit of the peak Reaction Mass force, as a percentage of holddown weight. Allowable range is 0 to 199%. **Typical entry =99**

**Max Fnd Force**- Set to the minimum value of fundamental force,expressed as a percentage of holddown weight, which does not flag an error. Allowable range is 0 to 99%. **Typical entry =99**

**AVR Fnd Force**- Sets the minimum value of average fundamental force, expressed as a percentage of holddown weight, which does not flag an error. Allowable range is 0 to 99%. **Typical entry =99**

**MAX Phase Err**- Sets maximum value of absolute phase error that does not flag an error. Allowable range is 1 to 99 degrees. **Typical entry =60**

**AVR Phase Err**- Sets maximum value of absolute average phase error that does not flag an error. Allowable range is 1 to 99 degrees. **Typical entry =5**

**MAX Distortion**- Sets maximum value of total harmonic distortion, expressed as a percentage of fundamental, which does not flag an error. Allowable range 0 to 99%. **Typical Entry =80**

**AVR Distortion**- Sets maximum value of average total harmonic distortion, expressed as a percentage of fundamental, which does not flag an error. Allowable range is 0 to 99%. **Typical Entry =30**

**Distortion Frequency Limit** – This entry determines the maximum frequency used for the distortion measurements. Example: With and entry of 200 Hz, all frequencies above 200 Hz are ignored when computing distortion. **Normal entry is 200 Hz**

### 11.3.7 Radio Control

- Radio Control
  - Vibrator ID
  - Crew ID
  - Start Code
  - PSS Type
  - Spk 0-norm 1-rev
  - Mic 0-norm 1-rev
  - Decoder Delay

**Vibrator ID**- Sets one of 16 (1-16) Vibrator ID's, used to start the sweep by radio. Vibrator number is a unique number form 1 to 16

**Crew ID**- Sets one of 256 (0-255) crew ID's. Crew number is used to start the sweep by radio. Crew number in vibrators must match the crew number set in the Start code Sequence parameters in the Universal Encoder for the vibrator to start.

**Start Code**- Sets one of four (0-3) start codes, used to start the sweep by radio. Start codes in vibrators and Universal Encoder must be identical.

**PSS Type**- Selects PSS type 12 or 15. PSS type 15 is required when using the VSS (Vibrator Signature system). All units must have same PSS type for proper operation

**Spk 0-norm 1-rev –** This selection allows the speaker circuit to be reversed. This is used when setting up the radio interface. All speaker polarities on a crew should be set the same. This setting in the Vibrator will affect the start time.

**Mic 0-norm 1-rev -**This selection allows the microphone circuit to be reversed. This is used when setting up the radio interface. All microphone polarities on a crew should be set the same. This setting in the Encoder will affect the start time.

**Decoder Delay**- This entry can be used to compensate for Start Time differences between vibrator units. This entry should only be used by advanced users of the system. Compensates for time delay in start code transmission over the radio. Allowable range is 0 to 9.99 milliseconds. See Start Time Setup section of manual.

### 11.3.8 Advanced Control

- Advanced
  - **Test Mass Fbk – Keyboard Entry Only – Normal 000**
  - **Test Valve Fbk –Key board Entry Only – Normal 000**
  - **Mass Position – Keyboard Entry Only – Normal 050**
  - Initial Advance, ms
  - Phase Preset
  - Force Preset
  - Phase Control Type
  - Force Control Type

**Mass Feedback**- ***Manual Entry Only***- Sets the attenuation of the mass feedback control loop. Entry of 0 causes the system to use the value determined during calibration. Entry of 1 corresponds to maximum loop gain. Entry of 255 disables mass feedback.
Typical starting manual entry of 55 can be used for testing.
**Normal entry =000** .

**Valve Feedback**- ***Manual Entry Only*** -Sets the attenuation of the valve feedback control loop. Entry of 0 causes the system to use the value determined during calibration. Entry of 1 corresponds to maximum loop gain. Entry of 255 disables valve feedback.
Typical starting manual entry of 68 can be used for testing
**Normal entry =000**

**Mass Position** - ***Manual Entry Only*** -Sets position of reaction mass. 0 is lowest position, 050 is centered, and +99% is highest position. Typical entry =050

**Initial Advance**- Sets time advance of drive signal to compensate for hydraulic system delay. Allowable range is 0 to 99 milliseconds. 10 msec. is typical.

**Phase Preset**- **NOT USED**-***Manual Entry Only***. Resets initial phase correction used at the beginning of the sweep. Allowable values are -180 to +180 degrees.
Normal entry is 0

**Force Output Preset**- **NOT USED**-***Manual Entry Only*** **Normal entry = 00**

**Phase Control Type**- **NOT USED**-***Manual Entry Only*** **Normal entry = 0**

**Force Control Type**- **NOT USED**-***Manual Entry Only*** **Normal entry = 0**

### 11.3.9 Calibration Data

Shows results of last calibration. Includes mass feedback attenuation setting, valve feedback attenuation setting, mass LVDT offset, valve LVDT offset, torque Motor offset, and results of accelerometer tests.

Accelerometer test results are in the form WXYZ where:

- W shows performance of loop mass acc
- X shows performance of sim mass acc.
- Y shows performance of loop base plate acc
- Z shows performance of sim base plate acc

The following numbers are used to show the results of the test

- 0 indicates that the accelerometer test is successful.
- 1 indicates that the accelerometer polarity is reversed.
- 2 indicates that the accelerometer is faulty.

A display of "0000" shows that all accelerometers passed the test

## 11.4 Vibrator parameters with Source Control

The Source Control program can be used to set almost all of the parameters in the Force Two Decoder Units.

The Computer running source Control is connected via serial port directly to the Force Two Decoder Unit.

The 9 pin male D sub connector on the side of the Force Two unit is normally used to connect directly to the computer's serial port. Some of the older Force Two units do not have the serial connection on the side, on these units the GPS connector can be used.

**F2 GPS connector: 9-pin Female – GPS connector on End of unit**

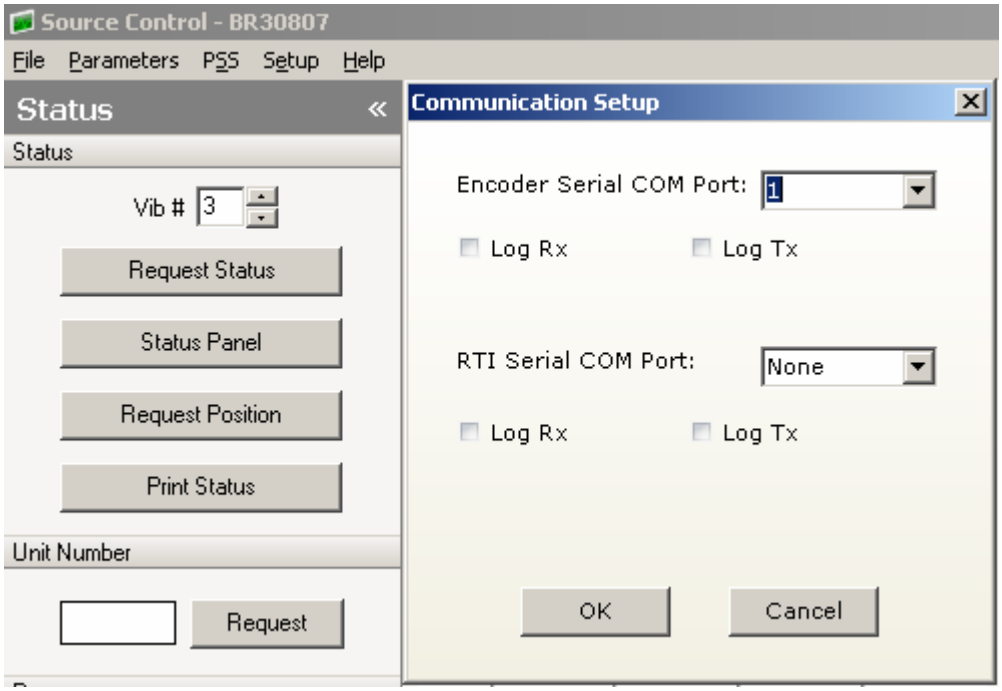
- 2 – GPS Transmit (nothing currently coming out)
- 3 – GPS Receive (VSR sends GPS positions and VSR status to F2) 19200
- 5 – Ground
- 6 – Parameter Transmit, 57600 (Pins 6 and 7 was installed before we had the parameter connector below)
- 7 – Parameter Receive, 57600
- 8 – Ground

**F2 Parameter connector: 9-pin Male – Connector on Side of unit**

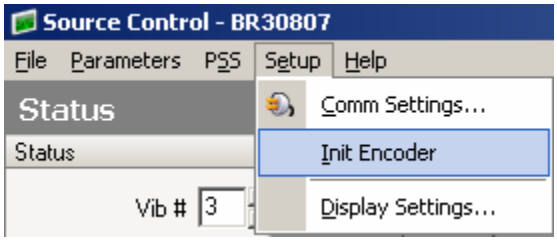
- 2 – Parameter Receive, 57600
- 3 – Parameter Transmit, 57600
- 5 – Ground

After connecting the serial cable form the computer to the Force Two Decoder, Start the **Source Control Program**.

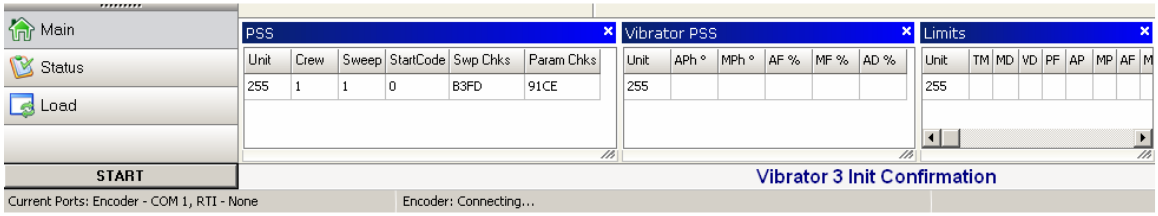
Go to the Setup Menu in the Source Control Program and select the correct serial port.



After selecting the correct serial port , check that communication to the unit is working. Go to the Setup – Init Encoder selection.




The Vibrator Init Confirmation message should appear on the bottom of the screen.




The Source Control Program is now connected to the Vibrator Decoder, and parameters can be transmitted and verified. Go to the Source Control program section of this manual for more information.

# 12 Optional Force Two systems

The Force Two Vibrator system has numerous options available, contact a Seismic Source representative or visit our website:
http://seismicsource.com/phpnuke/html/index.php

## 12.1 GPS option

The Force Two Decoder unit can be connected to most GPS receivers.

The Force Two unit is expecting RS232 serial data with the following message types:

**$GPGGA**
**$GPRMC**

The serial baud rate should be set as follows

**GPS Baud Rate: 19200, N,8,1 – no flow control**

The 9 pin Female D-sub connector on the end of the Force Two unit is used for the GPS connection. Pins 2, 3 and 5 are used fro the GPS connection.

**F2 GPS connector: 9-pin Female**

- 2 – GPS Transmit (currently not used)
- 3 – GPS Receive (VSR sends GPS positions and VSR status to F2) 19200
- 5 – Ground
- 6 – Parameter Transmit, 57600
- 7 – Parameter Receive, 57600
- 8 – Ground

## 12.2 VSR recorder (Vibrator Signature Recorder)

The Vibrator signature recorder can be used with the Force Two system to record 24 bit vibrator signature data from every Vibrator Point.

The VSR system consists of the following

1. Vibrator Signature Recorder – 24 bit – Records
    a. Baseplate Acceleration
    b. Reaction Mass Acceleration
    c. Ground Force Motion (Weighted Sum)
    d. True Reference
    e. GPS position
    f. GPS time to microsecond accuracy
2. GPS Receiver
3. Display computer (optional)
4. VSR Force Two Cable set

The Vibrator Signature Data can be recorded in the VSR recorder and downloaded every night, or the optional Display computer can be used to record the data and show the signature signal on the display.

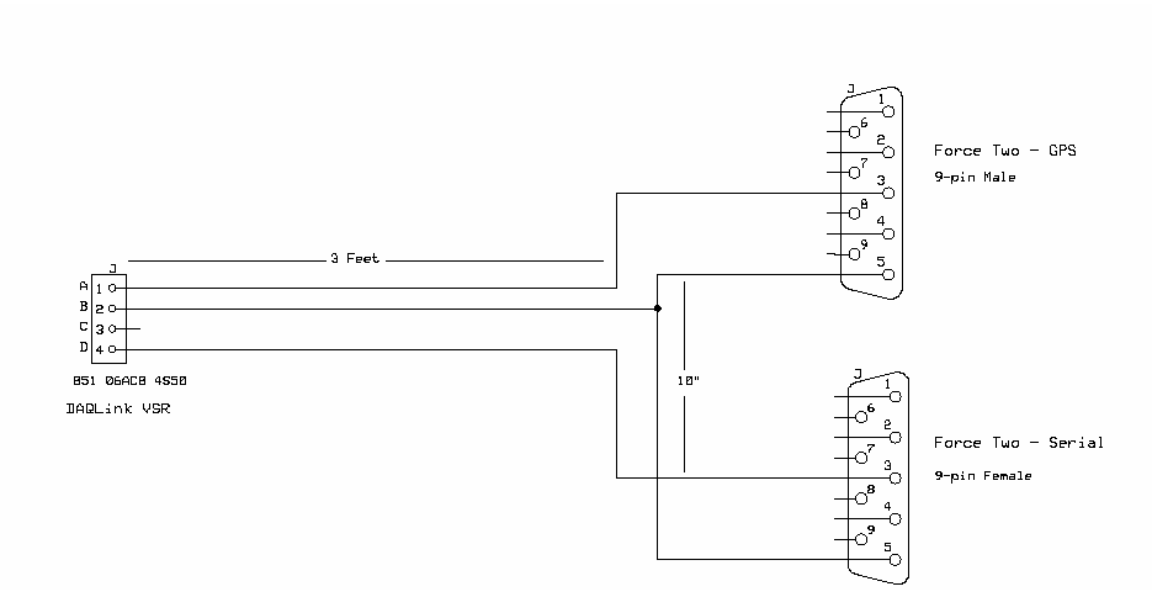
**Basic Operation:**

Typically the Seismic Recording system begins the operation by sending file and EP ID number to the Universal Encoder. This information is sent with the "Start Code" information to the Force Two Unit. After the "Start Code" has been received, this information is sent to the Vibrator Signature Recorder, and the data is stored along with the Vibrator Signature data. At the end of the Sweep, status information is sent to the Force Two unit from the VSR recorder. This VSR status information is added to the PSS information and sent back to the main Seismic Recorder.
The Status of the VSR recorders is displayed and stored by the Source Control program with all of the other PSS information. If any problem occurs, the observer or the vibrator operator, with the computer display, can quickly identify the problem.
At the end of the Day the VSR data is usually exported to SEG-Y files and sent to the processing center.

**Note:**
**GPS must be set to 19.2 K baud on the VSR system**

**Wiring:**

The following shows the serial connections required between the Force Two



## 12.3 Bird Dog II - Vibrator Quality Control

The Bird Dog II – Vibrator Quality control System is a completed independent test system designed to test Vibroseis Control Systems. The system includes the following:

- Bird Dog II 24 bit recorder
- Two independent accelerometers
- Force Two VibQC cable
- True Reference Cable
- Power and communication cable
- Geophone Test Cable

The System can be used with the independent accelerometers to test the complete vibroseis control system. The independent accelerometers verify that the polarity and summing of the accelerometers are done correctly.

In addition the system can be used with the Force Two Test connector to record all of the signals contributing to the vibrator's performance.

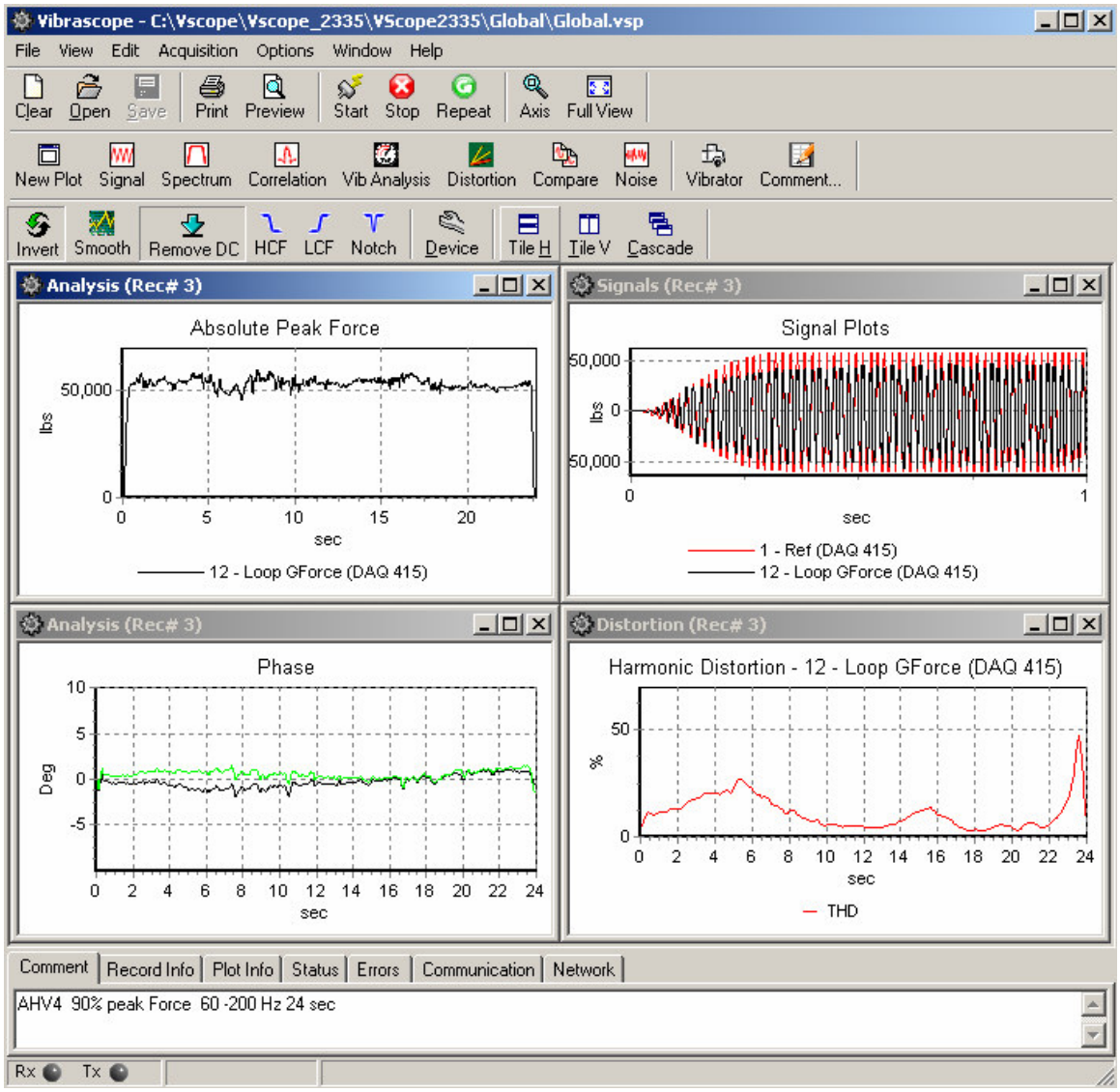
Connect the Bird Dog II unit to the 15 pin test connector on the side of the Force Two Decoder unit.

The following signals can be recorded using a 12 channel Bird Dog II unit.

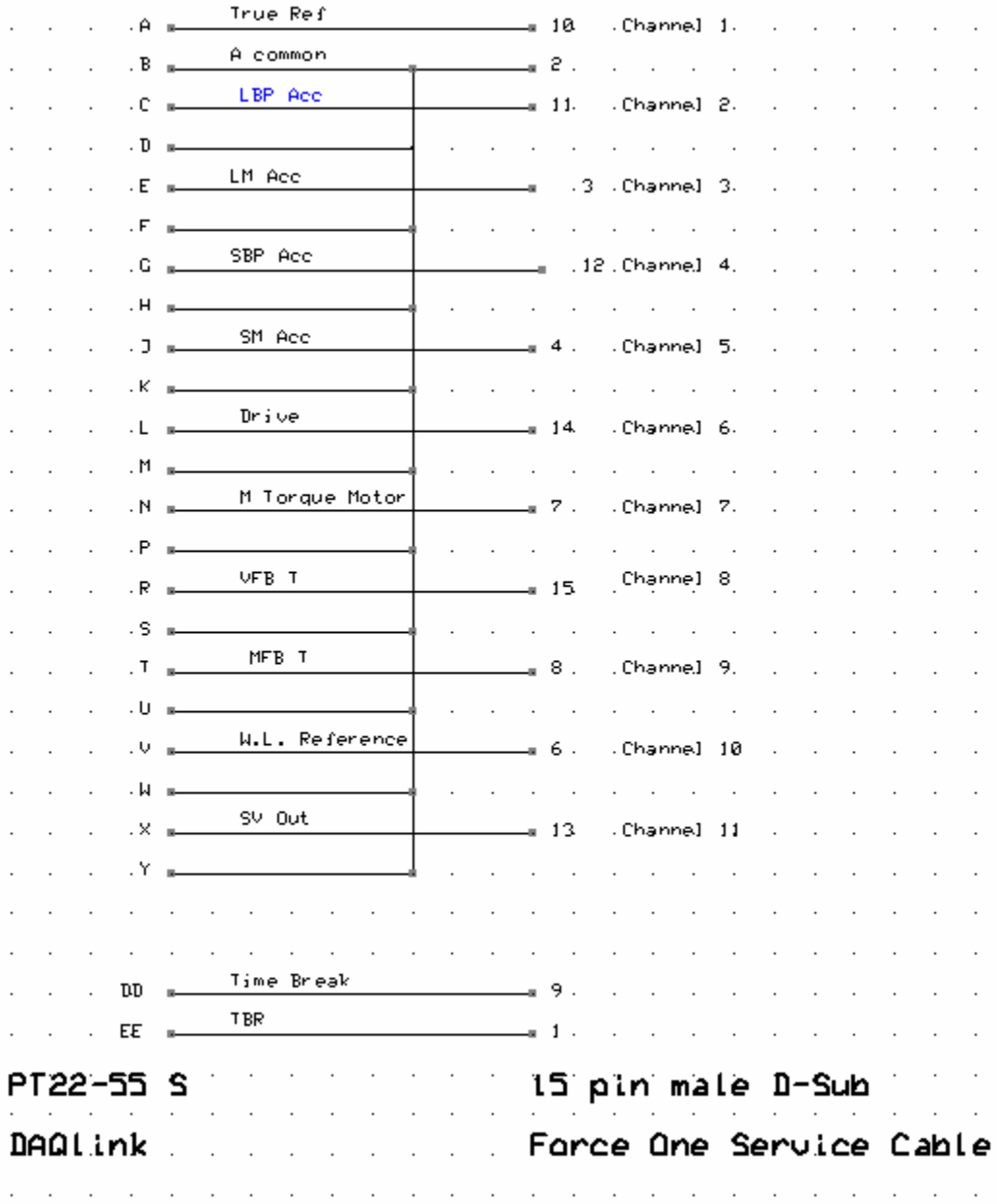
True Reference
Loop Baseplate Accelerometer
Loop Reaction Mass Accelerometer
Loop Ground Force Signal
Sim Baseplate Accelerometer
Sim Reaction Mass Accelerometer
Sim Ground Force Signal
Drive Signal – sine wave going to Torque Motor
Torque Motor Current
Valve LVDT – Main Valve displacement signal
Mass LVDT – Reaction Mass displacement signal

WireLine Reference – signals used for Wireline similarities
Svout – Similarity Vibrator Output – Normally GF - signals used for Wireline similarities

Typical Quality Control Plot showing Phase Error, Force Output, and Distortion



Schematic for cable between 15 pin Force Two Service Cable and Bird Dog II unit



### 12.3.1 Bird Dog II – Wireline System

The Bird Dog II – Vibrator QC Wireline System includes the following:

- Bird Dog II – 12 channel unit
- Five Vibrator Wireline connection box
- Cables for Wireline connection to Vibrators
- Bird Dog II Power and communication Cables
- Geophone Test Cable
- Vibrator QC adapter box
- Independent magnetic accelerometers (Optional)

The Bird Dog II Wireline systems allows the Wireline signals (Wireline Reference and Wireline Vibrator Output ) to be compared from up to 5 Vibrators simultaneously. There is also an input for the Wireline Reference and Time Break Signal from the Universal Encoder.

## 12.4 Vibrator Simulator

The Vibrator Simulator allows the Force Two Vibrator control electronics to be tested without an Hydraulic Vibrator. The Vibrator simulator simulated the following electrical signals produced on a Hydraulic Vibrator:

- Torque Motor Circuit
- Valve response and LVDT circuit
- Reaction Mass response and Mass LVDT circuit
- Reaction Mass Accelerometer
- Baseplate Acelerometer
- Lift Circuit
- Remote Down

The Vibrator Simulator is very useful in troubleshooting and isolating problems with the Vibrator Electronics, and Vibrator Radio System.

## 12.5 Vibrator PSS Monitor System – Spare UE

The Spare Universal Encoder can be used by the Vibrator mechanic or the client representative to monitor activity on the seismic crew.

The Spare UE with a radio and a computer running the Source Control Program can monitor or control the following:

- PSS data from all of the Vibrators or Source Control Units (AWD's, blaster's)
- GPS data from all of the Vibrators or Source Control Units

Monitoring the PSS data can be done during production; other operations should only be done by the Vibrator Technician when the crew is not in production.

- Loading and comparing operational parameters
- Loading and comparing Sweep Parameters
- Status Parameters
- Remote Radio similarities when the crew is not operating

The **UE monitor** can be used with both **Force Two** systems and **Vib Pro** system running PSS type 12 and PSS type 15.

# 13 Polarity and Phase Convention

The Force Two Vibrator system uses the following polarity standard for the accelerometer signal.

**Force Two Upward Acceleration = Positive Voltage (Tap on top gives negative pulse)**

This is opposite polarity than is used for most geophone strings.

The Ground Force Signal of the vibrator is approximated by using the weighted sum of the Reaction Mass Force and the Baseplate Force.

A positive Ground Force Signal is defined to be a positive compressive Force. With this polarity, Ground Force should be 180 degrees out of phase with the Reference from the Force Two Decoder and the Encoder units (when sweep phase is the same in both the Encoder and Decoders). This is also the suggested SEG Polarity Standard for Vibroseis operation.

(**Note: All Pelton Vibrator Electronics use this same polarity standard. i.e. Upward Acceleration = Positive**)

The SEG Polarity standard is written to address the polarity of the crew. The following must be checked to prove the polarity of the crew:

1. Geophone polarity – (Normal tap on top gives positive voltage)
2. Vibrator Polarity –
3. Polarity of the Encoder signal used for correlation.
4. Polarity of Recording to tape –

**Wireline Similarities to check Crew Polarity**

Wireline similarities can be used to check the polarity of a crew. The following is a quick procedure to check the polarity using the Force Two Wireline Sim signals.

a) Perform a Tap test of the Geophone Strings. Record the signals uncorrelated to tape. Typical Tap on top gives positive voltage.
b) Connect The Wireline cables of the Force Two System to the Recording System
c) Pressure Down the Vibrator Unit. Remove an accelerometer from the Vibrator unit and connect the accelerometer to the RM accelerometer input on the Connector Panel.. Install shorting plug in the Down Enable connector on the Connector Panel (This allows the vibrator electronics to start with the Vibrator Pressured down). Start a sweep from the Recording Truck and perform a Tap

test of the accelerometer signal. Make sure that it is the same polarity as the geophone. (The Vibrator should not be shaking at this point). If it is reverse polarity from the geophone, then swap the polarity of the Wireline connection.

d) After determining Wireline polarity in step "c" connect the vibrators to the wireline cables and do a wireline test.
e) For the suggested SEG polarity, the Ground Force signal should be in phase with the reference signal.

The Wireline Reference of the Force Two system is a Delayed True Reference Signal. The delay should be about 1.7 milliseconds.

When performing the Wireline Similarity tests it is good to acquire at least one record and use the systems Encoder to correlate the signal. This test will prove that there is not an additional reversal in the Encoder's True Reference signal used for correlation. The Ground Force signal should show a positive pulse at about 1.7 milliseconds.

**Radio Similarities**

The Radio Similarities will not show crew polarity, but can be used to show the Polarity of the Vibrator System.

The Source Control program can be used to analyze the radio similarities. For ease of use, the Source Control program can reverses the polarity of the returning vibrator signal so that the phase error plots will display 0 degrees.

# 14 Radio Requirements

The Radio must have the following specifications:

1. Response time of transmitter after keying PTT- less than 125 milliseconds.
2. Frequency range (3dB)- 300 to 3000 Hz.
3. Signal to noise ratio- 20dB
4. Receiver output level (100% modulation)- at least 2 volts p-p.
5. Mike input for 100% modulation- 0.2 volts p-p.

Note: Radio polarity must be observed. If vibrator does not start, reverse speaker polarity via the software selection in the Source Control software.

# 15 SERVICE & SUPPORT

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2391 E. Coleman Rd.
Ponca City, OK 74604
USA

Telephone: (580) 762-8233
Fax: (580) 762-1785

www.seismicsource.com

# 16 Appendix

## 16.1 Communication Card Jumper Settings

| **Board Mode Selection** | |
|---|---|
| | JMP5 |
| Program (Reserved for factory use) | 1-2 |
| **Operate Mode (default)** | **2-3** |

**Time Break (Start Program selects isolated or non-isolated)**

| | JMP6 | JMP4 |
|---|---|---|
| **Radio Board issues Time Break (default)** | **1-2** | **2-3** |

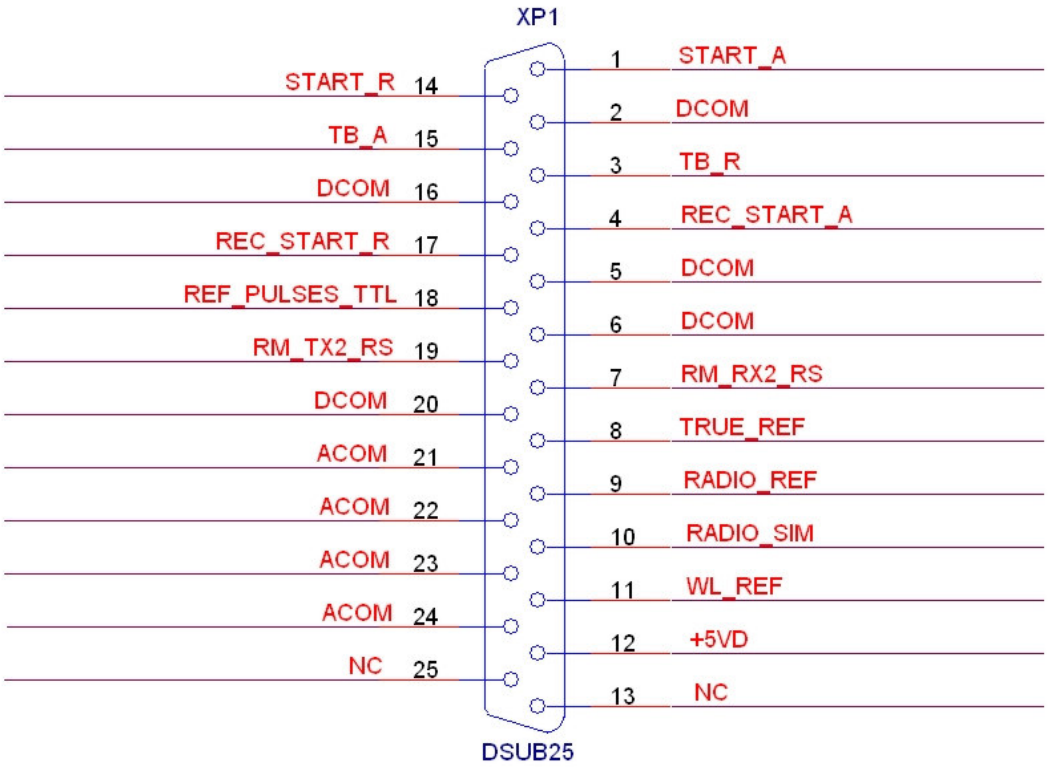
| **Serial Port** | | |
|---|---|---|
| | JMP3, JMP7 | JMP8 |
| **Computer port is RS-232 (default)** | **2-3** | **2-3** |

| **Universal Encoder Start signal conditioner**<br>(Start Program selects low going high or high going low signal input) | | | |
|---|---|---|---|
| | JM18 (GND) | JM19 (+5V pullup) | |
| Closure | 1-2 | 1-2 | |
| TTL | Open | Open | |

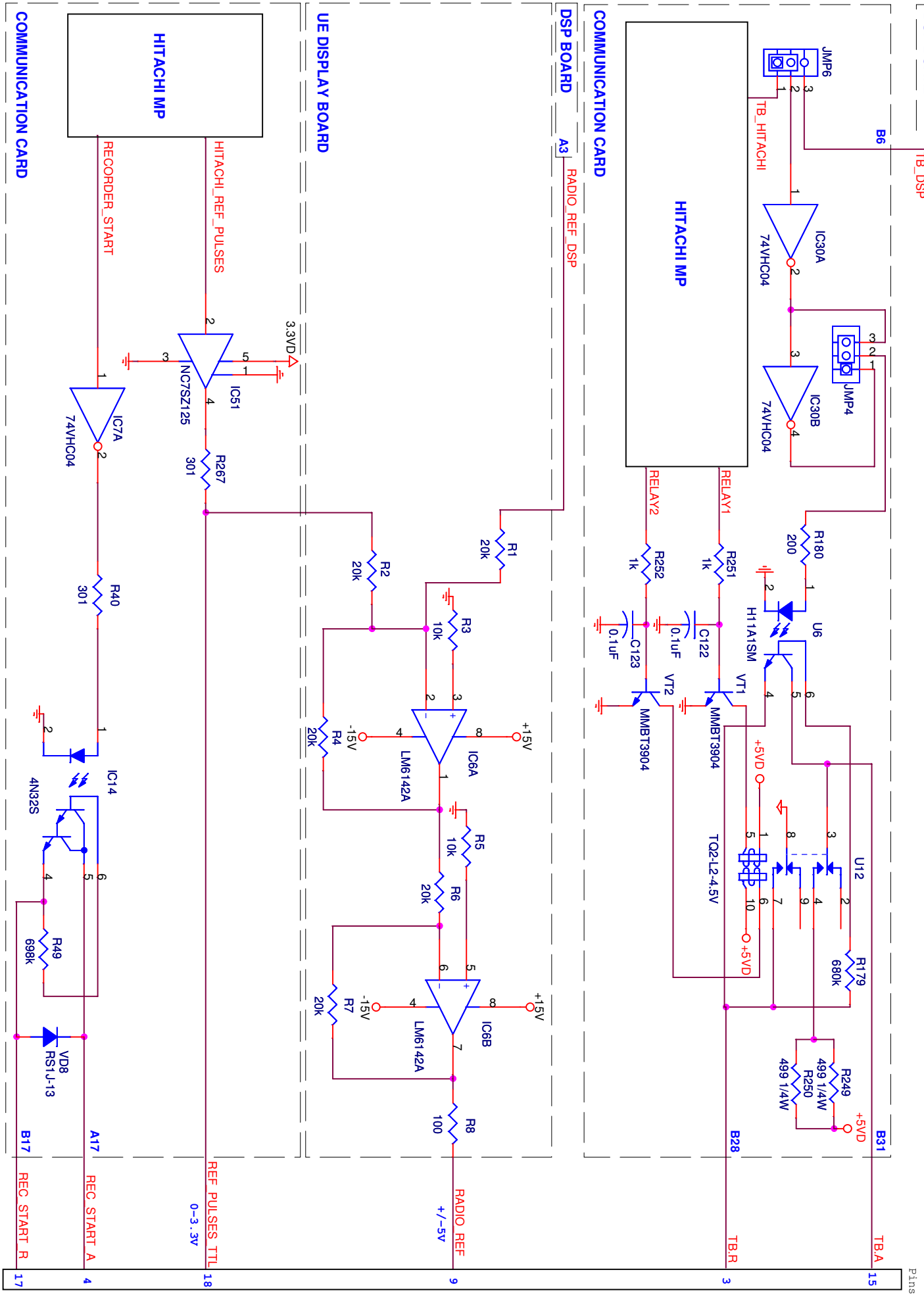
### 16.2 Encoder Information

# Universal Encoder 25 pin-Connector

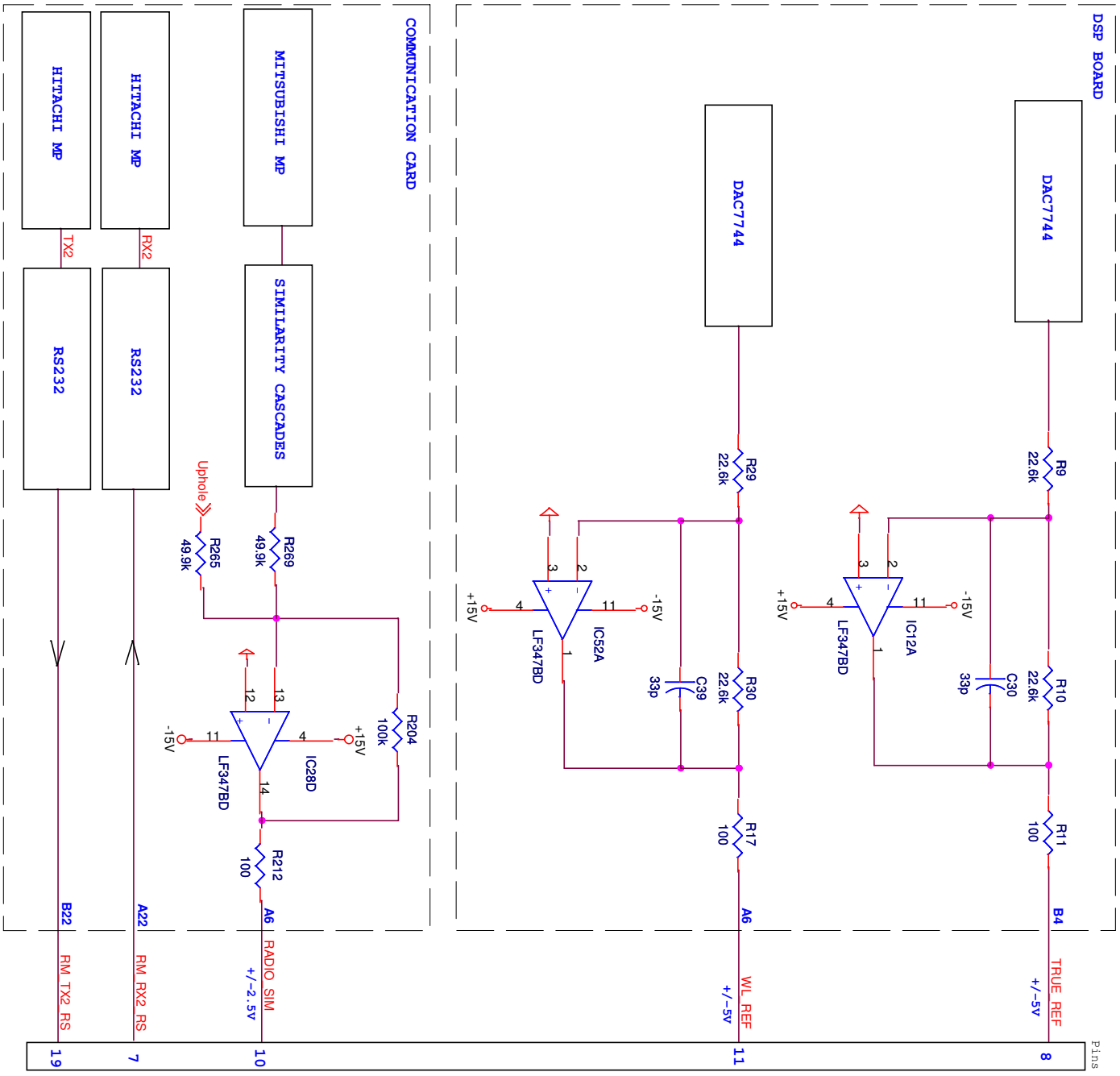
| | | |
|---|---|---|
| **1** | **START_A** | **Start UE Active Input Signal** |
| **2** | **DCOM** | **Digital Common Signal** |
| **3** | **TB_R** | **Time Break Return Output Signal** |
| **4** | **REC_START_A** | **Recorder Start Signal Active** |
| **5** | **DCOM** | **Digital Common Signal** |
| **6** | **DCOM** | **Digital Common Signal** |
| **7** | **RM_RX2_RS** | **Recording Truck Interface Receive Signal** |
| **8** | **TRUE_REF** | **True Reference Signal** |
| **9** | **RADIO_REF** | **Radio Reference Signal** |
| **10** | **RADIO_SIM** | **Radio Similarity Signal** |
| **11** | **WL_REF** | **Wireline Reference Signal** |
| **12** | **+5VD** | **+5 Volts DC** |
| **13** | **NC** | **Not Connected** |
| **14** | **START_R** | **Start UE Return Input Signal** |
| **15** | **TB_A** | **Time Break Active Output Signal** |
| **16** | **DCOM** | **Digital Common Signal** |
| **17** | **REC_START_R** | **Recorder Start Signal Return** |
| **18** | **REF_PULSES_TTL** | **Reference Pulses Signal** |
| **19** | **RM_TX2_RS** | **Recording Truck Interface Transmit Signal** |
| **20** | **DCOM** | **Digital Common Signal** |
| **21** | **ACOM** | **Analog Common Signal** |
| **22** | **ACOM** | **Analog Common Signal** |
| **23** | **ACOM** | **Analog Common Signal** |
| **24** | **ACOM** | **Analog Common Signal** |
| **25** | **NC** | **Not Connected** |

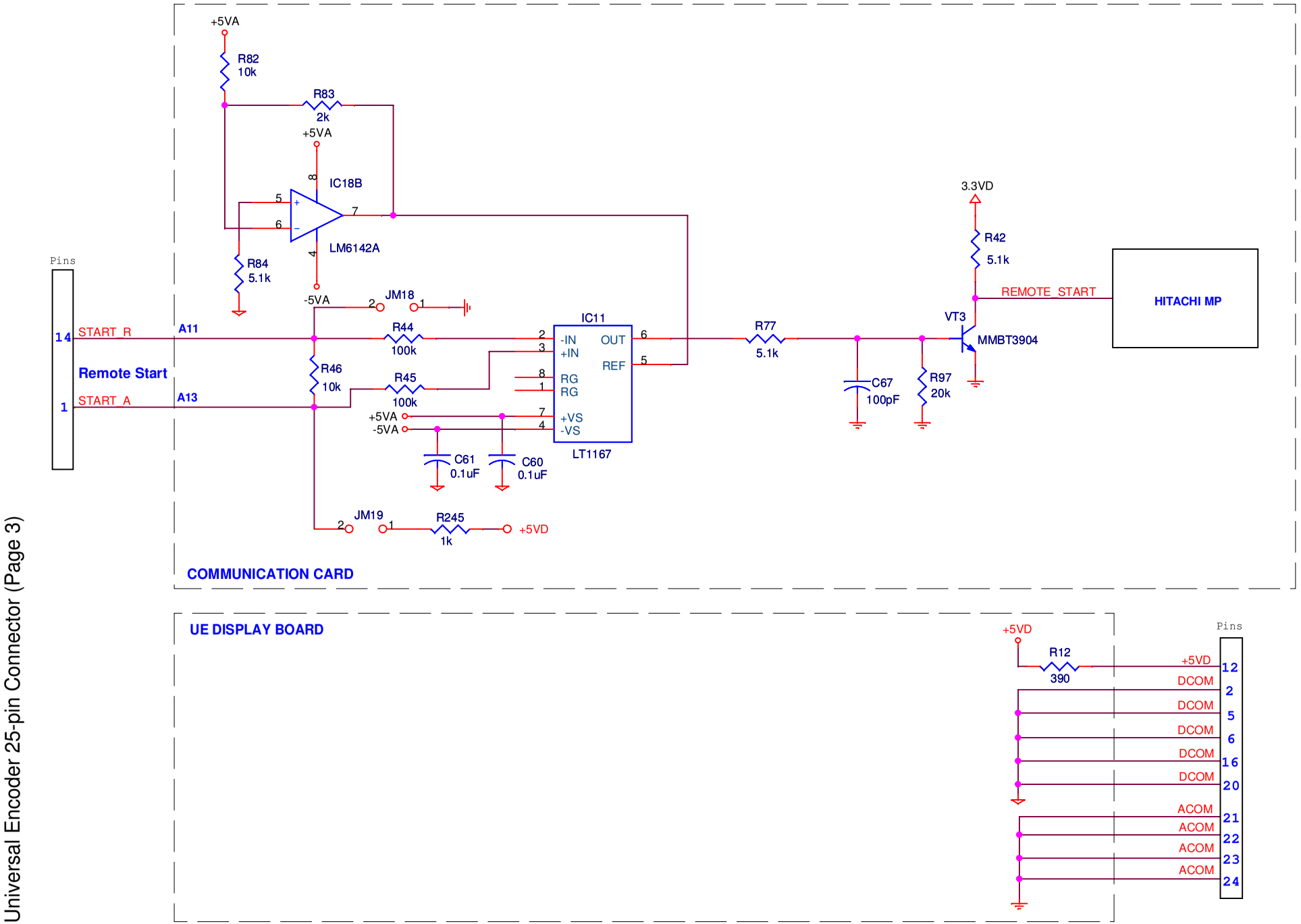

XP1
START_R 14
TB_A 15
DCOM 16
REC_START_R 17
REF_PULSES_TTL 18
RM_TX2_RS 19
DCOM 20
ACOM 21
ACOM 22
ACOM 23
ACOM 24
NC 25
1 START_A
2 DCOM
3 TB_R
4 REC_START_A
5 DCOM
6 DCOM
7 RM_RX2_RS
8 TRUE_REF
9 RADIO_REF
10 RADIO_SIM
11 WL_REF
12 +5VD
13 NC
DSUB25

Universal Encoder 25-pin Connector (Page 1)

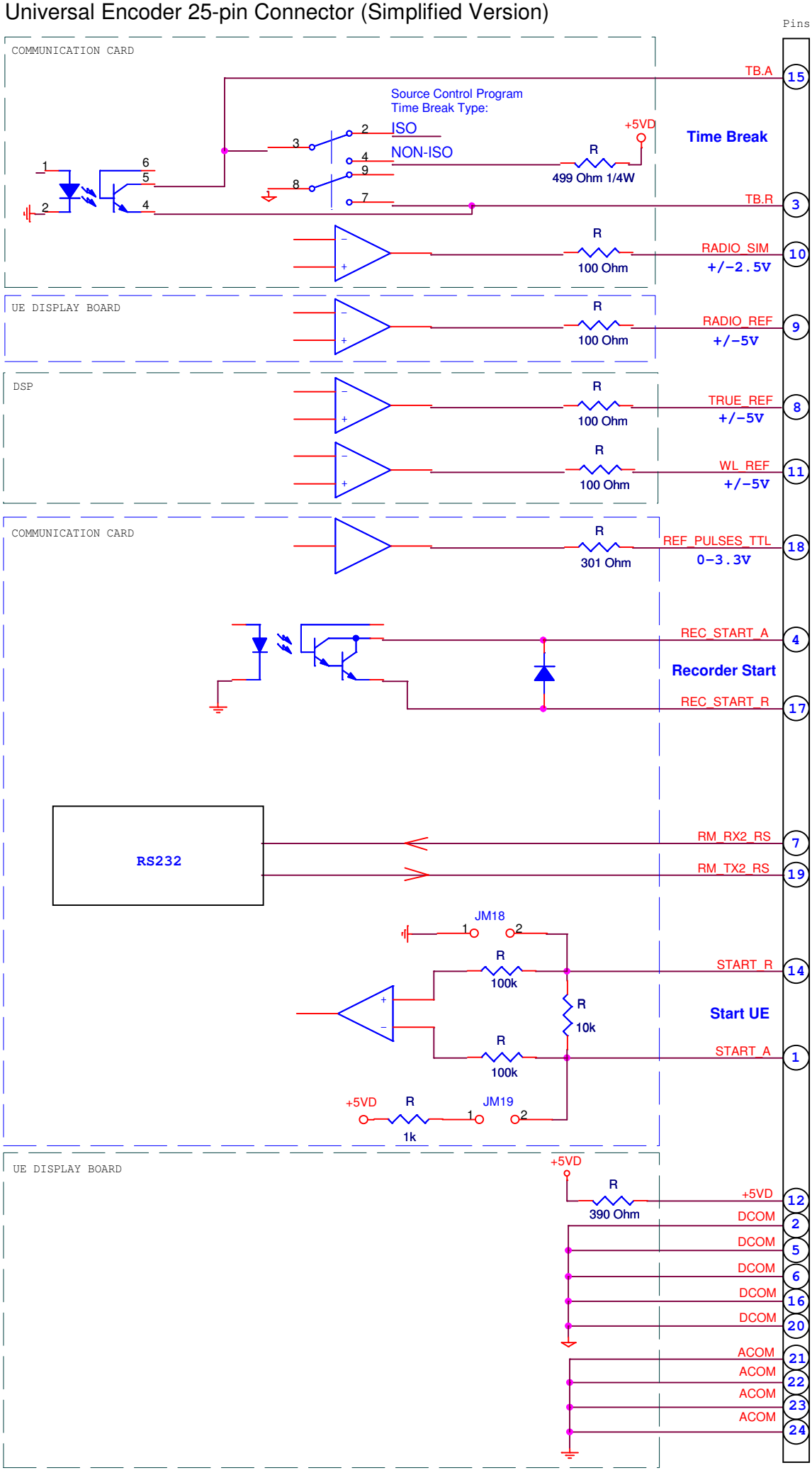


Universal Encoder 25-pin Connector (Page 2)



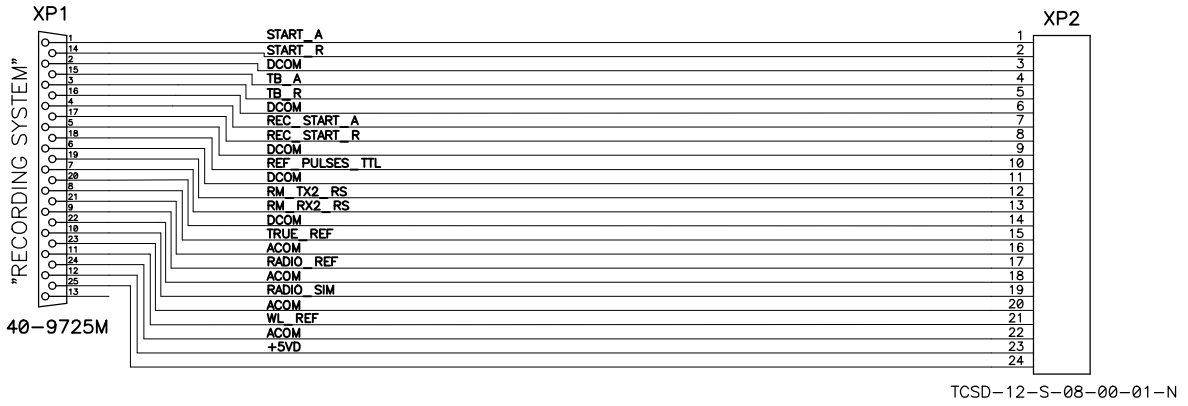

Universal Encoder 25-pin Connector (Page 3)
COMMUNICATION CARD
UE DISPLAY BOARD
Pins
14
1
START_R
START_A
A11
A13
Remote Start
+5VA
-5VA
R82
10k
R83
2k
R84
5.1k
IC18B
LM6142A
JM18
R46
10k
R44
100k
R45
100k
IC11
-IN
+IN
RG
RG
+VS
-VS
OUT
REF
LT1167
C61
0.1uF
C60
0.1uF
JM19
R245
1k
+5VD
R77
5.1k
3.3VD
R42
5.1k
VT3
MMBT3904
C67
100pF
R97
20k
REMOTE_START
HITACHI MP
R12
390
DCOM
ACOM
12
2
5
6
16
20
21
22
23
24

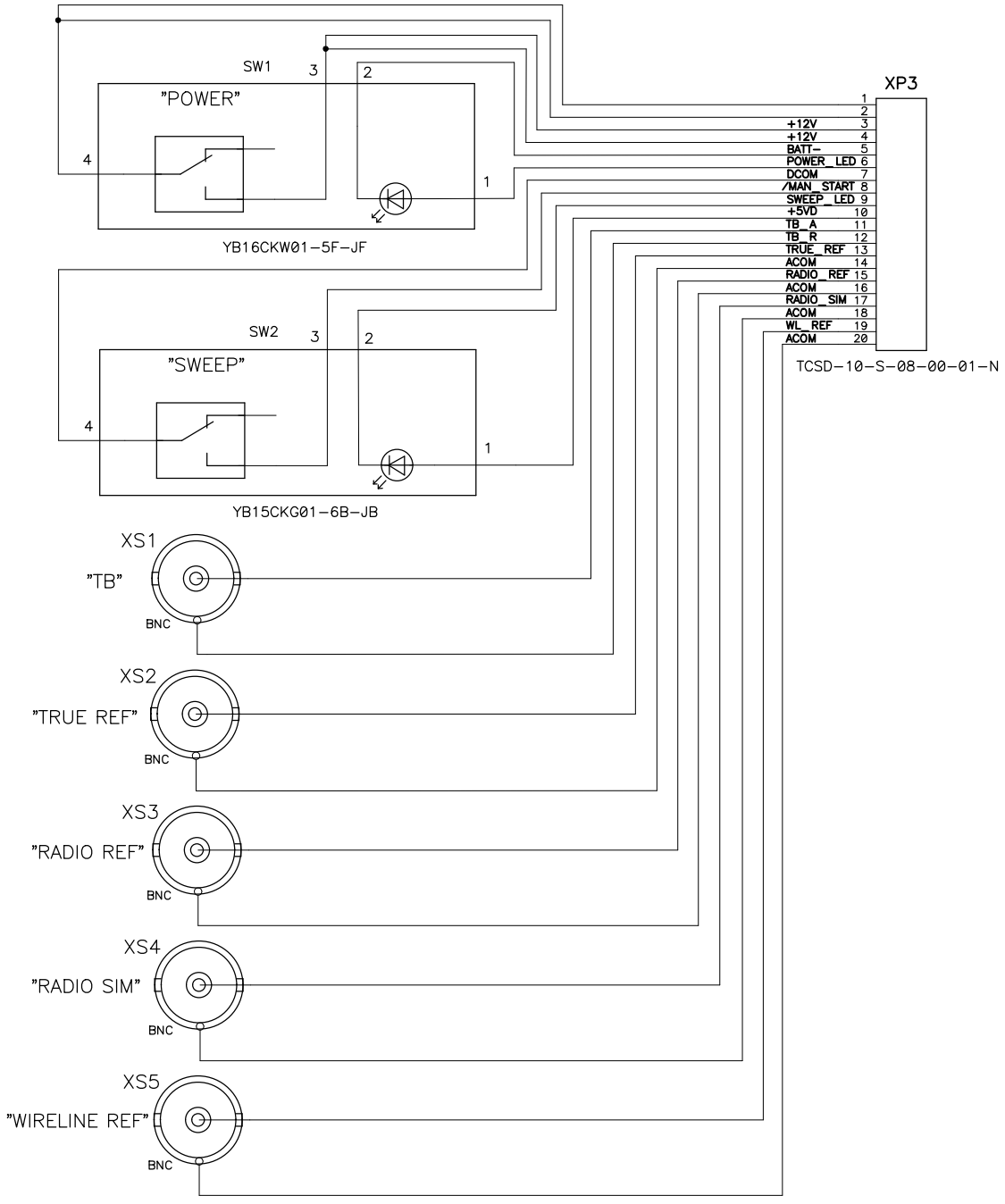
# Universal Encoder 25-pin Connector (Simplified Version)

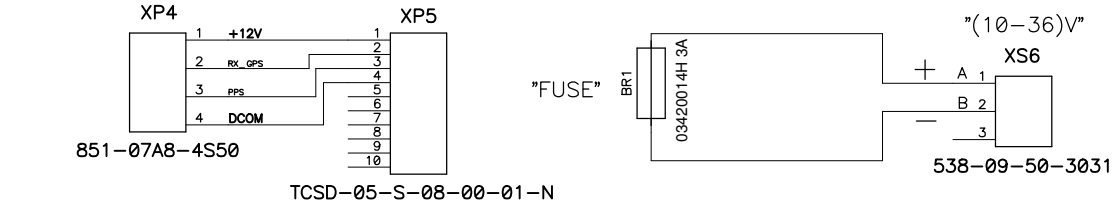


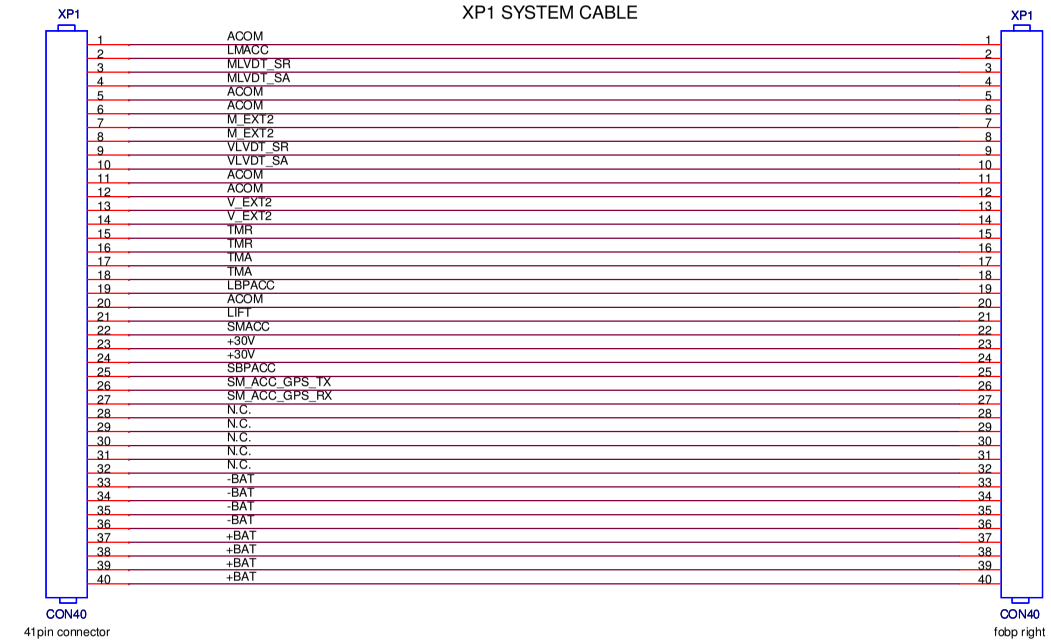

25 Pin D-SUB
Male Connector
(Simplified version)

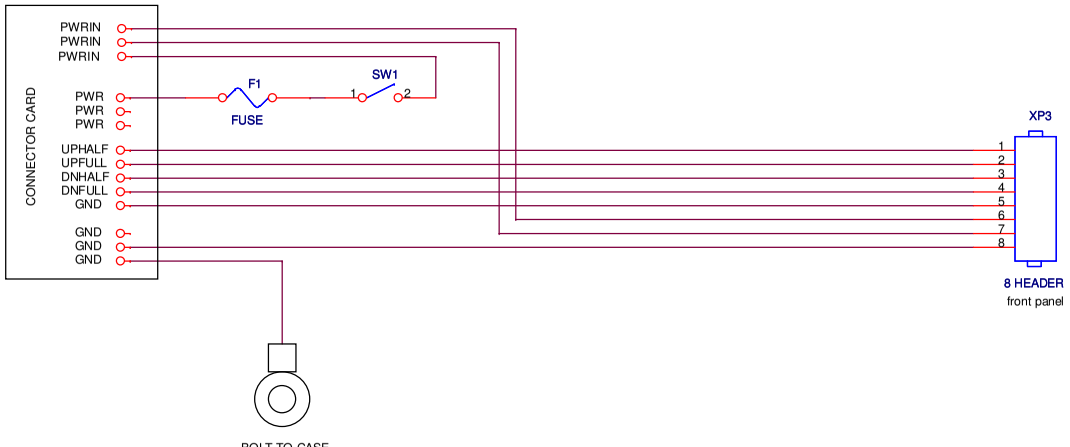
# Universal Encoder Front Panel

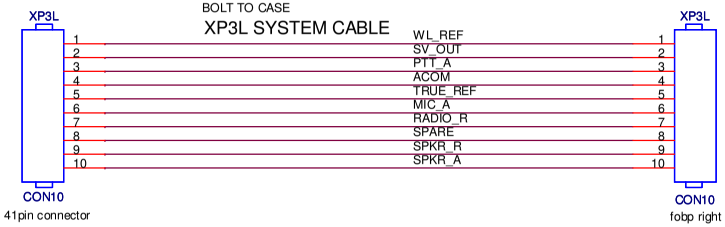


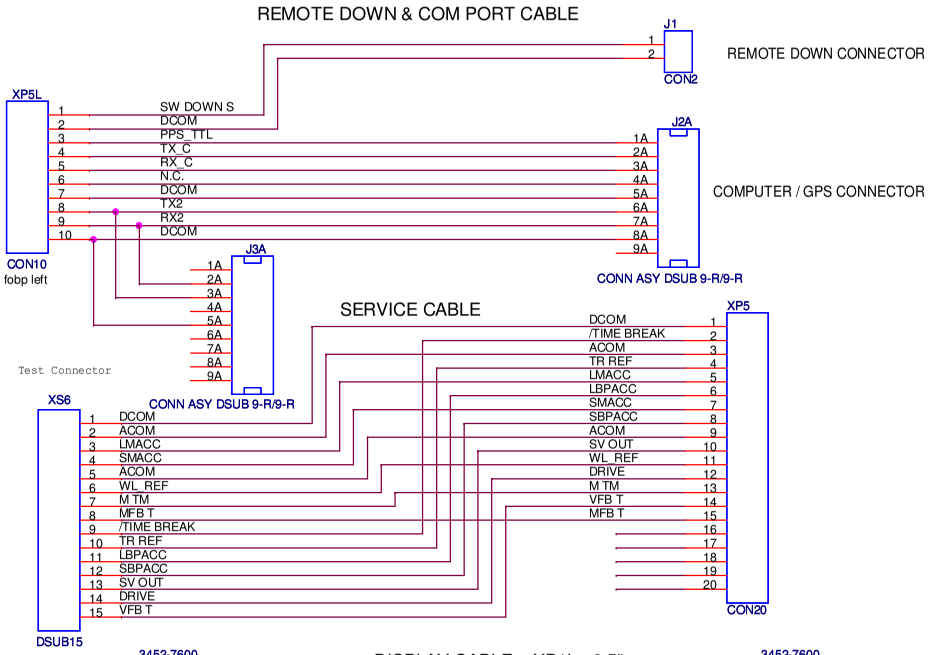



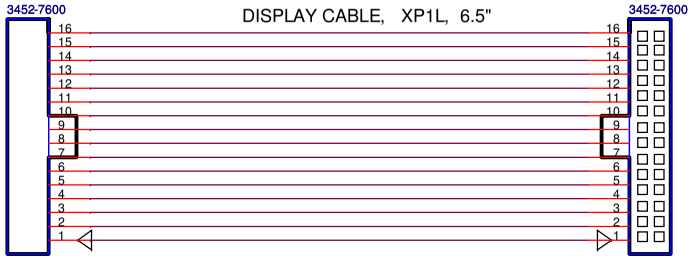



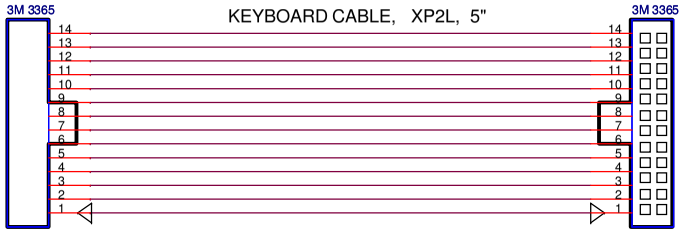



Force Two Connectors/Cables