INSTALLATION AND TUNE-UP

1.0 TEST EQUIPMENT REQUIRED

1.1 Calibrated 3 1/2 Digit Voltmeter

1.2 Calibrated Dual Trace Oscilloscope

1.3 Calibrated Frequency Counter (accurate to ± 1 Hz)

1.4 250 Watt, 50ς Non-Inductive dummy load

2.0 UNPACKING & MOUNTING

2.1 Remove the Transmitter cabinet from its shipping container , open the front panel, and remove any shipping material that may be included. Make a careful inspection looking for obvious shipping damage. Remove any foreign material that may have shaken loose.

2.2 Some PC boards are shipped in separate boxes. Individually unpack and inspect them for any obvious shipping damage. Check the connectors for any bent pins. Be sure to do this before attempting to plug any of the PCB's in.

2.3 Assuming the transmitter is not to be pre-tested in a lab facility, physically mount the Cabinet to its permanent structure. See drawing SDE10018, User's Manual, Page 5, for mounting hole dimensions.

3.0 PLUG INS

3.1 See the System installation drawings, SDF31002 User's Manual, Pages 9 and 10, for additional information pertaining to the following steps.

3.2 Remove the front panel exposing the Controller/ Monitor, Transmitter 1and User Sections

3.3 Remove the Controller Monitor cover panel and set it aside

3.4 Verify that the Monitor/Controller, Analog I/O and Digital I/O are installed and well seated in the correct slots according to the drawing.

3.5 Unpack the smaller 3U sized Low Voltage Power supply PCB (SLP10017) and examine it closely for any damage.

3.6 Check JP1 and JP2 on this PCB and verify they set correctly for the input voltage being used.

	JP1	JP2
115 VAC	A	B
230VAC	B	A

3.7 Refer to Drawing SDF31002 in the User's Manual, Page 10 and insert the LVPS PCB (SLP10017) into the left-most slot. The board insertion must be exactly as shown in the drawing or serious damage may occur.

3.8 Remove the Transmitter 1 cover panel

3.9 Unpack the Transmitter 1 PCBs and examine them closely for any damage

3.10 Install the RF Amplifier PCB (SLP10001) in slot #2 or right next to the already installed Filter /Bridge PCB (SLP10002) . See Drawing

3.11 Install the PA Power Supply PCB (SLP10003) in slot # 3 or the last slot from the right.

3.12 On the right hand side of the Section, look at the RF Mother Board (SLP10004) and verify the transformer connectors are seated properly.

3.13 Replace the Transmitter 1 cover panel

4.0 USER WIRING

4.1 The USER main AC breaker should be rated for 30 amps

4.2 Remove the mounting screws from the USER section and pull it forward on its mounting guides sufficient to allow access to the bottom rear cabling ports.

4.3 Utilizing the (SLM 25000/25040) installation kit route the AC, DC, and Coupler wiring into the bottom rear access holes.

4.4 Trim the excess wiring length to neatly reach the their individual connection points as cited below

4.5 Terminate the ends of the wires using the connectors supplied with the installation kit.

4.6 Connect a good Earth ground to the brass grounding terminal located on the bottom of the Cabinet

4.7 Locate the Main Power Connector TB1

4.8 Connect AC mains L1 to user section TB1-1 (115/230 VAC Hot)

4.9 Connect AC mains L2 to user section TB1-2 (115/230 VAC Neutral or Hot

4.10 Connect AC mains GND to user section TB1-3 (AC Power GND)

4.11 Connect the Battery I (current charge/discharge) Sample shielded cable center wire to TB1-4

4.12 Connect the Battery I (current charge/discharge) Sample shield to TB1-3 (GND)

4.13 Connect 48V Battery + to TB1-5

4.14 Connect 48V Battery - to TB1-6

4.15 Connect Modular telephone jack to Line In on the US Robotics modem.

4.16 Locate the USER Interface PCB.

4.17 If no modular style plug is available, a 4 wire conventional drop cable may be connected to TB8 (old J17) and the short modular jumper furnished by US Robotics connected from LINE-IN in of the modem to J65 (old J18). The connections are:

Tip or Green wire to TB8-1
Ring or Red wire to TB8-2
Sleeve or Yellow wire to TB8-3
Ground or Black wire to TB8-4

4.18 Connect the coupler +12V supply wire to TB4 -3

4.19 Connect the coupler GND wire to TB4-2

4.20 If the system uses MSK externally supplied RF signal connect MSK-1 to J61(old J13) and MSK-2 to J59 (old J14)

4.21 Dress and tie wrap the wires back to the end of the user panel.

4.22 Slowly push the USER drawer back in place.

4.23 If a 50 ohm Dummy load is available connect it to The N type RF output connector on the bottom of the cabinet for initial testing and operational verification.

5.0 PC HOOKUP AND SOFTWARE INSTALLATION

5.1 A Desk-top or Laptop PC capable of running either Windows 98 or later version Microsoft operating system is suitable for use as a local or remote control platform. Set the PC up near the transmitter.

5.2 Connect one end of a null modem RS232 cable or a standard RS232 cable with a null modem adapter to SERIAL PORT #1 on the PC

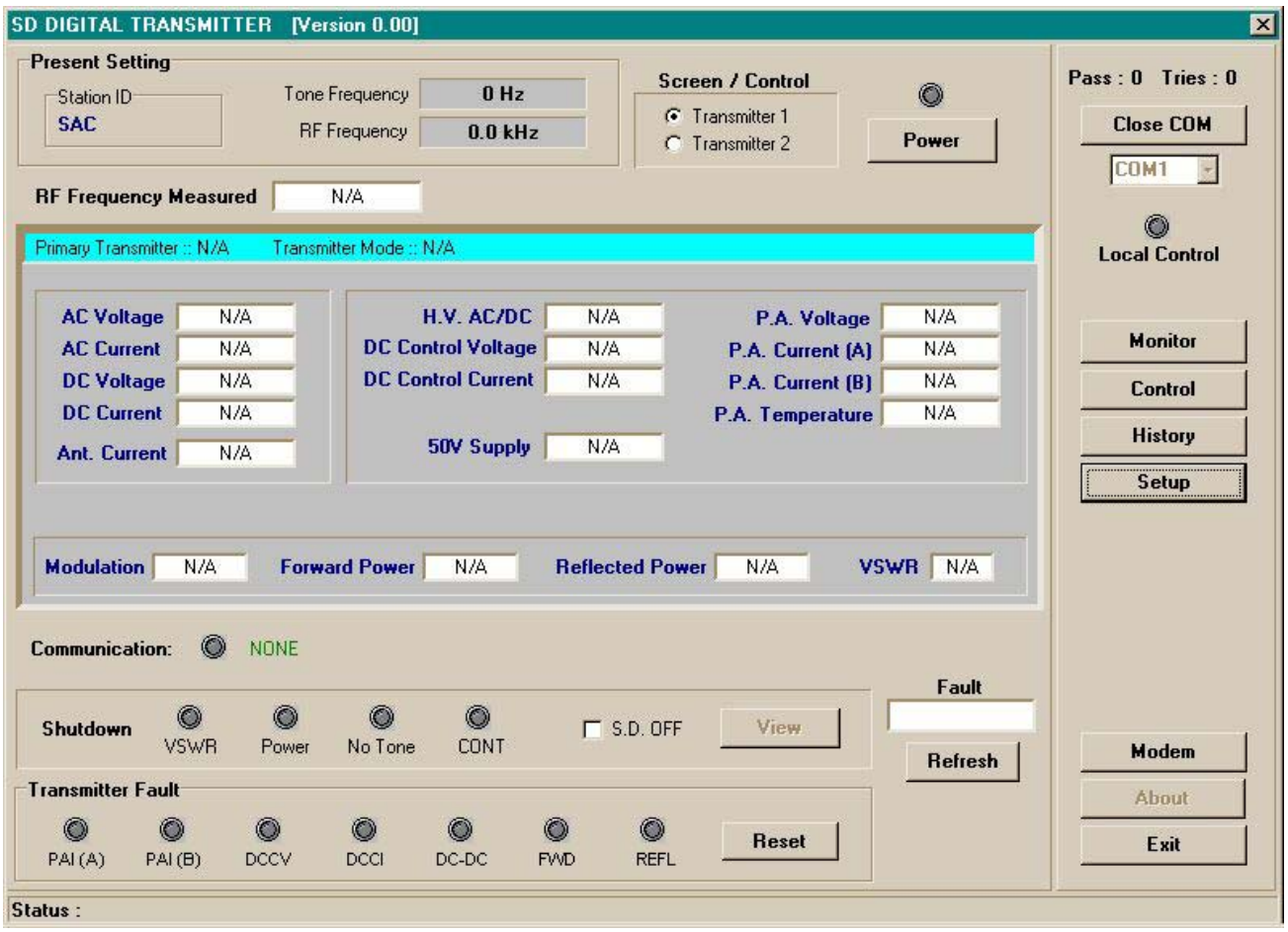
5.3 Locate the left hand Controller/Monitor PCB which is the second board from the left in the controller 3U Section .

5.4 Connect the other end of the RS232 cable to the Local Control Port, a DB9 connector on the front of the USER panel an the right hand side. (see drawing SDE 10004)

5.5 Start the computer and while it is booting up, locate the USER software which is included with each system shipped in an appropriately labeled protective package.

5.6 Load the software on the PC, following the enclosed instruction sheet which will alert you to any last minute changes that need attention.

5.7 Run the software and the SD DIGITAL TRANSMITTER window will open.



5.8 You will be required to enter a password. If no password is entered no operational changes will be allowed. Monitoring ,however, will still be available.

6.0 CONTROLLER/MONITOR POWER UP

6.1 See drawing SDE10004

6.2 Turn on the Site AC breaker.

6.3 On the USER panel in the MAIN POWER section , Switch AC to ON and observe the switch lights up.

6.4 Leave the DC switch OFF for now.

6.5 On the USER panel in the AC POWER DISTRIBUTION section , Switch Controller to ON and observe the switch lights up.

6.6 Observe the illumination of DS1 and DS2 the two green LEDS on the Digital I/O PCB (SLP10009) indicating the presence of +5 and +12 volts respectively.

6.7 On the Low Voltage Power Supply PCB (SLP10017) Meter the following to GND (TP0) and verify the tolerances

6.7.1 TP1 = 5.0 ± 0.25 VDC

6.7.2 TP2 = -11.4 ± 0.6 VDC

6.7.3 TP3 = 12.0 ± 0.6 VDC

NOTE: If any of these voltages are out of tolerance and require either repair or adjustment, a modified system alignment will be required before proceeding. See the Maintenance section for more details.

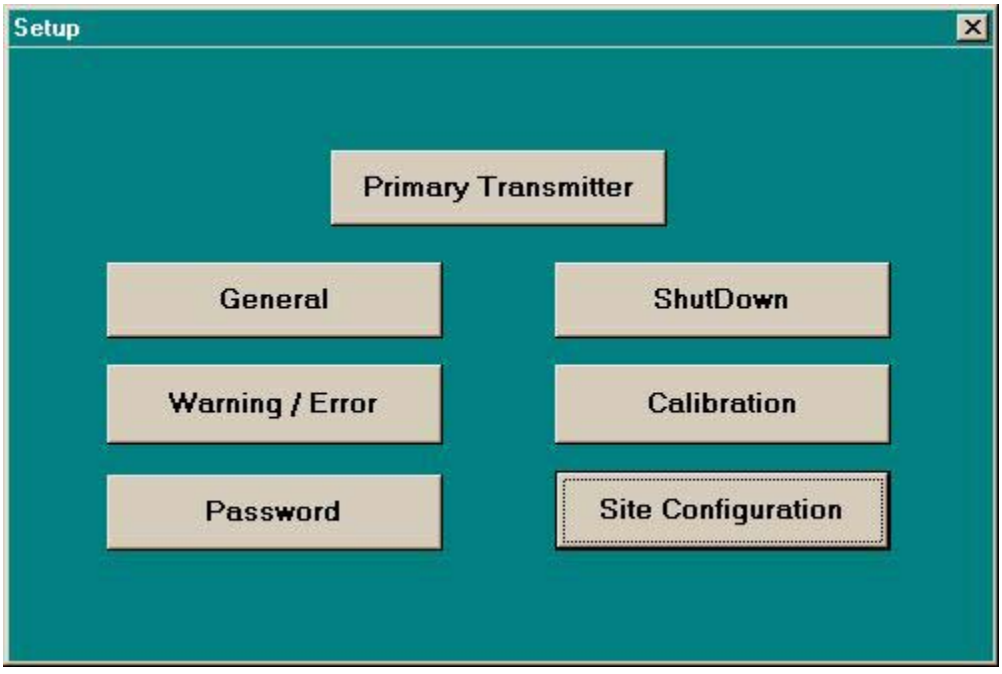
7.0 SYSTEM SITE CONFIGURATION

7.1 On the PC in the SD DIGITAL TRANSMITTER window just below the Open COM control there is a pull down menu to select a different serial port if desired. Click on the port you want then Click on **Open COM**.

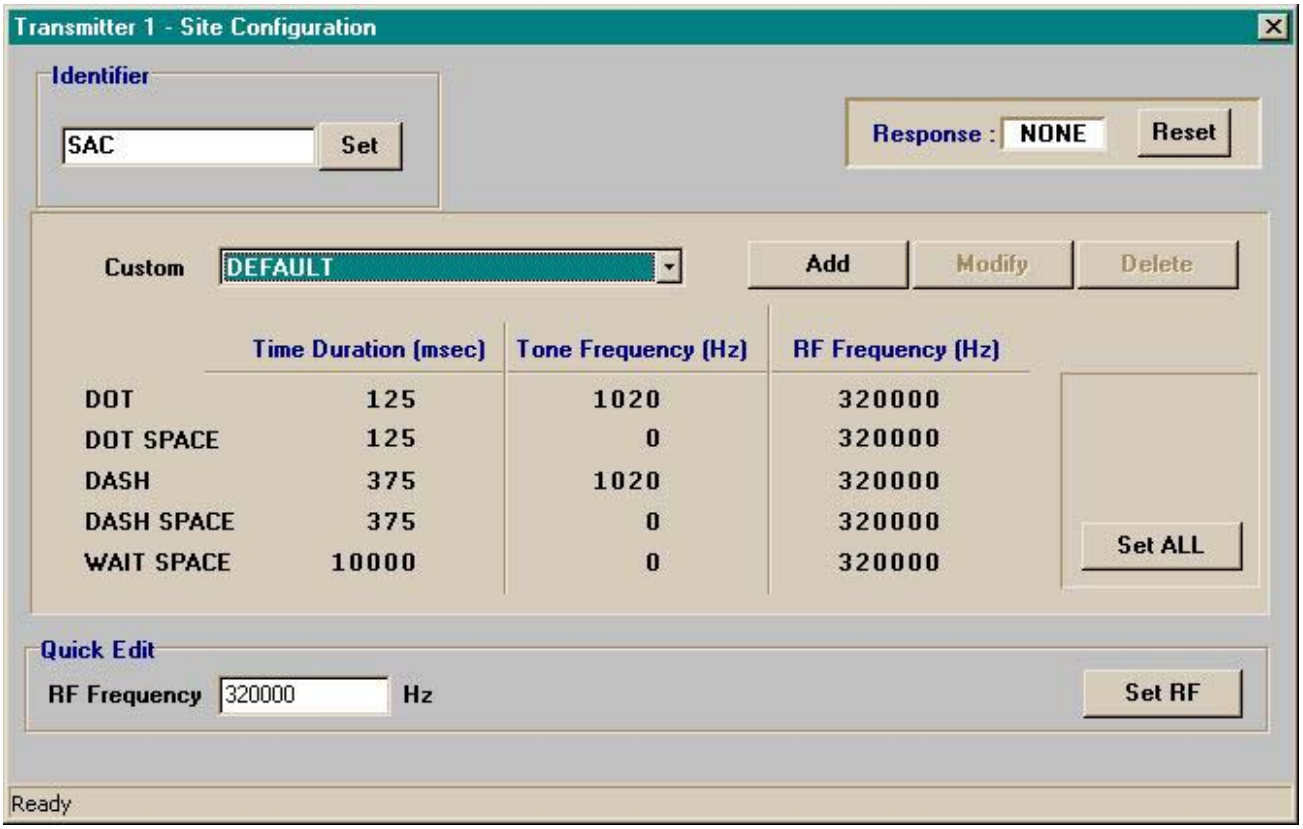
7.2 If opening the port was successful a bell will sound and the name of the control will change to CLOSE COM

NOTE: Clicking again will close the Port so be careful not to double click. Click CLOSE COM only when you are finished communicating with the system

7.3 The Morse Code ID sequence, Code Timing, Key tone Frequency, and RF frequency must now all be set according to the Site License. On the PC in the SD DIGITAL TRANSMITTER window Click on **Set up.**



7.4 From the menu select **Site Configuration**



7.5 A popup window called Transmitter 1 Site Configuration will open. In this window you may choose to add a custom configuration to the selection list or simply accept the default profile and modify it as follows:

7.5.1 To modify the existing default setting

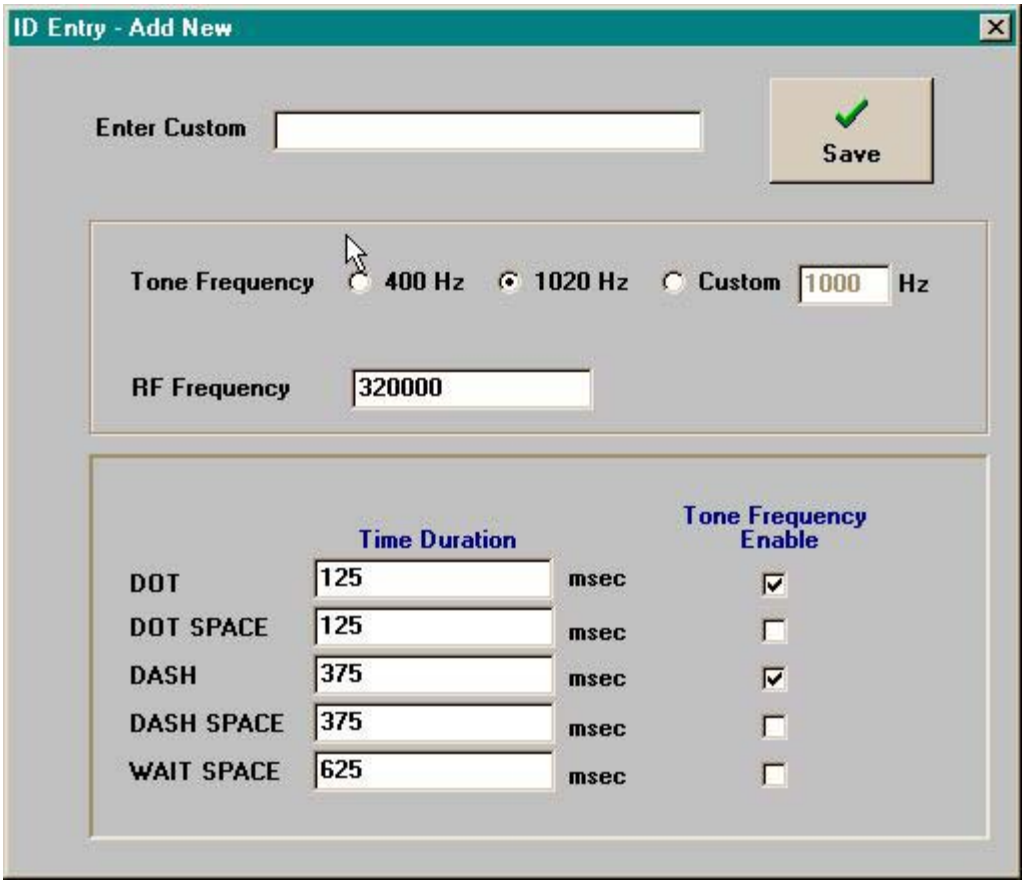
7.5.1.1. Click in the Identifier white space and change the ID to the new ID then click **Set.**

7.5.1.2. The new ID will be sent to the CF and the response window will read PASS when it is accepted

7.5.1.3. Click in the Quick Edit RF Frequency white space, enter the new frequency then click on **Set RF**

7.5.1.4. The new RF Frequency will be sent to the CF and the response window will read PASS when it is accepted

7.5.2 To Add a new Custom configuration Click on **Add** and a popup window will appear.



7.5.2.1. Enter a custom name for this configuration. (Note that pressing enter will have no effect)

7.5.2.1.1. Select one of the 2 default tone frequencies or enter any frequency manually between 300 and 3000 Hz.

7.5.2.1.2. Enter the RF frequency for this site.

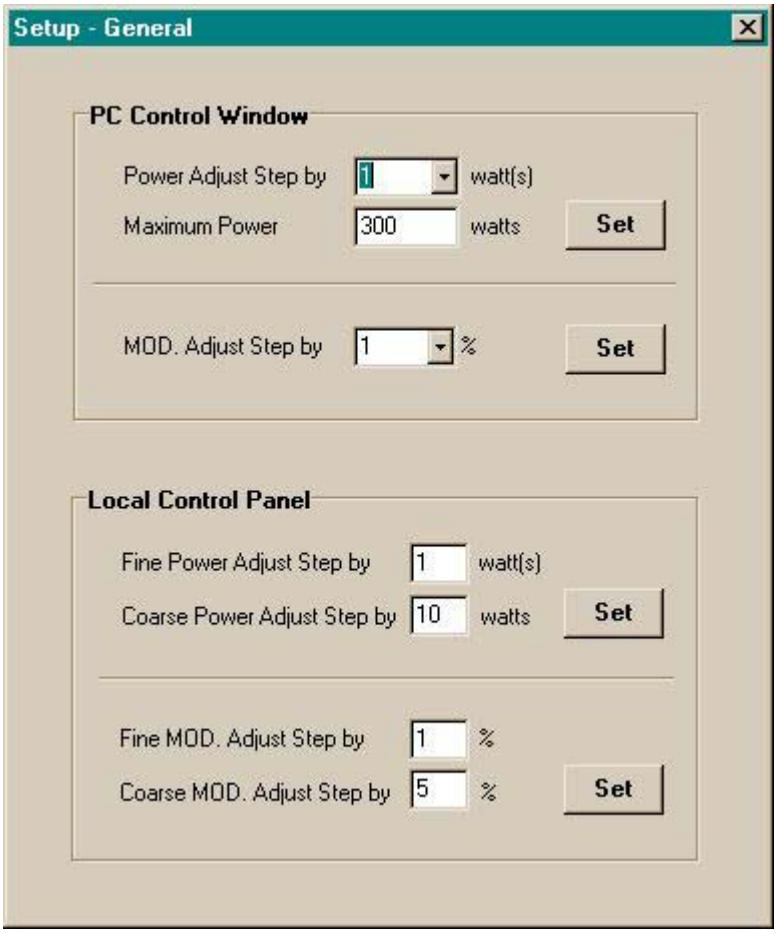
7.5.2.1.3. Mark/Space timing changes and tone enables are optional. They will default to the industry standard however they can be customized for special test sequences or minor adjustments necessary in certain countries. Simply change the values to those desired by clicking in the white space and entering a new value.

7.5.2.1.4. Click **Save.** The window will close returning to the Site Configuration window. The saved configuration will be in the custom window

7.5.2.1.5. Click on **Set ALL** and the new configuration will be sent to the Controller/Monitor

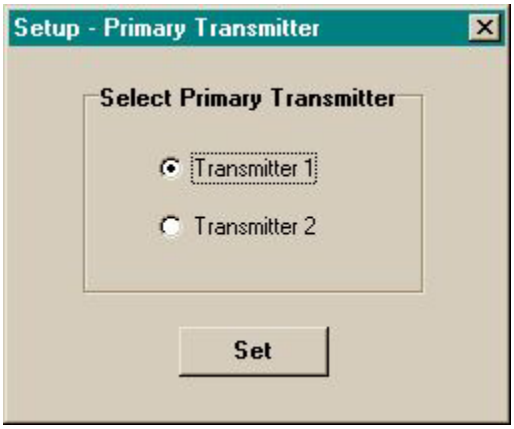
7.6 Having chosen and accomplished one of the above methods, close the Transmitter 1 Site Configuration window returning to the SETUP window.

7.7 In the Setup window, click on **General**, opening the general setup window



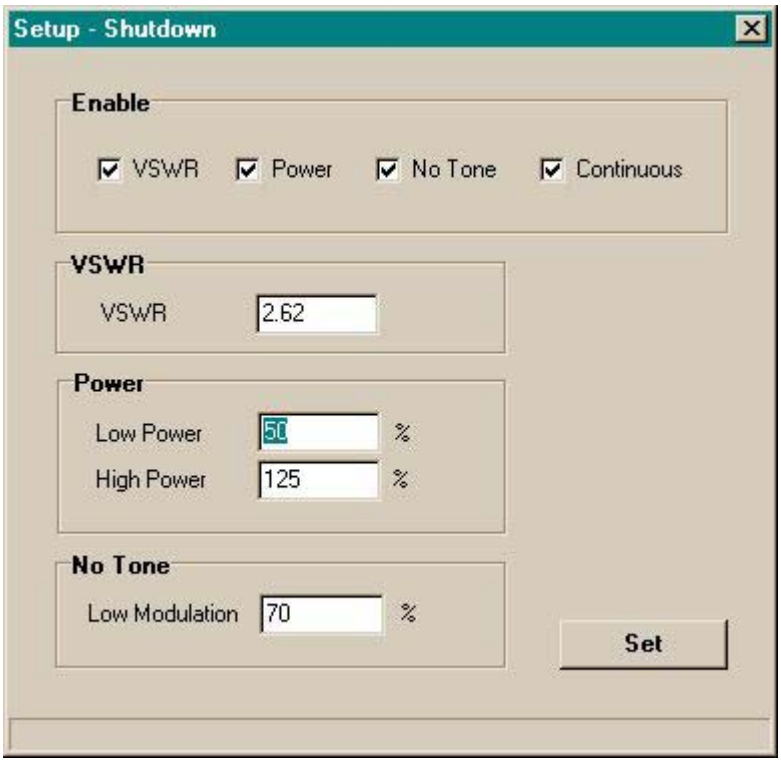
7.7.1 The PC control and Local Control sections allow the USER to define the fineness of control. The Maximum Power is Factory set to coincide with the maximum power allowed by the site. A lower power may be entered if the user chooses to run at a lower power. Firmware settings will not allow more power to be output than what was licensed. Accept the defaults for now and click on the X to exit

7.8 In the Setup window, click on **Primary Transmitter**, opening the selection window



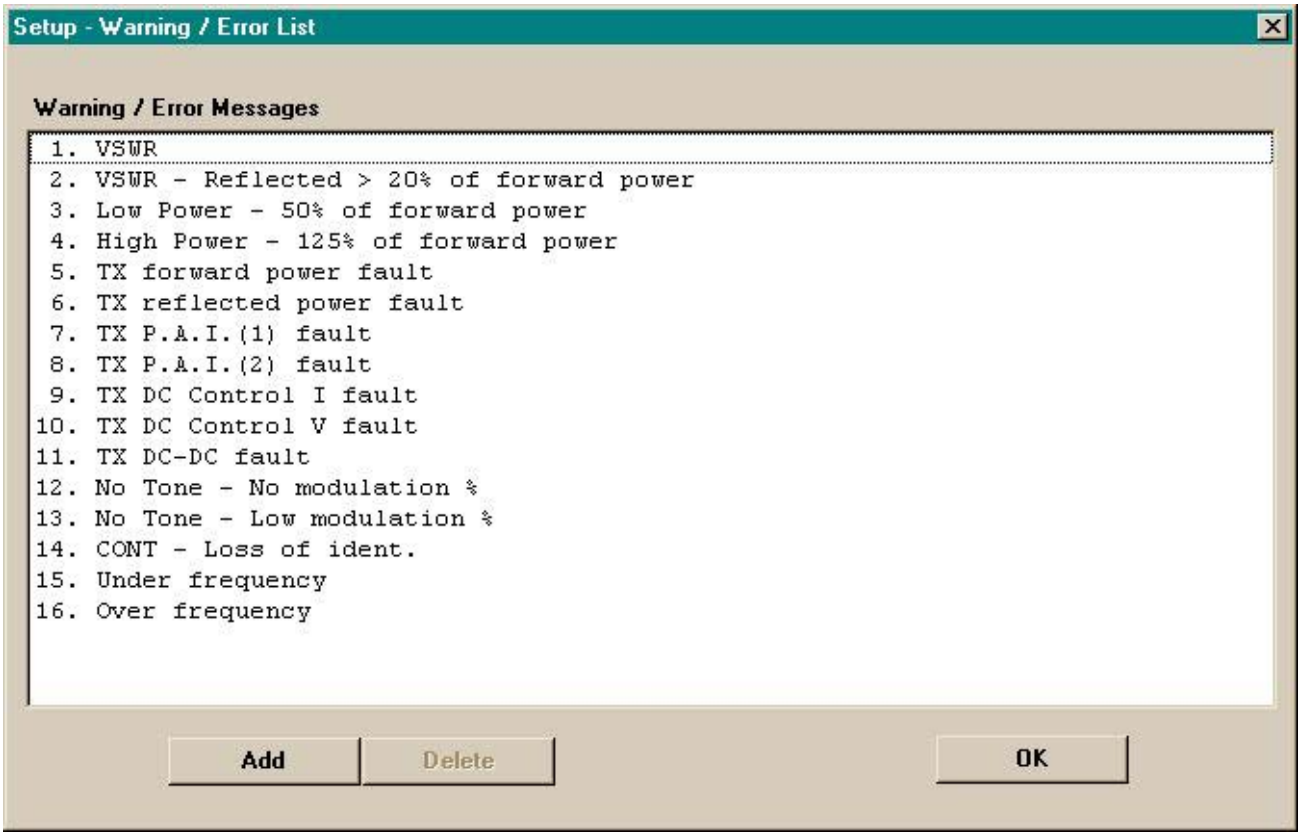
7.8.1 Accept the Default setting. If this were a Dual site you could choose which transmitter is Primary here. Just Click on **Set** to return to the Set up menu

7.9 In the Setup window, click on **Shutdown** , opening the shutdown option window



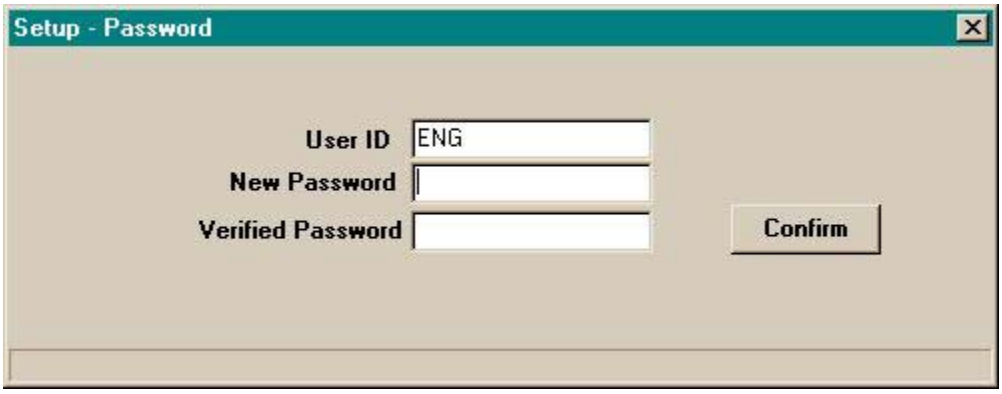
7.9.1 This section allows you to set the criterion for some of the shutdown alarms and to enable or disable them for test purposes. Since we will be testing a new installation, click to remove the checkmarks from VSWR, Power, No Tone, and Continuous, thus disabling them. Click on **Set** returning to the Setup window

7.10 In the Setup window, click on **Warning/Error** opening the warning /error list.



7.10.1 This list affords the USER a way to customize the error messages, re-writing them their native language for instance. You can change these now or accept the default messages. Click on **OK** to exit back to Setup

7.11 In the Setup window, click on **Password** opening the password window.



7.11.1 When the installation is complete a password should be entered here securing the site from un-authorized access to system configuration while still allowing casual monitoring.

7.11.2 For now no action is required so just press **X** to exit.

7.12 Press **X** to escape out of the Set up menu.

7.13 Verify the Correct Station ID, RF Frequency and Tone Frequency is displayed in the "Present Setting " section of the main screen. The middle monitoring section of the main screen will be indicating N/A in all of its display areas. (white boxes)

7.14 Having followed all the preceding steps the system should now be configured with the proper parameters to allow an operational check

8.0 OPERATIONAL CHECK

Note: The SD 250 is a Direct Digital Synthesis (DDS) based microprocessor controlled transmitter operating class D through broadband Butterworth filters. The system is quite adjustment free because of this , however there are checkpoints that should be verified with Calibrated test equipment to ensure proper operation.

8.1 Turn the AC POWER DISTRIBUTION TRANSMITTER 1 Switch (S4) on. It should illuminate.

8.2 On the PC click on **Monitor**, then select **Transmitter #1** and click on **Ready.** This signals the Controller /Monitor to begin sending transmitter data to the PC.

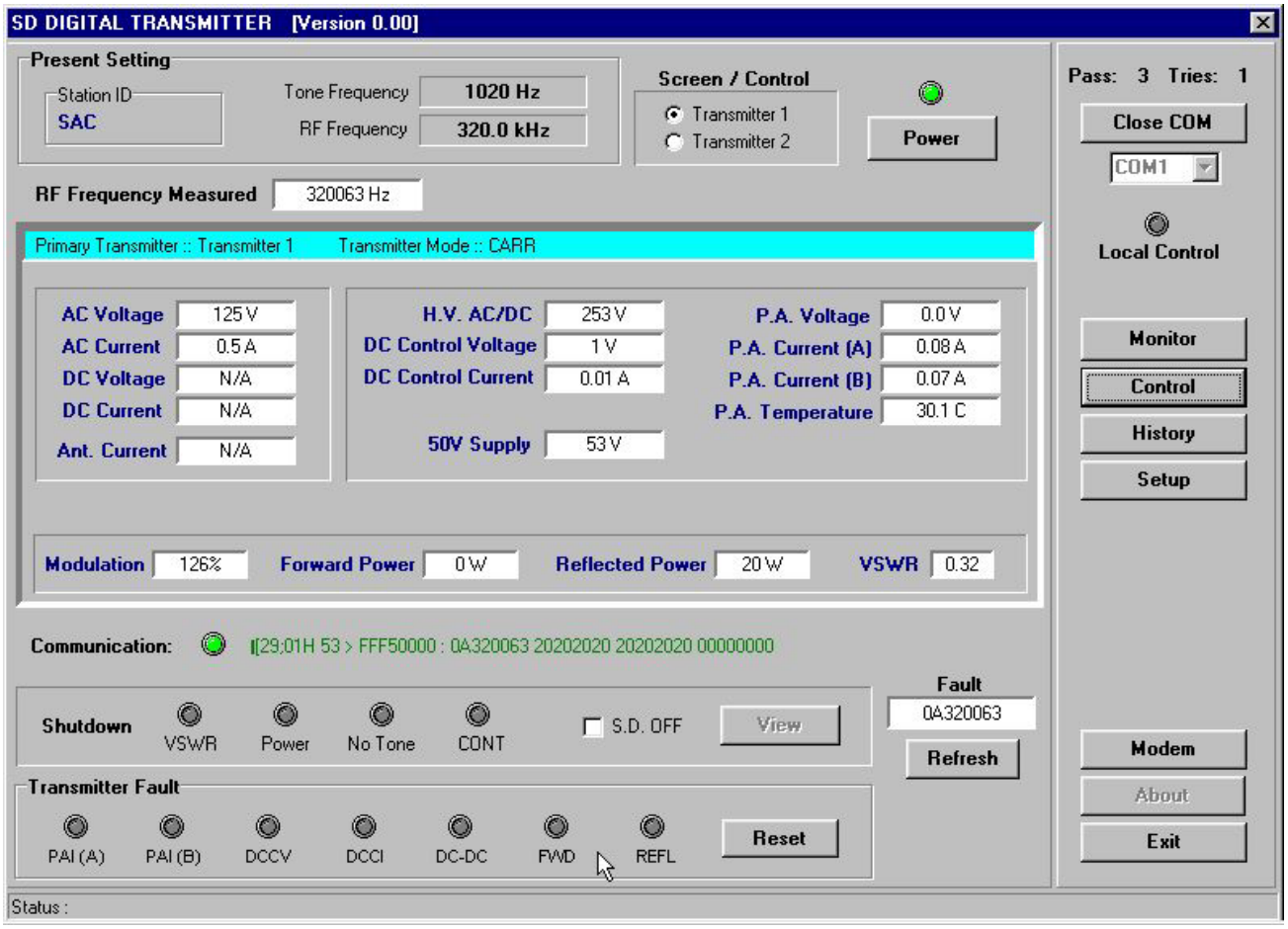
8.3 Click on Power and verify the following:

8.3.1 The High Voltage ON relay and the inrush circuit relay on the PA Power Supply PCB in the RF section will activate in sequence

8.3.2 DS2 on the RF mother board will illuminate indicating the presence of High Voltage.

8.3.3 DS1 on the PA Power Supply PCB will illuminate indicating the presence of High Voltage.

8.3.4 The data fields on the PC main window screen will fill with system wide information similar to that shown in the following screen capture



8.3.5 Note that DC Voltage, DC Current and Antenna Current readings are not shown. They are signals fed in from external sources and are optional. They must be with their own separate documentation.

8.3.6 Modulation, Forward Power, Reflected Power and VSWR fields will have arbitrary values at this time. This is normal

8.4 Frequency checks

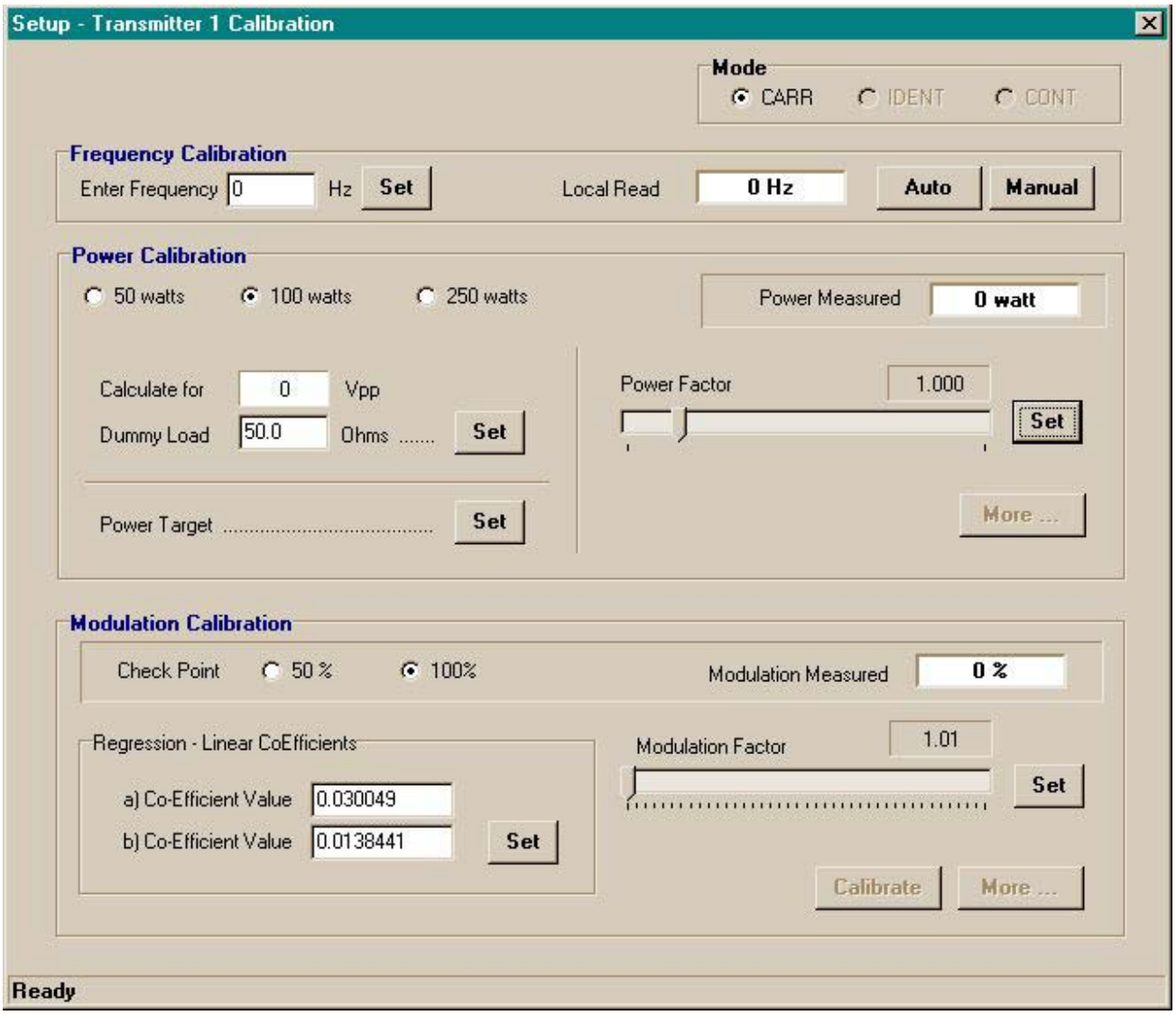
8.4.1 Connect a calibrated frequency counter to TP10 on the front of the RF Power Amplifier (SLP10001). This signal is the RF output from the Controller/Monitor DDS.

8.4.2 Verify that the frequency reads the site frequency ± 100 parts per million or in the case of the screen shown, 320,000 ± 32 Hz . Note: Regulations state 100 PPM is allowed if the Power is less than 200 watts, therefore to calculate the maximum deviation the formula would be as follows: **(Operating Frequency / 1,000,000) X 100**

8.4.3 If the frequency is not in tolerance calibration must be run as follows.

Note: Normally the DDS section is extremely accurate (± 3Hz) by itself. However a correction coefficient based on precision test equipment is generated at the factory and stored in the Controller /Monitor boards NVRAM. This Number is used to control the DDS output and will correct the frequency further. At the same time the on board frequency counter is also corrected to bring the test equipment , the output and the input into agreement. The Calibration routine should only be run if a component of the system needs replacement or if precision test equipment indicates the system is out of tolerance.

8.4.4 Click on Setup (see section 7.3) then click on **Calibration** opening the Frequency / Power / Modulation calibration window. NEED NEW WINDOW BELOW WHICH ADDS MANUAL MODE TO MATCH PROC!!!



8.4.5 Type in the frequency of operation in the window labeled "Enter Frequency"

8.4.6 Click on **Monitor** and wait until the reading in the Local Read window stabilizes (about 10 seconds)

8.4.7 A choice is now available as to the method of calibration. If Auto is clicked The controller / monitor will recalibrate the output frequency based on its own internal counter which itself is corrected at the factory. If Manual is selected the frequency as read by precision external equipment must be input and the correction will be based on that . (we will use the latter here.)

8.4.8 Click on **Manual** and a popup window will appear. Enter the external frequency counters readout and click **OK**

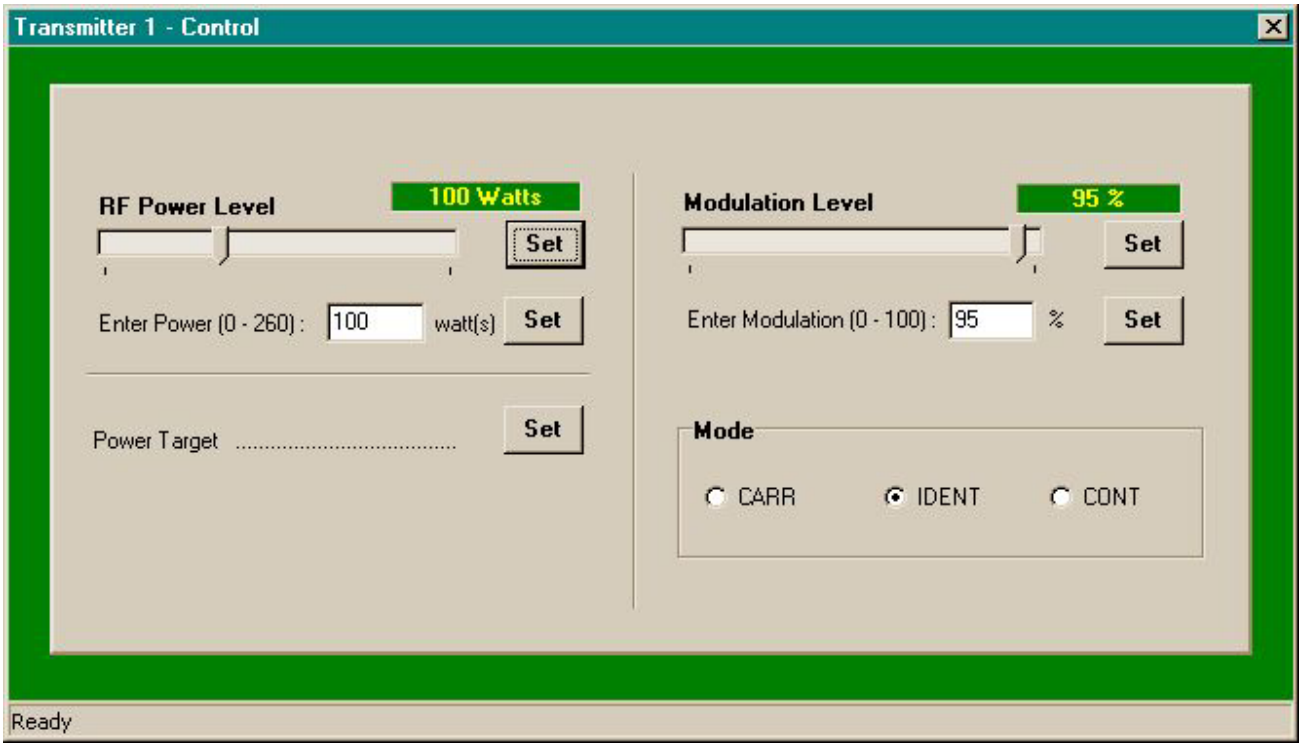
8.4.9 After a few moments verify that the frequency now being read on the PC monitor agrees with the Test equipment. This completes Frequency calibration.

8.4.10 Close the **Calibration** and the **Setup** windows

8.5 RF Power output checks

8.5.1 Scope the output of the transmitter at the Dummy Load

8.5.2 On the PC main window again click on **Control** and verify a popup window as follows:



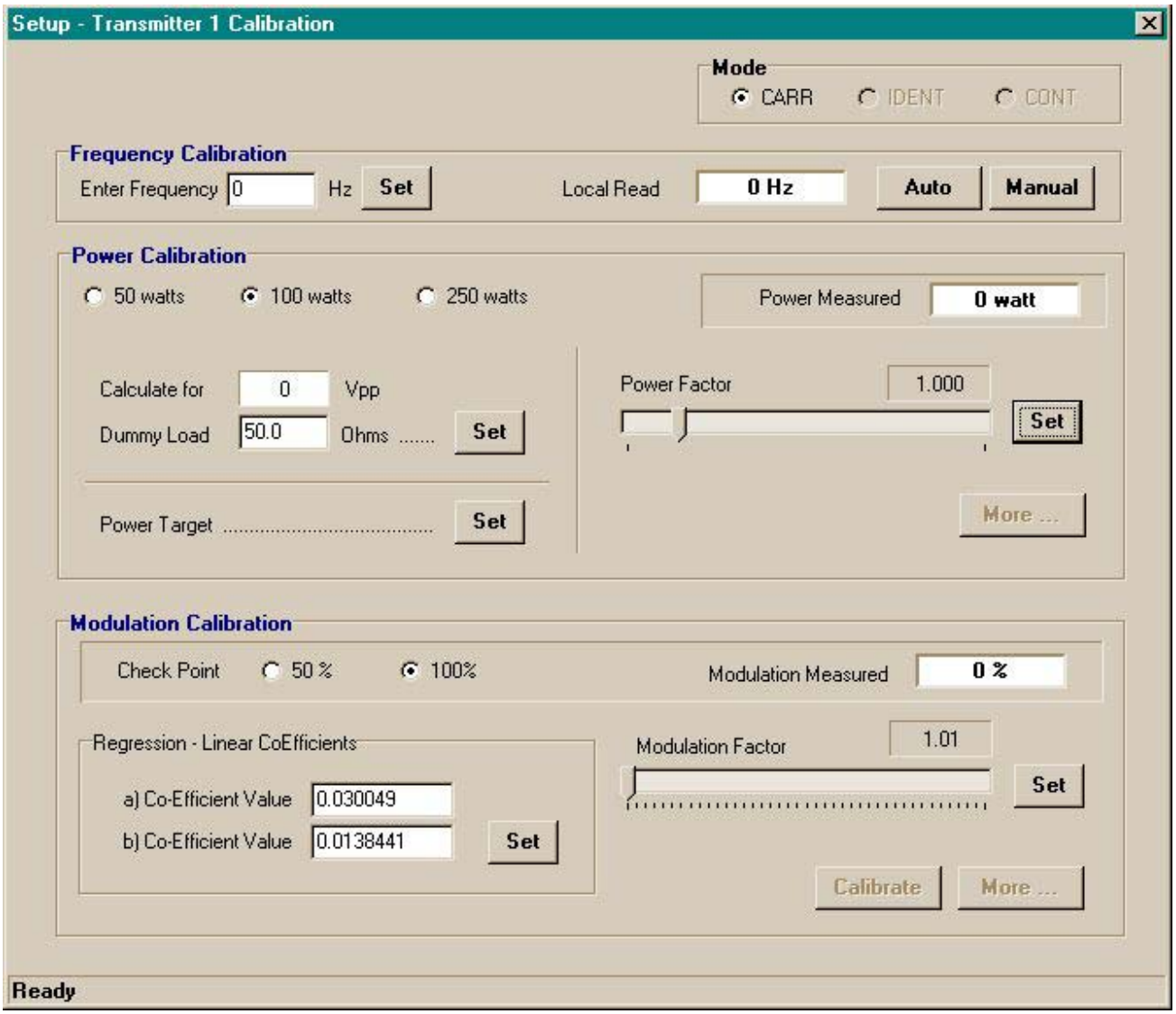
8.5.3 Manually enter or adjust the slider for 10 watts RF output power.

8.5.4 Verify the power output level agrees with the PC levels with the Scope using the formula $P = (Vpp \div 2.828)^2 / R_{DUMMY\ LOAD}$ (a direct reading calibrated power meter is also suitable). The tolerance is the same as a portable Bird wattmeter, 5%

8.5.5 Increase power in 5 or 10 watt steps up to the maximum allowable power verifying the power read on the test equipment agrees with the PC readout to a 5% tolerance.

8.6 Power Calibration

8.6.1 If the Output Power is out of tolerance a power calibration will be required. Click on **Setup**, then Click on **Calibration**



WARNING ! These Calibrations are normally done at the factory using Calibrated precision test equipment and a precision Dummy Load. A calibrated Scope and a non reactive dummy load of exact known value must be used. The power calibration cannot be done connected to the radiating system. Any attempt to do so will degrade system monitoring performance.

8.6.2 In the power section select a power range **equal to or less than** the maximum allowable power.

8.6.3 In the Dummy Load window enter the **EXACT** resistance value of the dummy load connected and click on **Set**.

8.6.4 The Voltage the Scope should read will show up in the **Calculate For** window for your convenience.

8.6.5 Observing the Scope RF Vpp value , adjust the **Power Factor** slider until the scope reads the Vpp that was calculated for it.

8.6.6 Click on Power Factor **Set** and Observe that the power in the **Power measured** window comes into agreement with the true power as adjusted to on the scope.

8.6.7 The Power curve has now been re referenced. Exit out of the Calibration and Setup menu .

8.6.8 Click on control and perform a few spot checks to confirm that the power being read out on the PC is accurate. Power calibration is complete. Leave the Scope attached to the dummy load and leave the System set at full legal output power.

8.7 Modulation Checks

8.7.1 Note the carrier only Vpp level on the Scope and write it down.

8.7.2 Click on **Control** and enter 100% modulation either manually or with the slider.

8.7.3 Set the Scope for reading a 400 or 1020 Hz modulation envelope. Verify the modulation envelope just touches zero baseline at modulation valleys

8.7.4 Verify that the modulation Vpp peaks are reaching twice the carrier Vpp ,earlier noted, within 5%

8.7.5 On the PC, adjust the Modulation level down to 50%

8.7.6 Read on the Scope measuring the valley and peak of the envelope. Using the formula Mod% = (Vmax-Vmin) / (Vmax+Vmin) compute the actual modulation.

8.7.7 Verify the set modulation and the observed modulation% agree to within 5%

8.7.8 If the Modulation does not track between these two points a calibration must be performed.

8.8 Modulation Calibration

8.8.1 Refer to the SDF31002 in the User's Manual, Page 10, drawing and locate the Analog I/O PCB (SLP10005) in the Controller Section. Connect a Scope probe to TP102 ...(use TP0 for GND)

8.8.2 Adjust the modulation level to 100%

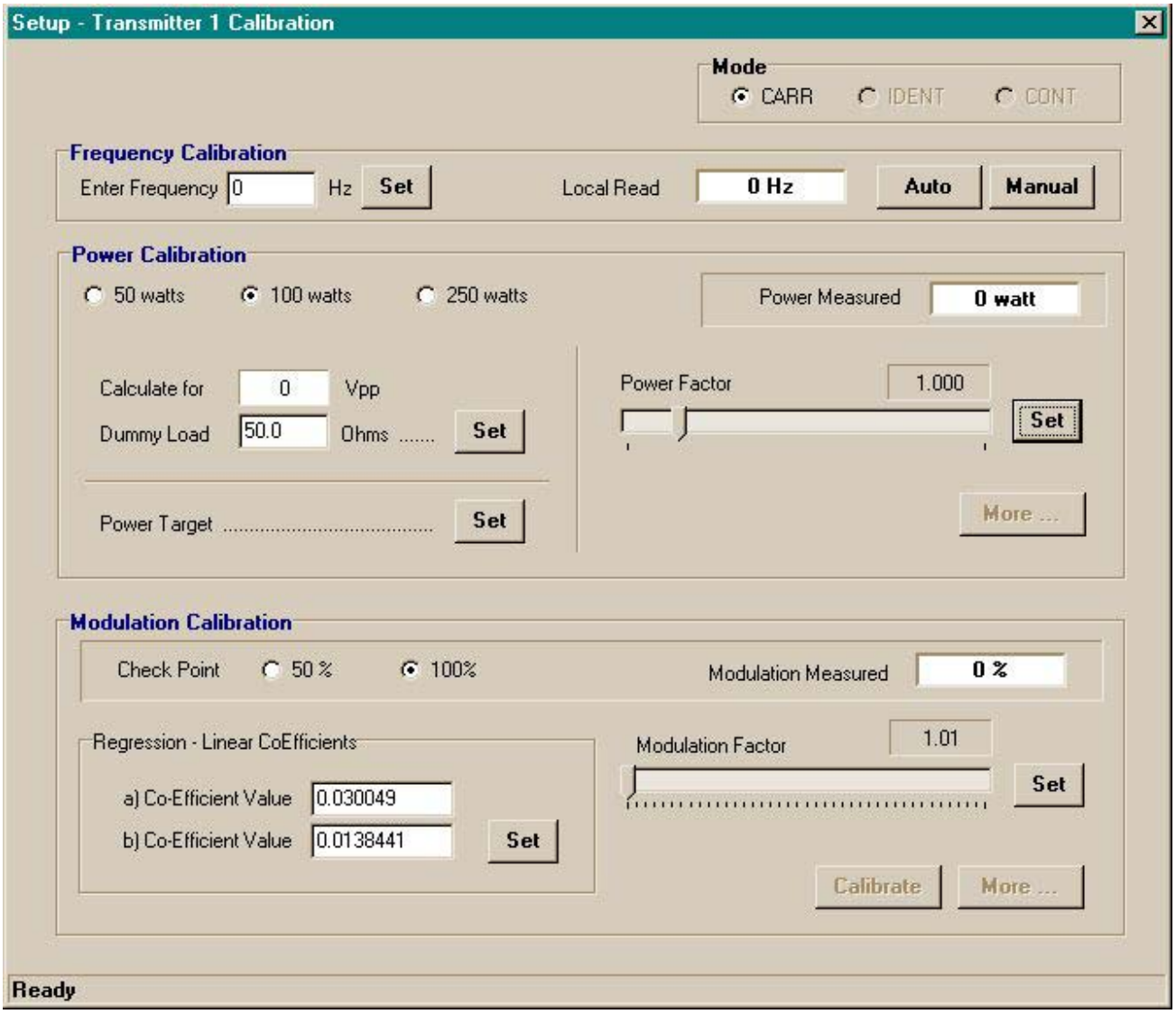
8.8.3 Adjust R10 on the same PCB until the waveform just touches the zero or GND reference point at its negative most excursion.

8.8.4 Meter TP103 and adjust R101so it reads 4.0VDC

8.8.5 Meter TP104 and adjust R102 so it reads 4.0VDC

8.8.6 Remove the scope and meter connections

8.8.7 Click on **Setup** then click on **Calibration**.



8.8.8 Click on the **50% set point**

8.8.9 Verify that the factory Modulation Coefficients are correctly entered. These will be listed in the factory acceptance test sheet. Re-enter them if they are corrupted or missing. Click on **Set** when they are correct

8.8.10 Adjust the **Modulation Factor** Slider until the modulation measured window reads 50%

8.8.11 Click on the **100% setpoint**

8.8.12 Verify that the modulation setting reads correctly at both points.

8.8.13 That ends modulation calibration.

8.9 Ident. Checkout

8.9.1 Close the Calibration and the Setup windows.

8.9.2 Click on Control and in the Mode section, Click on **IDENT**

8.9.3 Set the Modulation Level to 95% and click on **Set** .

8.9.4 Attach the Scope to the Dummy Load and verify that the output RF modulation envelope is being Keyed with the proper Morse code ID and timing interval as specified by the USER during setup.

8.10 Limits Tests.

8.10.1 On the PC, Click on Control and enter a Power level greater than the Maximum allowable power.

8.10.2 Observe that the controller /Monitor will not allow a power greater than the systems maximum allowable power rating as purchased.

8.10.3 Return the power setting to an allowed level.

8.10.4 Enter a modulation level above 100%

8.10.5 Observe that the Controller/Monitor will not allow more than 100% modulation.

8.10.6 Return the modulation setting to 95%

8.11 Optional DC/DC testing

8.11.1 If Battery backup operation is to be utilized to provide power during AC power line failures Go to the Optional DC Installation Section which is included in the Options section. An OEM battery charger modified to input charge/discharge information will be explained there.

8.12 Optional AWOS audio PCB.

8.12.1 The Audio PCB is installed and set up at the Factory and is not designed to be adjusted in the field. The Customer input level should typically be set to -17dBm however levels up to +5 dBm are acceptable

8.12.2 Note that the AWOS modulation path is NOT controlled by the Controller /Monitor. Its own AGC circuitry will prevent any sustained modulation in excess of the alignment value of 95% irregardless of the customer input level

8.13 Closing up the system

8.13.1 On the PC open the control window if not already opened and set the RF Power output to Zero

8.13.2 Toggle the AC mains power switch OFF

8.13.3 Replace all the previously removed front panels except the main watertight system housing cover.

8.13.4 Disconnect the Dummy load .

8.13.5 All general transmitter Dummy Load installation checks are complete. The transmitter is ready to be connected to the Beacon Site antenna system and no further adjustments will be required. It is not advisable to attempt any adjustments while connected to the Antenna system except those allowed by software.

9.0 PLACING THE SYSTEM IN OPERATION

9.1 Connecting to a Southern Avionics Antenna Coupler

9.1.1 Install the Coupler /Antenna combination according to the Coupler Installation Manual which depends on which type is purchased.

9.1.2 Connect the furnished N terminated Coax from the Transmitter RF output N connector to the Antenna Coupler . SAC couplers come with a standard N connector.

9.1.3 Using the PC to control the Transmitter, follow power-up and tuning directions in the coupler manual. Basically the coupler must be set up to present a 50 OHM , minimally reactive load to the Transmitter .

9.2 Connecting to an OEM coupler

9.2.1 Depending on the Coupler an adapter may need to be furnished or a new cable fabricated by the USER. It is the USER's responsibility to verify that the coupler is one designed for a standard 50 Ohm non reactive input.

9.3 The Installation Section is Complete