

USER'S GUIDE

MODEL 110

FREQUENCY SELECTIVE VOLTMETER
WITH SIGNAL GENERATOR
Hardware Version 2 (SN: 200 and higher)



Signalcrafters
TECH, INC

SIGNALCRAFTERS TECH, INC.

57 Eagle Rock Avenue, East Hanover, NJ 07936

Tel: 973 - 781 - 0880 or 800 - 523 - 5815

Fax: 973 - 781 - 9044

<http://www.signalcrafters.com>

DISCLAIMER:

Signalcrafters Tech, Inc has made every effort to ensure that the information contained in this document is accurate and complete. However, Signalcrafters assumes no liability for any errors, which may appear in this document, or for any damages that may result from the use of this document, or the equipment which accompanies. Signalcrafters reserves the right to make changes to this document or the product it describes at any time, without notice, and without a commitment to update the contents of this particular document. Contact Signalcrafters to obtain information concerning the latest release of this document.

Table of Contents

1.0 Description.....	5
2.0 Safety Information.....	6
3.0 General Information.....	7
3.1 Packaging of the Equipment.....	7
3.2 Supplied Items.....	7
3.3 Preparing the Model 110 for Use.....	7
3.4 Front Panel Description.....	8
3.5 If the Unit Does Not Work.....	9
3.6 Servicing the Model 110.....	9
3.7 Quick Reference Guide.....	9
3.8 Screen/Display Notes.....	10
3.9 Bargraph.....	10
3.10 Power Supply.....	10
3.11 Batteries.....	10
3.12 EMI/RFI Suppression.....	11
3.13 Storage.....	11
3.14 Definitions.....	11
4.0 Set-Up/Operation.....	13
4.1 Powering of the Unit.....	13
4.2 Back Light.....	13
4.3 Contrast.....	13
4.4 Speaker Level.....	13
4.4.1 Keypad Level.....	13
4.5 Impedance (Z).....	13
4.6 Vrms/dBm.....	13
4.7 Balanced/Unbalanced.....	14
4.8 Bandwidth (BW).....	14
4.9 Display Averaging (Displ Avg).....	14
4.10 dB Reference (dBREF).....	14
4.10.1 Activate from an existing reading.....	15
4.10.2 Enter a reference level.....	15
4.11 Clock/Date.....	15
4.12 Maximum Hold (MAX HLD).....	15
4.13 Bridged Z/High Z Termination (Bridged Z/HI Z Term).....	15
4.14 Steps (Steps).....	16
4.15 Clear (Clear).....	16
4.16 Enter (Enter {arrow}).....	16
4.17 2ND (2 nd).....	16
4.18 Permanent & Option 2 (Perm/Opt 2).....	16
4.19 Numeric (1-0, +/-, .).....	16
5.0 Frequency Selective Voltmeter (FSVM).....	17
5.1 Frequency Selective Voltmeter Mode (FSVM).....	17
5.2 Automatic Frequency Control (AFC).....	17
5.3 Tune Frequency (Tune Freq).....	17
5.4 Search.....	17
5.4.1 High/Low End Search.....	17
5.4.2 Up/Down Search.....	18

5.5	Threshold (Threshold).....	18
5.6	Demodulator (Demod).....	18
5.6.1	Selecting Modulation Type.....	18
5.6.2	Sideband Selection.....	18
6.0	Attenuators, Internal/External.....	19
6.1	Internal Attenuator (Int. Atten, High Level Input).....	19
6.2	External Attenuator (Ext Atten.).....	19
7.0	Wideband Operation.....	20
7.1	Wideband Mode (Wide).....	20
8.0	Oscillator Operation.....	21
8.1	Oscillator On/Off (Osc. Freq./Osc. Z).....	21
8.2	Oscillator Impedance (Osc. Z).....	21
8.3	Oscillator Frequency (Osc. Freq.).....	21
8.4	Oscillator Level (Level).....	21
9.0	Function Key.....	22
9.1	Function (Function).....	22
10.0	Screens/Displays.....	22
10.1	Standard/Digital Display.....	22
10.2	Analog Meter Display (Displ Digital Meter).....	22
10.2.1	Auto Ranging (Auto Scale/Manual Scale).....	22
10.2.2	Analog Meter Parameters.....	23
10.3	Power Budget Calculator.....	23
10.3.1	Power Budget Parameters.....	23
11.0	Memory/Storage Section.....	24
11.1	Storing a Reading.....	24
11.2	Recall a Reading.....	24
11.3	Clear a Reading.....	24
11.4	Store a Set-Up.....	25
11.5	Recall a Set-Up.....	25
11.6	Clearing a Set-Up.....	25
12.0	Downloading/Remote Control/Software.....	26
12.1	Hardware Requirements.....	26
12.2	Installing the Model 110 Remote Software.....	26
12.2.1	Exit Running Windows™ Programs.....	26
12.2.2	Insert the CD and Run Setup.exe.....	26
12.3	Menus.....	26
12.3.1	Set-Up.....	26
12.3.2	Reports.....	28
12.3.3	Update Unit.....	28
12.3.4	Help.....	28
12.4	Remote Control.....	28
12.5	Update Unit.....	28
12.6	Downloading from Model 110 to PC.....	29
12.7	Uninstall.....	29
12.8	Software License Agreement.....	29
13.0	Replaceable Parts.....	29
14.0	Specifications.....	30
15.0	Customer Service/Technical Support (Contact Information).....	32

1.0 Description

The Model 110 (M110) is a multi-function instrument for measuring voltage levels at frequencies in the range of 50 Hz to 5 MHz and incorporates a signal generator operational over the same frequencies. Utilizing surface mount technology, battery and/or AC operation and a convenient carrying handle, the unit is light enough for both field and laboratory use.

A transfective (320 x 240) monochrome Liquid Crystal Display (LCD) is used to display results, programming features and various functions. The frequency and level information, under normal conditions, can be read from a distance of approximately six and one half feet (6.5 feet / 2 meters). A back light for the screen can be switched on or off and a contrast control allows the user to adjust the display for best viewing under the ambient conditions at hand. The display may be switched among three screens, standard/main (digital readout), analog meter (digitally generated analog meter) and a power budget calculator.

Large keypad switches allows for selection of desired functions. Long life tactile switches on the UV textured control panel are used. The speaker level control allows for adjustment of the contact sound heard by the user.

An internal attenuator allows for measurements up to 100 Vrms (+53 dBm @ 50 ohms; +51.25 dBm @ 75 ohm) to accommodate the high levels used in systems such as power line carrier. The user may also utilize an external attenuator. Entering the amount of attenuation of the customer supplied attenuator will result in readings which include the attenuator and eliminate the need to calculate the correct level.

A built in sine wave oscillator is provided with a low level changeable 50 or 600 ohm source impedance. Maximum output levels are +12 dBm @ 50 ohms over the entire instrument frequency range of 50 Hz to 5 MHz and +3 dBm @ 600 ohms from 50 Hz to 250 kHz. Output levels are programmable in 1 to 12 dB steps.

Other features include storing and recall of set-up and up to 99 readings without clearing the memory. Date and time display, speaker level control, true rms wide band measurement, demodulation function (AM, LSB, USB, DSB), search capabilities, adjustable display averaging, threshold and reference readings, Maximum Hold, AFC, changeable impedances, balanced and unbalanced inputs and selectable bandwidths are all standard.

A RS-232 port (9 Pin) along with software is provided for both downloading of stored values as well as remotely controlling the instrument from a Windows™-based PC. Graphing and charting of results as well as additional memory can be realized using the software.

2.0 Safety Information

BEFORE USING THIS INSTRUMENT:

1. Read this User Guide and Safety Information.
2. Use the instrument only under conditions and purpose for which it was intended.
3. Be sure the AC supply Voltage and the unit supplied are at the same ratings. AC operation is intended for indoor use only.
4. Use only batteries recommended within this guide and read the lead acid battery information supplied within this guide.
5. The instrument is **NOT** waterproof or airtight. Return to the factory for evaluation if exposed to environmentally unusual conditions.
6. **DO NOT** operate this equipment in damp locations or if damage is apparent.
7. This instrument (other than battery and fuse replacement) is **NOT** field repairable. Return the unit to Signalcrafters Tech Inc. for repair or replacement. Disconnect all AC power and batteries when replacing parts, performing maintenance or opening the instrument. Only personnel qualified, trained and knowledgeable in electronic instrument repair and safety and who have read this guide should maintain this instrument.
8. **WARNING:** Operators should follow all standard safety procedures when utilizing this product and accessories. Special personal precautions must be adhered to when working with or around antennas, power lines, rf sources, etc. **FAILURE TO COMPLY WITH SAFETY RULES MAY RESULT IN INJURY OR DEATH.**
9. While using this product you may need to access other products or system parts. Read and follow the safety instructions of all components utilized.

3.0 General Information:

3.1 Packaging of the Equipment: Upon receipt of the equipment, inspect all cartons and packaging for visual damage. Report all damage to Signalcrafters Tech Inc. so that we may notify the carrier for a claim. If the packaging damage is noticeable while the delivery person is present, obtain a written statement from the carrier.

The Model 110 is provided in a storage/carrying case. To remove the instrument from the case, first place the case on a secure surface with the imprinted Signalcrafters side facing up. Open the two latches to expose the unit. Remove the unit from the case by the handle.

3.2 Supplied Items: Each new Model 110 (does not include repairs, returned equipment or replacements) is shipped with the following:

1. Model 110

1. Carrying Case

1. Accessory Case (attached to top of unit)

1. Quick Reference Sheet

1. User Guide

1. U.S. Standard AC Cord (Other Cords may be substituted if required and pre-arranged).

1. Coax Cable, white, 6 ft.

1. Coax Cable, black, 6 ft.

1. BNC to Banana Plug Adapter

1. Ground lead, green, 6 ft.

2. BNC to Alligator Clip Adapter

5. Alligator Clips, (2 Red, 2 Black, 1 Green)

2. Banana to safety Plug Adapter (1 Red, 1 Black)

1. Model 110 Software (CD, PC, Windows™ format unless pre-arranged otherwise)

3.3 Preparing the Model 110 for use:

1. Verify you have received the items from the ‘Supplied Items’ list.
2. Insure the unit is within the environmental range specified and the Safety Information has been read and understood.
3. Be sure the unit is in a stable position, then remove the front cover by holding both ends of cover and pulling outwards.
4. A Model 110 is shipped from the factory with the batteries charged. You may now turn on the unit by depressing the ON/OFF switch located on the lower left hand side of the front panel.

Or

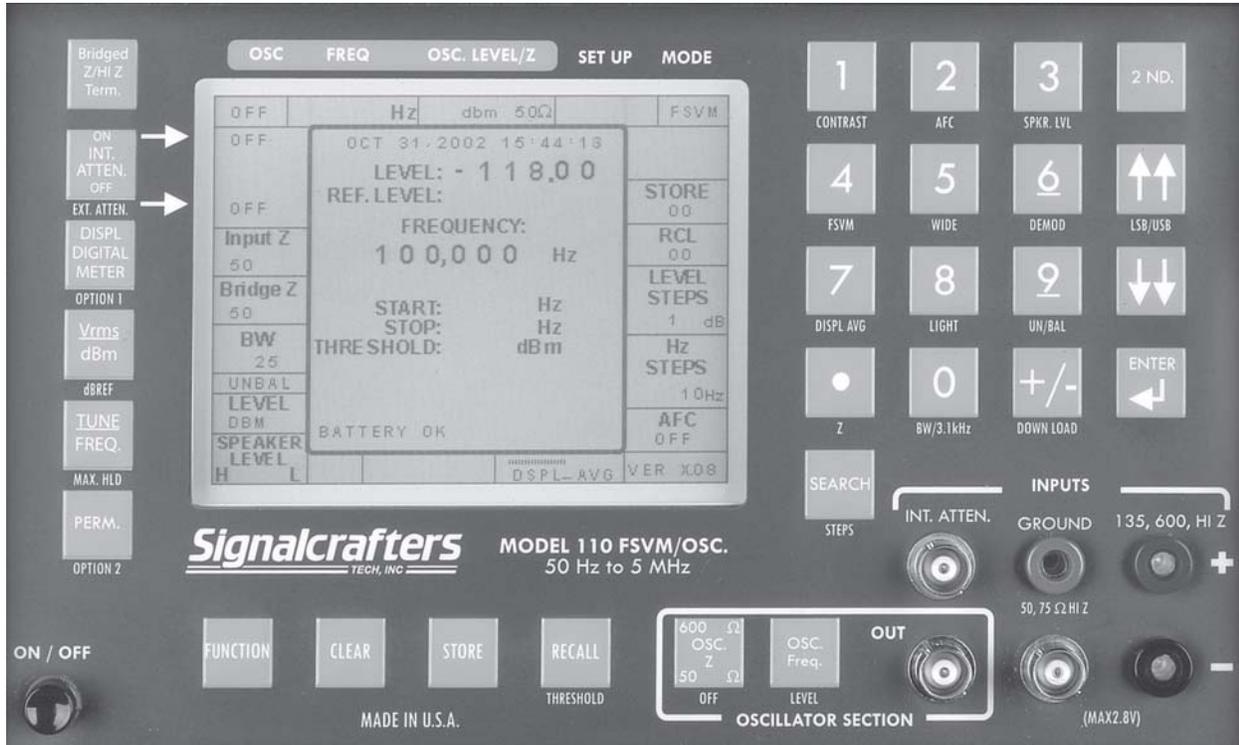
4A. Connect the power cord from the rear of the unit to the proper AC outlet. You may now turn on the unit by depressing the ON/OFF switch located on the lower left hand side of the front panel.

Either 4 or 4A The front panel display will turn on and “Signalcrafters” will appear for a short period. The main (digital) screen will appear.

5. Each time the unit is turned on and when the main screen appears, the following can be viewed by the user: Near the bottom of the screen a “NOTE” section will state “Calibration Valid Last Date Above”. Near the top of the screen a date will appear indicating the date the unit was initially calibrated (or recalibrated). This information indicates that the unit has accessed the calibration information and has entered the data to be used. The calibration date will disappear within 10 seconds and be replaced by the actual time and date. No further action by the user is required and calibration is complete.

6. The handle may be rotated to specific pre-set positions by pressing the two (2) buttons located at the case side of the handle. Rotate the handle to a desired preset lock position which is convenient and secure.
7. The Model 110 is now ready for use.

3.4 Front Panel Description:



The front panel of the Model 110 consists of five basic sections. The keypad which consist of twenty-seven (27 keys, the LCD display, oscillator with two (2) keys and output connector, input connectors and the nomenclature section around the LCD display.

a. Keypad: The keypad contains 27 keys marked with their respective function/purpose. Marking underneath a specific key indicates a second function/purpose of the key if applicable. To activate the second function first press and release the 2ND key, then press the function/purpose key desired. Specific instructions are within the operation section of this guide.

b. LCD Display: Displays all the results, entries and functions as entered via the keypad and/or processed by the instrument. In the set-up state various menus are displayed which allows the operator to select a function, enter data etc. Once chosen, the screen will display what has been entered, selected or chosen. On the digital display a bargraph is provided to display a visual indication of the signal strength. Three (3) screens are available, (a.) standard/main/digital (b.) digital-analog meter & (c.) power budget calculator. In the lower section of the main display a “Note” section will advise useful information, directives or suggestions.

c. Oscillator Section: Contains a BNC output connector and two (2) keypads for level, On/Off, frequency and impedance selection. 2ND function operation is described in the keypad section above and specific instructions are within the oscillator section of this guide. NOTE: The oscillator output BNC is an output only connection—do not feed signals into this connector.

d. Input Connectors: Contains unbalanced BNC input, Red and Black banana jacks for balanced input, internal attenuator BNC input and a Green banana jack for ground.

e. Nomenclature: The section around the LCD display contains fixed titles for various information which is displayed. The selections made for these titles and/or indications of status will be found in that area of the display.

3.5 If the Unit does not work:

a. Insure the AC cord is attached and plugged into a properly operating outlet and the batteries are charged.

b. Unplug the unit and check the fuses—replace if blown. Reconnect the unit and check if operational. If the fuse(s) again fail immediately disconnect the unit from the outlet and do not use.

c. Contact Signalcrafters Tech Inc. and obtain a Return Material Authorization (RMA). Warranty information is provided within this guide.

d. Repack the unit and return it. Ship with shipping charges prepaid unless directed otherwise when obtaining an RMA.

3.6 Servicing the Model 110: Other than fuse(s) and batteries there are no user-serviceable parts within the main unit. Surface mount technology is used in a majority of the unit and are not readily field repairable. Return the instrument to Signalcrafters Tech Inc. for repair. A Return Material Authorization number (RMA) must be obtained from Signalcrafters Tech Inc. prior to returning the instrument.

a. To replace a fuse: Turn off the unit and disconnect it from the AC power input along with any test leads connected to the unit. Use an appropriate size flat blade insulated handle screwdriver to unscrew the fuse holder cover located on the rear panel of the unit (there are three (3) customer accessible fuses). If the fuse is opened replace it with a working fuse at the same size and ratings specified. Reinstall the new fuse in the reverse manner as removal.

b. Replacing batteries: Caution should always be used when working with batteries. Follow handling and disposal of batteries as described in the appendix of this guide. Wear eye and hand protection. Turn off the unit and disconnect the AC power input and any test leads connected to the unit. Remove the four (4) black screws (two on the left side and two on the right side) of the top cover. Gently lift off the cover which will expose the internal portion of the Model 110. Disconnect the push on quick disconnect connectors, (red and black leads) on each battery. Locate and remove the two screws holding each battery retention plate being careful not to touch or short the active metal parts of the battery. Install a new battery of equal size and ratings. Install the hold down plate. and reconnect the quick disconnect connector to the proper terminals (+/-). Repeat these steps for the other battery. Reconnect the quick disconnect connectors to the proper terminals (+/-) of both batteries. Reverse the procedure for removal of the top cover to install. Retest the unit, **dispose of the used batteries properly** (in accordance to federal, state, local and company laws and regulations). Charge the unit. A message on the display of a properly operating unit will advise if charging is needed or it is charging.

3.7 Quick Reference Guide: A separate quick reference guide is provided with the equipment. Although a logical approach was taken in the operation of the Model 110, the guide gives the user visual and written guides in a short format. It should be understood in many of the features there is more than one method to obtain a result. The Quick Reference Guide shows the most direct route. This guide covers all these items in more detail.

3.8 Screen/Display Notes: To assist the user in operation of the Model 110 up to two lines of text are displayed on the bottom portion of the screen/display. These may be instructional, directive or suggestive. Varying display times of the notes are used so as not to confuse the user in proceeding steps used in a testing/set-up sequence. Note Example: when switching from balanced input to a unbalanced input or visa versa the Note will advise where to connect the test lead.

3.9 Bargraph: A bargraph is provided on the digital (main/standard) screen. It is provided to give a visual indication of the signal strength. It is auto-ranging and does not have a user interface. The digital analog meter screen may be used for actual visual readings of the signals present.

3.10 Power supply: The instrument can operate from an AC source at the rated value for which it was supplied or internal batteries.

a. A 120 VAC, 50/60 Hz AC power cord is provided. Optional adapters and/or power cords are available for other standard AC inputs and plug types.

b. The Model 110 power supply has an operating range from 85 to 264 VAC, 47/63Hz. The standard shipped unit is set for 120 VAC, 50/60 Hz unless otherwise specified at time of order.

c. The unit can be powered from the AC source with or without the batteries installed (disconnect the internal battery connections at the main board if this is the case although not recommended). However, without batteries the unit will shut down when the power cord is unplugged (either from the outlet or unit) or AC power is turned off/fails.

d. After insuring the instrument's AC input rating agrees with the outlet rating, mate the power cord with the socket on the rear of the instrument and then insert the power cord plug into the appropriate outlet. **DO NOT** attempt this step if the power cord is frayed, worn or damaged (discard the cord and replace with a cord of equal or better rating).

3.11 Batteries: The Model 110 is shipped with two 6V, 10 AH sealed lead acid batteries installed and charged. The battery charger operates from the AC source. The batteries are trickle charged when operated from an AC source. Trickle charging occurs at all times when AC power is properly applied regardless of the on/off condition of the unit. Indication of battery charged or charging is displayed on the screen during normal operation. A fully charged set of batteries will provide approximately twenty (20) hours of operation before recharging is required. As with most batteries of this type the unit should not sit idle for long periods of time without charging the batteries to extend battery life.

If the batteries are allowed to remain in a discharged state for a period of time, some difficulty in recharging may occur. If this happens, a prolonged recharge time of 24 hours or longer is suggested. A short period of discharge followed by another normal 16 to 18 hour recharge cycle may be required to restore the batteries to their full recharge capability. If this procedure fails to recharge the batteries, please consult the factory. Other methods, beyond the scope of this guide, may be able to restore the batteries to their normal operating state. Lead-Acid batteries will self-discharge if left without recharging for extended periods of time. For best results, the batteries should be recharged every 90 days.

Continued charging of lead-acid batteries, after they have reached the charged state, liberates hydrogen and oxygen gasses. The internal battery charging circuit minimises such overcharging and thus, minimises the production of these gasses. It is not possible to completely eliminate some outgassing. Do not allow the case to become obstructed while the batteries are being charged.

Refer to the Servicing and Lead Acid Battery Information in this guide for replacement and proper handling and disposal of lead acid batteries. A (MSD) material safety data sheet is also provided in the appendix of this guide. Wear proper safety apparatus when handling or working with lead acid batteries.

3.12 EMI/RFI Suppression: This instrument incorporates design features to reduce EMI/RFI interference. We do not have control over accessories or other instruments used in conjunction with this instrument. Use shielded leads and take necessary precautions in the operation of this unit. **Do not operate** the unit with the case open or defeat any of the EMI/RFI features.

Use of shielded test cables will reduce stray fields if they are present. These fields could induce interference in the test leads which will result in incorrect readings if improper test leads or procedures are used.

3.13 Storage:

a. Storage/carrying case: A storage/carrying case is provided with the Model 110 to protect the unit when not in use or in transit. The top of the case has Signalcrafters imprinted on it. With the top open and on a secure surface place the Model 110 with handle rotated to the top of the unit down to the accessory bag. Place the unit in the black case, close the lid and latched shut. The case and accessory bag is meant to handle those items shipped with the unit. If additional items have been added by the user they may have to be removed or rearranged for proper closing of the carrying case.

b. Storage: Storing the unit should be done in a weather resistant dry area within the temperature range of -40 to +70 degrees. It is suggested that the batteries be removed during long term storage (one year or more). See the Servicing Section for battery removal.

3.14 Definitions: Reference to terms used in this guide.

Absolute Power Level dBm: The log of the ratio of the power being measured to a reference power (1mW).

AFC: Automatic Frequency Control, adjusts the instrument receiver to the center of the actual input frequency. Used only in the FSVM mode and requires an input signal of sufficient strength within the pass band of BW bandwidth filter selected.

Boxes: See Display Boxes, below.

Bridge Impedance: Bridge impedance is the impedance used in calculating the dBm reading. As an example: If .707 Vrms is imposed across a 50 ohm resistor, the power produced will be +10 dBm. If the voltage is still .707 Vrms and the impedance is increased to 100 ohms, less power is dissipated in the resistor; the dBm value is now +6 dBm. Since the meter can have a high input impedance or the system may have a load in parallel with the Model 110, the bases for the dBm calculation is the bridge impedance.

Demod (Demodulation): Monitoring of AM, DSB, LSB and USB signals. In this mode the unit does not measure the strength of the signal but allows monitoring through the onboard speaker and frequency display. The different types of signals can be selected via the keyboard.

Display Averaging: The level on the display is calculated by an old value plus a new value and divided by the set amount. Used when rapidly fluctuating signals are being measured.

Display Boxes: Rectangular areas around certain functions which operator choices or entries within them. The boxes flash when the function is chosen and stop flashing when a choice within the box is selected.

FSVM: (Frequency Selective Voltmeter) Unit measures levels at various frequencies within a selected bandwidth.

Maximum Hold: Displays the maximum rms signal level of a variable input signal detected during the measurement period. Allows the check of idle channels for intermittent interference or overvoltages. The signal must be present long enough for the instrument to capture it. Not to be used in search function.

Relative Level: The difference in level between any point in a transmission system and the level at a reference point. At the reference point the relative level equal 0 dB.

Search: Instrument automatically searches for signals greater than the THRESHOLD level. The AFC function will cause the unit to stop its search at the first frequency meeting the threshold level. Start and stop frequencies for the search can be entered or the up and down keys will start the search from existing frequency. Time to complete the search depends on whether display average function is used and the (BW) bandwidth selected as well as the range of search.

Steps: An adjustable programmed frequency and level in which the unit will change when the up and down keys are utilized as well as internal operations.

Threshold: A value in dB or dBm for which the instrument will search for signals greater than the entered level. The default level is -20 dB or dBm.

Wide (Wideband): Unit becomes a flat type meter measuring true rms of all signals over the entire range of the instrument.

Demodulation (Demod): Will demodulate (USB, LSB, DSB, and AM) input signal with 7400 Hz bandwidth filter.

4.0 Set-up/Operation

This section covers the basic keys and functions which may be used in the various modes of operation and are not generally specific to one particular mode. Set-up/operation assumes the operator has prepared the instrument for use.

4.1 Powering of the Unit: The on/off switch is located on the lower left hand side of the front panel. To turn the unit on or off, press the ON/OFF switch. When turned on the Signalcrafters logo will appear on the display. After a brief time period the logo will be replaced by the main screen.

4.2 Back Light: A back-light is provided for the display. Depending on the lighting conditions it may be turned on or off. If the back light is off, pressing the 2ND key and then the # 8 key will turn on. To turn the back light off press the 2ND key and then the # 8.



4.3 Contrast: The display contains a contrast control to adjust the displayed data for clear and sharp viewing. The contrast can be changed by pressing the 2ND key and then the # 1. Using the up or down arrow keys the contrast can be adjusted for optimum display of the data under the conditions which it is being used.



4.4 Speaker level: In the Demod mode of operation a speaker output is used to hear the demodulated signal. To adjust the speaker level, press the 2ND key and then the #3. Use the up or down arrow keys to obtain a comfortable listening level. The speaker level is indicated by a horizontal bargraph located in the lower left hand side of the main screen. The graph indicates L (low) to H (high) with a changing bargraph indicating the relative level.



4.4.1 Keypad Level: The speaker level control is also used to increase or decrease the sound level heard when a keypad is depressed. It is adjusted as is the speaker level control.

4.5 Impedance (Z): Sets the input impedance of the balance/unbalanced inputs (low level inputs) to that which is being read. 50, 75, 135, 600 Ohms and High Impedance (\geq to 1 M Ω) are standard. The impedance selected is viewed on the upper left hand side of the display in the Input Z box. To select or change the impedance displayed press the 2ND key and then the • (period) key. Each time this is done the impedance will change. Repeat this sequence until the desired input impedance is displayed.



4.6 Vrms/dBm: The unit will display the measurement in either Vrms or dBm. To change the displayed reading from either simply press the Vrms/dBm keypad. The units of measure is displayed within the bezel after the reading on the standard screen and after the reading on the analog meter screen (below the simulated meter movement).



4.7 Balanced/Unbalanced: The **balanced** input are via the front panel **red and black banana jacks** and the **unbalanced** are via the **BNC input** (Low Level Input). Insure the input is connected to the proper input for which the meter is set and the type measurement desired or an incorrect reading may result. The state of balanced or unbalanced is shown on the display on the lower left hand side of the screen in a box marked Input. To switch the unit between balanced and unbalanced press the 2ND key and then 9. Repeat to return to the previous state. Be sure to move the test leads accordingly.



4.8 Bandwidth (BW): Four bandwidths of the input filters are provided in **FVSM** mode. These are 25 Hz, 100 Hz, 1.95 KHz and 3.1 KHz. The selection of a particular bandwidth is dependent upon the type of signals being read. 25 and 100 Hz bandwidths are suitable for measuring pilot levels, carrier leaks, idle signals in voice frequency channels and interference signals in the voice frequency band. 1.95 and 3.1 KHz are used to measure power and un-weighted noise. When measuring low end voice frequencies the Model 110 will automatically reduce the bandwidth of the input filter and display the bandwidth being used. The bandwidth being used is displayed in the BW box located on the lower left hand side of the display of the main screen and in the lower right hand of the parameter boxes on the analog meter display. To change or set the bandwidth, press the 2ND key and then the 0 key. Repeat until the desired bandwidth is selected and displayed in the BW box.

Two bandwidths of input are provided in Wide mode (Version 2 hardware only). These are 5MHz and Wide.



4.9 Display Averaging (DISPLAVG): The averaging function displays the average of rapidly changing signals. It is adjustable in the number of samples that are performed over time. Slower baud rates should be averaged over longer periods and faster baud rates require less samples. To activate display averaging press the 2ND key and then the 7 key. Use the up and down keys to increase or decrease the number of samples to best suit the application. When on, the display averaging box on the bottom right of the screen will show Disp Avg. and a horizontal bargraph will appear across the top of the words. The bargraph will increase or decrease accordingly to the up and down keys used. The more lines shown indicate a higher number of samples. To disengage display averaging, press the 2ND key and the 7 key. This function may be turned on and off during operation.

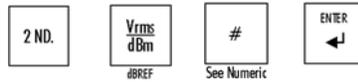


4.10 dB Reference (dBREF): A relative level is the difference in level between a point measured and that of another used as the reference point. At the reference point the reference level equals 0 dB (the absolute value changes to the 0 dB reference level) and the level measured is the difference from that level shown in dB. Example: You are reading a test tone level of -16 dBm, entering the instrument in the dBREF (dB reference) mode this is now the reference level of 0 dB. You then measure a signaling tone which displays a reading of -10 dB. The instrument actually measured this signaling tone at -26 dB and took the difference from the reference level of -16 dB and displayed the -10 dB. In our example the signaling tone is 10 dB below the test tone. There are two ways to set the reference level.

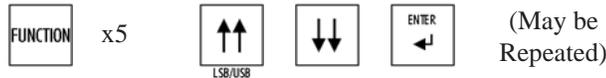
4.10.1 Activate from an existing reading: To activate dB Reference first read the level desired to be the reference level then press the 2ND key then the Vrms/dBm key and then the Enter key. The read value is now the reference level and it will appear in box directly below the bezel (surrounding the level reading) in the reference level box. To disable reference level, press the 2ND key and then the Vrms/dBm key.



4.10.2 Enter a Reference Level: To enter a reference level, press the 2ND key then the Vrms/dBm key. Directly below the bezel (surrounding the level reading) is the reference level box. A flashing box will be seen for numeric entry including +/- and decimal point. When the value is complete the press the Enter key. The entered value is now the reference level. To disable reference level, press the 2ND key and then the Vrms/key.



4.11 Clock/Date: The Model 110 has a real time clock and date feature. Should it be necessary to reset these to local time and or change the date the following steps are used. Press the Function key five (5) times. A flashing box will appear around the entire date and time information located near the top of the screen (directly above the bezel which contains the level reading). Pressing enter will place a smaller flashing box around the month. Using the up and down keys step through the months until the correct month is found and then press the Enter key. A small box will now flash around the date. As for the month use the up and down keys until the correct date is displayed and then press Enter. Continue this procedure until all the date and time information is correct. The Enter after setting the seconds will end this procedure.



4.12 Maximum Hold (MAX HLD): The Maximum Hold function displays the maximum Vrms signal level of a fluctuating input signal during a measurement period. **NOT** to be used during search functions and the note section will warn that max. hold is on. It allows the checking of idle channels for intermittent interference or over-voltages. A signal must be present long enough for the unit to capture the reading. To activate Maximum Hold press the 2ND key and then the Tune Freq. key. MAXHOLD will appear at the bottom center of the screen when it is on. To disable press the 2ND key and then the Tune Freq. key.



4.13 Bridged Z/High Z Termination (Bridged Z/Hi Z Term): Switches back and forth between the Input impedance being used and the High impedance termination (**For Balanced/Unbalanced Inputs**). A second use for this key is described in the internal attenuator section of this guide. To switch between the two impedances, press Bridged Z/Hi Z Term key.



4.14 Steps (Steps): Increments which the unit will “step” through in level or frequency when the up and down keys are used. Pressing the 2ND key and then the Search key will create a flashing box around the level or frequency step box. Pressing the 2ND key and then the Search key again will switch the flashing box to the other step (either the level or frequency box). Used in conjunction with the up and down keys to change the pre-programmed steps to the desired step within the flashing box.

4.15 Clear (Clear): The clear key returns the unit to the last value prior to using the up or down keys or the



numeric keys to make an entry. One exception is its use in clearing memory. Refer to the Clear Memory section for this procedure. Clearing is accomplished by pressing the Clear key.

4.16 Enter (Enter { ↵ }): Enters the data after the operator inputs the desired information.



4.17 2ND (2ND): The 2ND key is used to activate those functions listed underneath the main keys. When the

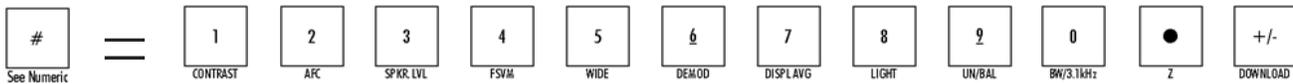


2ND key is depressed it is so indicated in the upper right hand side of the display. It will time out in approximately 10 seconds if another key is not activated or immediately if the Clear key is depressed.

4.18 Permanent & Option 2 (Perm/Opt 2): This key is presently reserved for internal use and future features/options.



4.19 Numeric (1-0, +/-, .): The numeric keys are used as required to enter values along with a decimal point and polarity if required.



5.0 FREQUENCY SELECTIVE VOLTMETER (FSVM)

5.1 Frequency Selective Voltmeter Mode (FSVM): The Model 110 has three basic modes of operation. The main function of the instrument is to measure voltage levels at specific frequencies. To activate the Frequency Selective Voltmeter (FSVM) there are two methods available; (1) press the 2ND key and then the 4 key or (2) pressing the Tune Freq. key. Either method will place the unit into the FSVM mode of operation. Above the display at the upper right hand side, the word “MODE” is part of the front panel. Directly below it and on the display, FSVM will appear when in the frequency selective voltmeter mode. FSVM will remain on the screen until another mode of operation or stored set-up is selected.



5.2 Automatic Frequency Control (AFC): The AFC is only used in the FSVM mode of operation. It adjusts the instrument receiver to the center of the actual signal input frequency. The signal must be of sufficient strength within the pass band of the bandwidth filter selected. To turn the AFC on, press the 2ND key and then the #2 key. In the bottom right hand side of the display and in the box marked AFC either On or Off will be shown to indicate the condition of the automatic frequency control. If it is ON press the 2ND key and then the #2 key to turn it OFF and repeat to turn it on.



5.3 Tune Frequency (Tune Freq): When this key is depressed the Model 110 will automatically enter the FSVM mode. It is used to input the frequency which is being sought. The frequency may be entered directly via the numeric keys or scrolled via the up/down keys. If the frequency is unknown refer to the search section of this guide. The digits will enter from left to right on the display. The same procedure may be used when in the analog meter display without using the function key (see Analog meter section of this guide).

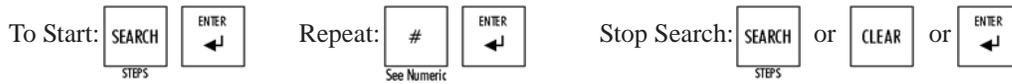


5.4 Search (Search): This instrument will automatically look for signals that are greater than a set threshold level. The threshold level can be changed and has a default value of -20 dB or dBm (See Threshold and dB Reference section of this guide). There are two methods to perform a search: 1). Set the high and low ends of the frequency band to be searched (the smaller the band of search the less time required to complete the search) or 2). Utilize the Up/Down arrow keys to start the search from the displayed signal frequency to the low or high end of the instruments frequency spectrum.

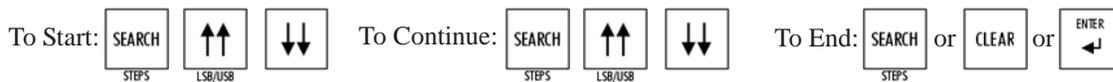


5.4.1 High/Low End Search: To Search for frequencies within a band of frequencies. Press the Search key then Enter. The display will show a flashing box around the Start frequency. If the value displayed is acceptable press Enter or input the frequency which you want to start the search at by using the numeric keys. Once the start frequency is entered and the ENTER key is pressed, a flashing box will stop and start flashing around the Stop frequency. Input the frequency which you want the search to Stop at by using the numeric keys. Once the stop frequency is entered or if the existing frequency shown is acceptable press the ENTER key. The box will stop flashing and start flashing around the Threshold level section. Either use the existing Threshold level or input the level via the numeric keys including the +/- key as required. At this point when the Enter key is depressed the box around Threshold will stop flashing

the search will begin locating frequencies between the lowest frequency entered to the highest, stopping at the first valid frequency above the threshold level. To continue searching within the band entered press the up or down arrow key(s) in the direction you want to continue searching (up towards the higher and down towards the lower frequency). To end the search press either the Search, Clear or Enter key. If no valid readings are present the unit will scan between the stop and start frequencies one time without stopping.



5.4.2 Up/Down Search (Search): To search for frequencies above or below the displayed signal frequency the up and down key(s) may be used. This procedure will be the same for both the main (digital) and analog meter display. Press the Search key and then press either the up arrow key to search for higher frequencies or the down arrow key to locate lower frequencies. The unit will stop at frequencies above the threshold level (the threshold level can be set in the digital display mode only). To continue a search after the unit finds a valid frequency press the Search key and either the up or down key depending on direction desired. To end a search press either the Search, Clear or Enter key. If no valid readings are present the unit will scan through the entire frequency range of the unit from the point started at and in the direction of the up/down key used.



5.5 Threshold (Threshold): A value at which a signal must exceed (be higher than) to be considered. The threshold is set in dB (if the dB Reference function is activated) or dBm and has a default value of -20 dB or dBm. It is displayed at the center bottom portion of the digital display. It can be accessed in the search mode high/low set-up (see search mode) or by pressing the 2ND key and then the Recall key. A flashing box will appear around the threshold section of the digital display. If the default value is acceptable for your application press enter. If a new setting is required enter it via the numeric keys including the +/- key then Enter. The flashing box will stop and the value disappears. The threshold value will re-appear when the 2ND, recall or Search keys are activated.



5.6 Demodulator (DEMOM): Various modulation types can be monitored by the unit but not measured. These are AM, DSB (Double Sideband), LSB (Lower Sideband) and USB (Upper Sideband). In order to monitor these signals the **unit must first be in the FSVM mode** before entering the DEMOM mode. After insuring the unit is in the FSVM mode press the 2ND key and then the 6 key. AM will appear under the Mode legend in the upper right hand side of the display.

5.6.1 Selecting Modulation Type: To switch between the different modulation modes press the 2ND key and then the 6 key. Repeat this procedure until the desired modulation mode appears under the Mode legend in the upper right hand side of the display.



5.6.2 Sideband Selection: As an alternate to selecting the modulation type the 2ND key followed by the Up Arrow will switch through LSB, USB and DSB. AM is not available in this procedure (see



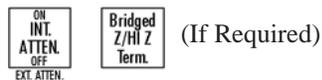
selecting Modulation type).

6.0 ATTENUATORS, INTERNAL/EXTERNAL

6.1 Internal Attenuator (INT. ATTEN, High Level Input): **Maximum input to this input is 100 Vrms, 141 Vp.** An internal high impedance input attenuator ($\geq 20k \Omega$ or higher) with 40 dB of attenuation is standard on the Model 110. To use the attenuator connect the test lead to the INT. ATTEN. BNC input (**High Level Input**) on the front panel. The standard input BNC to the bottom right of this connector should not be connected when using the Internal Attenuator. Press the INT. ATTEN key. Next to the ON arrow of this keypad the display will show ON and the Input box will display ATTEN. Measurements can now be made and the display will indicate the appropriate level.

It should be noted that the Bridge Impedance will now be used for the calculation. For convenience, the Bridge Impedance starts out at the impedance shown before the internal attenuator was turned on. The Bridge Impedance can be adjusted by pressing the **Bridged Z/HI Z Term** key. A flashing box will appear around the Bridge Z box and the value can be adjusted by entering via the numeric keys or using the Up/Down keys. The maximum impedance that can be entered is 9999. Once the desired impedance has been achieved press the Enter key.

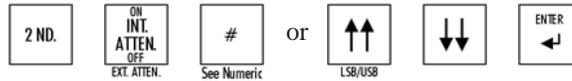
Example: If the Internal Attenuator input is connected to a signal source with a 400Ω impedance and the bridge impedance was 50Ω before turning on the internal attenuator. Press the Bridged Term key, then press the numeric keys or up/down keys to set to 400Ω . After the value reads 400Ω , press the ENTER key. The meter will display the dBm reading of the signal based on 400Ω with an internal attenuation of +40 dB.



To turn the internal attenuator off, press the INT. Atten key. Next to the ON arrow of the INT. ATTEN keypad the display will indicate OFF. The unit will return to the same termination and impedance settings that were in effect before the external attenuator was activated. The INPUT box will display UNBAL. The stored Bridge Impedance, however, will remain at the new value and may need adjustment if the Bridge High Z was used before activating the internal attenuator. Disconnect the input lead to the INT. ATTEN. BNC when done with the high level measurement.

6.2 External Attenuator (EXT. ATTEN.) This feature permits the user to connect an external attenuator (not supplied) and program the value of that attenuator into the unit. The display will include the added attenuation. To enter an external amount of attenuation, first affix the external attenuator to the standard BNC input (**Low Level Input**) located to left of the black banana jack (**DO NOT USE THE INTERNAL ATTENUATOR BNC INPUT**). Then press the 2ND key and the INT. ATTEN. Key. A flashing box will appear to the right of the INT. ATTEN. key and ON will appear next to the panel legend Int. Atten. and arrow. Either press the up/down arrow keys to change the value or use the numeric keys to set the amount of attenuation being used. Once the proper value is obtained press the Enter key and the box will stop flashing. The display note section will advise that attenuation is being added to the reading. Insure the impedance is set to the correct value. The maximum level into the low level connectors (output of the external attenuator is +18 dBm @ 50Ω , +16.5 dBm @ 75Ω , +14 dBm @ 135Ω and +7.5 dBm @ 600Ω). The level reading will include the attenuation programmed by the user. To turn off the external attenuator press the 2ND key and then the INT. ATTEN key. The attenuation dB value and display note will extinguish and the ON indication will change to OFF. The instrument reads the input level at the input connector (remove and turn off the external attenuator or future readings will be incorrect or the user must calculate the attenuation and add to the meter reading sepa-

rately). The attenuator value is saved in the meter and can be used again by following the above steps. If the last attenuation value is the same (using the same attenuator as last time), simply press the Enter key when the flashing box appears. You can also set the Bridged Z/HI Z Term if the external Attenuator needs to be terminated or not.



7.0 WIDEBAND OPERATION

7.1 Wideband Mode (WIDE): This mode of operations allows the Model 110 to operate as a true rms flat meter over the frequency range of the instrument. A flat meter is not frequency selective and will read the combined level of all signals including noise from 50 Hz to 5 MHz. To enter this mode, press the 2ND key and then the 5 key. The word WIDE will appear on the display under the MODE legend in the upper right hand portion of the display. It may be activated in the digital and analog meter display. You can select two bandwidths in Wide mode, 5MHz and Wide. To de-activate this mode of operation press the 2ND key and 4 to place the instrument in the FSVM mode or the Clear key to return to the previous mode used/entered.



FUNCTION	FSVM	WIDE	DEMODO
Wideband measurement	No	Yes	No
Receive Frequency	Yes	No	No
Search	Yes	No	No
Step	Yes	No	No
Tune	Yes	No	No
AFC	Yes	No	No
Level Reference (dB, dBm0, rms)	Yes	Yes	No
Bandwidth Selection	Yes	Yes	Yes
Demodulation	No	No	Yes
Monitor	No	No	Yes

8.0 OSCILLATOR OPERATION

8.1 OSCILLATOR ON/OFF (OSC. FREQ. / OSC. Z): The built in oscillator is provided to give the user a low level (+12 dBm @ 50 Ω from 50 Hz to 5 MHz and +3 dBm @ 600 Ω from 50 Hz to 250 kHz) sinewave output. The two (2) front panel controls and the output connector (BNC Type) are encompassed within a wide white boxed area in the lower mid to right hand section of the front panel. The keys select the various functions of the oscillator section. Results are displayed in the upper mid to left side of the display under the panel legend for the oscillator section. To turn the oscillator ON press the LEVEL key. To turn the oscillator OFF, press the 2ND key and then the OSC. Z key. Indication of the ON/OFF condition of the oscillator can be seen under the OSC legend in the upper left corner of the display. Although the operating time of the Model 110 during battery operation includes having the oscillator on, it is recommended it be turned off to increase battery time available.



8.2 Oscillator Impedance (OSC. Z) The oscillator has two (2) choices for output source impedance (50 Ω & 600 Ω). To change from one to the other press the Osc. Z key. 50 or 600 Ω will appear on the display under the panel legend Z on the top center of the front panel. This key will operate with or without the oscillator turned on. The oscillator impedance will be displayed until changed or power is turned off to the instrument.



8.3 Oscillator Frequency (OSC. Freq.): The oscillator frequency can be set or changed in two (2) ways. A.) Press the OSC. Freq key and then use the up/down arrow keys (the frequency will change by the amount set in the frequency steps each time it the key is pressed) until the desired frequency is reached. The frequency is displayed below the Freq. nomenclature on the front panel in the upper left/center of the display. Once the desired frequency is reached press the Enter key. B.) Press the OSC. Freq. key and enter the frequency desired via the numeric keys. Once the desired frequency is reached press the Enter key. The frequency is NOT available at the output until the Enter key is pressed and the box stops flashing. The frequency is displayed as in A.) above. In both cases when the OSC. Freq key is pressed a flashing box will appear around the area in which the frequency is to be displayed.



8.4 Oscillator Level (LEVEL): The oscillator level may be changed in steps preset by the user. To change the level of the output oscillator press the 2ND key and then the Osc. Freq key., a flashing box will appear in the level area at the top center of the display under the panel legend marked OSC. LEVEL. Using the Up/Down keys adjust the level to display the desired value. When reached, press the Enter key. The oscillator level will change only by the amount set in the Level Steps box on each pressing of the UP/DOWN key. It will not exceed the minimum/maximum level limits for 50 or 600 Ω (50 Ω; -37/+12 dBm, 600 Ω; -40/+3 dBm). The step level change may be useful in testing circuits like trip boost used in protection systems. See Steps to change level and frequency steps.



9.0 FUNCTION KEY

9.1 FUNCTION (FUNCTION): The display contains items which are selected during set-up or changed during operation. The Function key toggles through these items so they may be changed. In the analog meter and power budget displays it is the key that toggles through the various parameters which can be changed in those modes. As the function key is pressed it steps through the various parameters and a flashing box will be displayed around a particular parameter which can be changed accordingly. Normally the Up/Down keys will change a parameter. The actual changing of these parameters is covered in the designated section of this guide. Example: Pressing the Function key in the digital display screen five (5) times will bring you to the date and time section. Actual changing of time/date is covered under that section in this guide. In the digital display screen the function key repeats after five (5) actions.



10.0 SCREENS/DISPLAYS

10.1 Standard/Digital Display: The main/standard screen in this guide is the digital display. When turning on the instrument after a brief viewing of the logo the digital display will appear. It can be considered the default screen. The instrument also has two other screens; the analog digital meter and the power budget calculator.

10.2 Analog Meter Display (DISPL DIGITAL METER): For those who prefer to view an analog meter the unit has a digitally generated analog meter face. To activate it press the DISPL DIGITAL METER key. The entire screen will now be dedicated to the analog meter. Pressing the DISPL DIGITAL METER key again will return the display to default screen (digital display).



10.2.1 Auto Ranging (Auto Scale—Manual Scale): The Analog Meter has a auto-ranging feature. It will automatically change scales as the meter movement approaches high or low end levels on the meter scale. It is only available for use in the analog meter display mode. To turn On the Auto Ranging, press the Function key and then the Up arrow key. The display will read Auto Scale when on. To turn off the Auto Ranging again press the Function key and then the Down arrow key. The display will read Manual Scale when off. In the manual scale the meter range can be changed. After entering the manual scale press the Function key and a flashing box will appear to the right of the display. Using the up/down keys set the range to accommodate the level to be measured.



10.2.2 Analog Meter Parameters: Besides the auto ranging and manual scale setting features certain other parameters may be changed while in the analog meter screen. These include the frequency, bridged impedance, bandwidths and wideband mode. When in the analog meter display mode pressing the function key will toggle through the various parameters and indicate which parameter can be changed via a flashing box. Use the up or down keys or the other methods described in this guide to change the parameter for the application at hand. Settings from the digital display screen will carry over to the analog display when switched. Settings changed on this display will carry back to the digital display. The frequency parameter will be by-passed in the Wide mode when toggling through the parameters with the function key since in this mode is not frequency selective. An Enter will stop the flashing boxes, use the Function key to continue toggling through the parameters.



10.3 Power Budget Calculator: The Model 110 has a Power Budget Calculator and a separate calculator for voltage, dBm, current and wattage all on the same screen. This feature allows the user to calculate unknown power related values as well as budgeting signal levels for multi-tone and single sideband systems. The upper portion of the display is the power budget calculator and the bottom is a separate power related calculator. To access the calculator press the 2ND key and then the DISPL DIGITAL METER key. The calculator screen will appear and be available to enter parameters. To leave this display press the DISPL DIGITAL METER key once to go to the analog meter display and once more to go to the digital meter (default) display.

10.3.1 Power Budget Parameters: Various parameters need to be entered into the calculator to provide



(Press Displ Digital Meter key 1 time to return to Analog screen or 2 times for digital.)

results. Once in the power budget display use the Function key to toggle through each of the parameters. A flashing box will appear at each possible entry point. If the information in the flashing box is correct for your application press the Function key again to move on to the next. You will go through all parameters when pressing the function key. It is not necessary to make an entry if it is not required or blank (do change the entry if it has a value and not used). Results will be shown on the right hand side for the power budget portion and on the bottom for the power related calculator. Use the numeric keys to input your desired information and include the +/- key as required. The last box allows the user to set their own level. For multi-channel systems (like a multi-channel power line carrier system) enter the total number of test tones (TT) or Tones which are feeding the output amplifier. Example: A two channel power line carrier channel could have two test tones and two signaling tones ten (10) dB below them. You would enter two in the test tone (TT) and two in the -10 tones @ -10. The results on the right will indicate the readings for a single signal. The Clear key will return to the original value in a flashing box which is useful if the entry was made in error. The ENTER key turns off the flashing of a flashing box. The Function key acts as an enter and moves on to the next parameter.

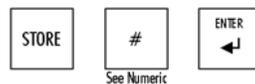


11.0 MEMORY/STORING SECTION

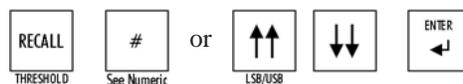
The instrument has the ability to store and recall twenty-four (24) set-ups plus the default and ninety-nine (99) readings. Set-ups are defined as the parameters/settings a user wants when using the instrument. The default settings may not be best suited for the user: Example: The default impedance is 50 Ω and the user's equipment is 75 Ω . The user may set the equipment to the parameters he/she desires and store as a set-up. Future use of the unit will allow the user to simply recall the stored set-up number and the Model 110 parameters will change to those desired and saved previously.

A reading is what is being measured at the time the user wants to store it. Like the set-up it can store and recall the parameters used to make the measurement but it also includes the value being read. Among other situations this may be useful for those traveling between sites or being called away for another task and wanting a documented, as left reading. It also can be useful when the download software is used for graphing and review. The user is required to note which stored location (number) for recall purposes or toggle through each stored reading. Time and date of when the storing took place is displayed when recalled. Unused registers are not shown and the instrument will automatically select the next storage register available.

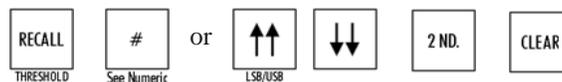
11.1 Storing a Reading: To store a reading press the Store key, note the store box is flashing and a number is indicated. Note this number then press the Enter key. The reading is now stored in register N# and available for recall.



11.2 Recall a Reading: To recall a reading press the RECALL key and enter the number of the reading desired to be recalled via the numerical keys or RECALL key and the up/down keys until the desired number appears. The number being recalled appears in the flashing RCL box on the right mid to upper side of the display. Pressing ENTER will display the reading associated with the number shown and the box will stop flashing. The reading will remain until Clear is pressed at which time the meter will revert back to its normal operation with the reading available for future reference.



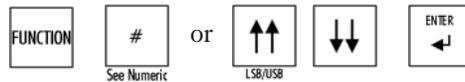
11.3 Clear a Reading: A reading may be deleted if no longer required or if the registers are full and more space is required. See downloading prior to clearing a reading should the user want to preserve the information). Press the RECALL key and use either the UP/Down or numeric keys to display the stored number reading which is to be deleted. The RCL box will be flashing and the selected number displayed. Pressing the 2ND and then Clear key will cause the box to stop flashing and the number selected to disappear. The note section of the display will advise the stored value has been cleared. The register is now available to the unit for future storing.



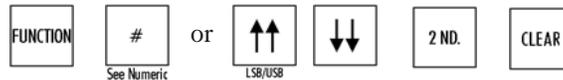
11.4 Store a Set-Up: To store a set-up first insure the parameters which the user desires have been set. Pressing the Function key once will start the SET UP box on the display located in the top right part of the display to flash. Press the Store key. The box will stop flashing and the Model 110 assigned number will appear and remain visible until changed, brought back to the Default setting or the OFF switch is activated. If future use of this set-up is desired the user should note the number assigned for faster access. The user may also toggle through the set-ups in the recall procedure to find the desired one.



11.5 Recall a Set-Up: To recall a set-up press the Function key and using the numeric keys input the number desired or using the up/down keys toggle to the desired number. The number will be shown in flashing box under the SET UP box located in the top right part of the display. Pressing Enter will cause the box to stop flashing and the parameters associated with the number selected activated.



11.6 Clearing a Set-Up: To clear a set-up press the Function key and using the numeric keys input the number desired or using the up/down keys toggle to the desired number. The Default set-up can not be erased. The number will be shown in the flashing box under the SET UP box located in the top right part of the display. Press the 2ND key and then the Clear key. The set-up and parameters will be erased and box will stop flashing. Press the function key again to return to the Default or select another set-up via number. The note section of the display will indicate the set-up was erased.



12.0 DOWNLOADING/REMOTE CONTROL/SOFTWARE

The Model 110 is supplied with Windows™ based software (Signalcrafters **Model 110 Remote**) for downloading and remote control of the instrument via a personal computer (PC). The connection to the Model 110 is made by a DB9 pin connector located at the rear of the unit to the computer RS 232 port (not all PC's have a RS 232 port and may require a customer supplied adapter). The cable is **not provided** with the instrument. The downloading of saved readings as well as most controls on the digital display screen can be operated through this software. It may also be used to update your Model 110 to the latest version of software when they are posted on Signalcrafters Tech Inc. WEB site (www.signalcrafters.com).

12.1 Hardware Requirements: To run the Model 110 Remote software, the following items are required (Minimum):

A personal computer using a Pentium™ 75 or higher microprocessor

VGA Graphics Card/Monitor

Printer (to print reports) and compatible printer port on the PC and appropriate cable.

32 MB of RAM

5 MB of Hard Drive Space

1 Serial Port (RS-232 Converter may be required on some PC's)

101 Enhanced Keyboard

Mouse or equivalent

CD-ROM

Cable, RS-232 type for connection from PC to Model 110 (DE-9-M-F or similar).

Windows™ (software) 95, 98, NT 4.0, 2000 or XP.

12.2 Installing the MODEL 110 REMOTE software:

12.2.1 Before starting the install process, it is recommended that you exit all other running Windows and DOS applications.

12.2.2 On an operating PC, insert the CD-ROM supplied and close (activate) the drive. Press the START, RUN. Browse the CD-ROM for the setup.exe. file or type x:\setup.exe and then press OK.

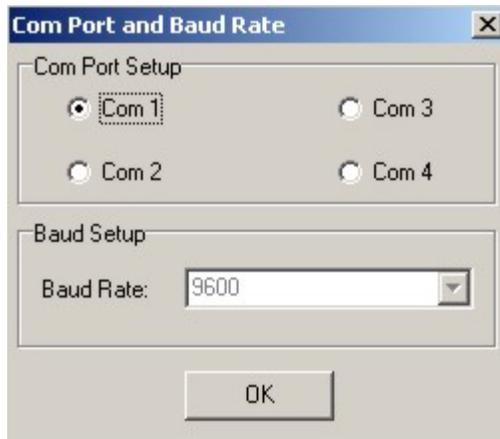
12.3 Menus: There are various menus within the program which can be accessed.

12.3.1 Set-Up: This menu is used to set-up the communications between the PC and the Model 110.

12.3.1.2 Com Port and Baud Rate:

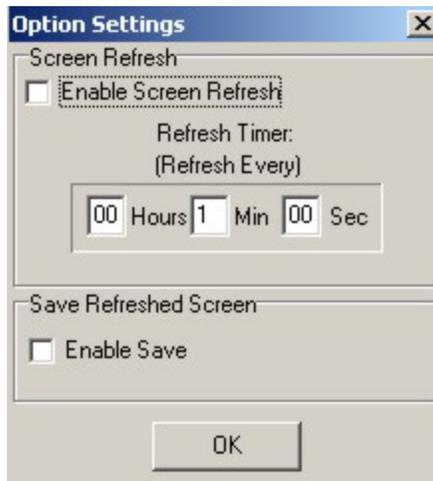
Com Port Set-up: Set to the desired com port of the PC which will transfer information to the Model 110.

Baud Rate Set-up: This is a fixed rate and may not be changed within the program. It is set to 9600 baud.



Com & Baud Rate Menu

12.3.1.3 Option Settings: The Option Settings menu enables you to refresh the PC screen, set the time of refresh and save each refresh in a database. Use the Option Settings to overcome the two (2) minute time out built into the Model 110.



Option Settings Menu

NOTE: Remote access to the Model 110 is timed for two (minutes). Once the program is opened and after two minutes of no (0) PC activity the Model 110 will shut down the interface between itself and the PC. If activity exists, it will time out two (2) minutes after the activity ceases. See SET-UP/OPTION SETTINGS in the menu section below to overcome this feature. If the Model 110 has timed out press the ENTER key to re-initiate communications.

12.3.2 Reports: A menu for viewing and exporting reports generated by the Model 110 Remote Software.

Download Report: In this menu you can view, export or sort the database which has been downloaded from the Model 110. Ref to 12.6

Refresh Data (History Report): In this menu you can view, export, clear or sort the history database that you saved buy enabling the Refresh Screen and Save Refresh Screen in the Option Settings Menu (12.3.1.3).

NOTE: Files exported are in COMMA delineated format with quotes.

Typical History Report generated

The screenshot shows a 'Print Preview' window with a table titled 'Model 110 History Report'. The table has the following columns: Time, Level, Ref. Level, Frequency, Bandwidth, Input Z, Bridge Z, and Input. The data rows show various measurements over time, including levels in dBm, frequencies, bandwidths, and input/bridge types like UNBAL and ATTEN.

Time	Level	Ref. Level	Frequency	Bandwidth	Input Z	Bridge Z	Input
Jan 31, 2003 13:27:01	-10.00dBm		500000	3100	50	50	UNBAL
Jan 31, 2003 13:26:01	-10.00dBm		500000	3100	50	50	UNBAL
Jan 31, 2003 13:25:01	-10.00dBm		500000	3100	50	50	UNBAL
Jan 31, 2003 13:24:01	-10.00dBm		500000	3100	50	50	UNBAL
Jan 31, 2003 13:23:01	-10.00dBm		500000	3100	50	50	UNBAL
Jan 31, 2003 13:22:01	-00.01dBm		500000	3100	50	50	UNBAL
Jan 31, 2003 13:34:01	-19.97dBm		125000	3100	50	50	UNBAL
Jan 31, 2003 13:33:01	-60.61dBm		5000000	3100	50	50	UNBAL
Jan 31, 2003 13:32:01	-93.77dBm		5000000	3100	50	50	UNBAL
Jan 31, 2003 13:31:01	-60.00dBm		500000	3100	50	50	UNBAL
Jan 31, 2003 13:30:01	-101.86dBm		500000	3100	50	50	UNBAL
Jan 31, 2003 13:29:01	+23.00dBm		500000	3100	High	50	ATTEN
Jan 31, 2003 13:28:01	+20.00dBm		500000	3100	High	50	ATTEN
Jan 31, 2003 13:21:01	+09.96dBm		500000	3100	50	50	UNBAL

12.3.3 Update Unit: This menu is for updating the software in the Model 110.

12.3.4 Help: A help menu is provided for access while in the Model 110 Remote software. Click on Help and locate the particular topic of interest.

12.4 Remote Control: Many of the features associated with the digital display of Model 110 may be controlled from the PC. On the PC screen a replica of the front panel of a properly connected and operating system will be viewed. Operations from the PC which are not permitted will be so indicated. Instead of pressing keys, the mouse and associated pointer are used. Locate the pointer over the key desired and press the left mouse button to activate the key. Operations from the PC are the same as described in this guide. Refer to the area of interest for details. The Model 110 actually performs as though the front panel keys where pressed.

12.5. Update Unit: This menu is for down loading software updates. You can obtain software updates from the Signalcrafters Tech Inc. web page, www.signalcrafters.com when posted.

To obtain an update:

1. Establish contact with Signalcrafters Tech Inc. web site at www.signalcrafters.com
2. Click on the Support menu
3. Click on Updates
4. Select the desired file.
5. Download the file to your desired PC storage media (Hard drive, floppy, etc.)
6. When download is complete you may disconnect from web site.
7. In the Update Unit menu, find/locate the downloaded update file. Select and open the file.
8. A note on the digital display will advise: Code Down Load Active
9. **See Warning below: After** and *only after* the message not to shut down the Model 110 DISAPPEARS/EXTINGUISHES, restart the unit by shutting off the power via the on/off switch and turn it back on.
10. You will note in the lower right hand side of the display the updated version number of the Model 110. It will now contain the latest upgrades posted by Signalcrafters.

WARNING/CAUTION: At the end of the transfer between PC and Model 110 a message will appear advising NOT TO SHUT DOWN THE MODEL 110. *Failure to follow instructions at this point may require return of the unit to Signalcrafters Tech Inc. for reloading of software.* This message will last approximately 10 seconds.

12.6 Downloading from Model 110 to PC: Prior to downloading readings to the PC there must be readings saved. Review Storing a reading in this guide. With both the PC and Model 110 operational and interconnection cable attached press the 2ND key and then the Down Load key. This may be done at the unit or via the remote control software on the PC.

12.7 Uninstall: To uninstall the software from the computer:

1. Start
2. Settings
3. Control Panel
4. Add & Remove Programs
5. Select Signalcrafters Model 110 Remote
6. Change Remove
7. Follow Window prompts

12.8 Software License Agreement: A copy of the software license agreement can be found in the Appendix of the guide.

13. Replaceable Parts:

The following is a suggested list of field replaceable parts.

- Battery: Two (2) required per instrument. BT1, BT2. Sealed lead acid. 6 Volt, 10 AH, PM 6100 or A6100 or equal. Signalcrafters Part Number: 60C5291
- Fuse: Two (2) used per instrument. F2, F3. 3Amp, 3AG. 250V. Signalcrafters Part Number: 54F0016
- Fuse: One (1) used per instrument. F1. 2Amp, 3AG, 250V. Signalcrafters Part Number: 54E5293

14.0 Specifications:

Input Connectors:

BNC type connector & Banana Jacks (WECO 241A/310).

Ground:

One binding post Banana Jack.

Input Range:

+53 dBm to -120 dBm, including Internal Attenuator.

Impedance:

Balanced/Unbalanced Inputs: 50 Ω , 75 Ω , 135 Ω , 600 Ω and High Impedance, Selectable.

Internal Attenuator Input: ≥ 20 k Ω

Internal Attenuator Input (High Level Input):

100 Vrms max. / 141 Vp max.

+ 53 dBm @ 50 Ω

+ 51.25 dBm @ 75 Ω

Balanced/Unbalanced Input (Low Level Input):

1.98Vrms max. / 2.8Vp max.

+ 18 dBm @ 50 Ω

+ 16.5 dBm @ 75 Ω

+ 14 dBm @ 135 Ω

+ 7.5 dBm @ 600 Ω

Typical Amplitude Accuracy:

See Charts, page 34 & 35

Amplitude Temperature Stability:

± 0.1 dB.

Frequency Range:

50 Hz to 5 MHz.

Frequency Accuracy:

± 3 ppm, ± 5 ppm max. for 10 years.

Frequency Temperature Stability:

± 1.5 ppm.

Bandwidths:

25 Hz, 100 Hz, 1.95 kHz, 3.1 kHz and Wideband.

Signal DC Input Voltage:

100 V Balanced.

Tuning Accuracy:

± 1 Hz.

Frequency Display:

7 digit, resolution: 1 Hz.

AFC Capture Range:

Input Level: 0 dBm.

25 Hz: ± 21 Hz, 100 Hz: ± 65 Hz, 1.95 kHz: ± 1.31 kHz,

3.1 kHz: ± 1.87 kHz

Level Display:

Digital display, maximum resolution 0.01 dB or 10 nVrms.

5 digit for dB and Vrms.

Bargraph, automatic.

Oscillator:

Frequency: 50 Hz to 5 MHz Sine Wave.

50 Ω Output Impedance:

Maximum Output: +12 dBm, 50 Hz to 5 MHz.

Typical Amplitude Accuracy: ± 0.1 dB

600 Ω Output Impedance:

Maximum Output: + 3 dBm, 50Hz to 250 kHz.

Typical Amplitude Accuracy: ± 0.2 dB

Output: BNC connector.

Total Harmonic Distortion: 1%.

Frequency Accuracy: 3 ppm, ± 5 ppm max. for 10 years.

Demodulator:

AM, Single (LSB, USB) and Double Sideband Demodulation; selectable. Built in speaker and volume control.

Memory:

24 Set-Up memories can be stored with one additional default setting.

99 Readings (with Set-up information) can be stored.

Power Supply:

Sealed Lead Acid: 2 @ 6 V 10 AH.

AC line operation via an AC line cord. Built-in 120 VAC/

240 VAC option, 50/60 Hz.

85 VAC to 264 VAC, 47 to 63 Hz.

Operating Times:

AC input: continuous. Battery: 20 hours.

Ambient Conditions:

Ambient Temperature:

Nominal Operating Range: 0 to +55°C

Storage: - 40 to +70°C

Relative Humidity: 5 to 95% @ 40°C. (Non-condensing)

Case Dimensions: 9.75"W x 5.75"H x 12.875"D

Weight with batteries installed: Approximately 19 lbs.

15.0 Customer Service and Technical Support:

For Customer Service, Return Material Authorizations and Technical Support contact Signalcrafters Tech Inc. at:

Telephone: 800-523-5815 or 973-781-0880

Fax: 973-781-9044

Internet: www.signalcrafters.com e-mail through web site.

Signalcrafters Tech Inc.

57 Eagle Rock Avenue

East Hanover, New Jersey (NJ) 07936-3144

USA

Appendix:

Input Amplitude Accuracy

For Hardware Version V2.00 and higher (Serial Number: 200 and up), Conditions following 1 hour warm-up

50Ω	+18.63 dBm	-5.40 dBm	-20.58 dBm	-36.10 dBm	-54.02 dBm	-114.9 dBm
75Ω	+16.87 dBm	-7.16 dBm	-22.35 dBm	-37.87 dBm	-55.78 dBm	-116.7 dBm
135Ω	+14.31 dBm	-9.72 dBm	-24.90 dBm	-40.42 dBm	-58.33 dBm	-119.2 dBm
600Ω	+7.84 dBm	-16.20 dBm	-31.37 dBm	-46.90 dBm	-64.81 dBm	-125.7 dBm
HI-Z	1.91 Vrms	120 mVrms	20.9 mVrms	3.5 mVrms	445 uVrms	400 nVrms

Input: Balanced or Unbalanced

Mode: FSV/M, Bandwidth: 25Hz, 100Hz, 1950Hz and 3100Hz

50 Hz to 5 MHz	±0.10 dB	±0.25 dB	±0.40 dB	±0.55 dB	±0.70 dB
----------------	----------	----------	----------	----------	----------

Input: Balanced or Unbalanced

Mode: Wide, Bandwidth: 5 Mhz

	1 mVrms				
50 Hz to 300 kHz	±0.10 dB	±0.25 dB	±0.40 dB	±0.55 dB	±0.70 dB
300 kHz to 500 kHz	±0.20 dB	±0.35 dB	±0.50 dB	±0.65 dB	±0.80 dB
500 kHz to 1MHz	±0.35 dB	±0.50 dB	±0.65 dB	±0.80 dB	±0.95 dB
1 MHz to 2.5 MHz	±1.00 dB	±1.15 dB	±1.30 dB	±1.45 dB	±1.60 dB
2.5 MHz to 4 MHz	±1.75 dB	±1.90 dB	±2.05 dB	±2.20 dB	±2.35 dB
4 MHz to 5 MHz	±2.00 dB	±2.15 dB	±2.30 dB	±2.45 dB	±2.60 dB

Input: Balanced or Unbalanced

Mode: Wide, Bandwidth: Wide

	1 mVrms				
50 Hz to 2 MHz	±0.10 dB	±0.25 dB	±0.40 dB	±0.55 dB	±0.80 dB
2 MHz to 5 MHz	±0.20 dB	±0.35 dB	±0.50 dB	±0.65 dB	±0.95 dB

100 Vrms

12 Vrms

2.09 Vrms

350 mVrms

44.5 mVrms

400 uVrms

Mode: FSV/M, Bandwidth: 25Hz, 100Hz, 1950Hz and 3100Hz

Input: INT. ATTEN. (Internal Attenuator Input) Measuring 50 Ω

50 Hz to 5 MHz	±0.50 dB	±0.35 dB	±0.20 dB	±0.35 dB	±0.50 dB
----------------	----------	----------	----------	----------	----------

Input: INT. ATTEN. (Internal Attenuator Input) Measuring 50 Ω

Mode: Wide, Bandwidth: 5 Mhz

50 Hz to 200 kHz	±0.50 dB	±0.35 dB	±0.20 dB	±0.35 dB	±0.50 dB
200 kHz to 500 kHz	±0.70 dB	±0.55 dB	±0.40 dB	±0.55 dB	±0.70 dB
500 kHz to 1 MHz	±1.30 dB	±1.15 dB	±1.00 dB	±1.15 dB	±1.30 dB
1 MHz to 3 MHz	±1.80 dB	±1.65 dB	±1.50 dB	±1.65 dB	±1.80 dB
3 MHz to 4 MHz	±3.05 dB	±2.90 dB	±2.75 dB	±2.90 dB	±3.05 dB
4 MHz to 5 MHz	±3.80 dB	±3.65 dB	±3.50 dB	±3.65 dB	±3.80 dB

Input: INT. ATTEN. (Internal Attenuator Input) Measuring 50 Ω

Mode: Wide, Bandwidth: Wide

50 Hz to 200 kHz	±0.50 dB	±0.35 dB	±0.20 dB	±0.35 dB	±0.50 dB
200 kHz to 500 kHz	±0.60 dB	±0.45 dB	±0.30 dB	±0.30 dB	±0.60 dB
500 kHz to 2 MHz	±1.00 dB	±0.85 dB	±0.70 dB	±0.70 dB	±1.00 dB
2 MHz to 4 MHz	±1.45 dB	±1.35 dB	±1.20 dB	±1.20 dB	±1.45 dB
4 MHz to 5 MHz	±2.00 dB	±1.85 dB	±1.70 dB	±1.70 dB	±2.00 dB

Apply additional error to reading for HI-Z Balanced and Unbalanced Inputs: 1%

Apply additional errors to reading for INT. Attention Input.

75 Ω add 0.2%, 135 Ω add 0.3%, 600 Ω add 1.5%.

Output Amplitude Accuracy

For Hardware Version V2.00 and higher (Serial Number: 200 and up)
 Conditions following 1 hour warm-up

	12 dBm	-6 dBm	-21 dBm	-37 dBm
OSC, Z: 50Ω				
50 Hz to 200 Hz	±0.60 dB	±0.75 dB	±0.90 dB	±0.90 dB
200 Hz to 3 KHz	±0.25 dB	±0.40 dB	±0.55 dB	±0.55 dB
3 KHz to 100 KHz	±0.10 dB	±0.25 dB	±0.40 dB	±0.40 dB
100 KHz to 1 MHz	±0.10 dB	±0.25 dB	±0.40 dB	±0.40 dB
1 MHz to 5 MHz	±0.20 dB	±0.35 dB	±0.50 dB	±0.50 dB

	3 dBm	-17 dBm	-32 dBm	-40 dBm
OSC, Z: 600Ω				
50 Hz to 200 Hz	±0.60 dB	±0.75 dB	±0.90 dB	±0.90 dB
200 Hz to 3 KHz	±0.25 dB	±0.40 dB	±0.55 dB	±0.55 dB
3 KHz to 100 KHz	±0.10 dB	±0.25 dB	±0.40 dB	±0.40 dB
100 KHz to 300 KHz	±0.30 dB	±0.45 dB	±0.60 dB	±0.60 dB
300 KHz to 500 KHz	±0.60 dB	±0.75 dB	±0.90 dB	±0.90 dB

1/1/2005