DSP-8100c

Audio Noise Reduction Filter

Operating Manual

March 10, 1997

TIMEWAVE TECHNOLOGY INC.

Congratulations

You have purchased the most advanced digital signal processor available. Please complete and return the enclosed Warranty Registration Card. Timewave Technology Inc. occasionally offers performance enhancing updates to its products. By returning the completed Registration Card, we will notify you about these updates. For current information and hints and tips about our products check out our World Wide Web site.

If you are in a hurry to use your new equipment, turn to the Quick Start section. It provides enough information to get your new equipment up and running. You still will want to read through the rest of this manual. It provides valuable operation tips and information that will allow you to use the features to full measure.

Serial Number

You will need your serial number when communicating with Timewave Technology, Inc. The number is on the bottom of the DSP-8100c. It is also stored within the unit and is displayed when you power up your unit. Record your serial number on your registration form and here for future reference.

DSP-8100c Serial Number: _____

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Table of Contents

1
Installation

To install a DSP-8100c in a station, the operator must provide power to the DSP-8100c and make audio input and output connections to the DSP-8100c.

Power Supply

The DSP-8100c requires a power source of 115 or 220 Volts ac depending on ordered configuration.

Connecting Cables

Use shielded cables with high quality connectors to minimize the possibility of RF interference to the DSP-8100c.

Wiring information

This information is to help you determine which connectors you need for your receiver or transceiver. Connector requirements vary widely. Check your radio owner's manual for exact details.

DSP-8100c Inputs and Outputs

The DSP-8100c uses Switchcraft Tini Q-G jacks on the back of the filter for balanced audio input and output.They will support both wet and dry circuits. DB-9 connectors are used for connections PTT switching, RS-232 Data I/O and speaker and specialized line output.

External Speaker

The most common external speaker connectors are a RCA phono jack, a 1/8" phone plug, or bare tinned wires.

Multimode Data Converter and Terminal Units (TU)

Data devices use a wide variety of connectors including phone jacks, RCA phono connectors, DIN connectors, D-subminiature, screw terminals and others. Consult your owner's manual.

Transceiver PTT and T-R Outputs

Transceiver PTT and T-R outputs use a wide variety of connectors including phone jacks, RCA phono connectors, DIN connectors, screw terminals and others. Consult your transceiver owner's manual.

Audio Input

Setup

The balanced input impedance of the DSP-8100c audio in/out is 600 ohms.

You will need to make cables for balance audio with Switchcraft Tini Q-G TA3F connectors on one end. The connectors on the other end of the cables are determined by the transceiver.

Audio Input Signal Level Setup

The audio inputs of the DSP-8100c are Switchcraft Tini Q-G connectors on the rear panel of the DSP-8100c. The input sensitivity is factory set to match the audio output levels typical of most transceivers. Use Setup to set the input sensitivity if the source is different. If you are using a transceiver with adjustable audio output, the best way to match the level is to use the adjustable audio output of the radio to set the input level to the DSP-8100c. After connecting the DSP-8100c to the radio, follow this simple procedure to match the audio levels.

First, tune the radio to a strong signal after setting the radio output gain control to a convenient midrange position. Adjust the output level control on the radio so the **Overload (red)** indicator LED on the front panel of the DSP-8100c occasionally flashes and the **Normal (yellow)** indicator LED always flashes with the normal audio input levels. Proper adjustment ensures optimum signal-to-noise ratio and minimum distortion. Adjust the radio output level only to maintain the proper input level to the DSP-8100c. Use only the **[Gain]** control on the DSP-8100c to control the monitor volume.

Audio Output

The DSP-8100c provides you with a choice of three audio outputs:

- Monitor jack
- Speaker outputs
- Line outputs

Monitor Jack

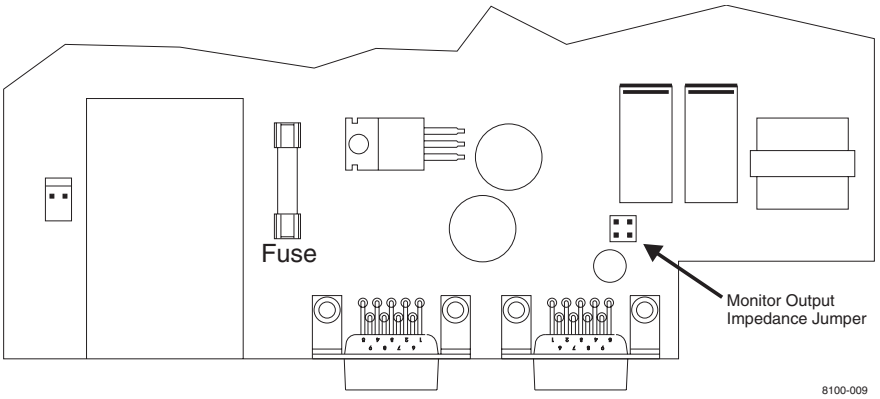
On the upper right hand corner of the DSP-8100c rear panel is a 1/4” (6.3 mm) jack. This is factory configured for headphones. **Timewave recommends stereo headphones**. Mono headphones will also work for many of the functions of the DSP-8100c, however, some of the advanced capabilities require stereo headphones or two speakers.

Inserting a plug into the monitor jack does not affect speakers connected to the Aux I/O connector on the DSP-8100c. The front panel monitor switch mutes speakers connected to the Aux I/O **and** the monitor jack.

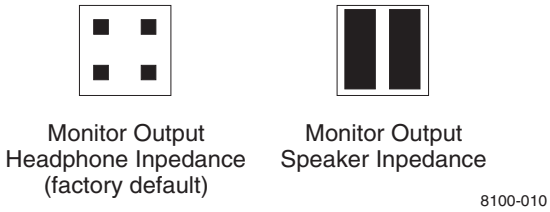
The monitor jack can also be configured as a speaker output.

Monitor Jack Jumper Access

1. Remove the power cord from the rear of the DSP-8100c.
2. Remove the three screws from the bottom of the case.
3. Remove the four screws holding the rear panel in place.
4. Observing static precautions carefully slide circuit board assembly out about two inches.



5. Change the location of the jumpers for the appropriate impedance. The factory default setting is both jumpers open. This is the position for headphones. Putting the jumper across pins sets in a front to back direction changes to impedance for speakers.



Reassemble the DSP-8100c by reversing the previous steps. Take care when sliding the circuit board assembly in not to pinch the attached ribbon cables.

Speaker Outputs

The speaker outputs of the DSP-8100c provide adequate output to drive 4 or 8 ohm speakers. The front panel gain control adjusts the audio level of all monitor outputs. The maximum output power is approximately 1.3 watts into a 4 ohm speaker, or 1.0 watt into an 8 ohm speaker.

Line Output

The line output on the rear panel of the DSP-8100c provides adequate output power to drive 600 ohm or greater loads. The front panel gain control does not adjust the audio level from these outputs. The output levels are equal to the respective audio input levels to the DSP-8100c.

PTT Input

Proper connection of the DSP-8100c to the rigs Push to Talk circuit allows full function of the DSP-8100c. While in voice mode, the PTT circuit in the rig mutes the audio output of the DSP-8100c so audio feedback is not possible. Many rigs do not fully mute their audio while transmitting. When the DSP-8100c amplifies the partially muted audio the result can be audio feedback through the speaker.

When operating in data mode you will also need the PTT output connected to your rig to allow the RTTY modem to trigger the transmit function on your rig. You can program the Push-To-Talk (PTT) Inputs to electronically bypass or mute the DSP-8100c in Data mode. Some operators like the output muted in data mode and some prefer to pass the output through. Within the data mode setup section of Setup the output is muted or not. Turn to page 5-9 for the Setup - Data procedure. Factory default setting is mute for data.

External contact closures operate the PTT Input circuits. No external power is required. Connect the return (shield) sides of the PTT Input jacks to the DSP-8100c circuit and chassis ground.

Many rigs have a separate jack on the back of the rig for PTT. See your owners manual for complete connection information.

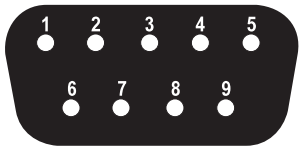
Some linear amplifiers have 115 volt supplies for their transmit-receive relays. **If a transceiver PTT line is used to drive both the DSP-8100c and a linear amplifier, an isolation relay and/or isolation diode may be required to prevent damage to the DSP-8100c (and any other solid state equipment connected to the PTT line).**

RTTY Modem Input/Output

To access the internal RTTY modem and all of its features you will need to configure an output port within setup. You will also need to use the Aux I/O jack and the RS-232 port. The Aux I/O connector has all the signals needed to connect to your transceiver. The RS-232 connector provides a serial connection to your computer.

Aux I/O Jack

The Aux I/O DB-9M connector on the back panel of the DSP-8100c has additional line outputs, speaker outputs, and PTT I/O. When using the internal RTTY modem, you will need to use this connector.



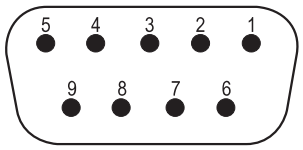
Aux I/O DB-9F Plug
Connection View

Pin	Signal
1	FSK out
2	PTT In
3	+5 Vdc
4	Speaker - Right
5	Signal Ground
6	Key Out
7	Reserved
8	PTT Out
9	Speaker - Left

8100-008

RS-232 Connector

The DB-9F connector provides a RS-232 compatible connection for the RTTY modem output to drive a computer. The output is demodulated FSK in the same code format (Baudot, ASCII, etc.) as the received signal. The DSP-8100c does not decode or change the signal in any way except for demodulation. The computer must have a software application loaded which can do the decoding and encoding.



RS-232 DB-9M Plug
Connection View

n	na	
2	RD	IN Mark/Space
3	TD	OUT Mark/Space
5	Signal Ground	
7	RTS	rx/tx activation
8	CTS	Reserved

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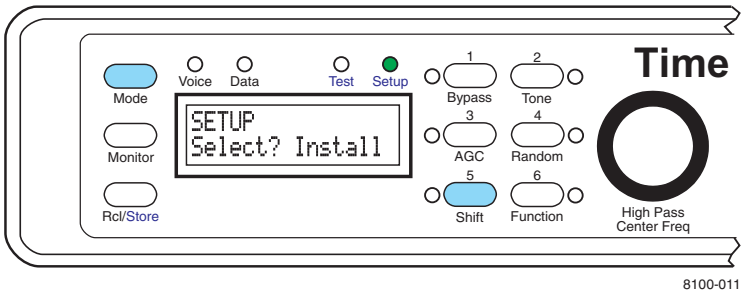
Setup - Install

There are three user adjustable variables within this mode of setup.

Even though these are called “Install” options, they are global options that you may change occasionally. We do not recommend changing any of these parameters until after you are thoroughly familiar with how the DSP-8100c works and that you really have to make the changes. Err on the side of caution when you make changes.

1. Press **[Shift+Mode]** twice to enter Setup mode.
2. Rotate **left knob** until `Install` appears on the bottom line of the display
3. Press the **left knob** to select.



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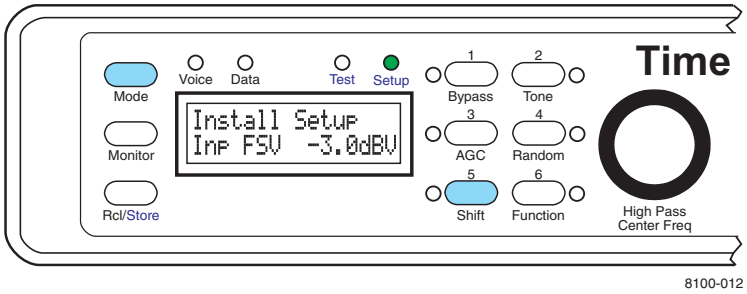
Audio Input Signal Level Setup

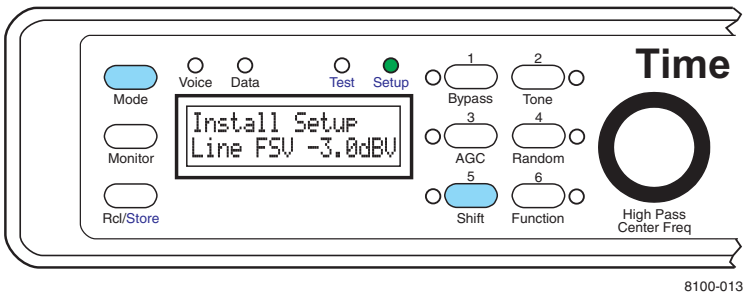
You can adjust the Input signal level. This should not be necessary if you are connected to the adjustable audio output of your receiver. The range of adjustment is from +6.0 dBV to -16.5 dBV in 1.5 dBV steps. The factory default is +6.0 dBV.



1. Press **[Shift+Mode]** twice to enter Setup mode.
2. Rotate **left knob** until `Install` appears on the bottom line of the display
3. Press the **left knob** to select.
4. Rotate **left knob** until `Inp FSV` appears on the bottom left of the display
5. Press the **left knob** to select.
6. Rotate **left knob** until the chosen value appears on the bottom right of the display
7. Press the **left knob** to accept choice and save. Press **middle knob** to escape without saving changes.
8. Rotate **left knob** until your next function to change appears on the bottom line of the display or press the **middle knob** to return to main setup menu.

Line Out Signal Level Setup

You should not need to change the factory default settings. If you need to change the settings for some reason, do so with some caution. The range of adjustment is +6.0 dBV to -15.0 dBV in 1.5 dBV steps. The factory default is +6.0 dBV.



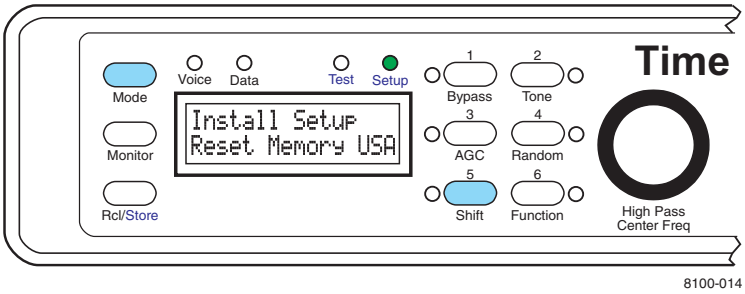
1. Press **[Shift+Mode]** twice to enter Setup mode.
2. Rotate **left knob** until `Install` appears on the bottom line of the display
3. Press the **left knob** to select.

4. Rotate **left knob** until `Line FSV` appears on the bottom left of the display
5. Press the **left knob** to select.
6. Rotate **left knob** until the chosen value appears on the bottom right of the display
7. Press the **left knob** to accept choice and save. Press **middle knob** to escape without saving changes.
8. Rotate **left knob** until your next function to change appears on the bottom line of the display or press the **middle knob** to return to main setup menu.

Reset Memory

When you select reset memory, you get the choice of USA or European. Selecting USA sets AM Line Noise to 60 Hz. Selecting European sets AM Line Noise to 50 Hz. These also are all individually adjustable in other sections of setup.

The big thing that Reset Memory does is resets all operation based memories. Examples include all user memories, power up mode configuration, and all modifications to Data mode parameters.



1. Press **[Shift+Mode]** twice to enter Setup mode.
2. Rotate **left knob** until `Install` appears on the bottom line of the display
3. Press the **left knob** to select.
4. Rotate **left knob** until `Reset Memory` appears on the bottom left of the display
5. Press the **left knob** to select.
6. Rotate **left knob** until the chosen value appears on the bottom right of the display. Your choices are USA or EUR.
7. Press the **left knob** to accept choice and save. Press **middle knob** to escape without saving changes.
8. Rotate left knob until your next function to change appears on the bot-

tom line of the display or press the middle knob to return to main setup menu.

Exit Setup

When you are through with Setup, press **[Mode]** to return to Voice mode.

2
Introduction

This section includes a short summary of both the front panel controls and the rear panel connectors. It also provides an overview of the features found in the DSP-8100c. Please see *Appendix A–Specifications* for detailed information on the capabilities of the DSP-8100c.

Digital Signal Processing

Digital **S**ignal **P**rocessing (DSP) is a powerful and complex method of analyzing and modifying analog signals. Audio signals like speech or radio data are analog signals. The speech and data signals have fairly well known and predictable characteristics; however, these characteristics are quite complex. By converting the analog signal to a digital signal, a powerful digital signal processor with a special program can analyze the characteristics of the analog signal. The digital signal processor can then modify the digital signal to enhance desired characteristics and to remove undesirable characteristics such as noise. The processed signal is converted back to an analog signal and sent on to a speaker, headphone, or data controller. The result is a signal with less noise and/or fewer data errors. In radio terms, DSP is capable of reducing or eliminating QRN (noise) and QRM (interference).

For a more detailed discussion of digital signal processing, consult the most recent ***ARRL Handbook***.

DSP-8100c Overview

The DSP-8100c is an extraordinarily versatile digital signal processor designed for communications and shortwave radio voice, and data operation. The DSP-8100c uses advanced digital signal processing technology to implement algorithms that perform five basic audio functions:

- Random noise reduction
- Adaptive multi-tone and manual notch filtering (Tone noise reduction)
- Bandpass/Highpass/Lowpass filtering
- Signal generation including RTTY modulation
- Signal detection and measurement including RTTY demodulation

The DSP-8100c combines these five basic functions to reduce noise and interference and improve radio communication. The DSP-8100c hardware and software architecture allow easy field upgrade with new features and algorithms. The same hardware and software architecture also allow ergonomic mode oriented operation of the DSP-8100c. The LCD alphanumeric display provides a clear view of operating settings when switching between operating modes. The quick-select push buttons and optical encoders for filter tuning allow instant mode change with total recall of last setting and memories. Front-panel selectable and adjustable inputs allow you to quickly setup and

adjust your DSP-8100c to wipe out noise and QRM like never before!

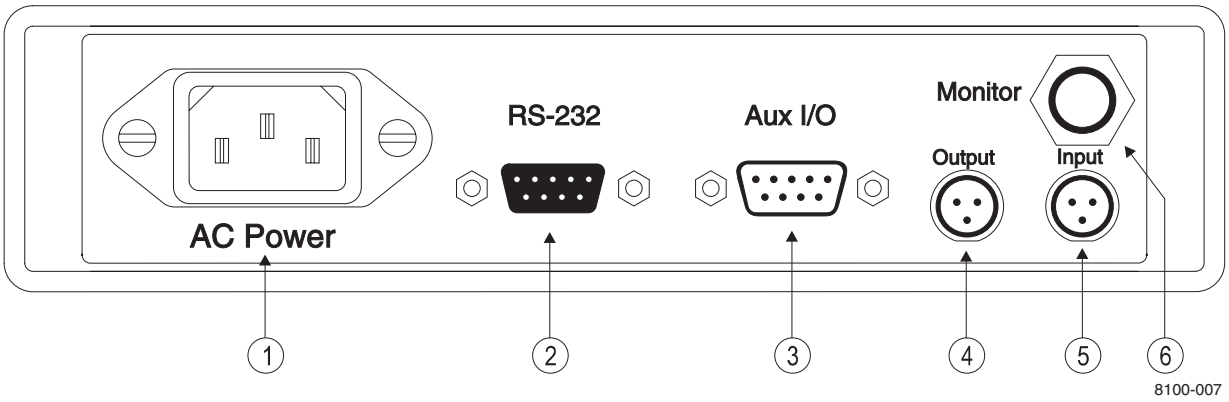
Here are a few more highlights among the many other operating features of the DSP-8100c:

- Selectable Automatic Gain Control
- Configurable bypass control
- Six memories for instant recall of user-defined configurations
- Test instrument mode for analyzing signals and other equipment

Signal Flow

The DSP-8100c converts analog signals into digital signals before it routes and processes them. The digital signal processor also controls the front panel switches, encoders, LEDs, LCD display, and back panel inputs and outputs.

Back Panel Connectors



1. Power In

1115/220 Volts ac.

2. RS-232

RS-232 compatible RTTY modem serial output for computer interface. DB-9F connector. Refer to chapter 1 for pin configuration.

3. Aux I/O

DB-9M connection for line out, speaker out, PTT out, PTT in, aux. digital in. Also contains connections reserved for future options. Refer to Chapter 2 for pin configuration.

4. Audio Output

Balanced 600 ohm line level output from DSP-8100c. Gain control doesn't vary this output. Switchcraft Tini Q-G TB3M.

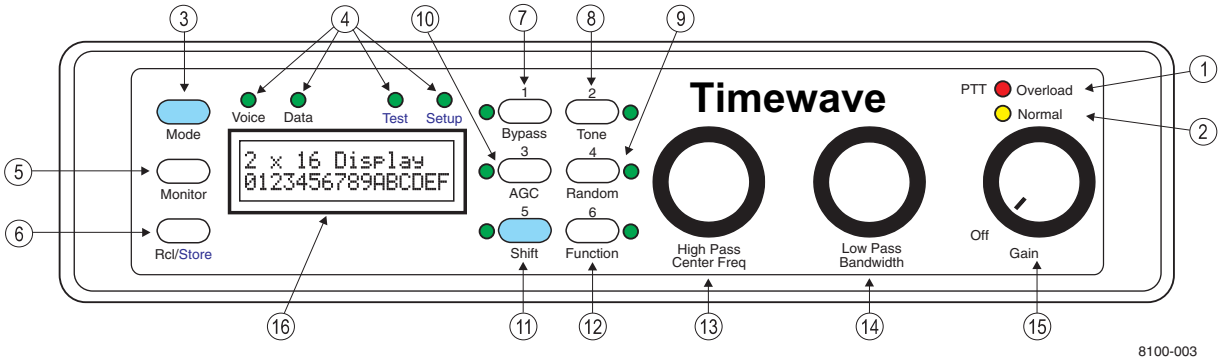
5. Audio Input

Balanced 600 ohm audio input from radio audio output. Switchcraft Tini Q-G TB3M.

6. Monitor Output

Configurable as a headphone output or 4-8 ohm speaker output. Gain is controlled by front panel gain control. 1/4" Phono connector.

Front Panel Controls



1. PTT/Overload LED

Red LED indicates a too high signal level into DSP-8100c from receiver. When PTT line from transceiver is connected, red LED on indicates PTT is activated.

2. Normal

Yellow LED indicates normal signal level into DSP-8100c.

3. Mode switch

Press to change mode (Voice, Data). Press **[Shift+Mode]** to switch to Setup and Test modes.

4. Voice, Data, Test, and Setup LEDs.

Indicate the selected mode of the DSP-8100c.

5. Monitor switch

Press **[Monitor]** to toggle speaker/headphones on and off. This does not control the Audio Output.

6. Rcl/Store switch

To recall memory, press this key and then one of the switches labeled 1 to 6. To store current settings in a memory, press **[Shift+Rcl/Store]**, then one of the switches labeled 1 to 6.

7. Bypass Switch

Press to Bypass DSP filtering.

8. Tone Switch

Heterodyne elimination for Voice.
Marker Tone for Data. Press **[Shift+ Tone]** to adjust the aggressiveness of the automatic tone notch filter or to activate the manual tuned notch filter in Voice Mode.

9. Random switch

Used to turn on random noise reduction. Press **[Shift+Random]** to adjust aggressiveness of the noise reduction.

10. AGC switch

AGC on.

11. Shift switch

This blue switch shifts the function of the next switch pressed to its function labeled in blue.

12. Function switch

This switch is used alone or in combination with the shift key to access specialized functions.

13. High Pass/Center Freq Control

Tunes the high pass filter in the Voice mode.
Tunes the bandpass filter center frequency in Data mode. In most menu modes, this knob is rotated to see menu choices. Pressing the knob selects the choice.

14. Low Pass/Bandwidth Control

Tunes the low pass filter in the Voice mode.
Tunes the bandpass filter bandwidth for Data mode.
Pressing knob will turn off temporary settings.

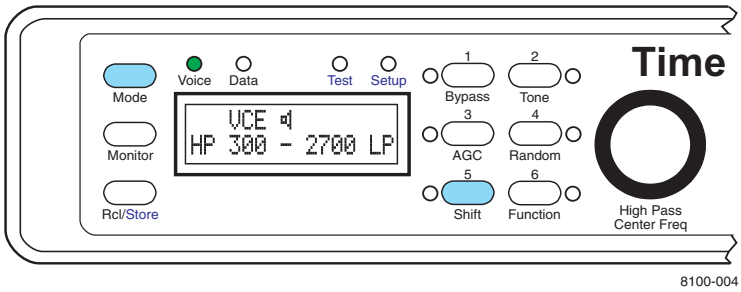
15. Gain/Power On/Off

Turns power on and off, and volume control for speaker output.

16. LCD Display

Backlit 2x16 alphanumeric display of mode, control, and test settings and data.

Features Common to All Modes



Random/Tone Noise Reduction

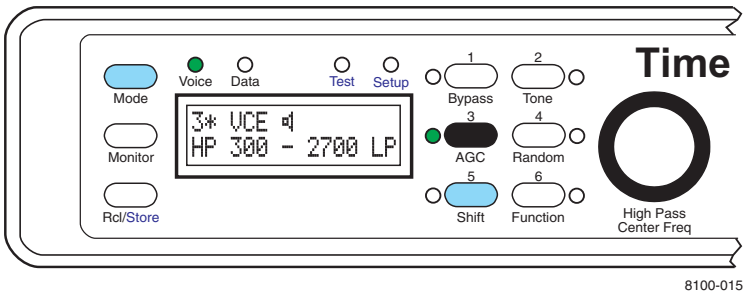
The noise reduction functions of the DSP-8100c operate by examining a characteristic of signals and noise called *correlation,* and dynamically filtering out the undesired signals and noise. The degree of correlation is relative. Random noise such as white noise or static is uncorrelated. Speech is moderately correlated. Repetitive or continuous noise such as a heterodyne is highly correlated. The DSP-8100c measures correlation and filters out signals and noise that are outside its correlation thresholds. The amount of noise reduction varies according to the correlation characteristics of the noise. Typical noise reduction ranges from 5 dB to 20 dB for random noise and up to 50 dB for heterodynes.

Adaptive Multi-tone and Manual Notch Filtering (Tone noise reduction)

The DSP-8100c has both an automatic notch filter and a manually tuned filter. The automatic notch filter is an adaptive multi-tone filter that can remove multiple tones simultaneously. The automatic multi-tone filter removes multiple heterodynes almost completely. The **[Center Freq]** encoder on the front panel tunes the manual notch filter. The manual notch filter is selectable and has a dual notch filter for data signals and a single notch filter for CW signals and heterodynes.

Visible Memories

The DSP-8100c has six memories to store complete settings and con-figurations. Pressing **[Shift+Store+{#}]** (# = 1 - 6) stores every setting and setup configuration except the audio gain control position. Pressing **[Rcl+ {#}]** instantly recalls the complete configuration stored in the chosen memory. The memory number is displayed along with the critical information on the LCD and LEDs.

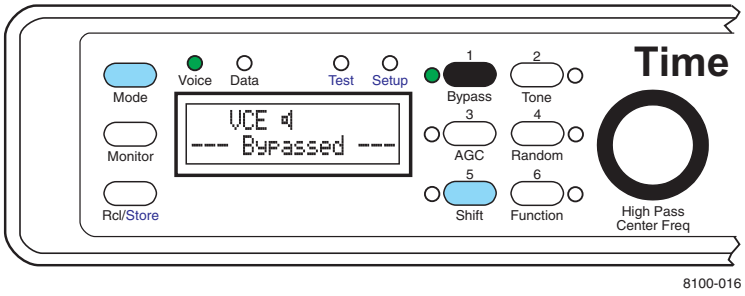


Automatic Gain Control

The DSP-8100c has switch-selectable automatic gain control to optimize the signal levels for best filter performance and to enhance listening by minimizing audible signal level variation.

Bypass Control

The DSP-8100c has bypass features that vary with the mode of operation. In voice mode, the bypass setting routes the signal through relay contacts to completely bypass the electronic circuitry of the DSP-8100c. Turning the power off to DSP-8100c uses the same relay bypass method. In data mode, the bypass route is through the DSP processor. The amount of signal delay through the bypass route is equal to the delay through the processed signal route. The purpose of this delay equalization is to allow switching between signal processing and bypass without breaking the handshaking link of modes like PacTOR and G-TOR.



Bypass respects the status of the monitor switch. If the monitor is turned off, bypass leaves it off.

Operating Modes

The DSP-8100c has two normal operating modes that operators will most often use:

- **Voice**
- **Data**

Pressing **[Mode]** alternates between Voice mode and Data mode.

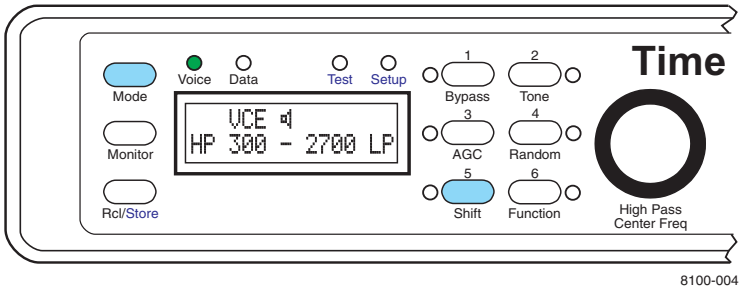
There are two more modes that operators will normally use during initial configuration, installation, and troubleshooting,

- **Test**
- **Setup**

Pressing **[Shift+Mode]** once places the DSP-8100c in Test mode. Pressing **[Shift+Mode]** again steps to Setup mode. Pressing **[Mode]** at any time places the unit back into Voice operating mode again. When in a menu or test instrument mode, pressing the **middle knob** will back you up one level. Think of the **middle button** in most cases as a cancel/clear button.

Voice Mode

The Voice Mode digitally processes all analog voice signals for all modes including SSB, AM, FM, and PM. Independently selectable processing techniques include noise reduction, heterodyne elimination, tunable high-pass/lowpass filtering, notch filtering and automatic gain control.



Highpass/Lowpass Filters

The DSP-8100c has highpass and lowpass filters that are independently tunable with front panel controls. The LCD display shows the corner frequencies of the filters as they are tuned. There are many uses for the variable combinations of highpass and lowpass filters that the DSP-8100c offers. In a typical example of a voice mode application, highpass and lowpass filters can improve a signal with a poor signal-to-noise ratio. The independent highpass and lowpass filters remove the low and high audio frequency components that do not contribute significantly to the speech intelligibility, thus improving signal quality. Another common voice mode example is the improvement of a SSB signal corrupted by adjacent channel interference (QRM). The steep skirts of the highpass and lowpass filters allow the operator to minimize or eliminate high side and low side interference independently with minimal impact on the desired signal.

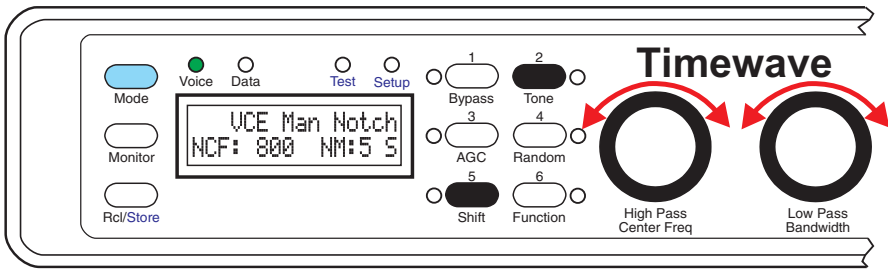
The DSP-8100c highpass filter adjustment range is from 100 to 1000 Hz and the lowpass range is from 1000 to 5000 Hz. Although the DSP-8100c has bandpass filters for the most common data modes, the selectable highpass and lowpass filter combinations also allow precise filtering for modes such as wideshift RTTY.

Random Noise Reduction

The DSP-8100c random noise reduction has proven to be useful in reducing a wide variety of noise types, including white noise, line noise and static crashes. The amount of noise reduction varies according to the characteristics of the noise. Typical noise reduction ranges from 5 dB to 20 dB. It is possible to change the level of aggressiveness within a regular operating mode without going into setup mode.

Adaptive Multi-tone and Manual Notch Filtering (Tone noise reduction)

The DSP-8100c has both an automatic notch filter and a manually tuned filter. The automatic multi-tone filter removes multiple heterodynes almost completely. The aggressiveness is adjustable.

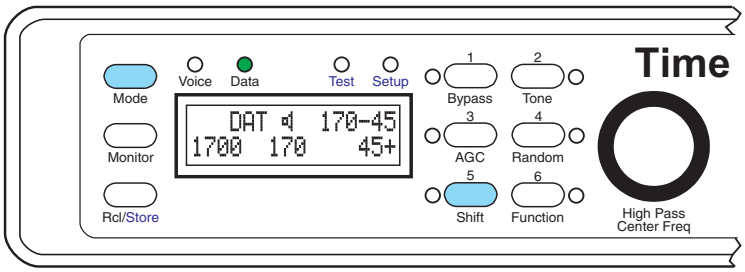


8100-017

The manual notch filter is selectable for either as a dual notch filter for data signals and a narrow bandwidth filter for CW signals and heterodynes. The center frequency of the filter is easily set. This filter can be used either to remove a single tone or to remove mark/space data tones.

Data Mode

The Data Mode digitally processes data signals including several versions of RTTY, SITOR, and WeFAX. Independently selectable processing techniques include noise reduction, tunable bandpass filtering and automatic gain control, and a special RTTY modem and RTTY remodulator.



8100-018

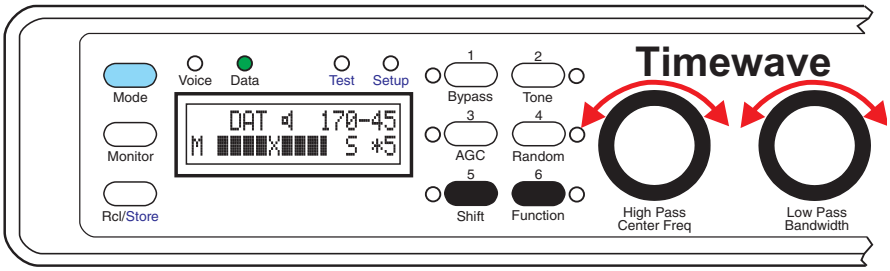
Bandpass Filters

The DSP-8100c has both fixed and tunable bandpass filters for the data mode. Narrow band data signals like RTTY require a bandpass filter with steep skirts, linear phase response, and matched amplitude response. Linear

phase response maximizes the usable signaling rate for a given bandwidth and minimizes ringing often heard on extremely sharp filters. The matched amplitude response tailors the filter to match the selected modulation type and baud rate to minimize noise and interfering signals.

The DSP-8100c has individual linear phase fixed bandpass filters with steep skirts for WeFAX. Since the bandwidths for these modes are fixed, the filters are primarily QRM filters for adjacent channel signals rather than noise reduction filters for eliminating random noise. WeFAX has no separate sync pulse so the filter bandpass covers 1500-2300 Hz.

Data Tuning Function



8100-019

Pressing **[Shift+Function]** turns the tuning display on. This display provides information graphically to allow precise tuning of the receiver. The display also shows the strength of the incoming data signal.

Random Noise Reduction

The DSP-8100c random noise reduction function is not specifically designed for data signals, but has been field proven to be useful for noise reduction under some conditions. It is usually most effective for 45.5 baud RTTY signals.

RTTY Modem

The DB-9F connector provides an RS-232 compatible connection for the RTTY modem output to a computer. The output is demodulated FSK in the same code format (Baudot, ASCII, etc.) as the received signal. It is not decoded or changed in any way except for demodulation. The AFSK modulated output for the transmitter appears on the line output connector of the selected channel. The channel is selectable within setup. The PTT output signal needed to put your transceiver in transmit mode is part of the DIN connector for the appropriate channel.

The AFSK output is a modulated AFSK signal in the same code format (Baudot, ASCII, etc.) as the keying signal from the computer. The DSP-8100c does not encode or change the signal in any way except for AFSK modulation. A software terminal program that can decode and encode Baudot and ASCII code needs to be installed on the computer connected to the DSP-8100c. Timewave does not provide the terminal program. This modem is for RTTY operation only with signaling rates at 75 Baud or less.

RTTY Remodulator

The DSP-8100c has another special data function for RTTY only. After passing through the optimized RTTY bandpass filter, a precision DSP-based FSK detector in the DSP-8100c demodulates the noisy incoming RTTY tones and uses the recovered digital data to drive a precision DSP-based AFSK generator. This remodulation process takes place entirely in the DSP-8100c. The precise clean tones from the RTTY AFSK remodulator can feed any analog multimode controller or TU via the DSP-8100c line audio output.

Many analog RTTY demodulators have difficulty with noisy signals of varying amplitude, but virtually all of them can adequately demodulate the precise DSP AFSK generator output. The **[Function]** push-button selects either the remodulator with RTTY filters or the RTTY filters only. This remodulator is optimized for non-burst data at 75 Baud or less.

RTTY FSK Test Signals

Press **[Tone]** while in the non burst Data mode at 75 baud or less activates a sync nul (diddle) test tone. If the baud rate is 100 baud or higher, pressing **[Tone]** activates a space mark reference calibration tone.

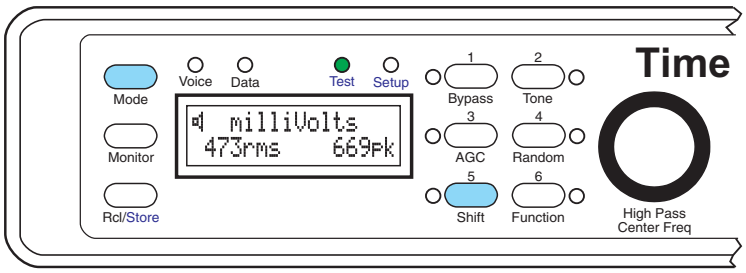
Pressing **[Shift+Tone]** while in the **Data** RTTY mode at 75 baud or less inserts a "RYRY" audio FSK test signal into the receive channel. The “RYRY” test signal center frequency, frequency shift, and baud rate are determined by the RTTY parameter settings. The level of marker tone is adjustable relative to the processed receive signal. If the baud rate is 100 baud or higher, nothing happens when **[Shift+Tone]** is pressed.

Test Instrument Mode

The Test Instrument function helps analyze signals and other equipment. It includes an audio millivoltmeter, an audio signal generator, and an audio tone decoder.

Audio Millivoltmeter

This mode measures audio voltage levels from other equipment including microphones, TNCs, multimode controllers, and receivers. Measurements are both peak and true RMS millivolts. Frequency response ranges from 20 Hz to 10 kHz. In EME work, the audio millivoltmeter mode is useful in antenna evaluation when comparing sun noise and cold sky noise.

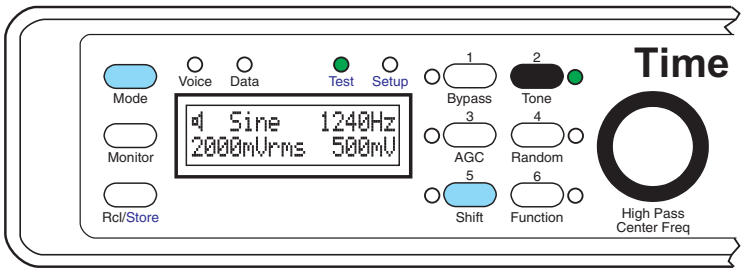


Maximum input level is 2000 millivolts rms.

Do not attempt to measure any voltage above 2000 millivolts, especially 115 Vac or 220 Vac power line voltage! You will damage the DSP-8100c! ALL WARRANTIES WILL BE VOID!

Audio Signal Generator

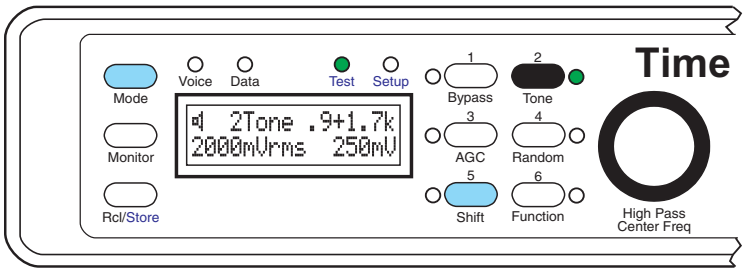
This mode produces tunable low-distortion, precision frequency sine wave test signals from 20 Hz to 10 kHz in 10 Hz steps. A two-tone test signal may be selected for SSB testing. The operator may use the precision test signals for calibration and/or trouble shooting of other equipment the user may own. The display shows the frequency and amplitude of the output signal from the line output.



8100-021

Two-Tone Generator

Produces a two-tone signal that can be used for SSB linearity testing. The DSP-8100c produces a very pure tone set. This provides for very accurate testing.

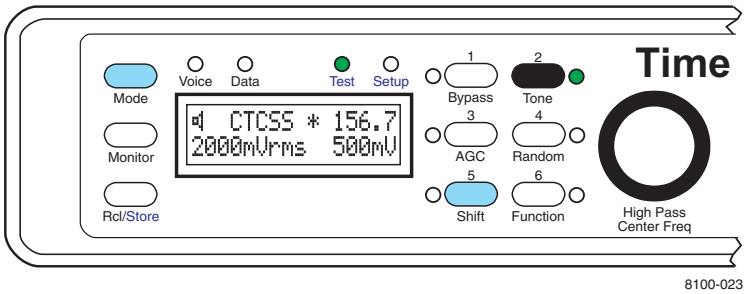


8100-022

CTCSS Tone Decoder

This mode decodes CTCSS tones. The CTCSS function shows the tone frequency and amplitude on the LCD display. There are two modes of operation. The first is the autodetect mode which displays the frequency and amplitude of any valid CTCSS tone received. The second is the tone squelch mode which detects a selected CTCSS tone and activates a switch output on the DSP-8100c as well as generates a tone on the selected CTCSS frequency. The audio millivoltmeter function displays the peak amplitude of the selected incoming CTCSS tone. This allows relative measurement of peak

deviation of CTCSS tones and voice for UHF and VHF FM/PM transmitters.



Set-up Mode

The DSP-8100c uses the setup mode to configure the features which typically do not change while operating.

- **Install Setup**. Common features are set before an operating session. Also features common to all modes such as input sensitivity and line output level are set during installation. (*See Section 1 - Installation* for detailed information.) The parameters available for change are:
  - Input Signal Level
  - Line Output Level
  - Reset Memory
- **Mode Setup**. Mode-specific features need only be set if that particular mode will be used. Those features are described in detail in the specific sections describing each mode (Voice, Data, Test Instrument).
  - **Voice**
    - AM Line Noise
  - **Data**
    - Speaker Mute/Bypass
    - Modem Assignment
    - Data Set Definitions
  - **Test Instrument**
    - Millivoltmeter Calibration
    - Signal Generator Calibration
    - Default CTCSS Tone
- **About Setup** You can find the serial number of the unit and the revision level of the firmware along with the copyright notice in this section.

3
General Operation

Introduction

The DSP-8100c provides you a well stocked tool box of powerful tools. Each tool is designed to do a specific job and do it well. You need to carefully select the correct tool to fix the problem. Like any other tool box, you should only use the tools you need.

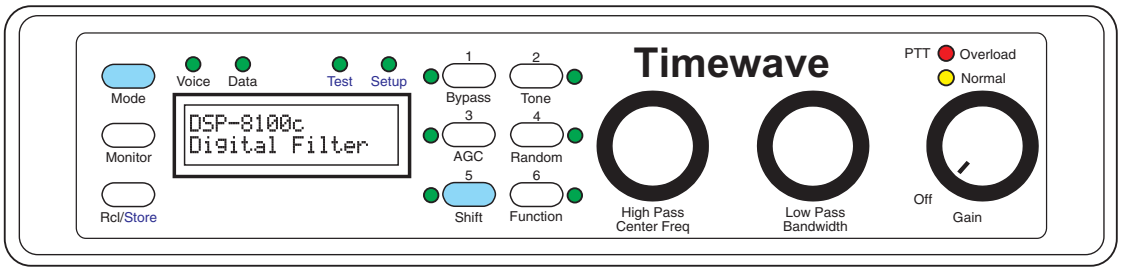
Front Panel Operation

Three knobs, two with push buttons built in, and nine push-button keys on the front panel control the DSP-8100c. One knob controls power and sets the speaker and monitor output level of the DSP-8100c. The other two knobs, with their built-in push buttons, select the filter and test generator frequencies of the DSP-8100c.

The operator can also use the left knob to make a selection from a menu or change a variable. Rotate the left knob to view the selections and press the knob to select your choice.

In most situations, pressing the middle knob deactivates temporary settings. It is also used to escape from menus without making a selection. You can think of the pressing the button middle knob as pressing an Esc/Cancel button.

The push-buttons select the operating modes and features of the DSP-8100c. Either an indicator LED or information on the liquid crystal display indicates active modes. Note that pressing a push-button always selects the mode indicated below the push-button.



8100-002

Controls Common to All Modes and Features

Primary Operating Modes [Mode]

Press the Mode key to switch between the main operating modes (Voice, Data). Each time you press **[Mode]**, the operating mode changes to the next mode. The active mode is indicated by a LED and is displayed on the LCD as a two or three character name.

Secondary Operating Modes and Features [Shift]

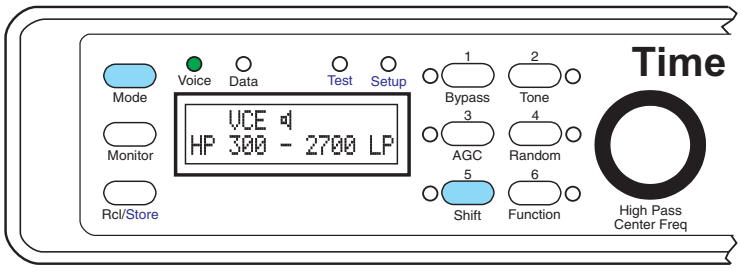
The **[Shift]** key selects modes and operating features with light blue lettering by pressing and releasing **[Shift]** before pressing the mode or feature key. The shifted modes include Setup **[Shift+Mode][Shift+Mode]** and Test Instrument **[Shift+Mode].** Shifted operating features include memory store **[Shift+Rcl/Store]**.

Many specialized mode dependent functions are controlled, for example, by pressing **[Shift+Tone], [Shift+Random],** or **[Shift+Function].** The availability of any of these and response vary depending upon many factors including operating mode. See mode specific sections for information.

If you press the **[Shift]** key and decide not to complete the shift operation, pressing the **[Shift]** key a second time before pressing another key will cancel the shift operation. If a mode or operating feature does not require a shift, pressing **[Shift]** and that mode or operating feature key cancels the shift and does not execute the mode or operating feature. The shift operation will automatically cancel if you do not press a key within three seconds after pressing **[Shift]**.

Monitor Control [Monitor]

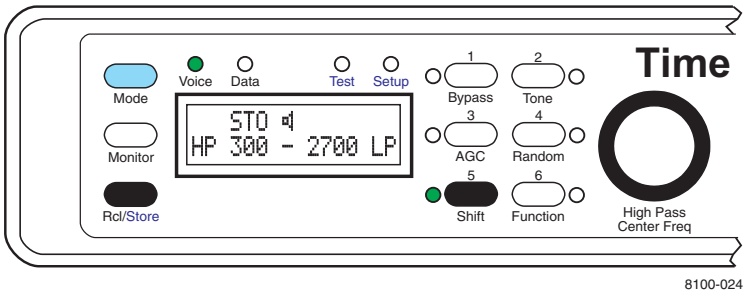
The **[Monitor]** key will mute both the 1/4" monitor jack and any speakers connected to the Aux I/O. The 🔊 icon near the top middle of the display is visible when the monitor outputs are active. The Monitor output setting does not affect the balanced audio outputs or the line outputs.



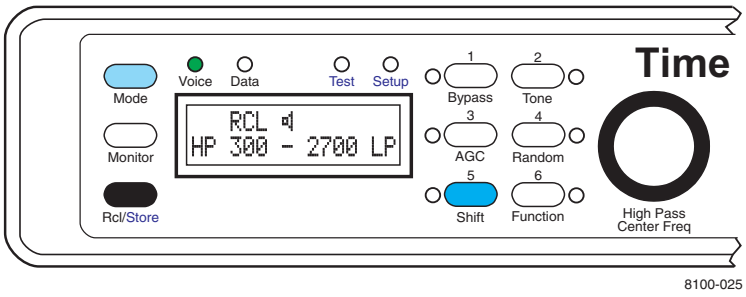
8100-004

Memory Operation [Rcl/Store]

To store a setting in memory, press **[Shift+Store+{#}].** (# = a digit in the range 1 to 6 printed in yellow letters above the corresponding key.)

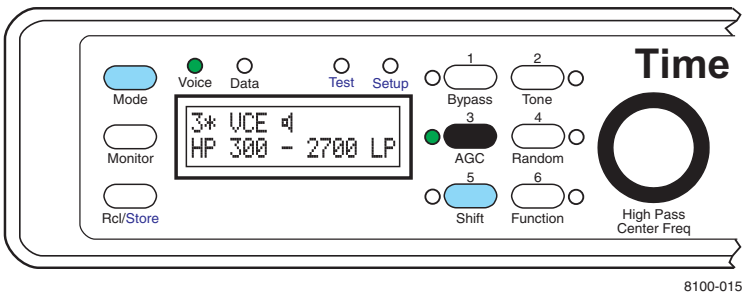


To recall a setting from memory, press **[Rcl+{#}].** (# = a digit in the range 1 to 6 printed in yellow letters above the corresponding key.)



If you start to store or recall a setting from memory and decide not to complete the store or recall, pressing any other key (including **[Store]** or **[Rcl]**) before a number key is pressed cancels the Store or Recall operation. The Store or Recall operation will automatically cancel if you do not press a number key within five seconds after pressing the **[Rcl/Store]** key.

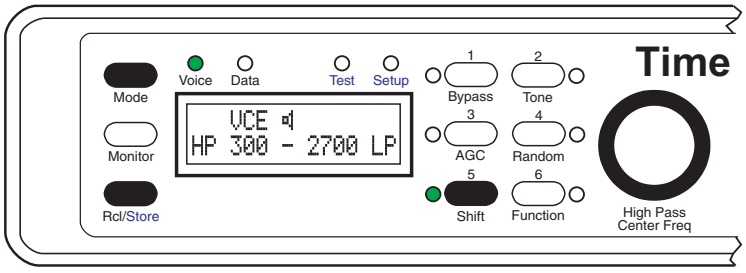
If you have recalled a setting from memory and want to restore the previous setting from before the memory recall, press **[Rcl+Rcl]**. The previous setting will replace the recalled setting. Pressing **[Rcl+Rcl]** again with bring back the recalled setting. For example, press **[Rcl+3]** to recall the memory 3 setting. Press **[Rcl+Rcl]** to restore the setting before memory 3 was recalled. Press **[Rcl+Rcl]** again to restore the memory 3 setting. Each time **[Rcl+Rcl]** is pressed the two settings will be swapped. This is a good way to compare two settings or switch quickly between two settings.



The memory number is displayed in the top left position on the display when you recall a configuration from memory. An asterisk is displayed next to the memory number if you make any changes to the configuration after recalling the configuration. The asterisk disappears if you store the new configuration or if you change operating modes.

It is good operating practice to reserve memory 1 as a scratch pad or temporary memory. Use memory 1 to store temporary configurations when you want to compare several configurations, or as a temporary location to store a new configuration to when you cannot decide which memory you want to use for a storage location.

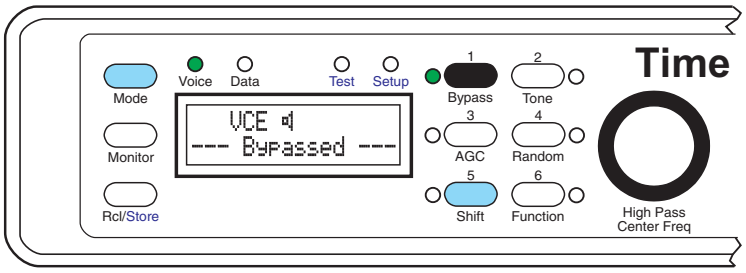
User Selectable Power Up Mode



8100-026

Select power up mode by pressing **[Shift+Store+Mode].** This stores the operating mode and channel that you wish to start with when the DSP-8100c is powered up. You may easily change this selection at any time in the future by repeating the process.

Bypass [Bypass]



8100-016

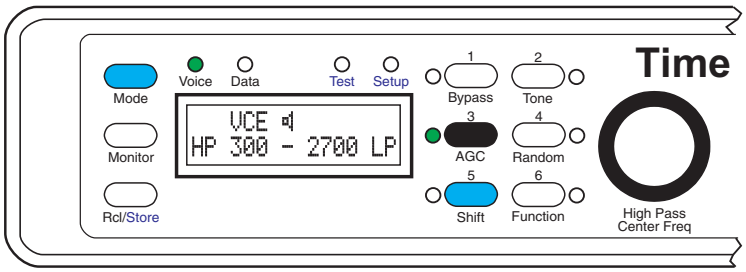
When you select **[Bypass]**, the other controls have no effect on the operation of the DSP-8100c. The LED next to the button and Bypassed displayed on the bottom line of the LCD indicates that bypass is active.

The bypass function completely bypasses the DSP electronics in Voice mode but follows the speaker setting. If the speaker is set to off, the speaker will remain off while in bypass mode.

The Data mode has a special electronic bypass mode for data link integrity

described in the *Data Mode* section on page 5-3.

Automatic Gain Control [AGC]



The AGC feature helps maintain a constant output level when the input level varies. The obvious use of the AGC feature is to keep the DSP-8100c output level when input signal levels vary rapidly as a result of operating conditions (for example, inconsistent band conditions, rapid fading). The AGC can also help alleviate two other common receiver problems. The first is increase the level of weak signals when receive system gain is low. In the process of maintaining the constant level, the signal processor can add up to 36 dB of gain to the DSP-8100c signal path. In some situations, this increased gain will also noticeably increase the background noise level.

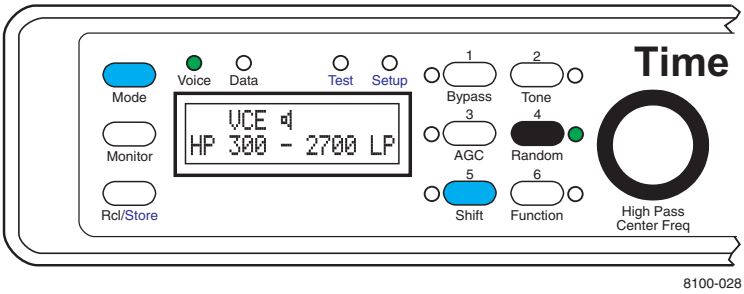
The second common problem is receiver desensing by the AGC action of strong signals in the passband of the receiver. The receiver selectivity may not be sufficient to separate a strong signal from a weak signal, but the DSP-8100c may easily separate the two signals. (This is a receiver problem because the weak signal couldn't be heard without the highly selective DSP filter.) Since the stronger signal controls the gain of the receiver via the AGC, the stronger signal effectively modulates the weaker signal.

Depending upon the relative AGC time constants of the DSP-8100c and the receiver, the DSP-8100c can help remove the AGC induced modulation. Experiment with changing the receiver AGC setting from Fast to Slow, Slow to Fast, or even turning off the receiver AGC. Try the same changes if "Pumping" of the signal levels occurs as a result of AGC interaction between the receiver AGC and the DSP-8100c AGC when listening to normal signals.

Leaving the AGC on all the time is not necessarily the best solution. You will find situations when you will have a better audio signal with AGC off.

Noise Reduction

Press **[Random]** to enable random noise reduction. The LED next to the key lights when the feature is on.



Power Switch/Gain Adjust Control

The gain knob on the front panel of the DSP-8100c is the power switch/gain adjust control. The gain control controls the output volume for the monitor circuits.

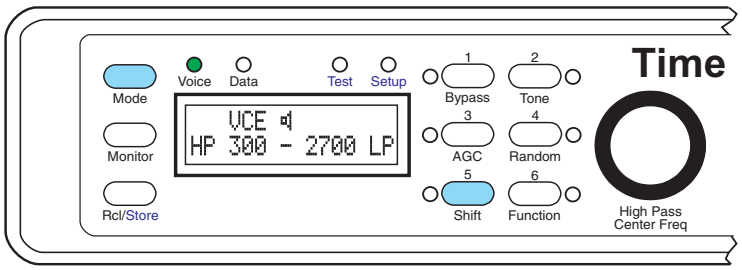
4
Voice Mode
Operation

In Voice mode, the DSP-8100c conditions the audio response of the DSP-8100c using a combination of highpass filters and lowpass filters, adaptively reduces random noise, and adaptively eliminates multi-tone noise (heterodynes). These three functions can operate simultaneously or independently as outlined below.

High Pass/Low Pass Filters

SSB and AM voice signals often have a high signal-to-noise ratio but have interference from other signals that overlap the desired signal. The steep skirts of the highpass and lowpass filters allow elimination of the interference with minimal impact on the desired signal.

- Highpass filters tune from 100 to 1000 Hz.
- Lowpass filters tune from 1000 to 5000 Hz.



8100-004

- Turn **[High Pass]** to the desired frequency indicated by the numbers in the lower left side of the display.
- Turn **[Low Pass]** to the desired frequency indicated by the numbers in the lower right side of the display.

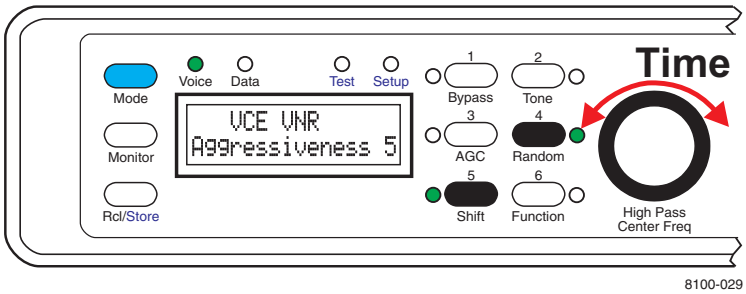
These two settings customize the frequency response of the DSP-8100c.

High Pass/Low Pass Hint

Set the Highpass Filter to 300 Hz and the Lowpass filter to 2.7 kHz for normal sideband operation. Adjust the Highpass filter up to 400 Hz to eliminate heavy QRM, if necessary. Adjust the Lowpass filter as low as 1.6 kHz to eliminate heavy QRM. Of course you may set the filter frequencies anywhere you wish, but remember that extremely narrow bandwidths will affect intelligibility, so keep the bandwidths wide, if possible.

Noise Reduction

To activate random noise reduction, press **[Random]**. When the feature is active, the LED next to the key lights.



- Press **[Shift+Random]** to adjust the aggressiveness of Noise Reduction.
- Then turn the **left knob** to adjust the amount of random noise reduction.
- The top line of the liquid crystal display shows VNR and the bottom line displays the relative amount of noise reduction aggressiveness while the **VNR** function is active.
- The aggressiveness value can be adjusted from one to nine with a default value of five. The higher the aggressiveness value is set, the greater the noise reduction.
- Pressing the **left knob** or pressing **[Shift+Random]** again stores the new value and returns the DSP-8100c to its normal operating mode. The noise reduction aggressiveness will remain at its last setting until it is changed.

Noise Reduction Operating Hints

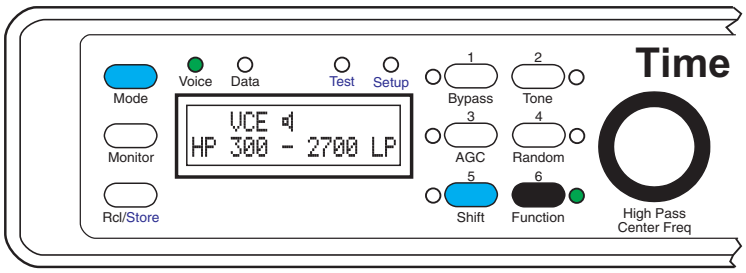
Power Line Noise

If your receiver has variable noise blanker controls, it is often possible to use the noise blanker and the DSP-8100c Random mode together. This can be a very effective noise reduction method for impulsive power line noise. Set the receiver noise blanker to remove the high amplitude noise spikes and the DSP-8100c to remove the remaining noise. An advantage of this combination is the ability to reduce the noise blanking settings of the receiver to minimize the blanking distortion caused by strong signals near the receive frequency.

Static Crashes

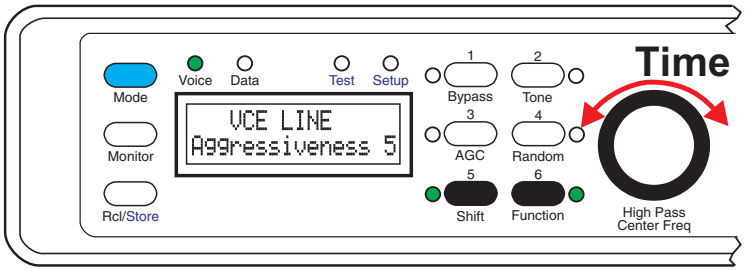
It is often possible to reduce atmospheric static crashes to a tolerable level using the DSP-8100c random noise reduction mode. It is important to try different AGC, input attenuator and RF gain settings on your receiver in addition to the DSP-8100c. Fast AGC with 10 - 20 dB of input signal attenuation usually helps prevent the receiver front end from overload and the AGC from desensing the receiver. Results vary with different receivers - don't be afraid to experiment. Don't try to operate if lightning is overhead! Disconnect your antenna and read this manual again.

AM Line Noise



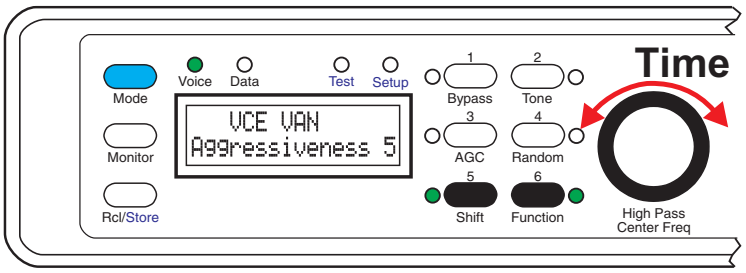
8100-038

When working weak signals working in shortwave and AM voice modes, you might have line noise interference. Press **[Function]** to activate the AM Line Noise Filter. This filter does not work on SSB! The AM Line Noise Filter is active when the LED next to the **[Function]** key is on. The aggressiveness of the AM Line Noise Filter is adjustable.



8100-032

- Press **[Shift+Function]** to adjust the aggressiveness of the AM Line Noise Filter.
- Then turn the **left knob** to adjust the amount of noise reduction.
- The top line of the liquid crystal display shows VCR LINE and the bottom line displays the relative amount of noise reduction aggressiveness while the AM Line Noise Filter function is active.



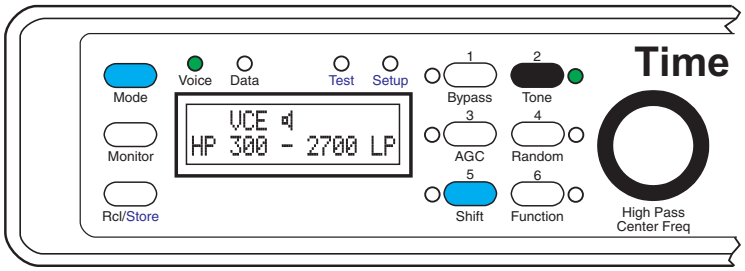
8100-035

- The aggressiveness value can be adjusted from one to nine with a default value of five. The higher the aggressiveness value is set, the greater the noise reduction.
- Pressing the **left knob** or pressing **[Shift+Function]** again stores the new value and returns the DSP-8100c to its normal operating mode with the AM Line Noise Filter activated. The noise reduction aggressiveness will remain at its last setting until it is changed.

Heterodyne Elimination/Notch Filters

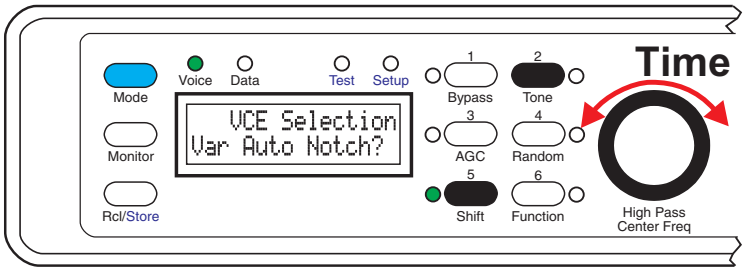
The DSP-8100c has both an automatic and a manual tone notch filter to help remove interfering heterodynes, CW, and data signals.

Automatic Notch Filter



8100-030

The automatic tone notch filter can reduce multiple heterodynes 40 to 50 dB, virtually eliminating the offending signals. The automatic tone notch filter substantially reduces CW and FSK data signals, depending upon the keying speed or baud rate. The automatic tone notch filter toggles on and off by pressing **[Tone]**. The LED next to the key will light when active. The aggressiveness of the automatic tone notch filter is adjustable.

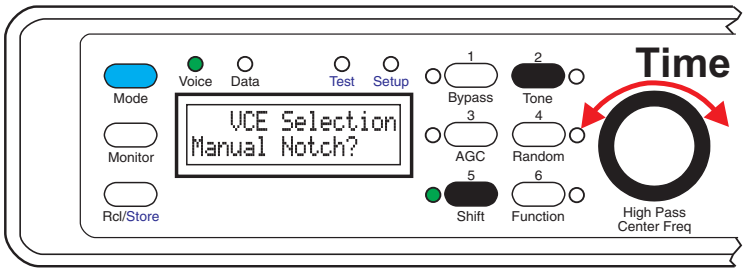


8100-033

- Press **[Shift+Tone].** Rotate left knob until `Var Auto Notch?` appears on the bottom line of the display.
- Press the **left knob** to select.
- The top line of the liquid crystal display shows `VCR VAN` and the bottom line displays the relative amount of noise reduction aggressiveness while the automatic tone notch filter function is active.
- Rotate the **left knob** to adjust the amount of noise reduction.
- The aggressiveness value can be adjusted from one to nine with a default value of five. The higher the aggressiveness value is set, the greater the noise reduction.
- Pressing the **left knob** or pressing **[Shift+Tone]** again stores the new value and returns the DSP-8100c to its normal operating mode with the automatic tone notch filter activated. The noise reduction aggressiveness will remain at its last setting until it is changed.

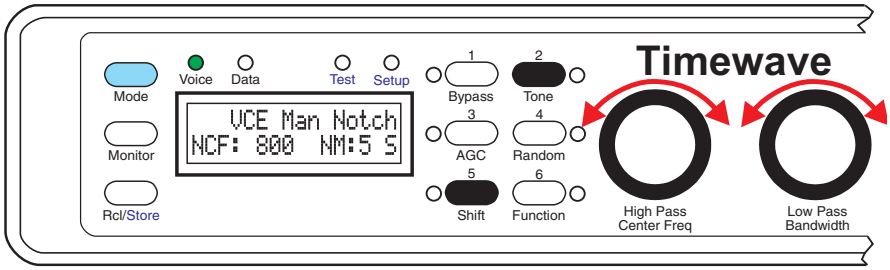
Manual Notch Filter

The manually tuned notch filter is equally effective in reducing the interfering signal levels, but may be used to eliminate a single heterodyne, CW or data signal.



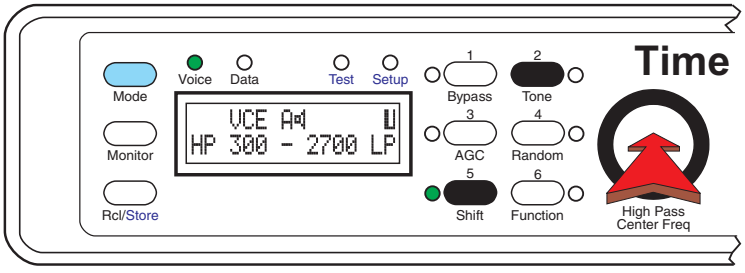
8100-034

- Activate the manual notch function by pressing **[Shift+Tone].** Rotate left knob until `Manual Notch?` appears on the bottom line of the display.
- Press the **left knob** to select.



8100-017

- Rotate the left knob **[Center Freq]** to change the notch center frequency (NCF) of the filter in 10 Hz steps.
- Rotate the middle knob **[Bandwidth]** to adjust the notch bandwidth (NW). The lower the value, the narrower the filter. Number one through five are single notch filters. Number six through nine are dual notch filters separated by 180 Hz for filtering out interfering data signals. As a reminder, a `S` or `D` will be displayed in the bottom right corner of the display to remind you if you have a single or dual notch filter.
- After tuning the filter to the desired center frequency and adjusting the bandwidth, push the momentary switch built into the **left knob**.

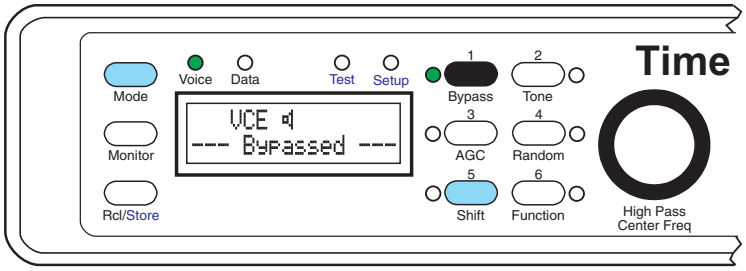


8100-31

The display changes back to the original operating mode with a **M** icon in the upper right corner of the display indicating that the manually tuned notch fil-

ter is active. Turn off the manual notch filter mode by pressing the momentary switch built into the **middle knob**.

Voice Bypass



8100-016

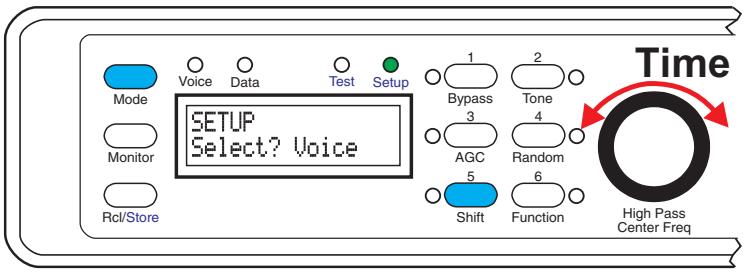
Depressing **[Bypass]** places the DSP-8100c into a bypass mode. In this mode, a relay connects the audio input jacks of the DSP-8100c directly to the speaker, line, and headphone output jacks. The **Bypass** mode has precedence over the voice mode. When the DSP-8100c is in bypass, the settings of the all other controls do not affect the signal.

Bypass respects the status of the speaker switch. If the speaker is turned off, bypass leaves it off.

Setup - Voice

There is one user adjustable variable within this mode of setup.

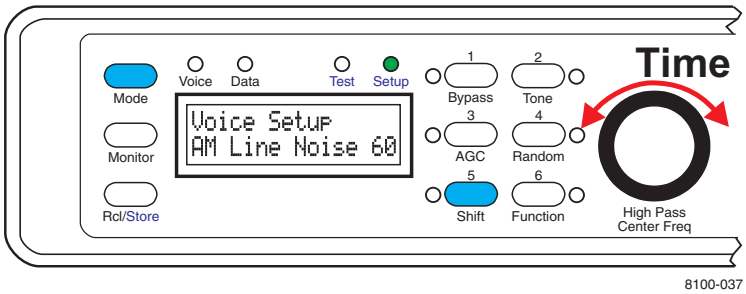
1. Press **[Shift+Mode]** twice to enter Setup mode.
2. Rotate **left knob** until `Voice` appears on the bottom line of the display
3. Press the **left knob** to select.



8100-036

AM Line Noise

To make the AM Line Noise filter most effective, you need to set it to the local power frequency. The selections are 50 Hz and 60 Hz.



1. Rotate **left knob** until `AM Line Noise` appears on the bottom left of the display
2. Press the **left knob** to select.
3. Rotate **left knob** until the chosen value appears on the bottom right of the display
4. Press the **left knob** to accept choice and save. Press **middle knob** to escape without saving changes.
5. Rotate **left knob** until your next function to change appears on the bottom line of the display or press the **middle knob** to return to main setup menu

Exit Setup

When you are through with Setup, press **[Mode]** to return to Voice mode.

5
Data Mode

Introduction

Data signals like RTTY require bandpass filters with steep skirts and linear phase response. Linear phase response maximizes the usable signaling rate for a given bandwidth. The baud rate, center frequency and frequency shift of a data signal determine the bandwidth of filter for that data signal. In the Data Filter mode, the DSP-8100c has an array of band-pass filters optimized for the most common high frequency (1.8-30 MHz) data modes.

The DSP-8100c also has a built in RTTY modem. The RTTY modem demodulates received RTTY audio tones and generates audio frequency shift keyed signals.

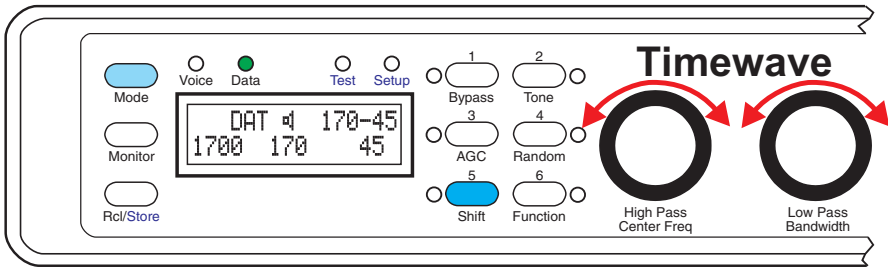
A third option within Data mode is the RTTY remodulator mode. This is a special receiving mode that regenerates the data tones to send them to an external modem.The RTTY remodulator is selected by pressing the **[Function]** key.

Configuration of the RTTY modem is done as part of Setup - Data.

Operations Common To All Data Types

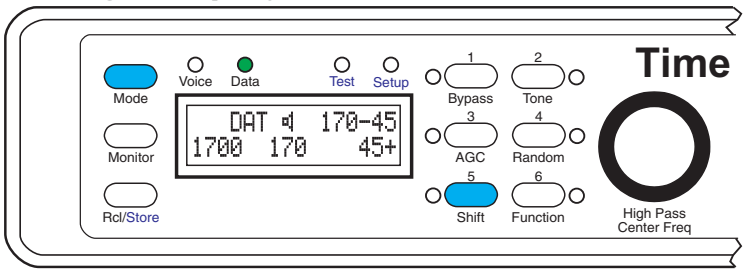
Basic Data Mode Operation

- Pressing **[Mode]** to select the Data mode.
- Turn the **left knob** to select the appropriate data filters.
- Turn the **middle knob** slightly to vary the filter bandwidth to suit the band conditions.



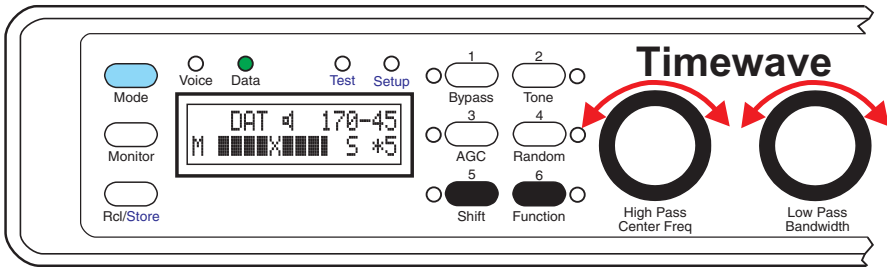
8100-005

Data Settings Display



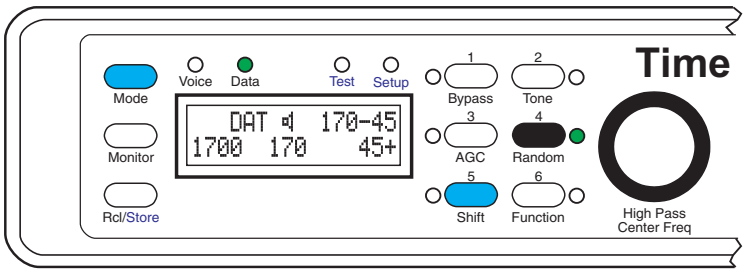
- DAT (Data filter) - Top left line
- Channel and speaker status - Top middle line
- Data signal type- right, top line
- Modulation center frequency - left, bottom line
- Total frequency shift, - center, bottom line
- Baud rate - right, bottom line.
- A **+** or **–** in the bottom right corner of the display indicates the new bandwidth is either greater than or less than the setup bandwidth.

Data Tuning Function



- Press **[Mode]** to select the Data mode.
- Turn the **left knob** to select appropriate data filter.
- Press **[Shift+Function]** to turn the FSK(AFSK) tuning display on.
- Tune in a FSK data signal on the receiver connected to the DSP-8100c.
- Adjust the receiver frequency so that the Mark and Space bars on the display are approximately equal length.
- Press **[Function]** to switch the middle knob from **[Bandwidth]** to **[DCD]** (Data Carrier Detect).
- Turn middle knob **[DCD]** for clean error-free copy on your terminal display.
- The DCD setting, with a range of 1 - 9, is displayed on the lower right corner of the display. When a data carrier is detected that exceeds the DCD setting, an asterisk (*) is displayed next to the DC setting.
- TX is displayed when the terminal program is switched to transmit.

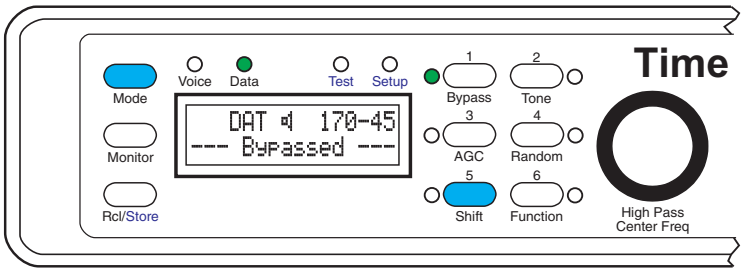
Random Noise Reduction



8100-040

The random noise reduction mode was not designed for data signals, but Timewave DSP users have found it helpful under some conditions. Generally, do not use the **Random** mode for data. If noise conditions are severe, and you have tried other filter combinations, then try the **Random** mode. To activate random noise reduction, press **[Random]**.

Data Bypass Mode



8100-041

Pressing **[Bypass]** places the DSP-8100c into an electronic bypass mode. In the data mode, the bypass mode routes the signal through an allpass DSP filter which has precisely the same delay as the normal narrow band filter. When switching from data mode to bypass mode, this prevents a time discontinuity that can cause some modes to lose synchronization. The bypass mode has precedence over the Data mode. When the DSP-8100c is in bypass, the settings of the gain control and the parameter select push buttons do not affect the signal.

Data Filter Mode

The Data Filter mode choices appear sequentially on the display. The table below lists the filter choices. (Use Setup to limit the number of choices to those actually used - see Setup - Data.) The following table lists the factory default values for each filter mode. Most can be modified or disabled within data setup.

	Center Freq.	Freq. Shift	Baud Rate	Comments
RTTY 170-45	1700	170	45	•
RTTY S 170-75	1700	170	75	•
RTTY 8 850-45	1275*	2125*	45	850 Hz shift * = Mark/Space freq.
RTTY 8 850-75	1275*	2125*	75	850 Hz shift * = Mark/Space freq.
WeFAX	Fixed	Fixed	Fixed	HF only, filter only
SITOR	2210	200	100	Same filters as AMTOR
USR 1	2210*	170*	45*	* = User Programmable
USR 2	2210*	170*	45*	* = User Programmable
USR 3	2210*	170*	45*	* = User Programmable

WeFAX

This mode uses individual fixed bandpass filters specifically designed for the WeFAX mode. Pressing **[Tone]** has no effect on the WeFAX filters.

RTTY FSK Test Signals

Press **[Tone]** while in a non burst Data mode at 75 baud or less activates a sync nul (diddle) test tone. The sync nul test tone may sound different than what you may be used to. It has been padded with extra stop bits to equalize the mark and space energies. It functions identical to what most consider “normal.”

If the baud rate is 100 baud or higher, pressing **[Tone]** activates a space mark reference calibration tone that toggles at the specified baud rate. It is not a standard ASCII character.

Pressing **[Shift+Tone]** while in the **Data** RTTY mode at 75 baud or less inserts a "RYRY" audio FSK test signal into the receive channel. The “RYRY” test signal center frequency, frequency shift, and baud rate are de-

termined by the RTTY parameter settings. The level of marker tone is adjustable relative to the processed receive signal. If the baud rate is 100 baud or higher, nothing happens when **[Shift+Tone]** is pressed.

Wideband Data Operating Hint

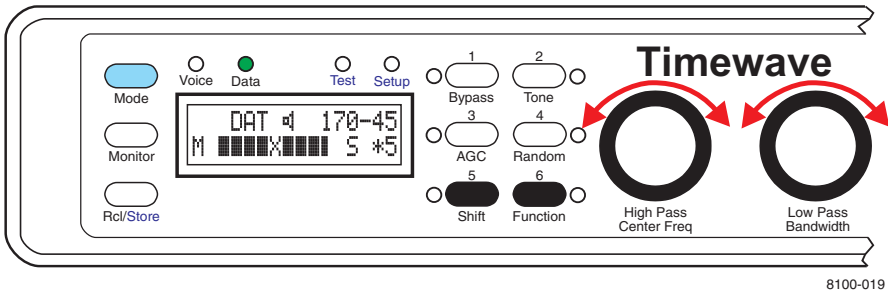
The DSP-8100c can simulate almost any filter necessary for wideband data signals. If you know the upper and lower audio frequency limits of the signal you are using, simply set the Highpass and Lowpass filters to pass those frequencies. The linear phase response and steep skirts of DSP-8100c will help reject QRM and improve S/N ratio. If you don't know the frequency limits, tune in a strong signal with the Highpass and Lowpass filters set to 300 Hz and 2.7 kHz. Then tighten up the filters until the copy from the signal begins to degrade. Then back off the filters until the copy is acceptable. Store these highpass and lowpass settings in a memory location or record them so that you can use them when you operate that mode again. You will have optimum QRM rejection and the best signal-to-noise ratio.

RTTY Modem Operation

The RTTY modem both demodulates received RTTY audio tones and generates AFSK and AFSK signals.

The modem is operational whenever you are in one of the RTTY modes. You need, however, to have a computer connected to the RS-232 port on the DSP-8100c and have appropriate software terminal program that can decode and encode Baudot and ASCII. Timewave does not provide the terminal program. You will also need to make appropriate cables to connect from the DIN connector to your transceiver. Consult your transceiver user manual for specific information.

Press **[Mode]** to select the Data mode.



8100-019

- Turn the **left knob** to select one of the RTTY filters.
- Press **[Shift+Function]** to turn the tuning display on.
- Tune in a RTTY signal on the receiver connected to the DSP-8100c.
- Adjust the receiver frequency so that the Mark and Space bars on the display are approximately equal length.
- Press **[Function]** to switch the middle knob from **[Bandwidth]** to **[DCD]** (Data Carrier Detect).
- Turn middle knob **[DCD]** for clean error-free copy on your terminal display.

- The DCD setting, with a range of 1 - 9, is displayed on the lower right corner of the display. When a data carrier is detected that exceeds the DCD setting, an asterisk (*) is displayed next to the DC setting.
- TX is displayed when the terminal program is switched to transmit.

Power your computer on first.

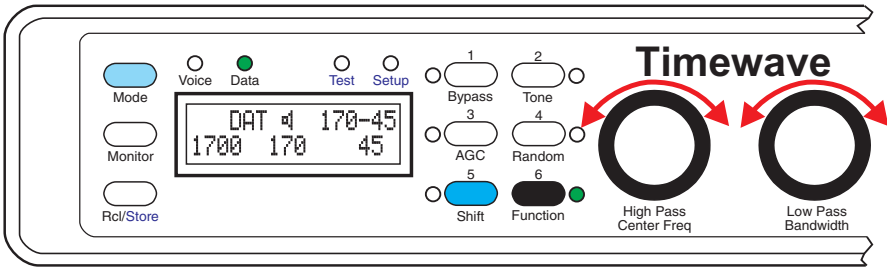
When your have a computer connected to the DSP-8100c, take care to turn the power on for the computer first. Then turn on the DSP-8100c. Under some circumstances, the DSP-8100c will power up in transmit mode keying your transmitter if the computer power is turned on last.

The AFSK output signal from the line output jack and pin 1 of the DIN connector on the DSP-8100c can drive the microphone input or AFSK input on a transceiver. Do not over-drive your transceiver. It prevents you from making clean contacts and generates QRM for everyone else. Carefully follow your transceiver or transmitter instructions for input drive level. See DSP-8100c ***Installation - Line Output Signal Level Setup*** (page 1-6) for instructions on setting DSP-8100c line output level.

The FSK output signal from pin 1 on the Aux I/O connector on the DSP 8100c can directly drive a FSK input on a transceiver. See ***Installation - RTTY Modem Input/Output*** (page 1-4) for more information on connections.

The RTTY modem has signal decoding; it modulates and demodulates only! A computer with a terminal program is required to use the RTTY modem. Timewave does not supply the terminal program.

RTTY Remodulator Operation



8100-042

The RTTY remodulator is a special mode for receiving RTTY. Its function varies slightly depending upon if you are using the DSP-8100c internal RTTY modem or using an external multimode controller:

- Press **[Mode]** to select the Data mode.
- Turn the **left knob** to select the appropriate RTTY data filters.
- Press **[Function]** to select the remodulator.
- The **middle knob** now adjusts the DCD threshold.

The LED illuminated next to the **[Function]** button indicates the RTTY remodulator is selected. The DSP-8100c filters and demodulates the received

RTTY signal. Then The DSP-8100c generates a new set of RTTY tones that are modulated by the output of the RTTY demodulator.

The incoming signal is sent to the Monitor and the remodulated signal is sent through the line output. Only the pure audio RTTY tones are sent to your multimode controller. You still need to monitor the incoming signal for quality. You still need to be tuned in and may need to adjust bandwidth.

When using the RTTY modem the process is similar. Pressing **[Function],** however only toggles the **middle knob** between **[Bandwidth]** and **[DCD]** threshold.

Data Operating Hints

Data Primer

RTTY and SITOR use Frequency Shift Keying (FSK). FSK is also called AFSK Audio Frequency Shift Keying when frequency shifted audio tones are used to modulate a transmitter.

A FSK signal is produced when the frequency shift audio is generated by circuitry within the radio. AFSK signals are generated when the audio containing the shifting frequency comes from outside the radio. A common example of this is a TNC connected to a radio through the microphone input. Our RTTY modem supports both forms. See your transceiver owners manual for specific information.

There are three important parameters used to describe an FSK or AFSK signal -- the frequency shift, the center frequency, and the keying or baud rate. The combination of frequency shift and baud rate determine the spectrum of the FSK signal. The goal of a filter is to reject everything in the spectrum except the desired signal while minimizing the degradation of the desired signal.

Frequency shift

You may specify the frequency shift in one of two ways. The most common specification is total shift or the difference between the low (Mark) and high (Space) tones. In the technical literature, the shift from a center frequency is more commonly specified. For example, a 170 Hz shift RTTY signal is the same as a +/- 85 Hz shift. Note the frequency shift remains the same whether it is shifting an RF signal or an audio frequency signal. In amateur radio, there are only two common frequency shifts - 170 Hz and 200 Hz. Other radio services use 425 Hz and 850 Hz shifts. 170 Hz is the standard RTTY frequency shift, while 200 Hz is the standard for SITOR. Unfortunately, some data converters use 200 Hz shift for RTTY, which adds to the problem of properly filtering data signals.

Center Frequency

The center frequency of a FSK signal is independent of the frequency shift or the baud rate. In the audio spectrum, either before an AFSK signal mod-

ulates a RF signal or after the RF FSK signal is demodulated, there are several common center frequencies.

QRM Operating Hint

Choosing the correct bandwidth for the baud rate and shift of a data signal is critical to reject QRM while minimizing the bit error rate from noise. If there is no QRM, wide bandwidths may be acceptable on a strong signal, but could cause increased bit errors on a weak signal. The factory default settings are the generally the best trade-off between bit error rate and QRM rejection. If necessary, change them slightly under severe band conditions. For example, normally 250 Hz is the recommended bandwidth for RTTY; however, other bandwidths from 175 Hz to 350 Hz may improve copy under some band conditions.

Mark Space Frequencies

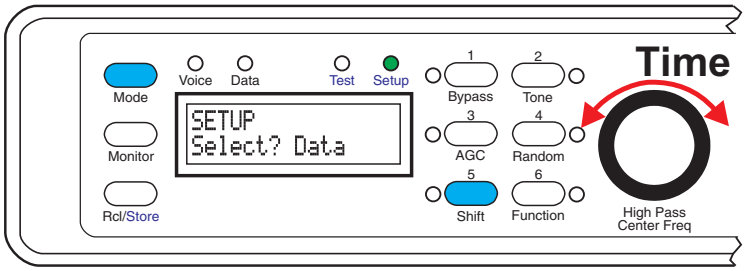
The mark-space frequencies of the modem, receiver and DSP-8100c must match. Default mark-space frequency shifts and center frequencies vary among modem and radio manufacturers, and in different parts of the world. Some modems have default HF Packet mark-space center frequencies different from their RTTY, AMTOR, and PacTOR mark-space center frequencies.

The mark-space center frequencies of the modem, receiver and DSP-8100c must match. Some modems and radios have programmable mark-space frequencies. If your modem and radio default to different mark-space center frequencies, you must change the modem or radio mark-space center frequencies to match the DSP-8100c, or change the DSP-8100c mark-space center frequencies to match the modem and radio mark-space center frequencies. See your radio or modem instruction manual.

Note that some receivers do not have specific provisions to use their narrow (200 - 600 Hz wide) filters for data. Operate these radios in their SSB voice filter bandwidth. Other receivers may have fixed or variable mark-space frequencies - check your operating instructions carefully!

Setup - Data Mode

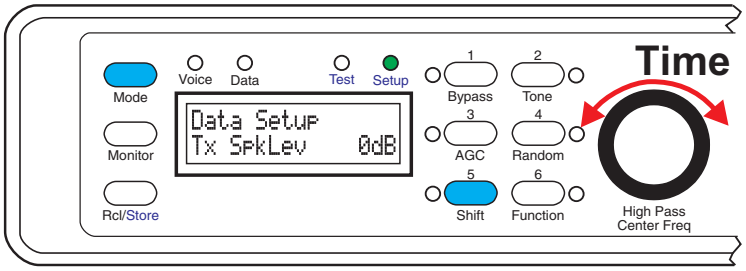
1. Press **[Shift+Mode]** twice to enter Setup mode.
2. Rotate **left knob** until Data appears on the bottom line of the display
3. Press the **left knob** to select.



8100-043

Monitor Mute/Bypass

You can adjust the transmit monitor volume of the data signal. This allows you to set the audio level of the transmitted signal from off the full volume when compared to incoming data signals. This is something of personal preference. The range is from 0 dB to -24 dB in 3 dB steps and off.

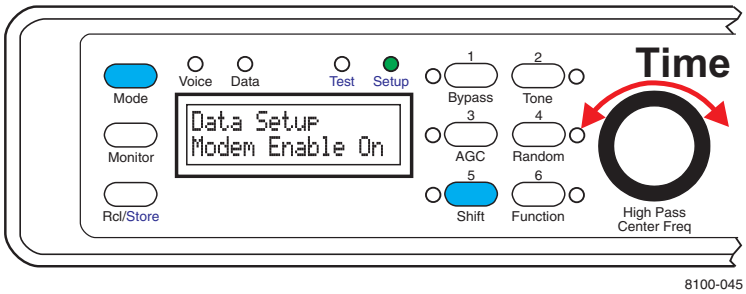


8100-044

1. Press **[Shift+Mode]** twice to enter Setup mode.
2. Rotate **left knob** until Data appears on the bottom line of the display
3. Press the **left knob** to select.
4. Rotate **left knob** until TX SpkrLev appears on the bottom left of the display
5. Press the **left knob** to select.
6. Rotate **left knob** until the chosen value appears on the bottom right of the display
7. Press the **left knob** to accept choice and save. Press **middle knob** to escape without saving changes.
8. Rotate **left knob** until your next function to change appears on the bottom line of the display or press the **middle knob** to return to main set-up menu.

Modem Enable

You can enable the internal RTTY Modem. This does not affect any other operating mode. You may also select to turn it off.

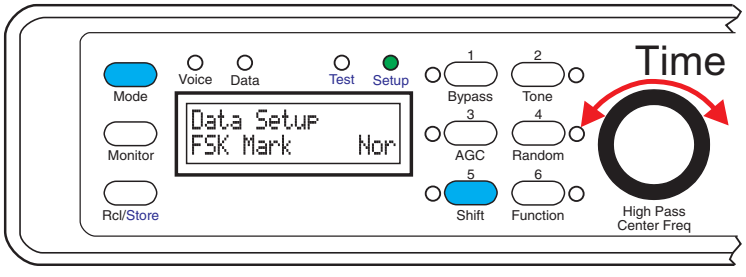


8100-045

1. Press **[Shift+Mode]** twice to enter Setup mode.
2. Rotate **left knob** until `Data` appears on the bottom line of the display
3. Press the **left knob** to select.
4. Rotate **left knob** until `Modem Enable` appears on the bottom left of the display
5. Press the **left knob** to select.
6. Rotate **left knob** until the chosen value appears on the bottom right of the display Your choices are `On` or `Off`.
7. Press the **left knob** to accept choice and save. Press **middle knob** to escape without saving changes.
8. Rotate **left knob** until your next function to change appears on the bottom line of the display or press the **middle knob** to return to main set-up menu.

FSK Mark Polarity Control

With some transceivers, the normal configuration for Mark within the FSK signal be reversed and not adjustable. Standard convention is for Mark to be at the lower frequency. Your choices are Normal (`Nor`) or Reverse (`Rev`). The factory default is Normal.



8100-046

1. Press **[Shift+Mode]** twice to enter Setup mode.
2. Rotate **left knob** until `Data` appears on the bottom line of the display

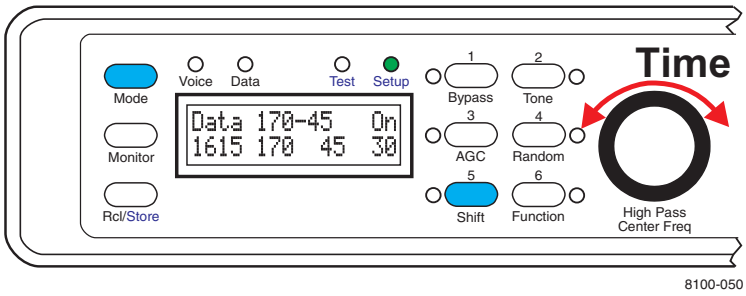
3. Press the **left knob** to select.
4. Rotate **left knob** until FSK Mark appears on the bottom left of the display
5. Press the **left knob** to select.
6. Rotate **left knob** until the chosen value appears on the bottom right of the display
7. Press the **left knob** to accept choice and save. Press **middle knob** to escape without saving changes.
8. Rotate **left knob** until your next function to change appears on the bottom line of the display or press the **middle knob** to return to main set-up menu.

Configuring Data Operating Modes

You can adjust the parameters for many of the data operating modes. For all data modes, you can turn access on or off. Selecting On will list the data operating mode as a choice while in Data Mode. The status is displayed in the upper right corner of the display. Selecting Off will remove the data operating mode from the menu while in data mode.

For the data operating modes that have user configurable information you can configure the following:

- Mark/Space Center Frequency
- Mark/Space Shift Frequency
- Baud Rate
- Bandwidth



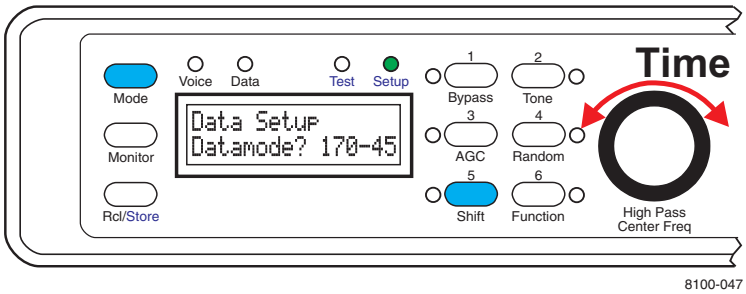
The four configurable values are displayed across the bottom of the display. From the left, the first number is the mark frequency. The second is the shift frequency. The third is the baud rate. The fourth is the bandwidth.

The **space frequency** is calculated by adding the mark frequency and the shift frequency. The range for the mark center frequency is 1200 - 2150 Hz in 5 Hz steps. The space center frequency can be no greater than 2350 Hz.

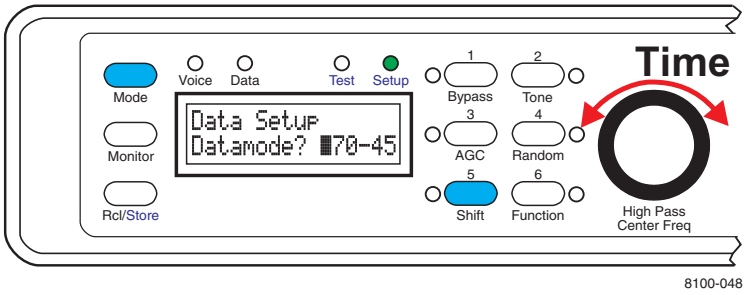
The choices for **frequency shift** are 170, 200, 425, and 850 Hz.

Baud rate choices are 45, 50, 57, 75, 100, 110, 150, 200, and 300 baud.

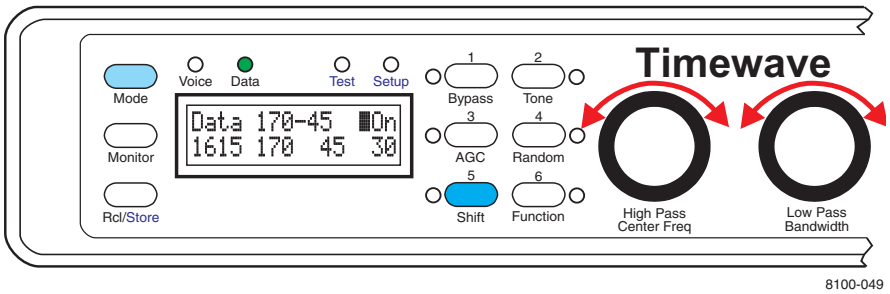
Bandwidth is adjustable in 5 Hz steps through a range from 20 - 600 Hz. Optimal bandwidth approximately equals the baud rate multiplied by 0.75. For example: If the baud rate is 100, the optional bandwidth would be 75 Hz. If the baud rate is 75 baud, the optional bandwidth would be 55 Hz.



1. Press **[Shift+Mode]** twice to enter Setup mode.
2. Rotate **left knob** until `Data` appears on the bottom line of the display
3. Press the **left knob** to select.
4. Rotate **left knob** until `Datamode?` appears on the bottom left of the display
5. Press the **left knob** to select.



6. Rotate **left knob** until the desired data operating mode appears on the bottom right of the display
7. Press the **left knob** to select.



8. Rotate the **middle knob** until the flashing cursor appears on the first character of the parameter you would like to change. Rotate **left knob** until correct value appears.
9. Rotate the **middle knob** gain until the flashing cursor appears on the first character of the next parameter you would like to change. Rotate

left knob until correct value appears.

10. When done, press the **left knob** to accept choice and save. Press **middle knob** to escape without saving changes.
11. Rotate **left knob** until your next function to change appears on the bottom line of the display or press the **middle knob** to return to main setup menu.

Exit Setup

When you are through with Setup, press **[Mode]** to return to Voice mode.

6
Test Instrument Operation

The Test Instrument mode helps analyze signals and other equipment. It includes an audio millivoltmeter, an audio sine wave signal generator, a two-tone generator, and a CTCSS tone encoder/decoder. The monitor may be switched on or off without affecting the Test Instrument functions.

Exiting from Test Instrument functions can be accomplished two different ways.

- Pressing **[Mode]** completely exits you from Test Instrument mode and returns you to Voice mode.
- Pressing the **middle knob** escapes you back to the Test Instrument function menu. You can then choose a different test function. You can then select a new test function. Pressing the **middle knob** again will put you back into Voice mode.

Audio Millivoltmeter

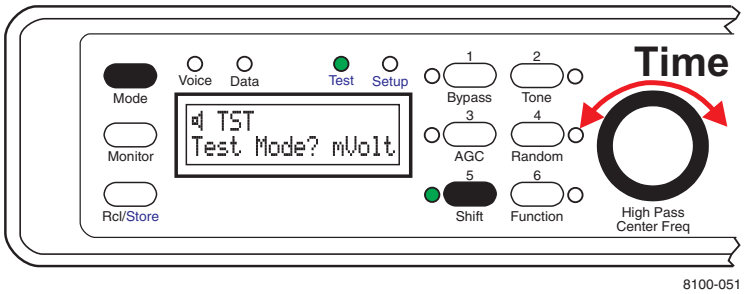
This mode measures audio voltage levels from other equipment including microphones, TNCs, multimode controllers, and receivers. Measurements include both peak and true RMS millivolts. Frequency response ranges from 10 Hz to 10 kHz.

The audio millivoltmeter has many applications in installation, maintenance, and operation of radio and audio equipment. In EME work, the audio millivoltmeter is useful in antenna evaluation when comparing sun noise and cold sky noise. In VHF/UHF FM work, the audio millivoltmeter's peak reading capabilities allow relative measurement of peak frequency deviation of received voice, data and control signals. When used with the CTCSS function of the DSP-8100c, the audio millivoltmeter allows relative measurement of frequency deviation of CTCSS tones received UHF and VHF FM/PM signals.

The audio millivoltmeter displays the voltage of the audio input signal for the selected channel. Audio millivoltmeter functions include true RMS voltage and peak voltage. The millivoltmeter display is also active in the sine wave, and two-tone modes.

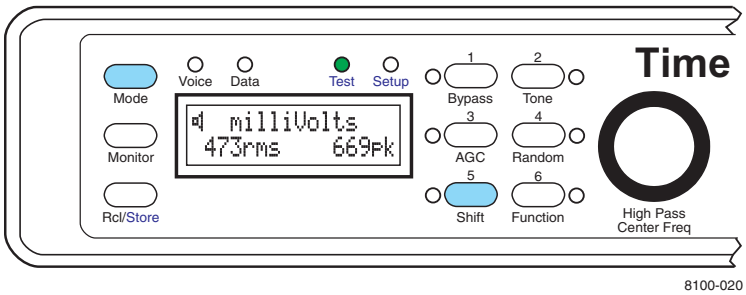
Operation

To use the AC millivoltmeter for general purposes, select sine wave or two tone mode and do not turn the tone on.



8100-051

- Press **[Shift+Mode]** to enter the Test Instrument mode.
- Turn the **left knob** to mVOLT.
- Press the **left knob** to enter the chosen mode.



8100-020

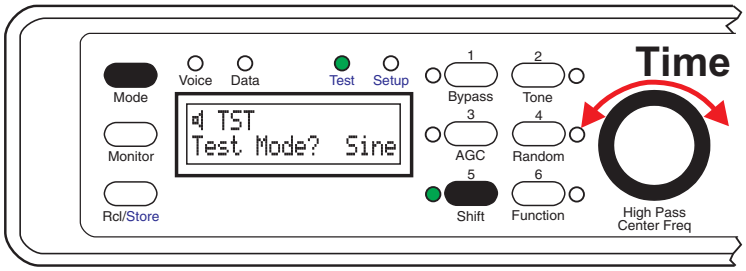
- The selected channel input voltage is displayed in the lower left of the display in mVrms and as mVpk in the lower right corner of the display. The DSP-8100c can measure and display up to 2000mV.
- Press **[Function]** to select input signal amplitude units - mVrms or mVpk.
- Press **[Monitor]** to turn the monitor on to listen to the input signal on the selected channel.
- Press **[Mode]** to exit Test Instrument mode. Press the **middle knob** to escape back to the test function menu.

Maximum input level is 2000 millivolts rms.

Do not attempt to measure any voltage above 2000 millivolts, especially 115 vAC or 220 vAC power line voltage! You will damage the DSP-8100c! All warranties will be void!

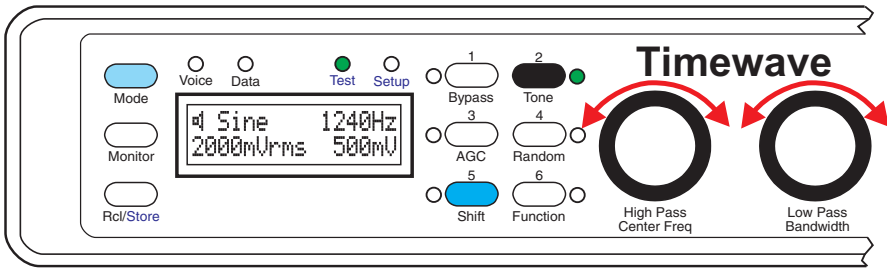
Sine Wave Generator

This mode produces a tunable low-distortion, precision frequency sine wave test signal from 20 Hz to 10 kHz in 20 Hz steps. Output signal voltage is adjustable from 5-50 mV in 1 mV steps and from 50-500 mV in 10 mV steps. The operator may use the precision test signal for calibration and/or trouble shooting of other equipment. The display shows the frequency and amplitude of the output signal from the line output.



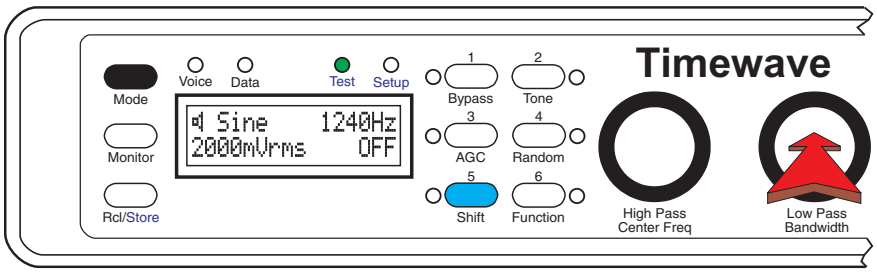
8100-052

- Press **[Shift+Mode]** to enter the Test Instrument mode.
- Turn the **left knob** to `Sine`
- Press the **left knob** to select the sine wave generator.



8100-055

- Press **[Tone]** to start generator.
- Turn **left knob** to set frequency.
- Press **[Function]** to select input signal amplitude units - `mVrms` or `mVpk`.
- Turn **middle knob** to set output amplitude (shown on lower right of display).
- Press **[Tone]** again to turn off generator.



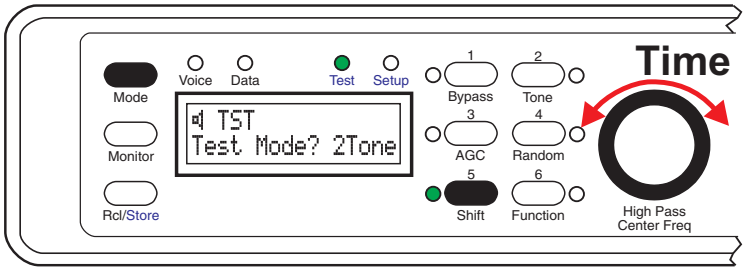
8100-056

- Press **[Mode]** to exit Test Instrument mode. Press the **middle knob** to

escape back to the test function menu.

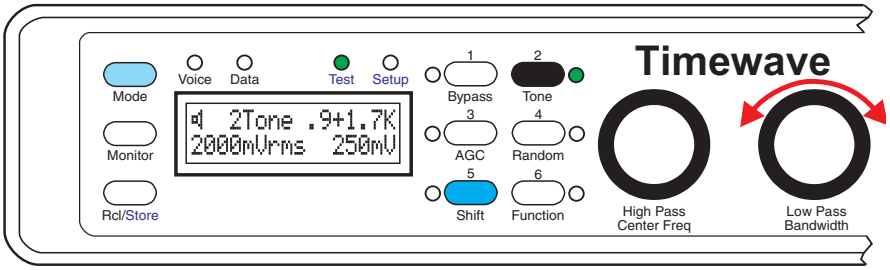
Two-Tone Generator

This mode produces two low-distortion, precision-frequency sine wave signals at 700 Hz and 1900 Hz. Output signal voltage is adjustable from 5-50 mV in 1 mV steps and from 50-250 mV in 10 mV steps. Two-tone signals are used for SSB transmitter linearity testing. Please read the latest edition of the ***ARRL Handbook*** for additional information on SSB two-tone testing. The display shows the frequencies of both tones and the amplitude of the two-tone output signal from the line output. The amplitudes of the two tones are identical and they track when adjusted.



8100-053

- Press **[Shift+Mode]** to enter the Test Instrument mode.
- Turn the **left knob** to 2Tone.
- Press **left knob** to select the two-tone generator.



8100-057

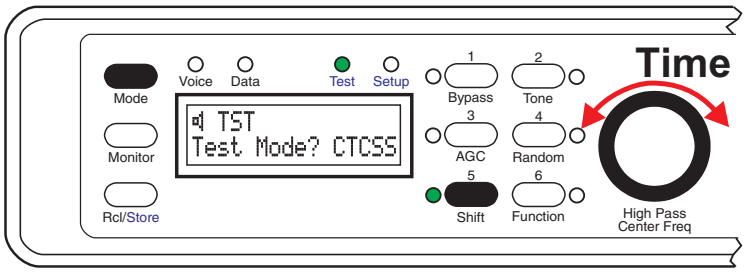
- Press **[Tone]** to Tone to turn on generator.
- Turn the **middle knob** to set amplitude (shown on lower right of display).
- Press **[Tone]** again to stop generator.
- Press **[Mode]** to exit Test Instrument mode. Press the **middle knob** to escape back to the test function menu.

CTCSS Decoder

The DSP-8100c has a CTCSS tone encoder and decoder built into the Test Instrument mode. The decoder can operate in an CTCSS autodetect mode or in a tone squelch mode. The autodetect mode automatically displays the frequency and amplitude of the incoming CTCSS tone. This allows relative measurement of peak deviation of CTCSS tones for UHF and VHF FM/PM transmitters. The tone squelch mode can detect a selected CTCSS tone and activate a switch output on DSP-8100c as well as generate a tone on the selected CTCSS frequency. Output signal voltage is adjustable from 5-50 mV in 1 mV steps and from 50-500 mV in 10 mV steps.

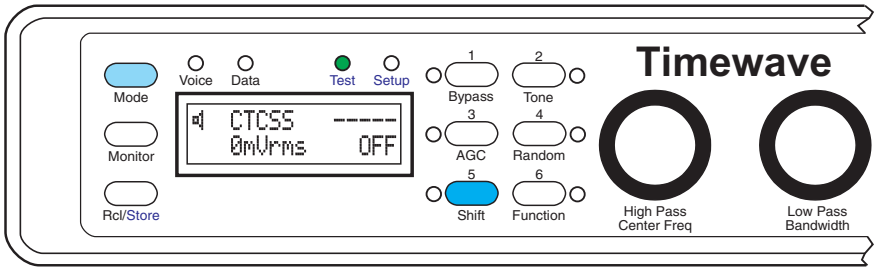
By design, some transceivers filter out low frequencies so that we normally do not hear them. The result is low speaker output of CTCSS tones that may not be detected reliably.

Autodetect



8100-054

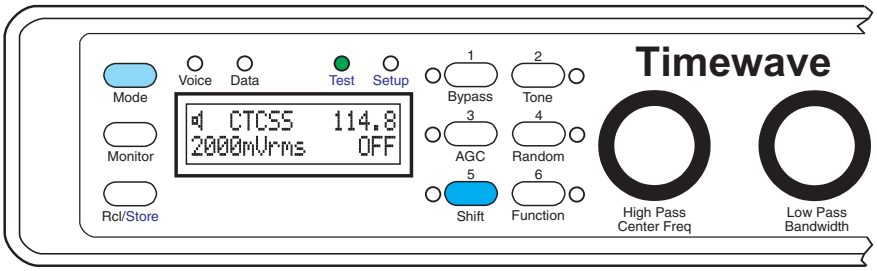
- Press [Shift+Mode] to enter the Test Instrument mode.
- Turn the **left knob** to CTCSS
- Press the **left knob** to enable the CTCSS Tone feature.



8100-060

- The DSP-8100c is now in the **autodetect** mode

Autodetect Display with Input CTCSS Tone



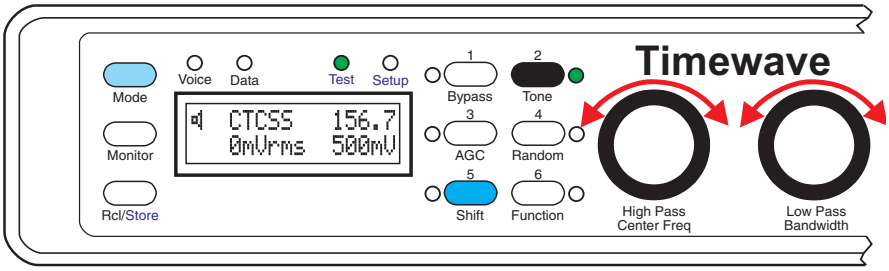
8100-061

Press [Function] to select input signal amplitude units - mVrms or mVpk.

- If there is an incoming CTCSS tone, the display will show the frequency (upper right) and the amplitude (lower left).

Tone Squelch

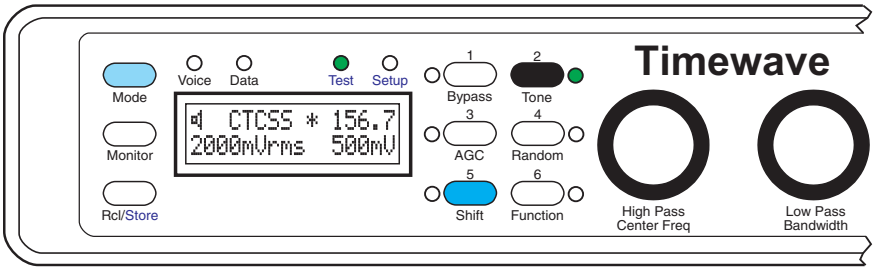
CTCSS Tone Squelch Selection



8100-059

- Press **[Shift+Mode]** to enter the Test Instrument mode.
- Turn the **left knob** to CTCSS
- Press the **left knob** to enable CTCSS Tone feature.
- Press **[Tone]** to turn generator on.
- The DSP-8100c is now in the **tone squelch** mode.
- The **left knob** selects the output and input CTCSS tone center frequency.
- Turn the **middle knob** to set the output tone amplitude in volts RMS (shown on lower right of display).

CTCSS Tone Squelch Detection



8100-058

- The amplitude of the selected CTCSS input signal is shown on the lower left side of the display.
- An asterisk is displayed in the upper middle section of the display if the

incoming CTCSS signal exceeds the tone squelch threshold level. The audio output is unmuted when the squelch is open.

- Press **[Tone]** again to stop generator and return to the autodetect mode
- Press **[Mode]** to exit Test Instrument mode. Press the **middle knob** to escape back to the test function menu.

	Frequency - Hz	Amplitude - Millivolts rms	Squelch Output
Decode Input	67.0 - 254.1 see Tone Freq. Table	5 - 2000	low = tone present
Encode Output	67.0 - 254.1 see Tone Freq. Table	5 - 500	NA

CTCSS Tone Squelch

The decoder has a detector that pulls a DSP-8100c output pin low when a signal exceeds the threshold. This output may be used to trigger a tape recorder or other monitoring device.

CTCSS Tone Squelch Switch Output Jack and Pin Numbers

Aux I/O Jack on DSP-8100c	Output Pin No.	Ground Pin No.
Radio	6	5

What are CTCSS tones?

CTCSS tones are normally used in VHF/UHF systems to help reject annoying interfering signals on repeaters or to allow only desired signals to be heard on direct radio links. A selected CTCSS tone mixes with the transmit audio to modulate a transmitted signal. When a tone is present on a received signal, a CTCSS tone decoder output opens the receiver audio squelch, allowing the incoming signal to be heard. The tone frequencies are all below 255 Hz and are usually not audible on most VHF/UHF radios if the frequency deviation is set correctly. The tones usually sound like a “hum” if they can be heard.

CTCSS is an acronym for “Continuous Tone Coded Sub-audible Squelch." 32 of the tone frequencies are TIA (formerly EIA) standards. Some companies have trademarked names for their CTCSS tone systems and have extended the frequency set to include more tones. Motorola calls their system “Private Line," which is commonly shortened to “PL." GE calls their system

"Channel Guard."

Most new VHF/UHF transceivers have built-in CTCSS encoders with optional CTCSS decoders. Older transceivers often have neither an encoder nor a decoder.

CTCSS Tone Frequencies - Hz

67.0	94.8	131.8	171.3	203.5
69.3	97.4	136.5	173.8	206.5
71.9	100.0	141.3	177.3	210.7
74.4	103.5	146.2	179.9	218.1
77.0	107.2	151.4	183.5	225.7
79.7	110.9	156.7	186.2	229.1
82.5	114.8	159.8	189.9	233.6
85.4	118.8	162.2	192.8	241.8
88.5	123.0	165.5	196.6	250.3
91.5	127.3	167.9	199.5	254.1

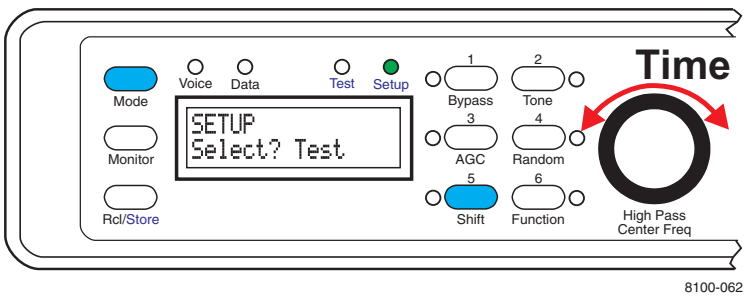
Checking CTCSS Tone Frequency and Deviation

The DSP-8100c can help identify the CTCSS tone frequency of the incoming signal and the CTCSS tone relative frequency deviation with respect to other signals heard on the same receiver. To identify and measure a CTCSS tone, use the CTCSS autodetect function to read the CTCSS frequency and amplitude on the LCD display. If the 8100c displays a much lower or higher CTCSS tone amplitude than a known good signal (or most other signals on the same frequency), the CTCSS tone deviation of the received signal is probably set incorrectly. Compare only CTCSS tones of the same frequency unless you know the audio output frequency response of your receiver is flat to less than 30 Hz into a 10K load impedance.

Setup - Test Instrument

There are eight user adjustable variables within this mode of setup.

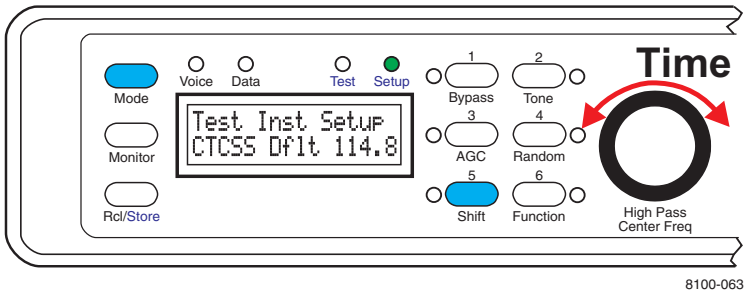
1. Press **[Shift+Mode]** twice to enter Setup mode.
2. Rotate **left knob** until `Test` appears on the bottom line of the display
3. Press the **left knob** to select.



8100-062

Default CTCSS Tone

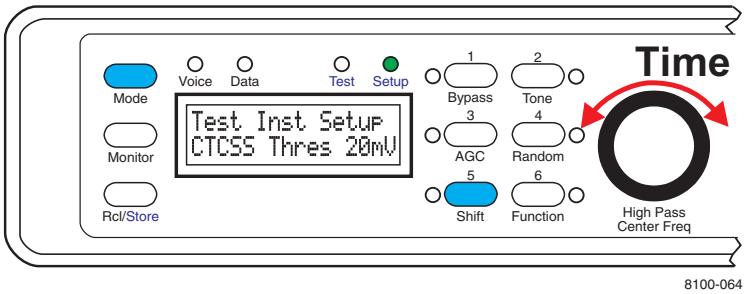
You can adjust the default CTCSS tone that will appear when you turn the CTCSS test function on.



1. Press **[Shift+Mode]** twice to enter Setup mode.
2. Rotate **left knob** until `Test` appears on the bottom line of the display
3. Press the **left knob** to select.
4. Rotate **left knob** until `CTCSS Dflt` appears on the bottom left of the display
5. Press the **left knob** to select.
6. Rotate **left knob** until the chosen value appears on the bottom right of the display
7. Press the **left knob** to accept choice and save. Press **middle knob** to escape without saving changes.
8. Rotate **left knob** until your next function to change appears on the bottom line of the display or press the **middle knob** to return to main set-up menu.

CTCSS Trigger Threshold

You can adjust the level that the CTCSS tone will trigger the squelch to open. The factory default is 20 mV.

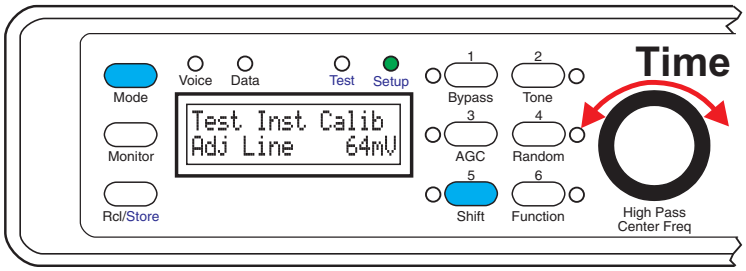


1. Press **[Shift+Mode]** twice to enter Setup mode.
2. Rotate **left knob** until `Test` appears on the bottom line of the display
3. Press the **left knob** to select.

4. Rotate **left knob** until CTCSS Thres appears on the bottom left of the display
5. Press the **left knob** to select.
6. Rotate **left knob** until the chosen value appears on the bottom right of the display
7. Press the **left knob** to accept choice and save. Press **middle knob** to escape without saving changes.
8. Rotate **left knob** until your next function to change appears on the bottom line of the display or press the **middle knob** to return to main set-up menu.

Signal Generator Calibration

This unit was delivered to you calibrated. If for some reason you decide that you need to re-calibrate the outputs and inputs on the DSP-8100c, do it with great care. Resetting the unit has no effect on these settings. Use a high quality digital multimode VOM meter, such as a Fluke 8060 or equivalent. It takes a unit of this caliber to be accurate at the 1 kHz calibration tone. Adjust meter to read AC voltage with a range of 0 - 2 volts.



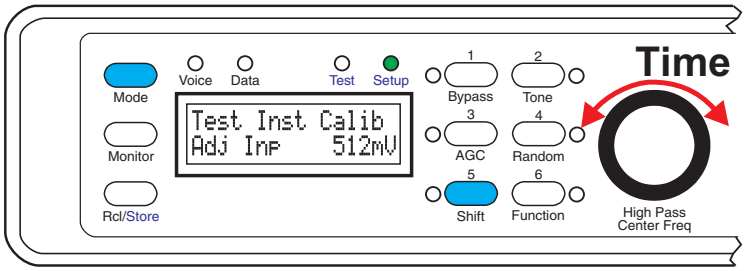
8100-065

1. Connect a Fluke 8060 or equiv. Set meter to AC volts, in the appropriate range to read the required voltage.
2. Press **[Shift+Mode]** twice to enter Setup mode.
3. Rotate **left knob** until Test appears on the bottom line of the display
4. Press the **left knob** to select.
5. Rotate **left knob** until Adj Line 64mV appears on the bottom line of the display
6. Press the **left knob** to select.
7. Rotate **left knob** until the reading on the meter reads 64 millivolts.
8. Press the **left knob** to accept choice and save. Press **middle knob** to escape without saving changes.
9. Rotate **left knob** until Adj Line 512mV appears on the bottom line of the display

10. Press the **left knob** to select.
11. Rotate **left knob** until the reading on the meter reads 512 millivolts.
12. Press the **left knob** to accept choice and save. Press **middle knob** to escape without saving changes.
13. Rotate **left knob** until your next function to change appears on the bottom line of the display or press the **middle knob** to return to main set-up menu.

Millivoltmeter Calibration

Again, like the previous calibration, it will usually not be required. If you do this procedure, proceed with caution.



8100-066

1. Press **[Shift+Mode]** twice to enter Setup mode.
2. Rotate **left knob** until `Test` appears on the bottom line of the display
3. Press the **left knob** to select.
4. Rotate **left knob** until `Adj Input` appears on the bottom line of the display
5. Press the **left knob** to select.
6. Rotate **left knob** until the `512mV` appears on the bottom right of the display
7. Press the **left knob** to accept choice and save. Press **middle knob** to escape without saving changes.

Exit Setup

When you are through with Setup, press **[Mode]** to return to Voice mode.

7
Troubleshooting

Most of the functions of the DSP-8100c can be checked using the LCD display, the LEDs, the internal sine wave generator and audio millivoltmeter and your ears.

The most common problem with radio equipment is defective or incorrectly connected cables. Check them carefully!

Check our World Wide Web site (http://www.timewave.com) for additional troubleshooting hints.

Common Problems and Solutions.

Nothing comes on when I turn on the power.

1. Check power connection to DSP-8100c.
2. Make sure your power supply is on.
3. Verify that you have 115/220 Vac at the power connection.
4. Check the fuse for continuity. Remove power cable.
5. Remove the four screws holding the rear panel in place.
6. Remove the three screws from the bottom of the case.
7. Observing static precautions carefully slide the circuit board assembly out about two inches.
8. Visually check fuse in lower left corner. Check with meter if not sure. If you need to replace fuse replace with 0.5A 5 mm x 25 mm
9. Reassemble reversing instructions above.
10. Reconnect only power cable and turn on. If lights stay on, power off and reconnect all other cables. Power back to test. If unit does not light up, call our technical support department.

"Normal" LED does not flash on audio peaks.

1. Check power connection to DSP-8100c.
2. Increase audio input level with receiver audio output level control until the "Normal" LED flashes.
3. Verify the audio level out of the radio by listening to the monitor. If no audio is heard in the headphones or speaker, check audio input connections from the receiver's external speaker output to the DSP-8100c. Make sure the cable polarity is correct. See the audio input installation section.

"Overload" LED flashes constantly on audio peaks.

1. Check power connection to DSP-8100c.
2. Reduce audio input level with receiver's audio output volume control, audio levels into the DSP-8100c are very important for distortion-free reception. Occasional flashes of the overload LED are usually not a problem.

No audio output

1. Check power connection to DSP-8100c.
2. Increase audio input level with receiver audio output level control until the "**Normal**" LED flashes.
3. The monitor icon should be visible on the top line of the display. If it is not visible, press **[Monitor]** to unmute the monitor.
4. Turn the DSP-8100c's front panel audio level control clockwise.
5. Verify the audio level out of the radio by listening to the monitor. If no audio is heard from the monitor, check the connections with the DSP-8100c and the connections between the receiver and the DSP-8100c. If no audio is heard in the headphones or speaker, check audio input connections to the DSP-8100c from the receiver.
6. Check audio output device (speaker or headphones).

It still does not work!

If the DSP-8100c does not seem to work correctly after carefully following the installation, operation and troubleshooting instructions in this manual, call, write, E-mail or FAX the Timewave Customer Service Department for additional help.

Timewave Technology Inc.
501 Lawson Ave. W.
St. Paul, MN 55117
U.S.A.
Phone 651-489-5080
FAX 651-480-5066
E-mail dsp@timewave.com
WWW http://:www.timewave.com

Appendix A
Specifications

AUDIO INPUT

Impedance	600 ohms, transformer balanced
Signal range for full output	-16.5 dBV to +6.0 dBV, front panel programmable

AUDIO OUTPUT

LineOutput	600 ohms, transformer balanced
Full Scale Line Output	-15 dBV to +6 dBV, front panel programmable within Setup
Monitor Ooutput power	1.0 watts into 8 ohms ,
Monitor jack	1/4 " two circuit jack, < 1 ohm or 100 ohms, selectable

NOISE REDUCTION FILTERS

	Frequency Range	Attenuation	Type	Delay
Random Noise Reduction	entire freq. range of selected filter	Up to 20 dB, varies with noise characteristics. Noise reduction aggressiveness front panel adjustable	Adaptive	5 msec max
Variable Tone Eliminator (Multiple Automatic Notch)	entire freq. range of selected bandpass filter	Up to 50 dB, varies with noise characteristics	Adaptive	5 msec max
Tone Eliminator (Manual Notch)	entire freq. range of selected bandpass filter	Up to 50 dB, varies with noise characteristics	manual	
Note:	The random noise reduction and bandpass filters can operate simultaneously. The random noise reduction, tone notch and highpass/lowpass filters can operate simultaneously.			

DATA FILTERS

RTTY, SITOR	Mark/Space bandwidth 60 Hz to 100 Hz, Center Frequency selectable Frequency shift - 170, 200, 425, and 850 Hz, selectable	40 dB at 60 Hz outside the passband	FIR Linear phase	37 msec max
Note:	RTTY and AMTOR filters have a notch at the center frequency .			
WeFAX	1500-2300 Hz	55 dB at 75 Hz outside the passband	FIR Linear phase	21 msec max

FSK Marker Tones

1) **RY string** - Alternating sine waves at mark-space freq. of selected data filter . Baud rate matches selected RTTY data mode.

2) **Sync-Nul Character (Diddle)** - Baud rate matches selected data filter.

DATA MODEM

Shifts	170, 200, 425, 850 Hz
Data Rates	45, 50, 57, 75 Baud
Input	Audio from receiver
Output	Open collector FSK and variable level AFSK
Transmit Data Polarity	Normal or Reverse
I/O	Receive data, Transmit data, PTT (RS-232 compatible)

VOICE FILTERS

	Frequency Range	Attenuation	Type	Delay
Highpass	Corner freq. = 100 to 1000 Hz, 10 Hz steps.	60 dB at 180 Hz outside the passband	FIR Linear phase	24 msec max for any combination of
Lowpass	Corner Freq. = 1000 to 5000 Hz, 10 Hz steps.	60 dB. at 180 Hz outside the passband	FIR Linear phase	highpass & lowpass

AUTOMATIC GAIN CONTROL (AGC)

Voice mode	36 dB
CW and Data Modes	18 dB

SIGNAL PROCESSING

A-D/D-A Converter	16 bit linear, sigma-delta conversion, dual channel
Signal Processor	16 bit, 27ns Analog Devices ADSP-2181 with 80 KB of memory

TEST INSTRUMENT MODE

Audio Generator	Single or two-tone. single Sine wave tunable from 20 Hz to 10 kHz. Two-tone fixed 700Hz and 1900Hz. Sine wave distortion less than 1%.
Audio millivoltmeter	True RMS from 4mV to 2000 mV., 20Hz to 10 kHz
CTCSS encoder -decoder	Generates and decodes and displays CTCSS “PL” tones from 67.0 Hz to 254.1 Hz.
CTCSS squelch	Open collector output pulls low when selected CTCSS tone is present. (connection on back panel Aux I/O connector)

MEMORY

Six Memories	All configuration setups can be stored and recalled (except volume control setting).

DISPLAY

2x16 alphanumeric characters, dot-matrix, yellow-green backlit LCD.

DIMENSIONS

Size	7.6 in. wide x 11.25 in. deep x 1.9 in. high (193 mm wide x 285 mm deep x 48 mm high)
Weight	4.01 lb. (1.82 Kg.)

POWER

Requirements	110/220 Vac at 50/60 Hz, 25 watts max.
Fuse	0.5A 5 mm x 25 mm

Note: RTTY and SITOR Packet data filter bandwidths are specified at -3 dB points to comply with traditional data filter specification methods. All other filter bandwidths are specified to comply with conventional DSP FIR filter parametric descriptions.

Appendix B
Glossary

AFSK (Audio Frequency Shift Keying)
A common RTTY mode most often used for VHF and UHF communications. The signal is generated by switching between two audio tones fed into the microphone input of a FM transmitter.

AMTOR
Amateur Teleprinting Over Radio is an error correcting digital mode. Date is sent in three character blocks then waits for a response of ACK or NAK to indicate successful or unsuccessful transmission.

Bandpass Filter
A filter that allows only a given range of frequencies to pass through. All frequencies outside the range are either eliminated or significantly reduced in volume.

Center Frequency
The nominal frequency at which the RTTY data signal is transmitted. The signal is actually a rapid switching between two frequencies (Mark and Space) centered on the nominal frequency. Nothing is actually transmitted on the center frequency. The normal range is 1200 to 2500 Hz. The North American standard is 2210 Hz.

CLOVER
A digital communications mode that utilizes a four-tone modulations system and digital signal processing to pass data on the HF bands. It has a relatively narrow signal bandwidth of 500 Hz. Because CLOVER stations share information concerning signal conditions and power output levels, it has the ability to automatically adjusts power output to maintain stable communications. It is however, extremely sensitive to frequency shift. It cannot tolerate frequency drift of more than 15 Hz while linked.

DCD (Data Carrier Detect)
A “squelch “ circuit for data. This is done by sampling data transmissions to verify that it is valid data in the mode selected. When found, the circuit opens the circuit to allow data to flow through.

FSK (Frequency Shift Keying)
A common RTTY mode most often used for HF communications. The signal is generated by switching a HF carrier between two separate frequencies.

G-TOR
A data mode that use several compression, checking or correction techniques besides automatic repeat requests. Faster than either AMTOR or PacTOR.

Heterodyne
The combining of two different frequencies to produce beats whose frequency is either the difference or the sum of the two frequencies.

Highpass Filter
A filter that permits frequencies above a certain cutoff frequency to pass and eliminates or significantly reduces signals below the filter frequency.

Lowpass Filter
A filter that permits frequencies below a certain cutoff frequency to pass and eliminates or significantly reduces signals above the filter frequency.

Mark-Space Frequency
The two frequencies at which RTTY data is actually sent. The common frequency shifts between Mark and Space are 170 Hz and 200 Hz.

PacTOR
A packet-like digital mode combining aspects of packet and AMTOR and also has AX.25 compatibility. Unlike standard packet radio, PacTOR does not allow frequency sharing. PacTOR is faster than AMTOR and uses the complete ASCII character set and can easily handle binary data transfers.

RTTY
The original data communications mode and is well suited for "roundtable" QSOs with several stations. It does not support frequency sharing or error correction. RTTY was originally designed for use with mechanical teleprinters, predating personal computers.

SSTV
Slow-Scan TV is a narrow bandwidth image mode popular on the HF bands that transmits pictures at 8, 16 or 32 seconds per frame.

WeFAX
Weather facsimile image format. There are two modes HF and satellite. The DSP-8100c currently supports only HF mode Detailed information on satellite mode can be found in *The Weather Satellite Handbook* published by the ARRL.

Appendix C
Product Warranty

Timewave Technology Inc. products carry the following warranty:

Timewave hardware products are warranted against defects in materials and workmanship. If Timewave receives notice of such defects during the warranty period, Timewave shall, at its option, either repair or replace hardware products which prove to be defective.

Timewave software and firmware products which are designated by Timewave for use with a hardware product are warranted not to fail to execute their programming instructions due to defects in materials and workmanship. If Timewave receives notice of such defects during the warranty period, Timewave shall, at its option, either repair or replace software media or firmware which do not execute their programming instructions due to such defects. Timewave does not warrant that operation of the software, firmware, or hardware shall be uninterrupted or error free.

The warranty period for each product is one year from date of shipment.

Limitation of Warranty: The foregoing warranty shall not apply to defects resulting from:

1. Improper or inadequate maintenance by the Buyer;
2. Buyer-supplied software or interfacing;
3. Unauthorized modification or misuse;
4. Operation outside the environmental specifications of the product;
5. Improper site preparation and maintenance.

Exclusive Remedies:

The remedies provided herein are the Buyer's sole and exclusive remedies. In no event shall Timewave be liable for direct, indirect, special, incidental or consequential damages (including loss of profits) whether based on contract, tort, or any other legal theory.

Appendix D
Electromagnetic Interference

To maintain the integrity of the EMI prevention measures in this unit, it is important to replace all hardware if the unit is reassembled after opening the housing.

This unit has been tested to verify compliance with EMI requirements of FCC rules part 15. The following notice is required by the FCC.

NOTE:
This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician.

Appendix E
Schematic Diagrams

The schematic diagrams in this manual may differ slightly from any particular DSP-8100c. Timewave reserves the right to make changes in the DSP-8100c at any time.