DSP-59Y

Audio Noise Reduction Filter

Operating Manual

November 7, 1996

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.

Serial Number

You will need your serial number when communicating with Timewave Technology, Inc. The number is on the bottom of the DSP-59Y. 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-59Y Serial Number: _____

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This manual may contain errors, omissions or "typos." Please send your comments, suggestions and corrections:

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Quick Check

Turn to *Section 1—Installation* for detailed information on how to install your DSP-59Y within a Yaesu SP-5/6 external loudspeaker.

Section 2—DSP-59Y Introduction covers basic information that you will need to know for operation of your DSP-59Y.

Sections 3-6 provide detailed operation specific to each operating mode.

What is packed with your DSP-59Y

- DSP-59Y
- Operator Manual (what you are now reading)
- Operation Reference Card
- Warranty Registration Card
- 5.5 x 2.1 mm power connector
- One 4-40 machine screw
- One cable assembly with connector on each end.

What is not packed with your DSP-59Y that you will need

- A Yaesu® SP-5 or a Yaesu SP-6 external loudspeaker. The Timewave DSP-59Y is designed to be installed within one of these two external loudspeakers. It is not designed to be used as a stand alone unit. If you do not have one of these external loudspeakers, you will need to purchase one.
- 12-16 Volt dc power supply capable of providing a minimum of 1 ampere. Most commercial power supplies produce 13.8 Vdc and are rated as 12 Vdc. Please see page 1-2 for more information.
- Two-conductor cable to connect between power supply and DSP-59Y
- Cables to connect DSP-59Y with your transceiver speaker output, PTT input, and optional multimode controller. All of these cables will need a RCA type connector on the end that attaches to the DSP-59Y. The other connector will vary with the equipment on the other end. Consult your owner's manuals.
- In some data modes you will need a cable from the 8-pin DIN connector of the DSP-59Y to your transceiver. You may also need a 9-pin serial cable to connect to your computer to connect to the DSP-59Y.

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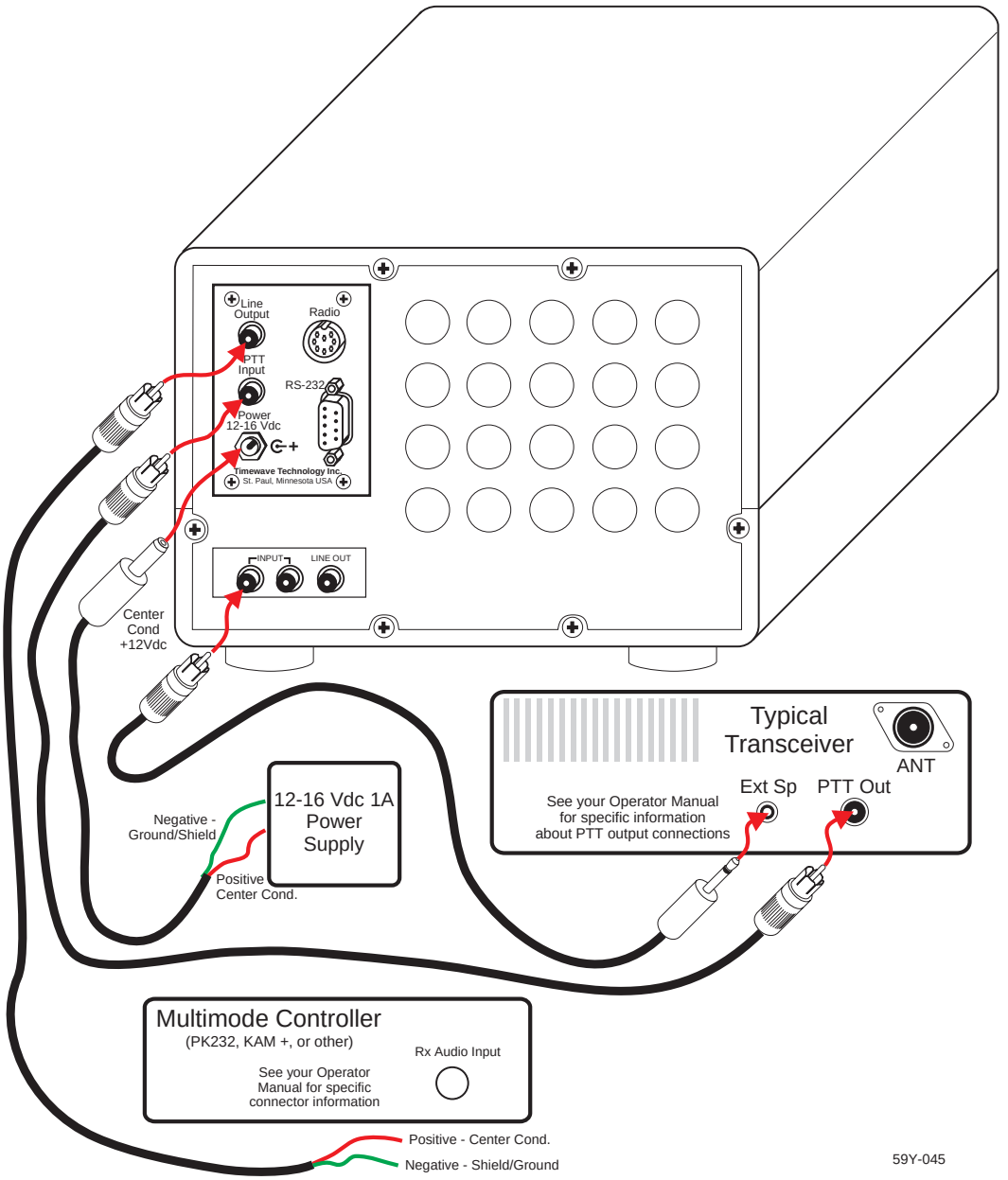
1
Installation

To install a DSP-59Y, the operator must have a Yaesu SP-5/6 external speaker and provide a power source for the DSP-59Y. The operator will need to install the DSP-59Y within the Yaesu SP-5/6 external speaker. Complete instructions are included within this section. The operator will also have to make input and output connections to the Yaesu SP-5/6 and DSP-59Y. A typical connection is shown below.



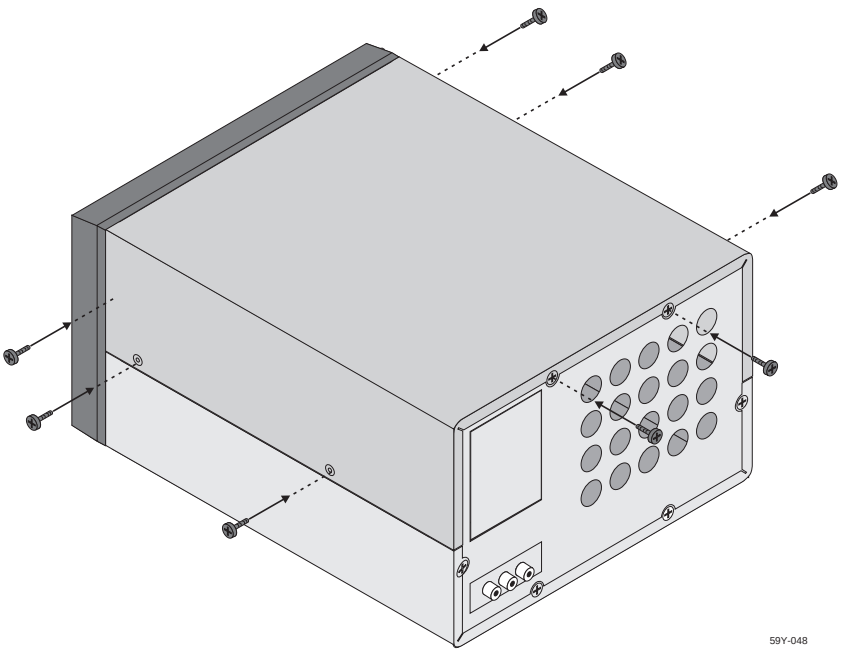
Installation in Yaesu SP - 5/6 Extension Speaker

Tools You will Need:

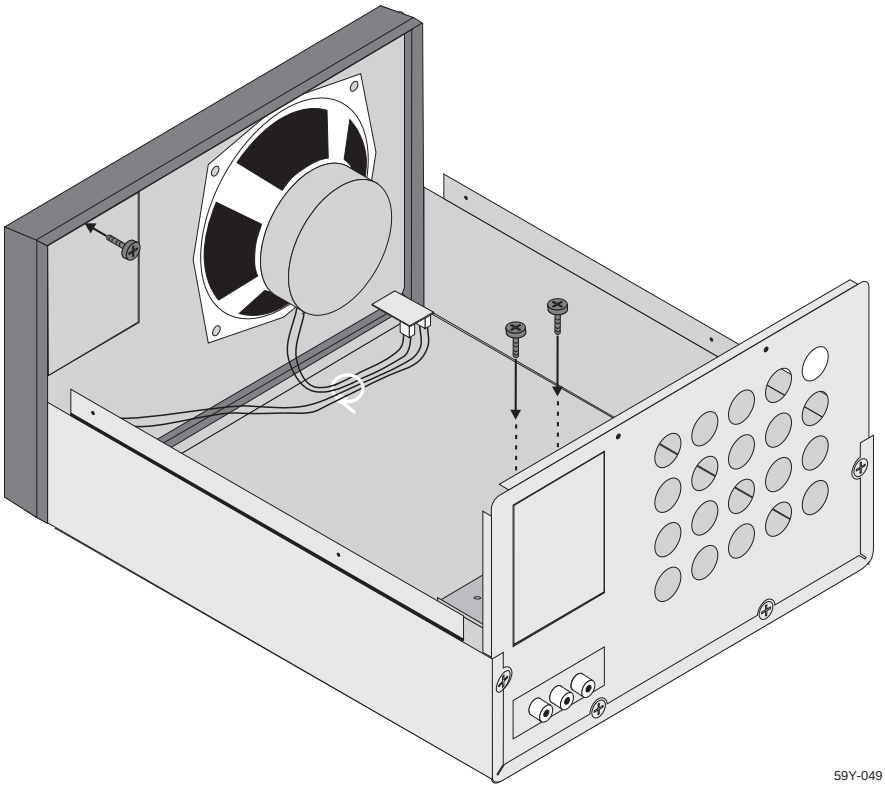
- #1 Phillips Screwdriver
- Small flat blade screwdriver
- Small wire cutter
- Clear workspace

Yaesu SP-5/6 External Speaker Preparation

- With a Phillips screwdriver, remove the eight screws holding the top cover of the Yaesu SP-5/6. Slide the cover back and remove it.



- Locate the screw on inside of the top panel, just behind the Frequency Response plate. Remove the screw and push the plate out from behind. Insert screw back into plate for storage. This plate is not used when the Timewave DSP-59Y is installed, but you may wish to keep the plate for referencing the Frequency Response Chart.

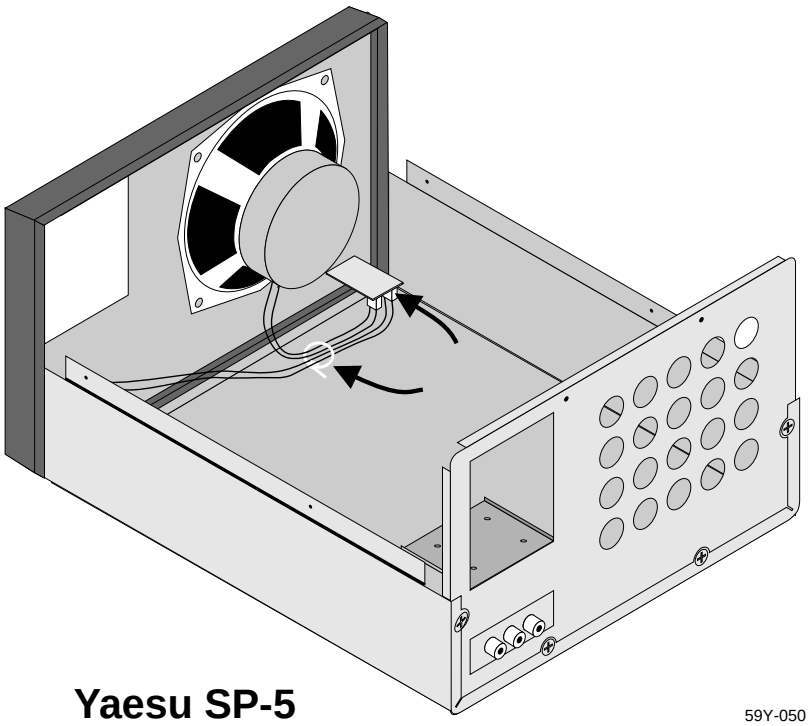


- On the rear panel, directly behind the Frequency Response plate, locate the sheet metal cover over the rectangular cut-out. Remove its screws, and remove this cover. Set the screws aside. One will be needed later to attach the DSP-59Y.

- Locate the speaker and the wires running from it. Carefully cut a cable tie that is around the speaker wire and two other wires. Take care not to nick or cut the insulation on the wires.

DSP-59Y Installation

- The following step differs for the SP-5 and SP-6.



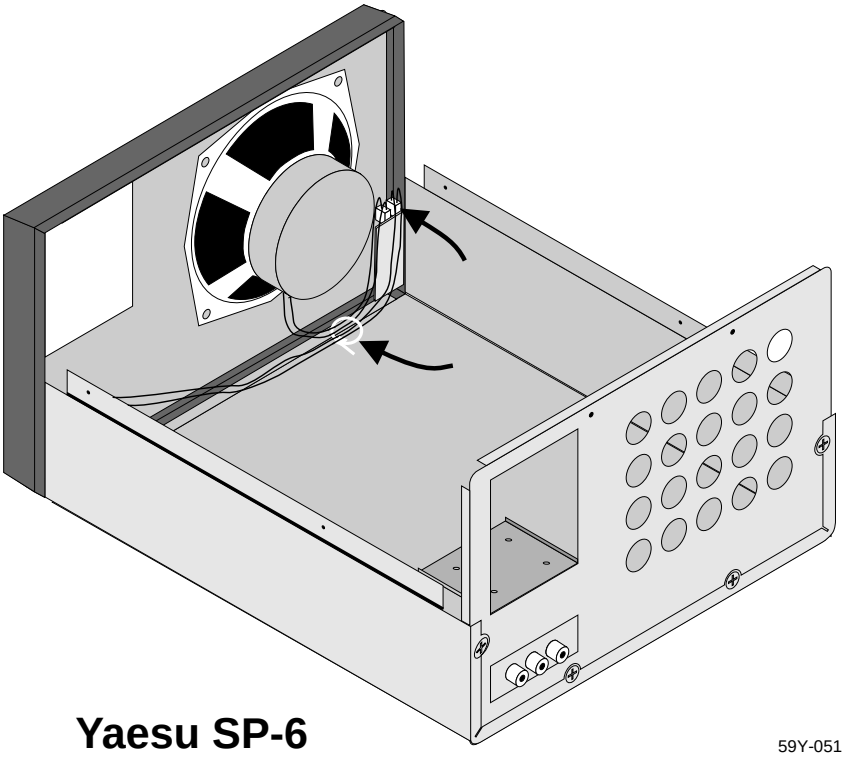
Yaesu SP-5

59Y-050

- **Yaesu SP-5 Procedure:** Remove the four screws that attach the front panel of the unit to the base. Two of the screws are on the bottom of case an one screw is on each side. Carefully tip the front down and lay face down.

  Locate the small PC board sticking straight up next to the speaker with the speaker wires connected to it. Locate the plug with the two wires that are **not** connected to the speaker from the PC board. Slide a small flat blade screwdriver along the side of the plug that has a small notch in the top of it, to release the lock. Pull upward on the plug and remove. Plug in the provided cable in its place.

  Tip the front panel back up into place and reattach with the four screws.



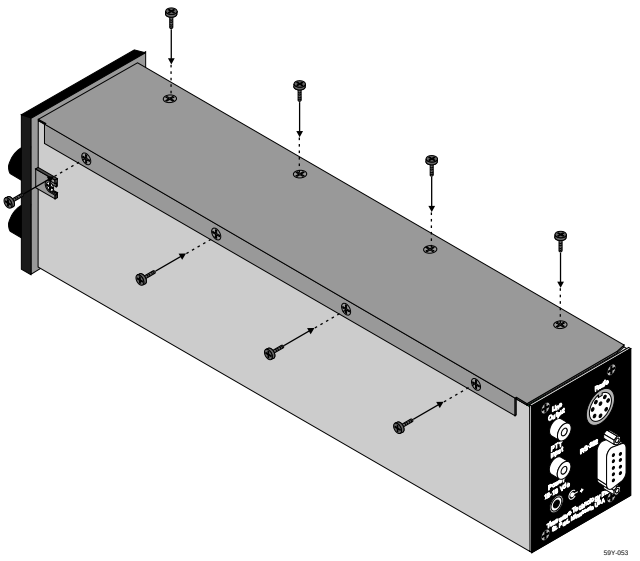
Yaesu SP-6

59Y-051

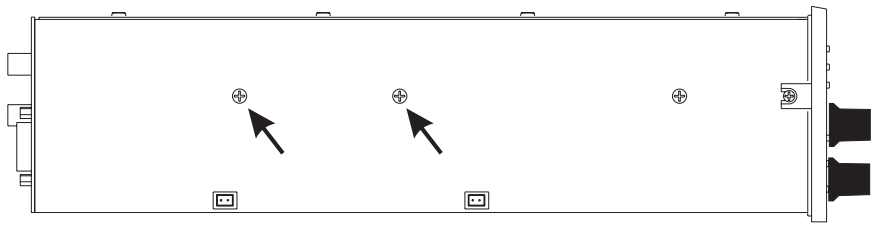
- **Yaesu SP-6 Procedure:** Locate the small PC board next to the speaker with the speaker wires connected to it. Locate the plug with the two wires that are **not** connected to the speaker from the PC board. Slide a small flat blade screwdriver along the side of the plug that has a small notch in the top of it, to release the lock. Pull upward on the plug and remove. Plug in the provided cable in its place

DSP-59Y Preparation

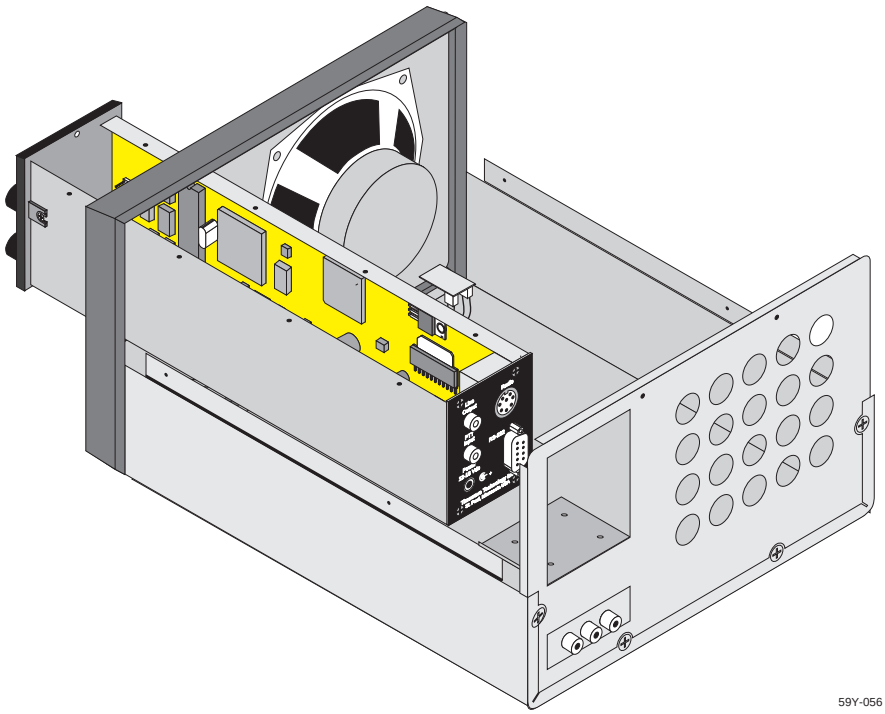
- Remove the DSP-59Y from its packaging. Remove the eight screws that hold the top cover on the DSP-59Y. Set screws and cover aside.



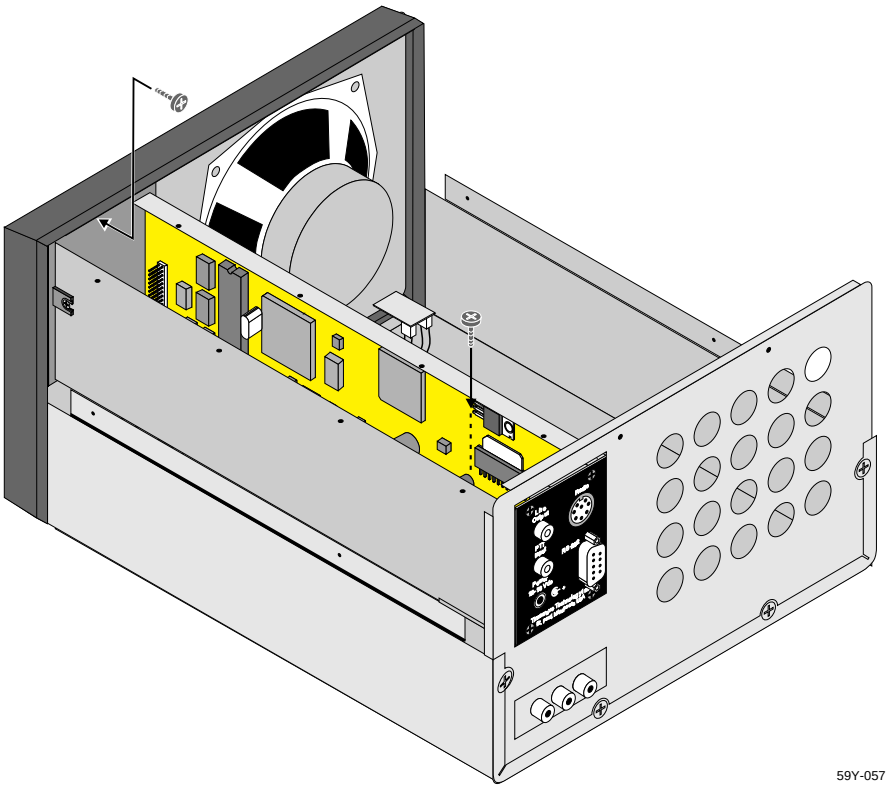
- Locate the three screws on the same side of the DSP-59Y as the two connectors. Loosen the two screws closest to the rear of the unit about one sixteenth of an inch.



- Tip the DSP-59Y up and slide the unit into the front of the Yaesu SP-5/6. Lower the front of DSP-59Y and slide the unit in. Press on the two screws that you loosened and slide DSP-59Y the rest of the way in. Do not force the unit. The most likely place the unit will stick is the two connectors on the side of the unit.

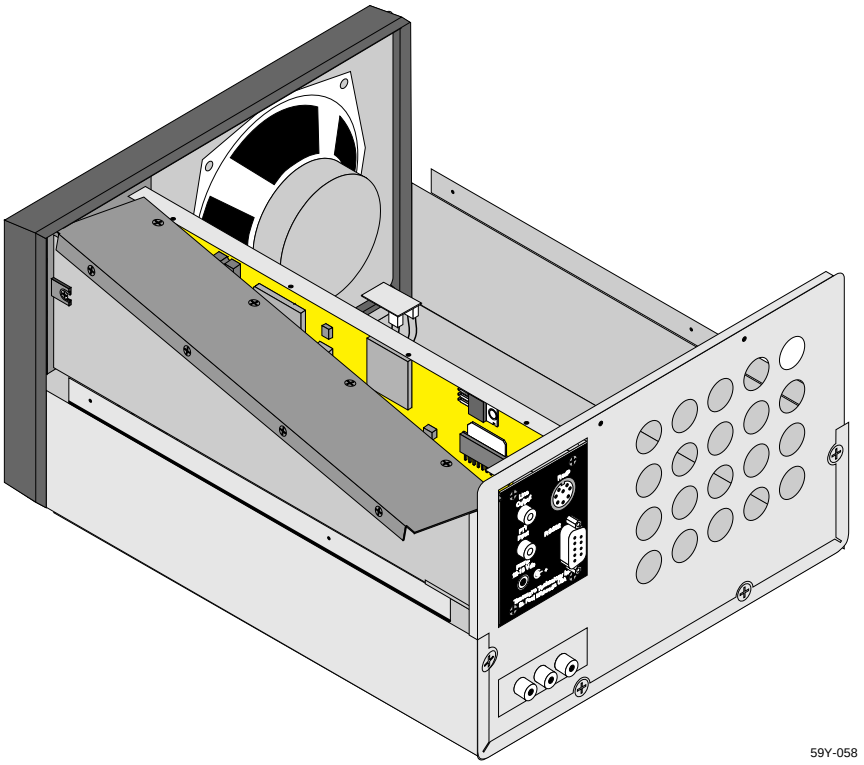


- Install provided 4-40x1/4 machine screw from inside top front of the DSP-59Y to lock front panel of unit in place. Tighten snugly - do not over tighten. **Do not use the screw that you remove previously.** It has metric tread.

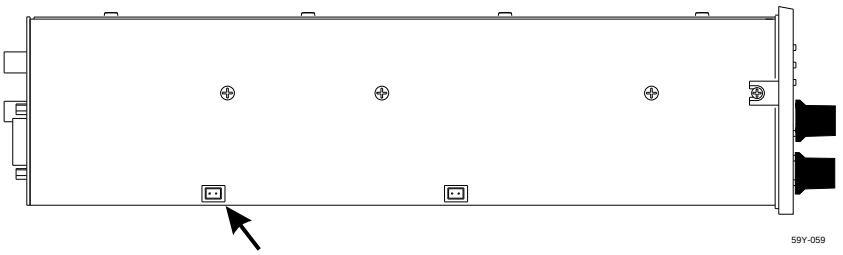


- Locate one of the two screws that held in the rear cover plate in place. Locate two oval holes in the bottom near the rear of DSP-59Y. Align holes with threaded holes in the chassis. Insert the screw into the hole closest to the front of the DSP-59Y and tighten snugly.
- Tighten the two screws that you previously loosened.

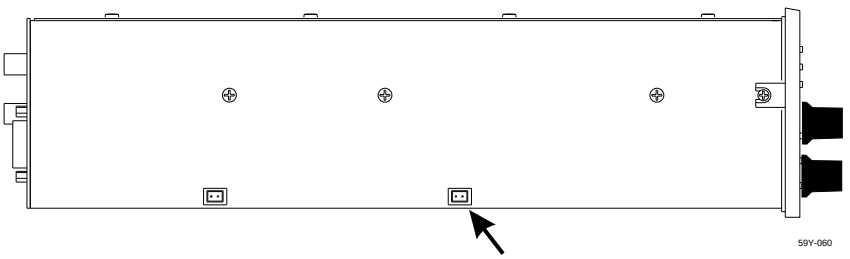
- Replace the top cover on the DSP-59Y. Slide the front portion of the cover on first slide on first and push it forward. The rear portion of the cover should then slide into place. Insert the eight screws and tighten snugly.



- Plug the jumper cable that you attached to the rear jack located on the side of the DSP-59Y. **The jacks are keyed so the jumper cable will only fit one way. Do not force the connector.**



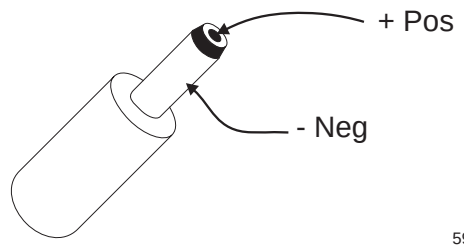
- Plug in the connector that you disconnected from the PC board into the keyed front jack on the side of the DSP-59Y.



- Slide the top cover back onto the Yaesu speaker cabinet. Insert the two long screws in the front edge of the cover. Insert the remaining six screws along the edge of the cover.

Power Supply

The DSP-59Y requires a power source of 12 to 16 Volts dc at 1.0 Ampere. The center pin of the power connector is POSITIVE (+). The DSP-59Y chassis is negative. The correct power plug size is 5.5 mm outside diameter and 2.1 mm inside diameter.



Acceptable power sources include:

- A 12 volt dc 1 amp unregulated wall mount or desktop power supply.
- A separate regulated 13.8 volt dc power supply with a minimum of 1.0 amp output.
- 13.8 volt dc transceiver power supply **Note that some transceivers with internal power supplies have accessory power jacks with insufficient current output to drive the DSP-59Y. Do not use these internal supplies!**

Users of some rigs (Kenwood and Ten-Tec) experience ground loop problems when using a common power supply for their rig and the DSP-59Y. We recommend that a separate power supply be used for the DSP-59Y.

Switching power supplies are generally noisy and **not** recommended, unless they are specifically designed to drive amateur radio equipment.

Connecting Cables

Use shielded coaxial cables with RCA phono connectors to minimize the possibility of RF interference. Timewave recommends coaxial video cables with metal adapters to match the connectors on transceivers and speakers.

Do not connect the center pin on the Yaesu SP-5/6 audio input connector to the transceiver speaker ground. Check the connections carefully - this is one of the most common problems in DSP-59Y installations!

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-59Y Inputs and Outputs

The DSP-59Y uses two RCA phono jacks on the back of the filter for PTT switch, and line output. Use cables with RCA phono plugs on one end to connect to the DSP-59Y. The connectors on the other end of the cables are determined by the other devices.

The DSP-59Y also has a DIN connector for additional connectivity. This connector replicates the RCA jacks for PTT and line output. It also provides an additional signal input connection. You will need to select this input source as part of Setup if you desire to use the DIN signal input.

Transceiver Speaker Output

A 1/8" mono phone jack is usually available on most receivers and transceivers for the speaker output. You most likely will use a cable with a 1/8" mono phone plug on one end. The other connector is a RCA phono plug to connect to either channel A or B of the Yaesu SP-5/6. Some transceivers have other speaker output connectors such as 1/4" phono or RCA phono jacks.

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.

Figure 1 shows a RCA phono plug and Figure 2 shows a 1/8" mono plug.

The list of pre-made cables are from Radio Shack.

- Part #42-2444 - 1/8" phone plug to RCA phono plug (Transceiver speaker output to Yaesu SP-5/6 audio input). This cable is furnished with new Yaesu SP-5/6 speakers.
- Part #42-2370 - phono plug to split bare tinned (DSP-59Y PTT input from a transceiver PTT output connector).
- Part #42-2366 is a RCA phono plug to RCA phono plug.

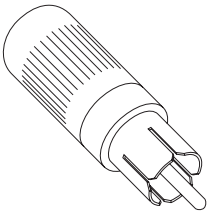


Figure 1 - RCA phono plug

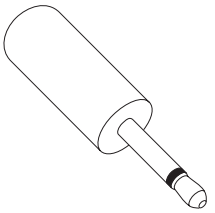


Figure 2 - 1/8” mono plug

For more information see your ***ARRL Handbook*** on connectors.

Audio Input

There are three audio input sources for the DSP-59Y.

- RCA phono jack labeled Channel A on the Yaesu SP-5/6.
- RCA phono jack labeled Channel B on the Yaesu SP-5/6.
- DIN jack labeled Radio on the DSP-59Y.

The first two are selectable with the input selector button on the front of the Yaesu SP-5/6.

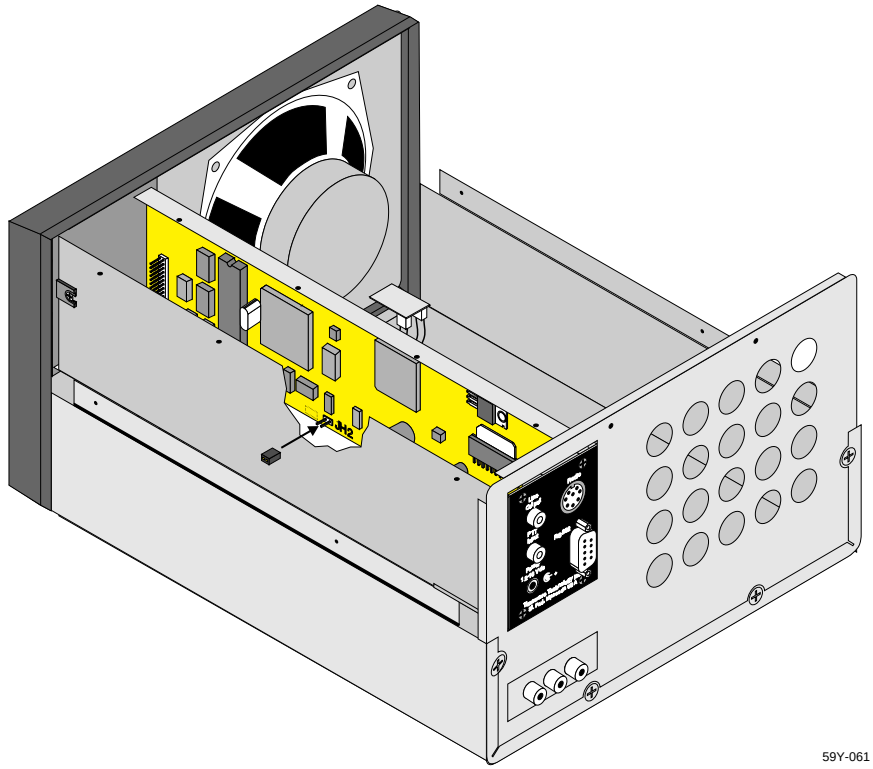
Input Impedance Setup

The factory default input impedance of the DSP-59Y is approximately 22 ohms. This impedance is appropriate for most radios when driven by the speaker output of the radio. The alternate input impedance of the DSP-59Y is 20k ohms. This impedance is appropriate for most radios when driven by the auxiliary output of the radio and for other higher impedance sources.

The reason for the two choices of impedance is that some radio output stages oscillate if they are not loaded with a proper impedance load. Other radio output stages are stable with high or low impedance loads. When using a radio, start with the radio loudspeaker output connected to the DSP-59Y with the default factory impedance. This should work for all radios. If you are using a high impedance source, you can configure the DSP-59Y for a high or low input impedance by moving a shorting jumper.

The input impedance for the DIN signal input is fixed at 20K ohms.

Input Impedance Jumper Access



1. Remove the eight screws holding the cover of the Yaesu SP-5/6 extension loudspeaker in place. Lift cover off the unit.
2. Remove the eight screws holding the top cover of the Timewave DSP-59Y in place.
3. Slide cover off the DSP-59Y.
4. Observing static precautions carefully turn the unit so you can easily see the circuit board assembly. Locate jumper JH2 near the bottom center of the main circuit board.
5. Change the location of the jumper. Putting the jumper on only one of the pins sets the input to high impedance. Putting the jumper on both pins sets the input to low impedance.

High Impedance (Open)

Low Impedance (Shorted - Factory Default)

59Y-062

6. Reassemble the DSP-59Y by reversing the previous steps.

Audio Input Signal Level Setup

Matching the output level of the radio to the input level of the DSP-59Y is necessary to take maximum advantage of the wide dynamic range of the DSP-59Y. The Setup mode of the DSP-59Y allows adjustment of input sensitivity of both inputs. Turn to page 1-16 for the Setup procedure. The speaker input sensitivity is factory set to match the speaker output levels typical of most amateur transceivers. Use Setup to set the input sensitivity if the source is different from a loudspeaker output. If you are using a loudspeaker 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-59Y. After connecting the DSP-59Y 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-59Y 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-59Y. Use only the **Gain** control on the DSP-59Y to control the listening volume.

Audio Output

The DSP-59Y provides you with a choice of four audio outputs:

- Headphone jack on the front of the Yaesu SP-5/6.
- Speaker in the Yaesu SP-5/6
- RCA Line Output on back of DSP-59Y
- DIN Line Output on back of DSP-59Y.

Headphone Jack

On the lower left corner of the Yaesu SP 5/6 front panel is a 1/4” (6.3 mm) jack connected for stereo headphones. **Timewave recommends stereo headphones**. Mono headphones will also work.

Speaker Output

The speaker output of the DSP-59Y provide adequate output to drive the built in 8 ohm speaker in the Yaesu SP-5/6. The front panel gain control adjusts the audio level to the speaker. The maximum output power to the speaker is approximately 3 watts into an 8 ohm speaker.

Line Outputs

The Line Output RCA phono jack on the rear panel of the DSP-59Y provides adequate output power to drive 600 ohm or greater loads. The front panel gain control does not adjust the audio level from this output. The output level is relative to the respective audio input level to the DSP-59Y. The signal output is duplicated through the DIN jack.

PTT Input

Proper connection of the DSP-59Y to the rigs Push to Talk circuit allows full functional operation of the DSP-59Y. While in voice mode, the PTT circuit in the rig mutes the audio output of the DSP-59Y so audio feedback is not possible. Many rigs do not fully mute their audio while transmitting. When the DSP-59Y amplifies the partially muted audio the result can be audio feedback through the speaker.

When operating in CW mode, the PTT circuit does not mute the speaker output. This allows you to hear your internally generated sidetone from your radio. If you do not use the PTT circuit, the narrow CW filter within the DSP-59Y may not allow you to hear your sidetone.

You can program the Push-To-Talk (PTT) Inputs to electronically bypass or mute the DSP-59Y in Data mode. Some operators like the output muted in data mode and some prefer to pass the output through. Within Setup - Data Mode setup, you can choose to have the output muted or not. Turn to page 6-11 for the Setup - Data procedure. The factory default setting is mute for data.

Relay 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-59Y circuit and chassis ground.

Many rigs have a separate jack on the back of the rig for PTT. On **Kenwood** rigs, the connection is made through pin 3 on the DIN jack. See your owners manual for complete connection information.

Maximum voltage on PTT line is 25VDC. Some older linear amplifiers have 115 volt supplies for their transmit-receive relays. **If a transceiver PTT line is used to key (short to ground) both the DSP-59Y and a older linear amplifier, an isolation relay must be used to prevent damage to the DSP-59Y (and any other solid state equipment connected to the PTT line).** A detailed circuit diagram is available from Timewave either by mail or on http://www.timewave.com.

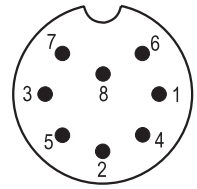
RTTY Modem Input/Output

To use the internal RTTY modem and all of its features you will need to enable the modem feature within setup. You will also need to use the DIN connector and the RS-232 port. The DIN connector provides access to all the signals needed to connect to your transceiver. The RS-232 connector provides a serial connection to your computer.

Radio DIN Jack

The 8 pin circular DIN connector (labeled Radio) on the back panel of the DSP-59Y is the only source for PTT, Key, and FSK output. It also has redundant line output, audio, and PTT input. It also has connections that are reserved for future options.

This connector provides an alternate single jack connection of the DSP-59Y to radio interface. When using the internal RTTY modem, you will need to use this connector. The plug is available from Radio Shack (Part #274-026) or other sources.



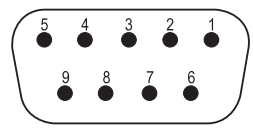
8 Pin DIN Plug
Connection View

Pin	Signal
1	Line Out
2	Signal Ground
3	PTT Out
4	Key Out
5	FSK Out
6	DIN Audio In
7	PTT In
8	Reserved

599-021

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-59Y 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.

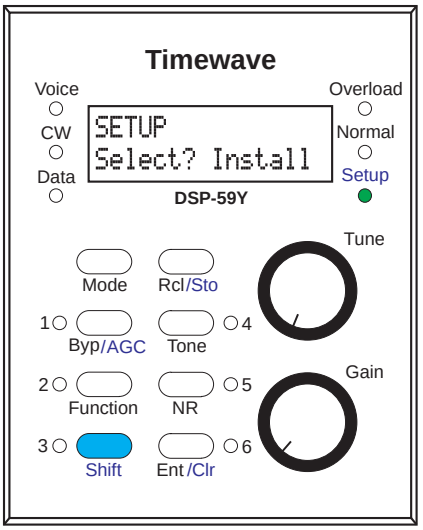


RS-232 Plug
Connection View

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

599-020

Setup - Install



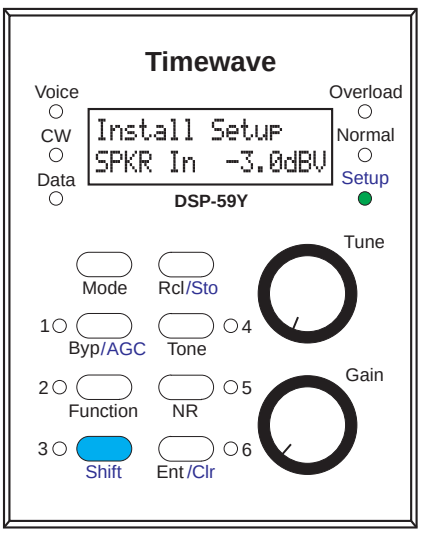
59Y-014

There are four 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-59Y works and that you really have to make the changes.** Err on the side of caution when you make changes.

1. Press **[Shift+Mode]** to enter Setup mode.
2. Rotate **Tune** knob until `Install` appears on the bottom line of the display
3. Press the **[Ent/Clr]** key to accept choice.

Audio Input Signal Sensitivity Setup



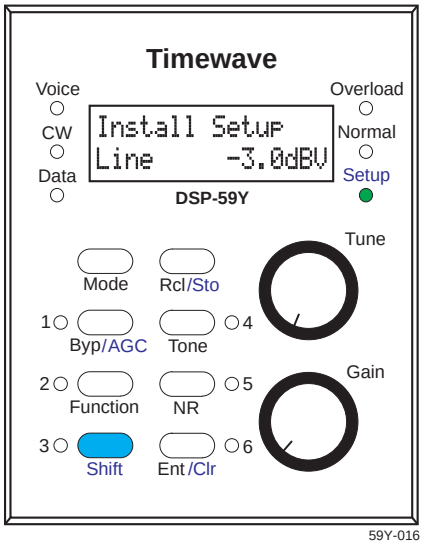
59Y-015

You can separately adjust the Input signal sensitivity level of the Yaesu speaker channeled inputs and the DIN connector input. Normally, adjustment of the Yaesu speaker channeled input sensitivity should not be necessary if you are connected to the speaker output of your receiver. This might be necessary if you are connecting a high impedance device such as a tape recorder to the DSP-59Y. These usually do not have volume control. The range of adjustment is from +6.0 dBV to -16.5 dBV in 1.5 dB steps. The factory default is -3 dBV.

1. Press **[Shift+Mode]** to enter Setup mode.
2. Rotate **Tune** knob until `Install` appears on the bottom line of the display
3. Press the **[Ent/Clr]** key to select.
4. Rotate **Tune** knob until `SPKR In` appears on the bottom left of the display
5. Press the **[Ent/Clr]** key to select.
6. Rotate **Tune** knob until the chosen value appears on the bottom right of the display
7. Press the **[Ent/Clr]** key to accept choice and save.
   Press **[Shift+Ent/Clr]** to escape without saving changes.
8. To change DIN Input sensitivity, repeat the above steps selecting `DIN In` instead.

9. Rotate **Tune** knob until your next function to change appears on the bottom line of the display or press the **[Shift+Ent/Clr]** to return to main setup menu.

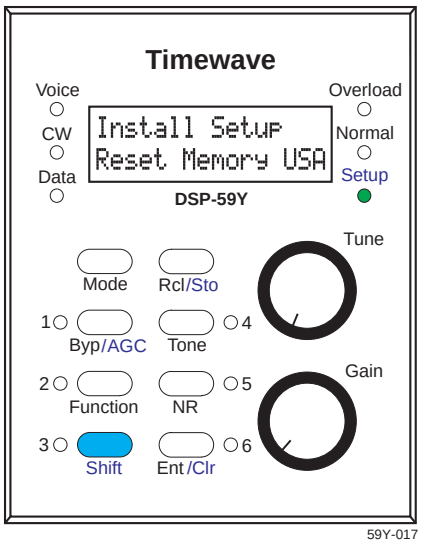
Line Out Signal Level Setup



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 -3.0 dBV to -24.0 dBV in 1.5 dB steps. The factory default is -3.0 dBV.

1. Press **[Shift+Mode]** to enter Setup mode.
2. Rotate **Tune** knob until `Install` appears on the bottom line of the display
3. Press the **[Ent/Clr]** key to select.
4. Rotate **Tune** knob until `Line` appears on the bottom left of the display
5. Press the **[Ent/Clr]** to select.
6. Rotate **Tune** knob until the chosen value appears on the bottom right of the display
7. Press the **[Ent/Clr]** key to accept choice and save.
   Press **[Shift+Ent/Clr]** to escape without saving changes.
8. Rotate **Tune** knob until your next function to change appears on the bottom line of the display or press the **[Shift+Ent/Clr]** key 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. and sets RTTY frequency tones to 2210 Hz. Selecting European sets AM Line Noise to 50 Hz. and sets RTTY frequency tones to 1360 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]** to enter Setup mode.
2. Rotate **Tune** knob until `Install` appears on the bottom line of the display
3. Press the **[Ent/Clr]** to select.

4. Rotate **Tune** knob until `Reset Memory` appears on the bottom left of the display
5. Press the **[Ent/Clr]** to select.
6. Rotate **Tune** knob until the chosen value appears on the bottom right of the display. Your choices are USA or EUR.
7. Press the **[Ent/Clr]** to accept choice and save. Press **[Shift+Ent/Clr]** to escape without saving changes.
8. Rotate **Tune** knob until your next function to change appears on the bottom line of the display or press the **[Shift+Ent/Clr]** to return to main setup menu.

Exit Setup

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

2
DSP-59Y 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-59Y. Please see *Appendix A—Specifications* for detailed information on the capabilities of the DSP-59Y.

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 amateur 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-59Y Overview

The DSP-59Y is an extraordinarily versatile digital signal processor designed for amateur and shortwave radio voice, data, and CW operation. The DSP-59Y 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 for RTTY demodulation

The DSP-59Y combines these five basic functions to reduce noise and interference and improve radio communication. **The DSP-59Y 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-59Y. The LCD alpha-

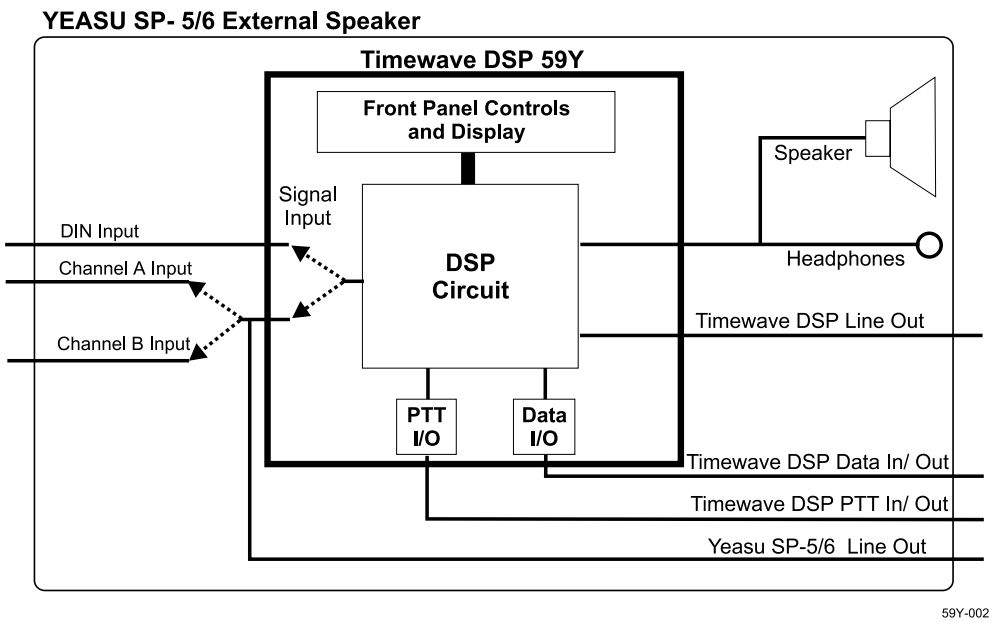
numeric display provides a clear view of operating settings when switching between operating modes. The quick-select push buttons and optical encoders for filter tuning allow instant mode change with total recall of last setting and memories. Front-panel selectable and adjustable inputs allow you to quickly setup and adjust your DSP-59Y to wipe out noise and QRM like never before!

Here are a few more highlights among the many other operating features of the DSP-59Y:

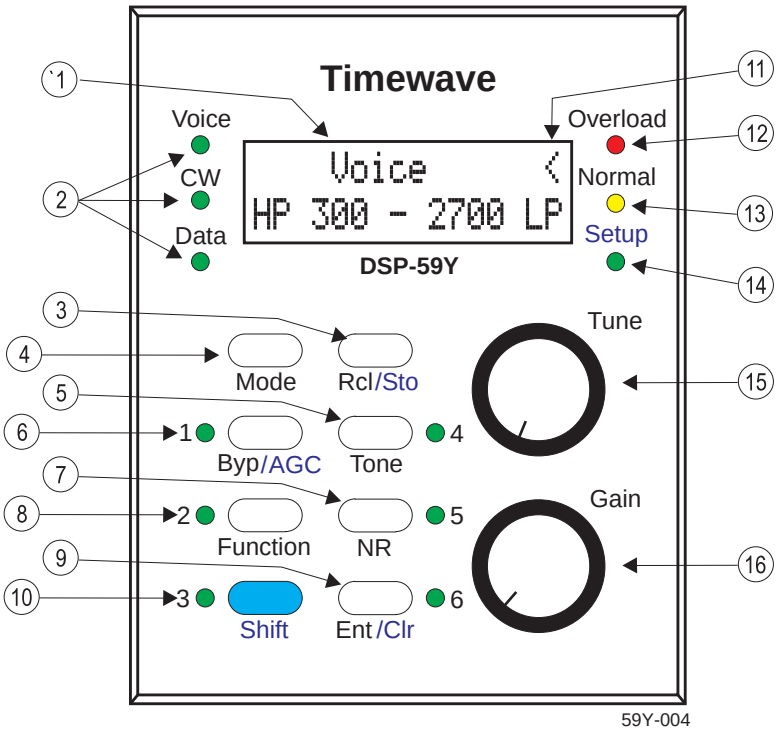
- Selectable Automatic Gain Control
- Configurable bypass control
- Three selectable input channels
- Six memories for instant recall of user-defined configurations

Signal Flow

The DSP-59Y 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. This figure is a greatly simplified block diagram of the DSP-59Y.



Front Panel Controls



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

2. Voice, CW, Data, and LEDs.
Indicate the selected operating mode of the DSP-59Y.

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

4. Mode Button
Press **[Mode]** to change mode (Voice, CW, Data). Press **[Shift+Mode]** to switch to Setup and mode.

5. Tone Button
Press **[Tone]** for Heterodyne elimination for Voice, Marker Tone for CW and Data. Press **[Shift+Tone]** to activate manually tuned notch filter in voice and CW operating modes.

6. Byp/AGC Button
Press **[Byp/AGC]** to Bypass DSP filtering. Press **[Shift+Byp/AGC]** to activate Automatic Gain Control.

7. NR Button
Press **[NR]** to toggle on random noise reduction. Press **[Shift+NR]** to adjust aggressiveness of the noise reduction in voice and CW operating modes.

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

9. Ent/Clr Button
Press **[Ent/Clr]** to accept menu choices. Press **[Shift+Ent/Clr]** to discard or escape the selected choice.

10. Shift Button
This blue button shifts the function of the next switch pressed to its function labeled in blue.

11. Tune Control Indicator
The arrow in the top right corner of the display will have an arrow in if this knob controls more than one function. Arrow will indicate which function is controllable.

12. Overload/PTT LED
Red LED indicates a too high signal level into DSP-59Y from receiver. When PTT line from transceiver is connected, red LED on indicates PTT is activated.

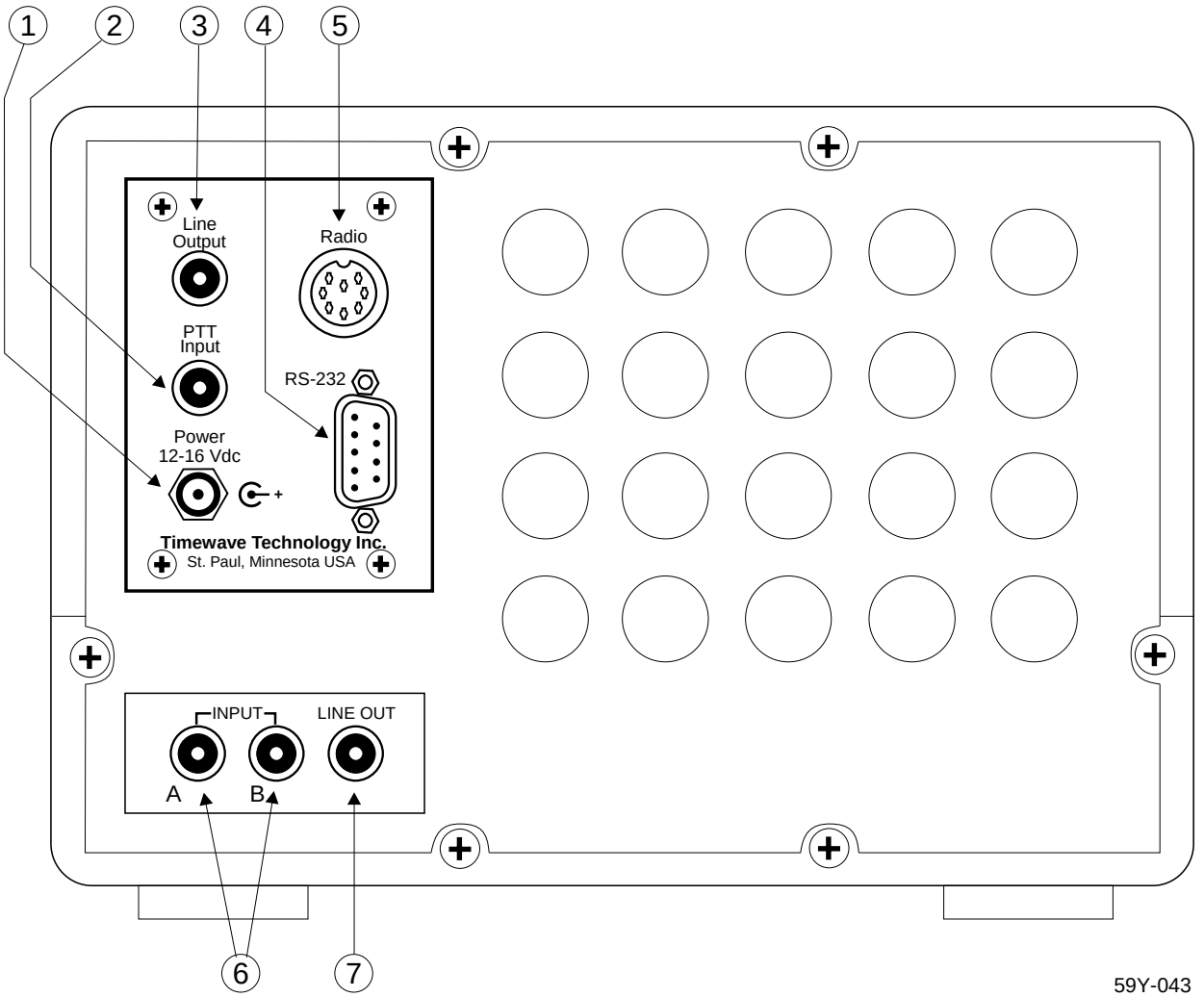
13. Normal LED
Yellow LED indicates normal signal level into DSP-59Y.

14. Setup Mode LED
When illuminated, indicates that the DSP-59Y is in Setup Mode.

15. Tune Knob
The function of this knob changes with the mode of operation. Functions within an operating mode are toggled by pressing the knob.

16. Gain/Power On/Off
Turns power on and off, and volume control for speaker output.

Back Panel Connectors



1. Power In

12-16 Volts DC Use 5.5 mm/2.1 mm matching plug, center positive.

2. PTT Input

PTT line from transceiver PTT output. RCA Phono connector.

3. DSP Line Output

Line level output from DSP to multimode data controller. RCA Phono connector.

4. RS-232

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

5. Radio

Alternative single 8 pin DIN connection for line out, audio in, PTT out, PTT in, aux. digital in. Also contains connections reserved for future options. Refer to Chapter 1 for pin configuration.

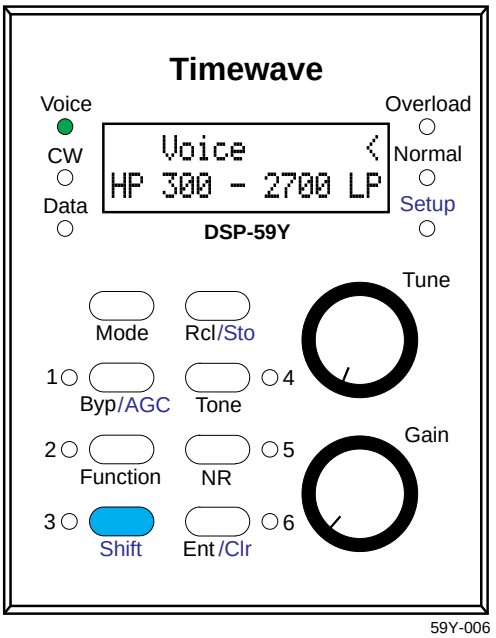
6. Inputs A & B

Normally configured for speaker level input. Passes signal through Yaesu front panel controlled analog low cut and high cut filters and channel selection switch.

7. Yaesu Line Output

Speaker level output that has passed trough the Yaesu front panel controlled cutoff filter and has not passed through the Timewave DSP-59Y.

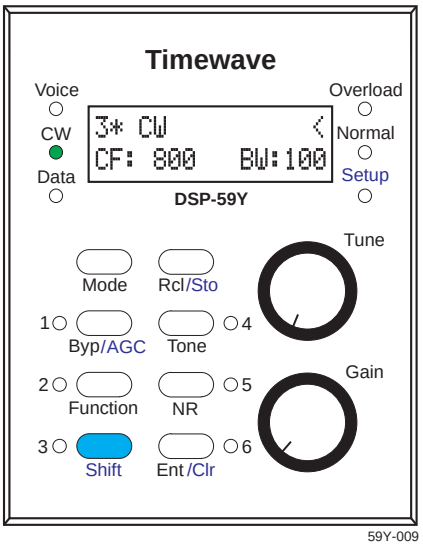
Features Common to All Modes



Random Noise Reduction

The noise reduction functions of the DSP-59Y 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-59Y 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.

Visible Memories



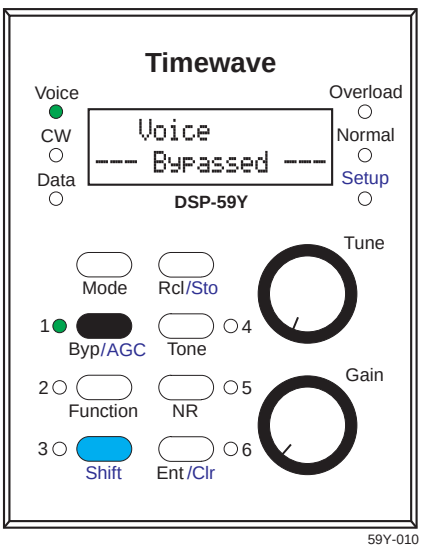
The DSP-59Y has six memories to store complete settings and configurations. Pressing **[Shift+Rcl/Sto+{#}]** (# = 1 - 6) stores every setting and setup configuration except the audio gain control position. Pressing **[Rcl/Sto+{#}]** instantly recalls the complete configuration stored in the chosen memory. The memory number is displayed along with the critical information on the LCD and LEDs.

The * following the recalled memory number indicates minor changes have been made to the operating parameters since the memory recall.

Automatic Gain Control

The DSP-59Y 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-59Y has bypass features that vary with the mode of operation. In voice and CW modes, the bypass setting routes the signal through relay contacts to completely bypass the electronic circuitry of the DSP-59Y. Turning the power off to DSP-59Y 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.

Operating Modes

The DSP-59Y has three normal operating modes that operators will most often use:

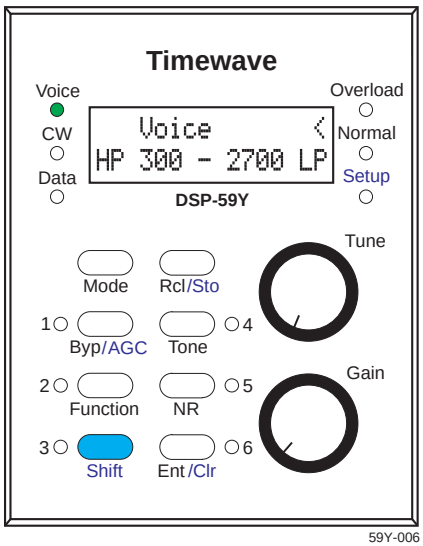
- **Voice**
- **CW**
- **Data**

Pressing **[Mode]** steps from Voice mode to CW mode to Data mode back to Voice mode in a circular manner.

There is also Setup mode that operators will normally use during initial configuration, installation, and troubleshooting,

Pressing **[Shift+Mode]** places the DSP-59Y in Setup mode. Pressing **[Mode]** at any time exits current Setup Mode without saving and places the unit back into Voice Mode again. When in a menu, pressing the **[Shift+Ent/Clr]** will back you up one level.

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.

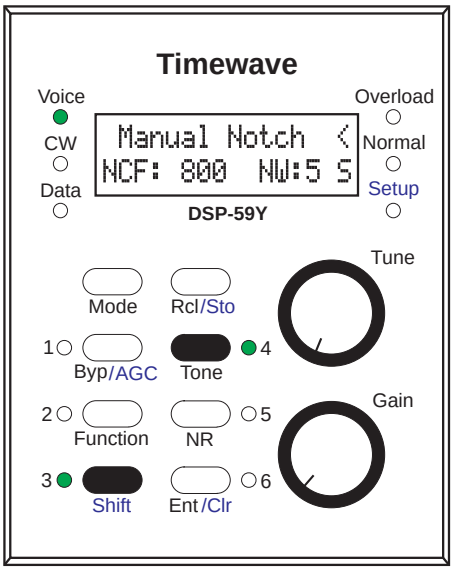
Highpass/Lowpass Filters

The DSP-59Y 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-59Y 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-59Y highpass filter adjustment range is from 100 to 1000 Hz and the lowpass range is from 1000 to 5000 Hz.

Random Noise Reduction

The DSP-59Y 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 voice operating mode without going into setup mode.



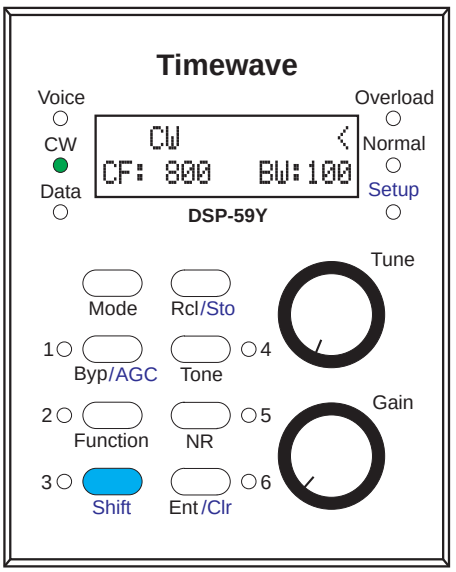
59Y-011

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

The DSP-59Y has both an automatic notch filter and a manually tuned notch filter. The automatic notch filter is an adaptive multi-tone filter that can remove multiple tones simultaneously. The automatic multi-tone filter removes multiple tones simultaneously.

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 with the **Tune** knob**.** This filter can be used either to remove a single tone or to remove RTTY data tones from voice signals.

CW Mode



59Y-007

The CW Mode digitally processes analog CW (Continuous Wave) signals for Morse code reception. Independently selectable processing techniques include noise reduction, tunable bandpass filtering, notch filtering and automatic gain control.

Bandpass Filters

The DSP-59Y has a fully tunable bandpass filter for use in the CW mode. The LCD display shows the center frequency and bandwidth of the filter as the operator tunes with front panel tune control. Narrow band signals like CW and RTTY require a bandpass filter with steep skirts and linear phase response. Linear phase response maximizes the usable signaling rate for a given bandwidth and minimizes ringing often heard on other extremely sharp crystal and audio filters. The DSP-59Y CW filter has skirts so steep that a signal literally falls off the edge of the passband as you tune through a CW signal.

Bandwidths for the bandpass filter range from 10 Hz to 600 Hz, and center frequencies range from 200 to 2095 Hz. The narrow filter bandwidths are useful for trying to dig out extremely weak signals from the noise and QRM. The narrow bandwidth is also an excellent way of tuning to a single CW signal in a crowded band condition. The wider filter bandwidth allows easy tuning and listening to multiple CW signals simultaneously.

Random Noise Reduction

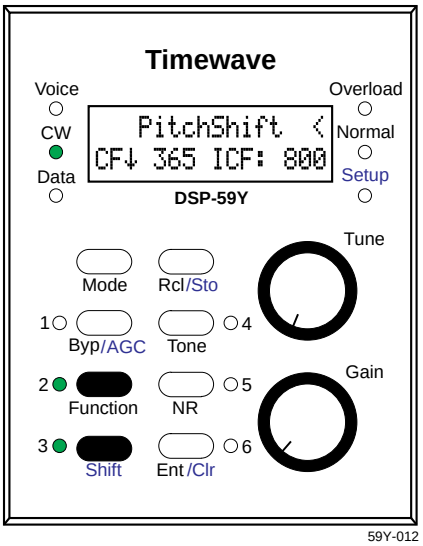
The DSP-59Y random noise reduction has proven to be useful in reducing a wide variety of noise types, including white noise, line noise and static crashes. The amount of noise reduction varies according to the characteristics of the noise. Typical noise reduction ranges from 5 dB to 20 dB. In the CW mode, random noise reduction is generally most effective in the wider CW bandwidths (400-600 Hz).

Manual Notch Filtering

The DSP-59Y has a manually tuned notch filter. The **Tune** knob on the front panel tunes the center frequency of the manual notch filter. The manual notch filter has an adjustable bandwidth allowing removal of many types of signals such as data signals, CW signals and heterodynes. Usually a narrow bandwidth filter is most effective for the greatest improvement of a CW signal, but some operating conditions (i.e., a contest) dictate a wide CW filter bandwidth. The manual notch can remove a single strong annoying signal.

Marker Tone

Pressing **[Tone]** while in the **CW** operating mode inserts an audio marker or spotting tone at the center frequency of the bandpass filter. Tuning the bandpass filter center frequency changes marker tone center frequency. Matching the marker tone frequency with the received signal allows switching in a narrow filter without losing the signal outside the passband of the narrow filter. The level of marker tone is adjustable relative to the processed receive signal.



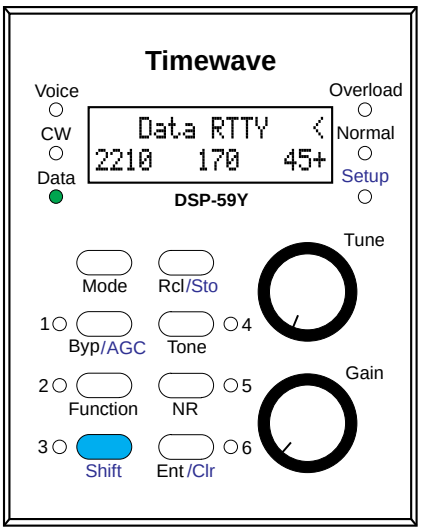
59Y-012

CW Tone Pitch Shift

A Timewave DSP unique feature found in the DSP-59Y is the ability to easily shift the CW tone pitch to another frequency. This feature works well with receivers that have non-adjustable, relatively high pitch CW tone, since most hams prefer to listen to 400 - 600 Hz CW tones.

Data Mode

The Data Mode digitally processes data signals including several versions of RTTY, AMTOR, SITOR, PacTOR, G-TOR®, CLOVER HF packet, SSTV and WeFAX. Independently selectable processing techniques include noise reduction, tunable bandpass filtering and automatic gain control, and a special RTTY modem and RTTY remodulator.



59Y-008

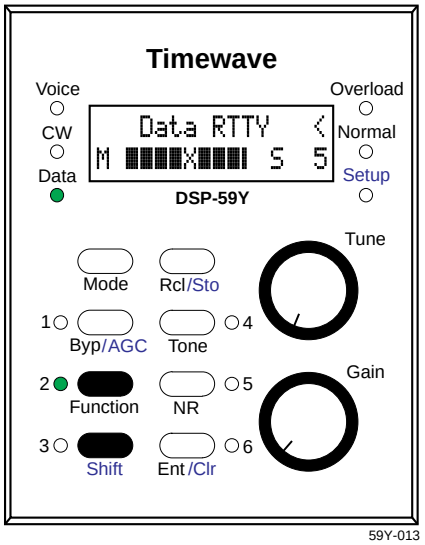
Bandpass Filters

The DSP-59Y 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-59Y also has fixed frequency matched bandpass filters centered at 2210 Hz as well as lower frequencies for European standards and 1600-1800 Hz HF packet. The selectable bandwidths of the bandpass filters provide optimum filtering for 170 Hz and 200 Hz frequency shift data signals of various baud rates. Within setup, you can select between European or American standards as your default.

The DSP-59Y has individual linear phase fixed bandpass filters with steep skirts for SSTV, WeFAX and CLOVER. 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. The SSTV filter is a dual passband filter with one passband centered on the

SSTV sync pulse at 1200 Hz, and the other passband around the varying FM picture tones from 1500-2300 Hz. WeFAX is similar to SSTV but has no separate sync pulse so the filter bandpass covers 1500-2300 Hz. The CLOVER filter has a 500 Hz bandwidth with a center frequency of 2250 Hz.



Data Tuning Function

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-59Y 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. The PTT output signal needed to put your transceiver in transmit mode is part of the DIN connector.

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-59Y 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-59Y. Timewave does not provide the terminal program. This modem is for RTTY operation only with signaling rates at 75 Baud or less.

This modem feature is designed for RTTY operation. It is not designed to be used as a TNC.

RTTY Remodulator

The DSP-59Y 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-59Y 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-59Y. The precise clean tones from the RTTY AFSK remodulator can feed any analog multimode controller or TU via the DSP-59Y 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 an audio FSK test signal into the receive channel. The "RYRY" test signal is centered at 2210 Hz with a frequency shift of +/- 85 Hz. The baud rate is 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.

Set-up Mode

The DSP-59Y 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:
  - Speaker and DIN Input Signal Sensitivity
  - 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, CW, Data).
  - **Voice**
    - Input Select
    - AM Line Noise
  - **CW**
    - Input Select
    - Tone Level

- **Data**
  - Input Select
  - Speaker Mute/Bypass
  - Data Set Definitions

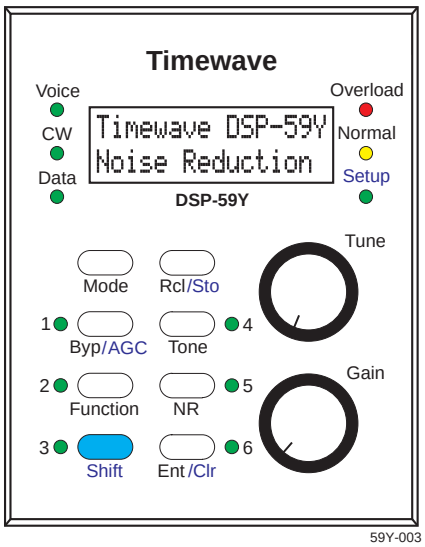
- **About Setup** You can find the serial number of the unit and the revision level of the firmware along with the copyright notice in this section.

3
Operation Basics

Introduction

The DSP-59Y provides you a well stocked toolbox 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 toolbox, you should only use the tools you need.

Front Panel Operation



Two knobs, one with a push button built in, and eight push-button keys on the front panel control the DSP-59Y. One knob controls power and sets the speaker and headphone output level of the DSP-59Y. The other knob, with the built-in push button, selects the filter frequencies of the DSP-59Y.

The operator can also use the tune knob to make a selection from a menu or change a variable. Rotate the tune knob to view the selections and press **[Ent/Clr]** to select your choice. In most situations, pressing **[Shift+Ent/Clr]** deactivates temporary settings. It is also used to escape from menus without making a selection

The push-buttons select the operating modes and features of the DSP-59Y. 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.

Controls Common to All Modes and Features

Primary Operating Modes [Mode]

Press the Mode key to switch between the main operating modes (Voice, CW, 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.

Secondary Operating Modes and Features [Shift]

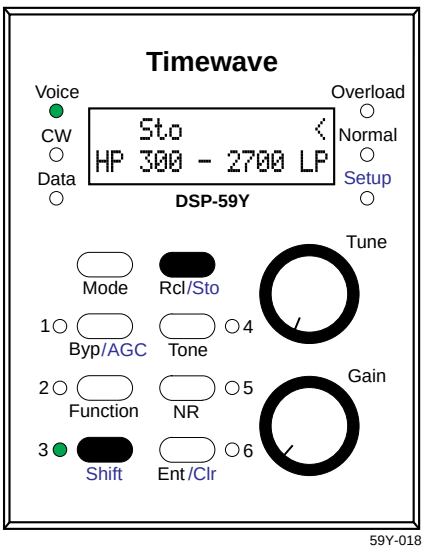
The **[Shift]** key selects modes and operating features with light blue lettering by pressing and releasing **[Shift]** before pressing the mode or feature key. The shifted modes includes Setup **[Shift+Mode].** Shifted

operating features include AGC **[Shift+Byp/AGC]**, and memory store **[Shift+Sto]**.

Many specialized mode dependent functions are controlled, for example, by pressing **[Shift+Tone], [Shift+NR],** 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]**.

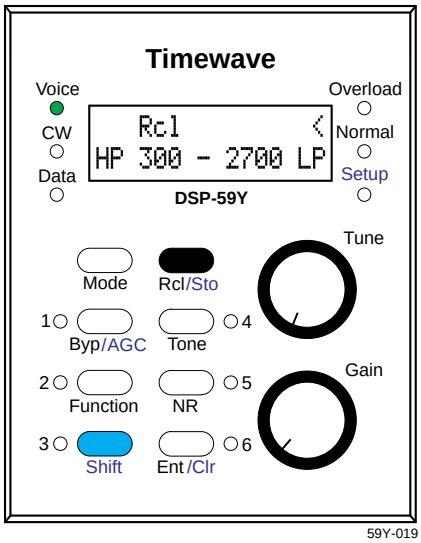
Memory Operation [Rcl/Sto]



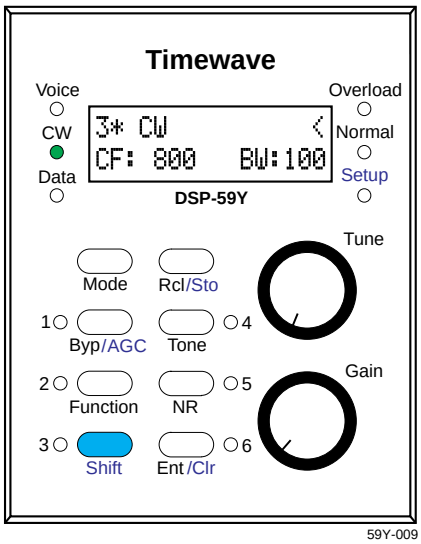
To store a setting in memory, press **[Shift+Rcl/Sto+{#}].** (# = a digit in the range 1 to 6 printed in yellow letters above the corresponding key.)

To recall a setting from memory, press **[Rcl/Sto+{#}].** (# = 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 **[Rcl/Sto]**) 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/Sto]** key.



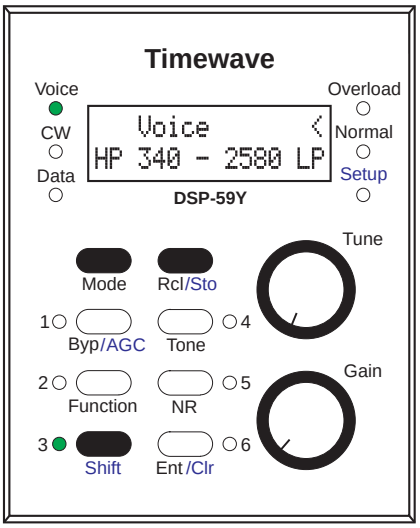
If you have recalled a setting from memory and want to restore the previous setting from before the memory recall, press **[Rcl/Sto+Rcl/Sto]**. The previous setting will replace the recalled setting. Pressing **[Rcl/Sto+Rcl/Sto]** again with bring back the recalled setting. For example, press **[Rcl/Sto+3]** to recall the memory 3 setting. Press **[Rcl/Sto+Rcl/Sto]** to restore the setting before memory 3 was recalled. Press **[Rcl/Sto+Rcl/Sto]** again to restore the memory 3 setting. Each time **[Rcl/Sto+Rcl/Sto]** 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.

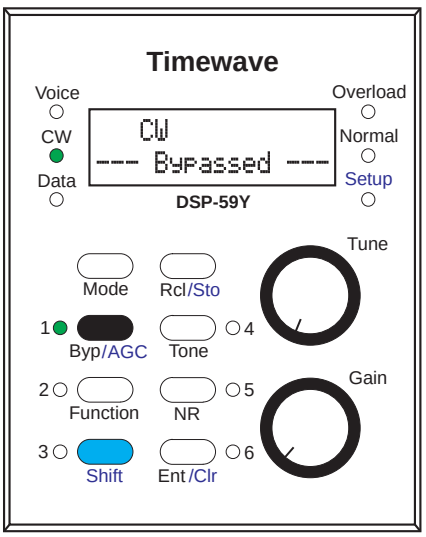
User Selectable Power Up Mode



59Y-020

Select power up mode by pressing **[Shift+Rcl/Sto+Mode].** This stores the operating mode that you wish to start with when the DSP-59Y is powered up. You may easily change this selection at any time in the future by repeating the process.

Bypass [Byp/AGC]



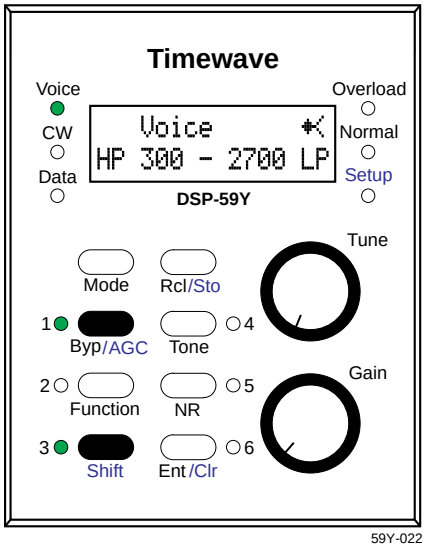
59Y-021

When you select **[Byp/AGC]**, the other controls have no effect on the operation of the DSP-59Y. 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 and CW modes. The speaker in the Yaesu SP-5/6 will still be on when DSP-59Y power is off.

The Data mode has a special electronic bypass mode for data link integrity described in the *Data Mode* section on page 6-3.

Automatic Gain Control [Byp/AGC]



Press **[Shift+Byp/AGC]** to toggle Automatic Gain Control. When AGC is enabled, ✦ is displayed near the top right corner of the display.

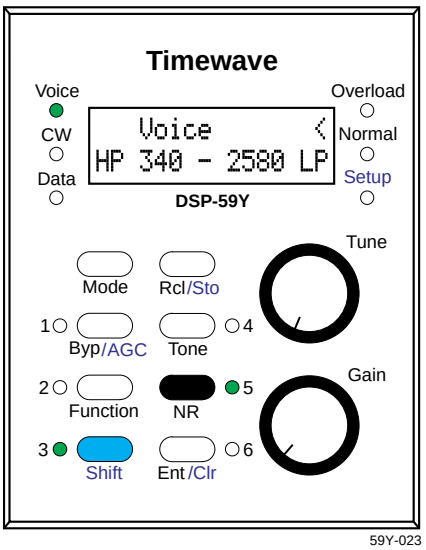
The AGC feature helps maintain a constant output level when the input level varies. The obvious use of the AGC feature is to keep the DSP-59Y output level when input signal levels vary rapidly as a result of operating conditions (for example, nets, contests, rapid fading). The AGC can also help alleviate 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-59Y 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-59Y 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-59Y and the receiver, the DSP-59Y 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-59Y 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 [NR]



Press **[NR]** 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-59Y is the power switch/gain adjust control.

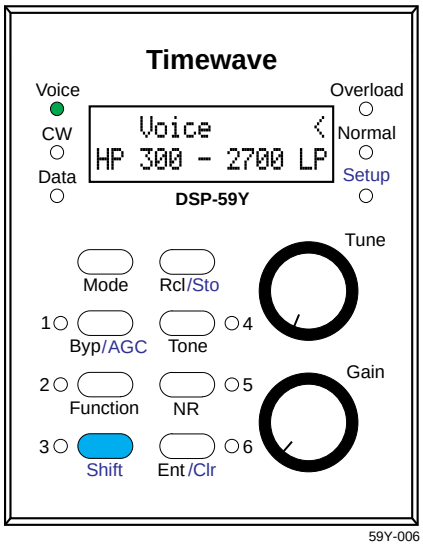
Turning off or removing power from the DSP-59Y automatically de-energizes a bypass relay and forces the DSP-59Y into the bypass mode and the audio signal is passed directly to the speaker within the Yaesu SP-5/6.

4
Voice Mode

Operation

In Voice mode, the DSP-59Y conditions the audio response of the DSP-59Y 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.

High Pass filter adjustment

Press the **Tune** knob so the arrow in the upper right corner of the display points to the left. Turn the **Tune** knob to the desired frequency indicated by the numbers in the lower left side of the display.

Low Pass filter adjustment

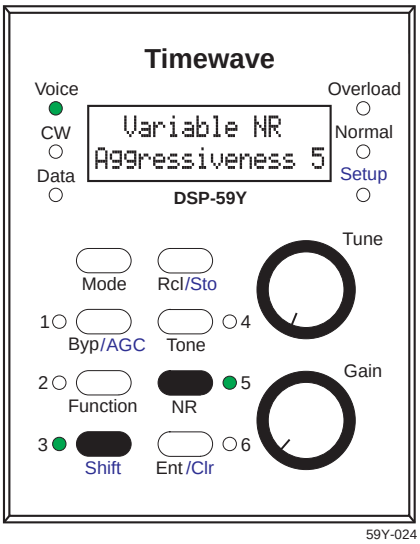
Press the **Tune** knob so the arrow in the upper right corner of the display points to the right. Turn the **Tune** knob to the desired frequency indicated by the numbers in the lower left side of the display.

These two settings customize the frequency response of the DSP-59Y.

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 **[NR]**. When the feature is active, the LED next to the key lights.

- Press the **[Shift+NR]** key to adjust the aggressiveness of Noise Reduction.
- Then turn the **Tune** knob to adjust the amount of random noise reduction.
- The top line of the liquid crystal display shows `Variable NR` and the bottom line displays the relative amount of noise reduction aggressiveness while the **Variable Noise Reduction** 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 **[Ent/Clr]** stores the new value and returns the DSP-59Y 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-59Y 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-59Y 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.

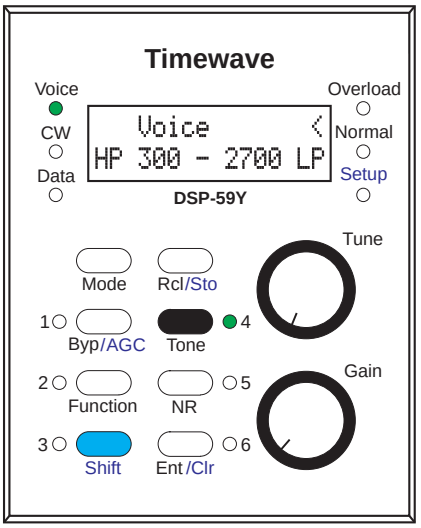
Static Crashes

It is often possible to reduce atmospheric static crashes to a tolerable level using the DSP-59Y 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-59Y. 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

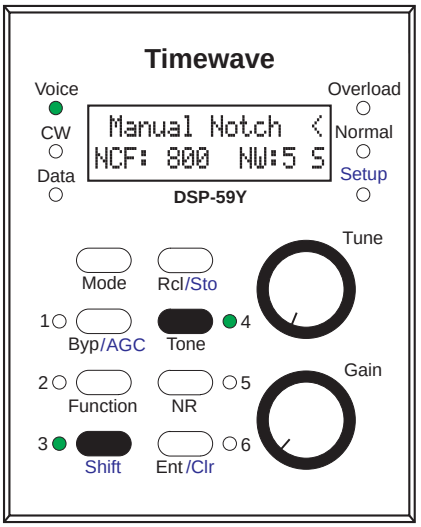
If you have line noise when working in AM voice mode, press **[Function]** to activate the AM Line Noise filter. This filter does not work on SSB! The aggressiveness of the AM Line Noise Filter is not adjustable.

Heterodyne Elimination/Notch Filters

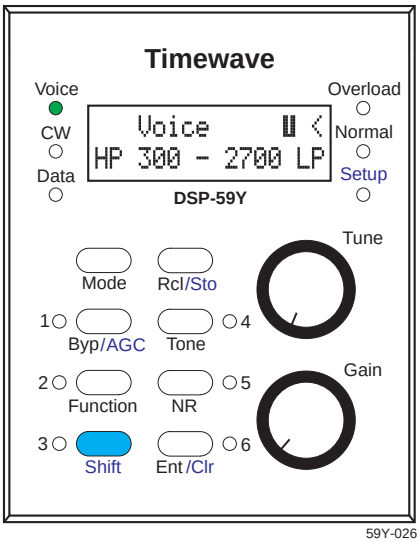


The DSP-59Y has both an automatic and a manual tone notch filter to help remove interfering heterodynes, CW, and data signals. The automatic filter can reduce multiple heterodynes 40 to 50 dB, virtually eliminating the offending signals. The automatic filter substantially reduces CW and FSK data signals, 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 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.

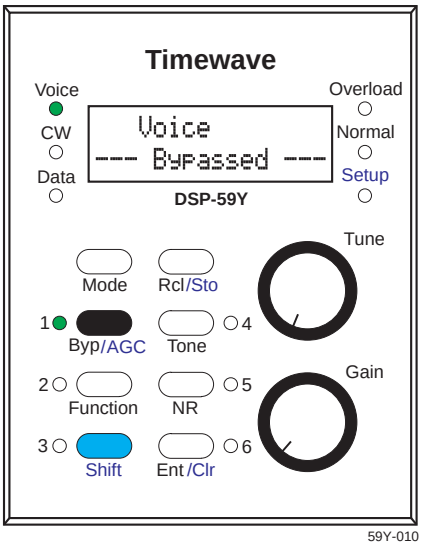


- Activate the manual notch function by pressing **[Shift+Tone].**
- Verify that the **Tune** knob function arrow in the upper right of the display is pointing left. Rotate the **Tune** knob to change the notch center frequency (NCF) of the filter in 10 Hz steps.
- Switch the **Tune** knob function by pressing it so the function arrow points right. Rotate the **Tune** knob 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 **[Ent/Clr]** key to accept the values.



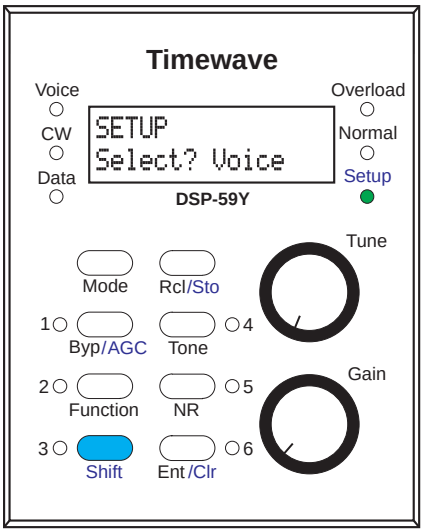
The display changes back to the original operating mode with a ▮ icon near the upper right corner of the display indicating that the manually tuned notch filter is active. Turn off the manual notch filter mode by pressing **[Shift+Ent/Clr].**

Voice Bypass



Depressing **[Byp/AGC]** places the DSP-59Y into a bypass mode. In this mode, a relay connects the audio input jacks of the DSP-59Y directly to the Yaesu speaker and headphones and the line output jack. The Bypass mode has precedence over the voice mode. When the DSP-59Y is in bypass, the settings of the all other controls do not affect the signal.

Setup - Voice



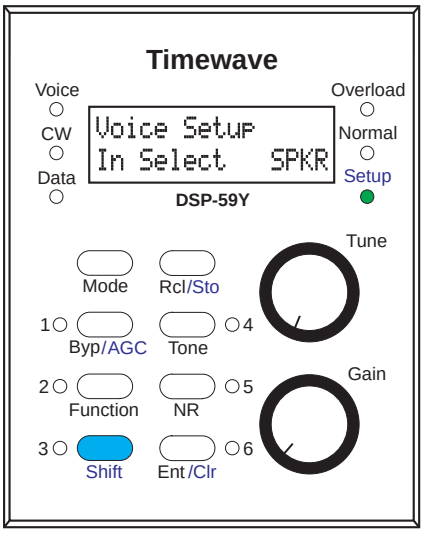
There are two user adjustable variables within this mode of setup. They are:

- Signal Input Select
- AM Line Noise

General Procedure:

1. Press **[Shift+Mode]** to enter Setup mode.
2. Rotate **Tune** knob until `Voice` appears on the bottom line of the display
3. Press **[Ent/Clr]** to accept.

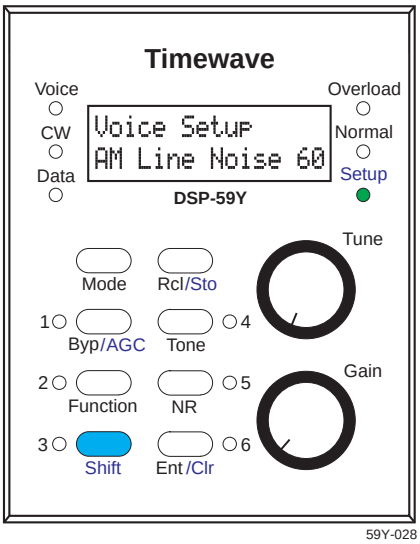
Signal Input Select



You can select one of two inputs within the DSP-59Y. The choices are the Yaesu SP-5/6 loudspeaker inputs or the DIN connector labeled “Radio” on the rear of the DSP-59Y. The factory default is the speaker input.

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

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. Press **[Shift+Mode]** to enter Setup mode.
2. Rotate **Tune** knob until `Voice` appears on the bottom line of the display
3. Press **[Ent/Clr]** to accept.
4. Rotate **Tune** knob until `AM Line Noise` appears on the bottom left of the display
5. Press **[Ent/Clr]** to accept.
6. Rotate **Tune** knob until the chosen value appears on the bottom right of the display
7. Press the **[Ent/Clr]** to accept choice and save. Press **[Shift+Ent/Clr]** to escape without saving changes.
8. Rotate **Tune** knob until your next function to change appears on the bottom line of the display or press the **[Shift+Ent/Clr]** to return to main setup menu.

Exit Setup

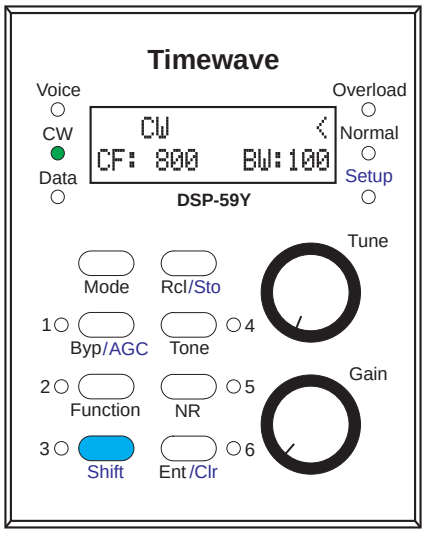
When you are through with Setup, press **[Mode]** to return to Voice mode.

5
CW Mode

Operation

The CW Mode digitally processes analog CW (Continuous Wave) signals for Morse code reception. Independently selectable processing techniques include noise reduction, tunable bandpass filtering, manual notch filtering and automatic gain control.

Bandpass Filters



A narrow band signal like CW and RTTY requires bandpass filters with steep skirts and linear phase response. Linear phase response maximizes the usable signaling rate for a given bandwidth and minimizes ringing often heard on other types of extremely sharp filters. The filter skirts on the CW filters are so steep that a signal literally falls off the edge of the passband as you tune through a CW signal.

- Bandwidths range from 10 Hz to 600 Hz.
- Center frequencies from 200 to 2100 Hz.

The narrow filters are useful for trying to dig out extremely weak signals from the noise and QRM. The wider filters allow easy tuning and listening to multiple CW signals simultaneously.

In the CW Bandpass mode, the DSP-59Y tailors the audio input using tunable bandpass filtering, adaptive random noise reduction, and manual notch filtering. These functions can operate simultaneously or independently. The DSP-59Y also provides a marker tone at the center frequency of the selected CW bandpass filter.

Center Frequency adjustment

Press the **Tune** knob so the arrow in the upper right corner of the display points to the left. Turn the **Tune** knob to the desired frequency indicated by the numbers in the lower left side of the display.

Bandwidth adjustment

Press the **Tune** knob so the arrow in the upper right corner of the display points to the right. Turn the **Tune** knob to the desired bandwidth as indicated by the numbers in the lower left side of the display.

Noise Reduction

To activate random noise reduction, press **[NR]**. The LED next to the button lights when the feature is activated. Random nose reduction is not nearly as effective in CW mode. It only works under special situations.

Automatic Gain Control [Byp/AGC]

Activating Automatic Gain Control can be very effective in making weak CW jump out of background noise. Press **[Shift+Byp/AGC]** to activate Automatic Gain Control.

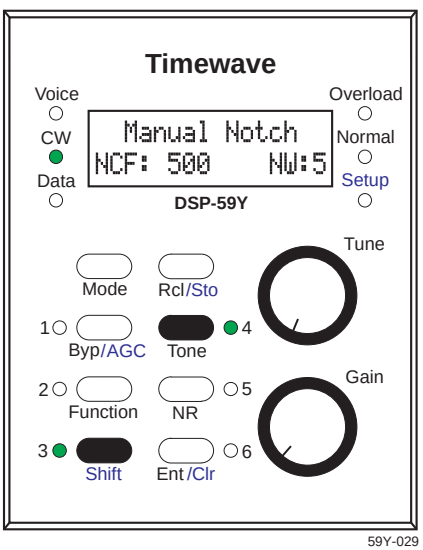
CW Operating Hint

The extremely narrow linear phase filters in the DSP-59Y will allow you to copy very weak and closely spaced CW signals. Use 10 to 100 Hz bandwidths, but tune very slowly. Since many radios are difficult to tune slowly, use the bandpass center frequency control to help pick out the weak and closely spaced signals. If you want to change your receive frequency, the RIT or Clarifier controls on some receivers allow very fine tuning.

If you have little interest in working very weak signals, tune with the bandwidth set at 400 to 600 Hz and decrease the bandwidth further only if you need to eliminate QRM. Use the 10 to 25 Hz bandwidths if you are trying to copy a very slow CW signal (10 words per minute or less). EME (Moonbounce) is a typical application for the 10 to 25 Hz filters. Random noise reduction **[NR]** is especially helpful when listening to CW in the 400-600 Hz bandwidth.

Use the **[NR]** and **[AGC]** combination to boost the level of very weak CW signals when your receiver is at maximum gain. Some CW signals seem to magically pop out of the noise.

Manual Notch Filter



59Y-029

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 in Voice and CW modes.

- Activate the manual notch function by pressing **[Shift+Tone].**
- Verify that the **Tune** knob function arrow in the upper right of the display is pointing left. Rotate the **Tune** knob to change the notch center frequency (NCF) of the filter in 10 Hz steps.
- Switch the **Tune** knob function by pressing the knob so the function arrow points to the right. Rotate the **Tune** knob to adjust the notch bandwidth (NW). The lower the value, the narrower the filter.

- After tuning the filter to the desired center frequency and adjusting the bandwidth, press **[Ent/Clr]** to accept the values.

The display changes back to the original operating mode with a ▮▮ icon in the upper right corner of the display indicating that the manually tuned notch filter is active.

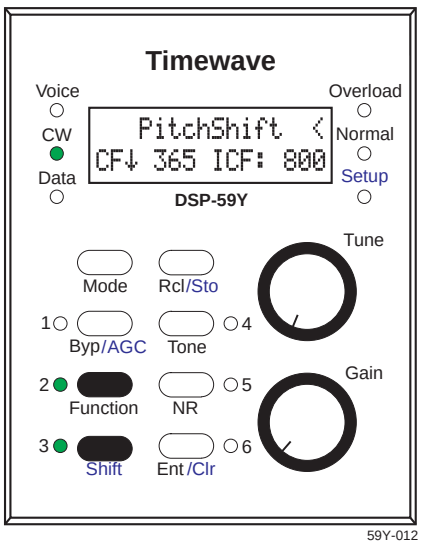
- Turn off the manual notch filter mode by pressing **[Shift+Tone]** or press the **[Shift+Ent/Clr]** key.

CW Marker Tone

- To activate the marker tone for CW, press **[Tone]**.

The DSP-59Y generates an audio tone at the bandpass filter center frequency. Use the marker to center a wide bandpass filter (300 - 600 Hz) on a signal by matching the marker tone pitch to signal pitch by ear. The tone can be set to within 2.5 Hz of any frequency from 200 Hz to 2150 Hz. Then reduce the bandwidth of the bandpass filter as narrow as required. The desired signal will not be "lost" outside the passband of the filter.

CW Tone Pitch Shift



A feature unique to Timewave is the ability to easily shift the CW tone pitch to another frequency. This feature works well with receivers that have non-adjustable, relatively high pitch CW tone, since most hams prefer to listen to 400 - 600 Hz CW tones.

- Press **[Shift+Function]** to enable CW Pitch shift.
- Verify that the **Tune** knob function arrow in the upper right of the display is pointing left. Rotate the **Tune** knob to shift the output CW pitch that you hear. As soon as you start turning the knob, you will notice that an up/down arrow will replace the colon following CF.
- Switch the **Tune** knob function by pressing the knob so the function arrow points to the right. Rotate the **Tune** knob to shift the input CW pitch from the radio.
- Press **[Ent/Clr]** to save the values and to switch back to standard operating mode.

The LCD will change to display the input center frequency (ICF) and the final center frequency (CF) that the user will hear.

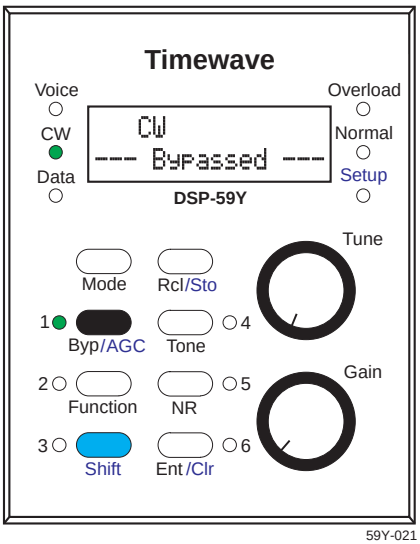
Let's use for example a Yaesu transceiver with an 800 Hz CW pitch and we would like to change it to 365 Hz.

- Press **[Shift+Function].**
- Verify that the **Tune** knob function arrow in the upper right of the display is pointing left. Rotate the **Tune** knob to display `ICF: 800` (the input CW pitch from the radio).
- Switch the **Tune** knob function by pressing the knob so the function arrow points to the right. Rotate the **Tune** knob to display `CF↓ 365` (the output CW pitch you want to hear).
- Press **[Ent/Clr]** to accept the values and to switch back to standard operating mode.

The colon after `CF` has been replaced with a arrow indicating that you have programmed in a pitch shift and it is up or down. The CW pitch shift will remain the same until it is reprogrammed to a new frequency with the above procedure or deactivated.

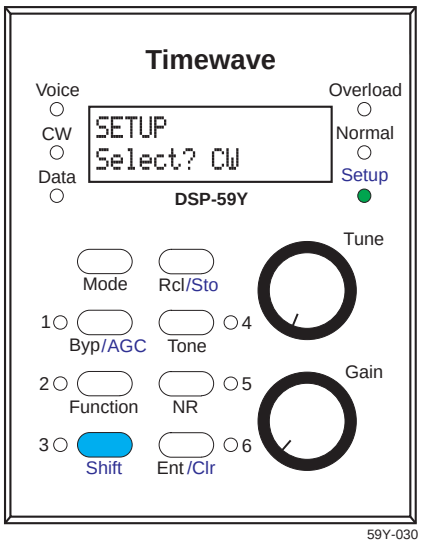
- To remove the pitch shift, press **[Shift+Function].** Then press **[Ent/Clr**] to deactivate.

CW Bypass Mode



Press **[Byp/AGC]** to place the DSP-59Y into a bypass mode. In this mode, a relay connects the audio input jacks of the DSP-59Y directly to the Yaesu SP-5/6 speaker/headphone jack and the line output jack. The Bypass mode has precedence over the CW mode. When the DSP-59Y is in bypass, the settings of the all other controls do not affect the signal. Turning off or removing power from the DSP-59Y automatically de-energizes the relay and forces the DSP-59Y into the bypass mode.

Setup - CW



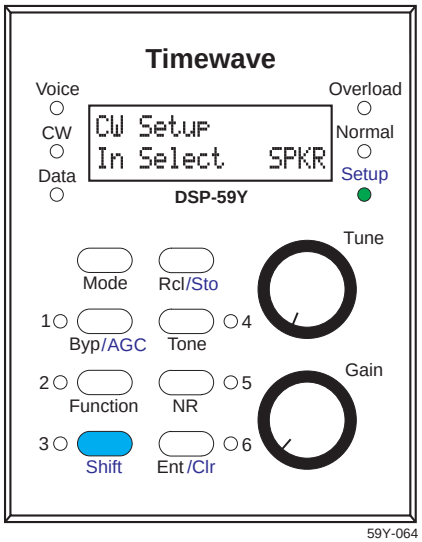
There are two user adjustable variable within this mode of setup. They are:

- Signal Input Select
- Marker Tone Level

General Procedure:

1. Press **[Shift+Mode]** to enter Setup mode.
2. Rotate **Tune** knob until `CW` appears on the bottom line of the display
3. Press the **[Ent/Clr]** key to select.

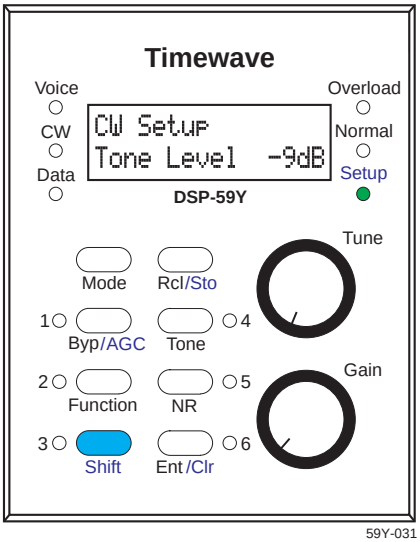
Signal Input Select



You can select one of two inputs within the DSP-59Y. The choices are the Yaesu SP-5/6 loudspeaker inputs or the DIN connector labeled “Radio” on the rear of the DSP-59Y. The factory default is the speaker input.

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

Marker Tone Level



You can adjust the volume of the CW Marker Tone. This allows you to set the tone level to approximately match the level of the incoming CW tones. The range is from 0 dB to -36 dB in 3 dB steps.

1. Rotate **Tune** knob until `Tone Level` appears on the bottom left of the display
2. Press the **[Ent/Clr]** key to select.
3. Rotate **Tune** knob until the chosen value appears on the bottom right of the display
4. Press the **[Ent/Clr]** key to accept choice and save.
5. Rotate **Tune** knob until your next function to change appears on the bottom line of the display or press **[Shift+Ent/Clr]** to return to main setup menu.

Exit Setup

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

6
Data Mode

Introduction

Data signals like CW and 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-59Y has an array of band-pass filters optimized for the most common high frequency (1.8-30 MHz) data modes.

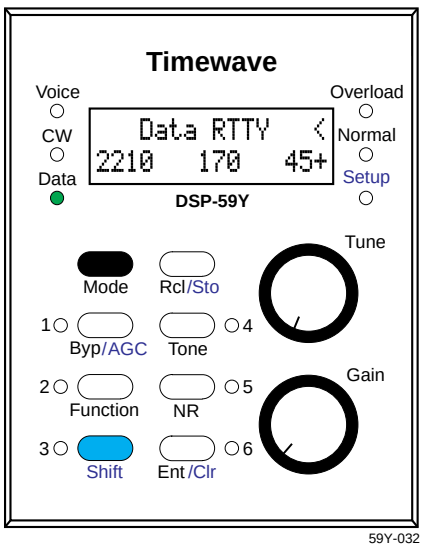
The DSP-59Y also has a built in RTTY modem. The RTTY modem demodulates received RTTY, audio tones and generates audio frequency shift keyed signals.

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.

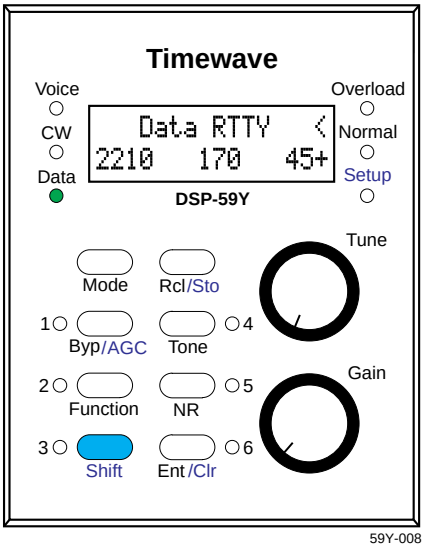
Operations Common To All Data Types

Basic Data Mode Operation



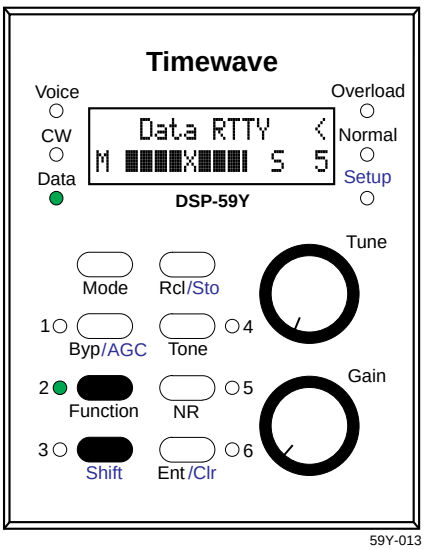
- Pressing **[Mode]** to select the Data mode.
- Turn the **Tune** knob to select the appropriate data filters.
- Press the **Tune** knob to have the indicator arrow in the upper right corner facing right. Turn the **Tune** knob slightly to vary the filter bandwidth to suit the band conditions.

Data Settings Display



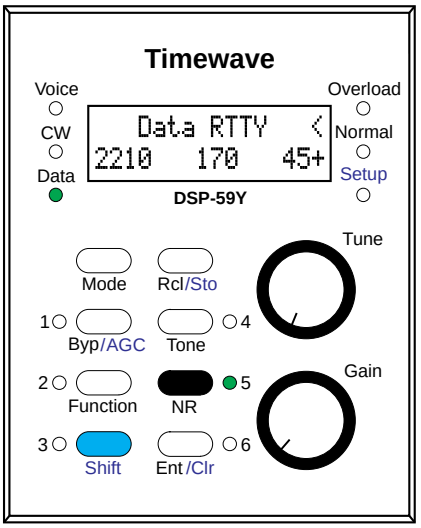
- Data (Data filter) - Top left line
- Data signal type- right, top line
- Modulation center frequency - left, bottom line
- Total frequency shift, - center, bottom line
- Baud rate - right, bottom line.
- A **+** or **−** in the bottom right corner of the display indicates the new bandwidth is either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

Data Tuning Function



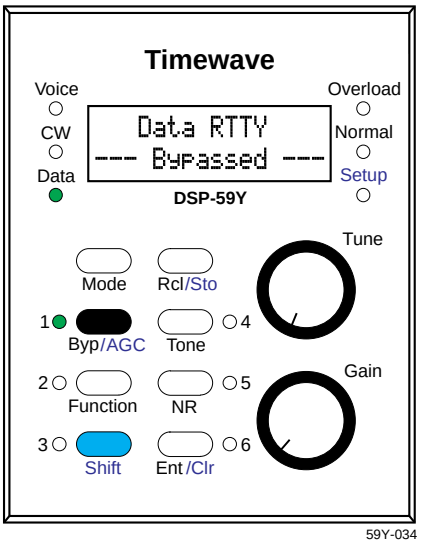
- Press **[Mode]** to select the Data mode.
- Turn the **Tune** knob to select appropriate data filter.
- Press **[Shift+Function]** to turn the FSK(AFSK) tuning display on.
- Tune in a FSK data signal on the receiver connected to the DSP-59Y.
- Adjust the receiver frequency so that the Mark and Space bars on the display are approximately equal length.
- When the Tune knob indicator is pointing to the left, the Tune knob adjusts the Bandwidth. When the Tune knob indicator is pointing to the right, the **Tune** knob adjusts the Data Carrier Detect (DCD). Press **Tune** knob to switch the function of the Tune knob to DCD adjust.
- Turn the Tune 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 [NR]



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 **NR** mode for data. If noise conditions are severe, and you have tried other filter combinations, then try the **NR** mode. To activate random noise reduction, press **[NR]**.

Data Bypass Mode [Byp/AGC]



Pressing **[Byp/AGC]** places the DSP-59Y 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 an AMTOR or PacTOR link to lose synchronization. The bypass mode has precedence over the Data mode. When the DSP-59Y is in bypass, the settings of the gain control and the parameter select push buttons do not affect the signal.

- Turning off or removing power from the DSP-59Y automatically de-energizes the bypass relay and forces the DSP-59Y into the relay bypass mode.

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	2210	170	45	
RTTY 2	2210	200	45	
AMTOR	2210	200	100	Same filters as SITOR
PacTOR	2210	200	200*	*100/200 - adaptive
G-TOR	2210	170	300*	*100/200/300 - adaptive
HF Packet	1700	200	300	PK-232 = 2210 Hz. CF
WeFAX	Fixed	Fixed	Fixed	HF only, filter only
SSTV	Fixed	Fixed	Fixed	Filter only
CLOVER	Fixed	Fixed	Fixed	Filter only
RTTY S	2210	170	75	Common shortwave RTTY parameters
RTTY 4	1275*	1700*	45	425 Hz shift. * = Mark/Space freq.
RTTY 8	1275*	2125*	45	850 Hz shift * = Mark/Space freq.
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

RTTY, AMTOR, SITOR, PacTOR, G-TOR

Normal operation for RTTY, AMTOR, SITOR, PacTOR and G-TOR uses a 2210 Hz center frequency filter in the USA. A 1360 Hz center frequency is common in Europe. The defaults used in your DSP-59Y can be chosen from within Setup - Install.

HF Packet

HF packet modems are usually centered at 1700 Hz or 2210 Hz, depending upon the modem manufacturer. Kantronics' Kam+ is factory set to 1700 Hz center frequency and 200 Hz frequency shift. AEA's PK-232 is factory set to 2210 Hz center frequency and 200 Hz frequency shift.

CLOVER

CLOVER is a DSP-based mode and theoretically should not benefit from additional filtering. However, Timewave DSP users report some benefit from using a 500 to 600 Hz bandwidth filter.

SSTV and WeFAX

These two modes use individual fixed bandpass filters specifically designed for the each mode. Pressing **[Tone]** has no effect on the SSTV and 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 an audio FSK test signal into the receive channel. The "RYRY" test signal is centered at 2210 Hz with a frequency shift of +/- 85 Hz. The baud rate is 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.

Wideband Data Operating Hint

The DSP-59Y 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-59Y 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.

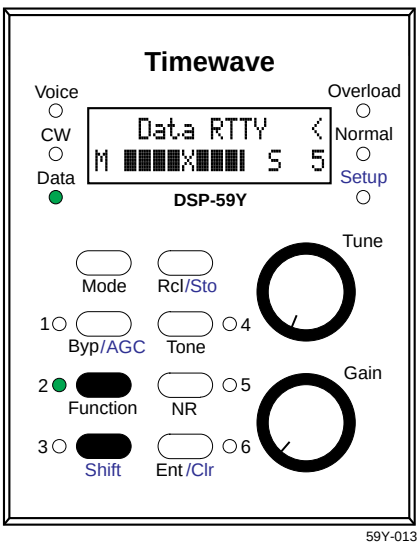
RTTY Modem Operation

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-59Y and have appropriate software terminal program that can decode and encode Baudot and ASCII.

Timewave does not provide the terminal program. One program that has been tested and can be recommended is COMPRTTY. It is available from: David Rice, KC2HO; 4452 Ashfield Terrace; Syracuse, NY 13215.

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.
- Turn the **Tune** 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-59Y.
- Adjust the receiver frequency so that the Mark and Space bars on the display are approximately equal length.
- When the Tune knob indicator is pointing to the left, the **Tune** knob adjusts the Bandwidth. When the Tune knob indicator is pointing to the right, the **Tune** knob adjusts the Data Carrier Detect (DCD). Press the **Tune** knob to switch the function of the **Tune** knob to DCD adjust.
- Turn the **Tune** 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.

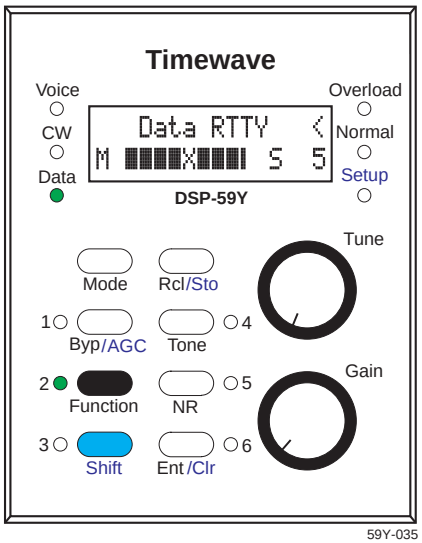
When your have a computer connected to the DSP-59Y, take care to turn the power on for the computer first. Then turn on the DSP-59Y. Under some circumstances, the DSP-59Y will power up in transmit mode keying your transmitter if the computer power is turned on last.

The AFSK output signal from the line output jack and pin 1 of the DIN connector on the DSP-59Y 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-59Y ***Installation - Line Output Signal Level Setup*** (page 1-12) for instructions on setting DSP-59Y line output level.

The FSK output signal from pin 5 on the DIN connector on the DSP 59Y can directly drive a FSK input on a transceiver. See ***Installation - RTTY Modem Input/Output*** (page 1-10) 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



The RTTY remodulator is special mode for receiving RTTY. It's function varies slightly depending upon if you are using the DSP-59Y internal RTTY modem or using an external multimode controller:

- Press **[Mode]** to select the Data mode.
- Turn the **Tune** knob to select the appropriate RTTY data filters.
- Press **[Function]** to select the remodulator.
- Press **[Shift+Function]** to turn the tuning display on.
- When the Tune knob indicator is pointing to the left, the **Tune** knob adjusts the Bandwidth. When the Tune knob indicator is pointing to the right, the **Tune** knob adjusts the Data Carrier Detect (DCD). Press the **Tune** knob to switch the function of the **Tune** knob to DCD adjust.
- Turn the **Tune** knob **[DCD]** for clean error-free copy on your terminal display.

The LED illuminated next to the **[Function]** button indicates the RTTY remodulator is selected. The DSP-59Y filters and demodulates the received RTTY signal. Then The DSP-59Y generates a new set of RTTY tones that are modulated by the output of the RTTY demodulator.

The incoming signal is sent to the speaker/headphone 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. When the Tune knob indicator is pointing to the left, the **Tune** knob adjusts the Bandwidth. When the Tune knob indicator is pointing to the right, the Tune knob adjusts the Data Carrier Detect (DCD). Press **Tune** knob to switch the function of the Tune knob to DCD adjust.

Data Operating Hints

Data Primer

RTTY, AMTOR, SITOR, PacTOR, G-TOR and HF Packet all 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 in amateur radio 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 and G-TOR frequency shift, while 200 Hz is the standard for AMTOR, SITOR and PacTOR. 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 modulates a RF signal or after the RF FSK signal is demodulated, there are

several common center frequencies. In the North America, 2210 Hz is the standard center frequency for RTTY, PacTOR, AMTOR, SITOR, and G-TOR, while both 1700 Hz and 2210 Hz share the standard for HF packet. In Europe and some other parts of the world, lower center frequencies of 1300, 1360 and 1530 Hz are more common.

Baud Rate

Baud rates vary from 45.5 baud for RTTY to 300 baud for HF packet. G-TOR, PacTOR, and Clover have adaptive baud rates which change depending upon the quality of the incoming signal.

For a more complete discussion of data modes, see the latest edition of the ***ARRL Handbook***.

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-59Y 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.

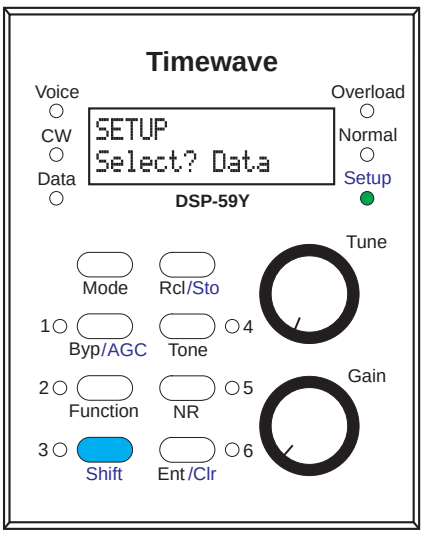
The DSP-59Y mark-space center frequency factory setting is 2210 Hz for RTTY, AMTOR, G-TOR and PacTOR data modes. The DSP-59Y HF Packet mark-space center frequency factory setting is 1700 Hz. The mark-space center frequencies of the modem, receiver and DSP-59Y must match. Some modems and radios have programmable 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-59Y, or change the DSP-59Y 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!

The Kantronics KAM+ usually has the HF Packet mark-space center frequency set to 1700 Hz (1600-1800 Hz mark-space frequencies). See the KAM+ manual for the procedure to change the KAM+ mark-space center frequency setting via software.

Setup - Data Mode



59Y-036

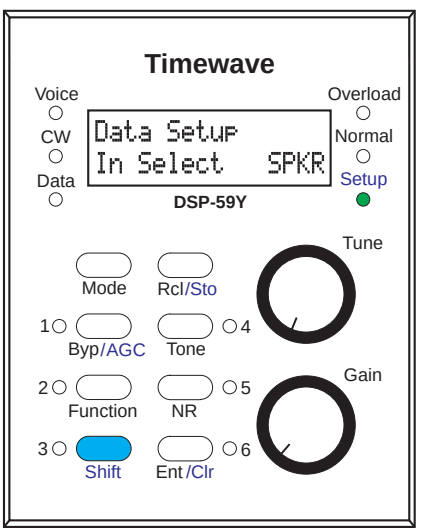
There are two user adjustable variable within this mode of Setup. They are:

- Signal Input Select
- Speaker Mute/Bypass
- FSK Mark Control
- Configuring Data Operating Modes

General Procedure:

1. Press **[Shift+Mode]** to enter Setup mode.
2. Rotate **Tune** knob until `Data` appears on the bottom line of the display
3. Press the **[Ent/Clr]** key to select.

Signal Input Select



59Y-065

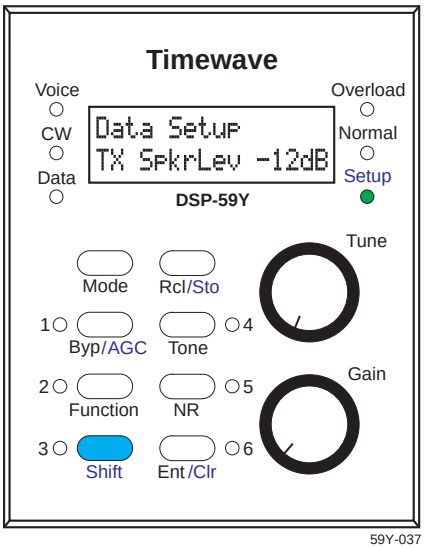
You can select one of two inputs within the DSP-59Y. The choices are the Yaesu SP-5/6 loudspeaker inputs or the DIN connector labeled “Radio” on the rear of the DSP-59Y. The factory default is the speaker input.

1. Press **[Shift+Mode]** to enter Setup mode.
2. Rotate **Tune** knob until `Data` appears on the bottom line of the display
3. Press **[Ent/Clr]** to accept.
4. Rotate **Tune** knob until `In Select` appears on the bottom left of the display
5. Press **[Ent/Clr]** to accept.
6. Rotate **Tune** knob until the chosen value appears on the bottom right of the display
7. Press the **[Ent/Clr]** to accept choice and save. Press **[Shift+Ent/Clr]** to escape without saving changes.

8. Rotate **Tune** knob until your next function to change appears on the bottom line of the display or press the **[Shift+Ent/Clr]** to return to main setup menu.

Speaker Mute/Bypass

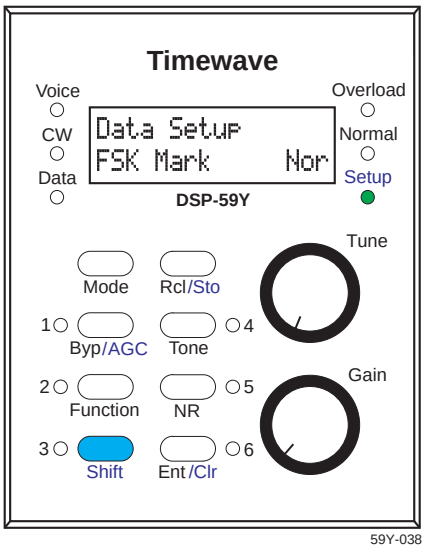
You can adjust the transmit speaker volume of the data signal. This allows you to set the audio level of the transmitted signal from off the full volume when compared to incoming data signals. This is something of personal preference. The range is from 0 dB to -24 dB in 3 dB steps and off. The factory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



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

FSK Mark Control

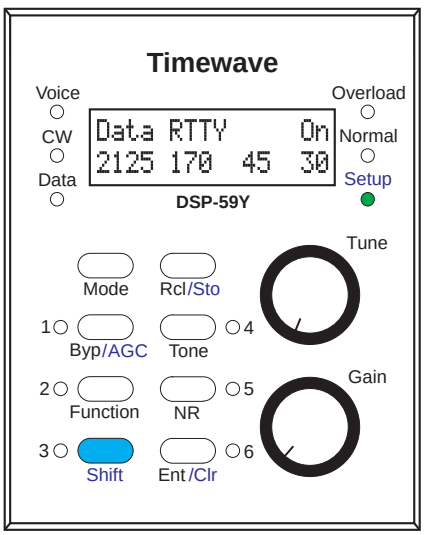
With some transceivers, the normal configuration for Mark within the FSK signal be reversed and not adjustable. Standard convention is for Mark to be at the lower frequency. Your choices are Normal (Nor) or Reverse (Rev). The factory default is Normal.



59Y-038

1. Press **[Shift+Mode]** to enter Setup mode.
2. Rotate **Tune** knob until Data appears on the bottom line of the display
3. Press the **[Ent/Clr]** key to accept choice.
4. Rotate **Tune** knob until FSK Mark appears on the bottom left of the display
5. Press the **[Ent/Clr]** key to accept choice.
6. Rotate **Tune** knob until the chosen value appears on the bottom right of the display
7. Press the **[Ent/Clr]** key to accept choice and save. Press **[Shift+Ent/Clr]** to escape without saving changes.
8. Rotate **Tune** knob until your next function to change appears on the bottom line of the display or press the **[Shift+Ent/Clr]** key to return to main setup menu.

Configuring Data Operating Modes



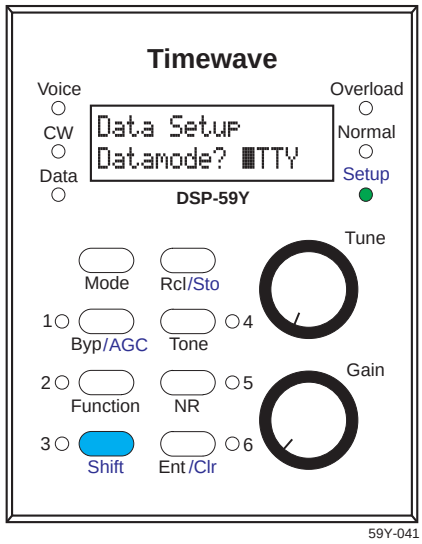
59Y-039

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.



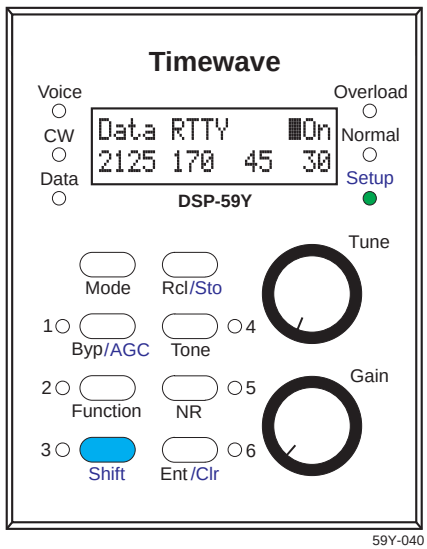
The **space frequency** is calculated by adding the mark frequency and the shift frequency. The range for the mark center frequency is 1200 - 2150 Hz in 5 Hz steps. The space center frequency can be no greater than 2350 Hz.

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]** to enter Setup mode.
2. Rotate **Tune** knob until `Data` appears on the bottom line of the display
3. Press the **[Ent/Clr]** key to accept choice.
4. Rotate **Tune** knob until `Datamode?` appears on the bottom left of the display.
5. Press the **[Ent/Clr]** key to accept choice.
6. Rotate **Tune** knob until the desired data operating mode appears on the bottom right of the display
7. Press the **[Ent/Clr]** key to accept choice.
8. Each time that you press the **Tune** knob, the flashing cursor moves to the next adjustable parameter. Press the **Tune** knob repeatedly until the flashing cursor appears on the first character of the parameter you would like to change. Rotate the **Tune** knob until correct value appears.
9. Press the **Tune** knob again until the flashing cursor appears on the first character of the next parameter you would like to change. Rotate **Tune** knob until correct value appears.
10. Repeat the above procedure until you have changed all the parameters that need to be changed. When done, press the **[Ent/Clr]** key to accept choice and save. Press **[Shift+Ent/Clr]** to escape without saving changes.



11. Rotate **Tune** knob until your next function to change appears on the bottom line of the display or press the **[Shift+Ent/Clr]** to return to main setup menu.

Exit Setup

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

7
Troubleshooting

Most of the functions of the DSP-59Y can be checked using the LCD display, the LEDs, and your ears.

The most common problem with amateur 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-59Y.
2. Make sure your power supply is on.
3. Verify that you have 12-16 Vdc at the power connection with center pin positive.
4. Check the fuse for continuity. Remove power cord from DSP-59Y.
5. Remove the four screws holding the cover on the Yaesu loudspeaker in place. Slide cover off the unit.
6. Remove the eight screws holding the top cover in place on Timewave DSP-59Y.
7. Observing static precautions, remove and visually check fuse located on rear portion of the main PC board. Check with meter if not sure. If you need to replace fuse replace with 1.6A 5 mm x 20 mm (Radio Shack Part #270-1051 or equiv.)
8. Reassemble reversing instructions above.
9. 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-59Y.
2. Increase audio input level with receiver audio output level control until the "Normal" LED flashes.
3. Bypass the DSP-59Y by turning it off. Verify the audio level out of the radio by listening to the speaker. If nothing is heard, plug a set of **stereo** headphones into the front panel headphone jack. If no audio is heard in the headphones or speaker, check audio input connections from the receiver's external speaker output to the DSP-59Y. 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-59Y.
2. Reduce audio input level with receiver's audio output volume control, audio levels into the DSP-59Y 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-59Y.
2. Verify that the channel selector switch on the front of the Yaesu SP-5/6 is set to match the input connection.
3. Verify the input selection within Setup for the current operating mode.
4. Increase audio input level with receiver audio output level control until the "**Normal**" LED flashes.
5. Turn the DSP-59Y's front panel audio level control clockwise.
6. Bypass the DSP-59Y by turning it off. Verify the audio level out of the radio by listening to the speaker. If no audio is heard from the speaker, check the speaker connections with the DSP-59Y and the connections between the receiver and the DSP-59Y. If no audio is heard in the headphones or speaker, check audio input connections to the DSP-59Y from the receiver.
7. Check audio output device (speaker or headphones).

It still does not work!

If the DSP-59Y 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.
2401 Pilot Knob Road
St. Paul, MN 55120
U.S.A., North America
Phone 612-452-5939
FAX 612-452-4571
E-mail dsp@timewave.com
WWW http//:www.timewave.com

Appendix A
Specifications

AUDIO INPUT

Impedance	20 K ohms or 25 ohms, jumper selectable
input signal range for full output	10 mV to 1.0 volt, front panel programmable

AUDIO OUTPUT

Speaker output power	3.0 watts into 8 ohms at 13.8 VDC
Line output	0 dB level referenced to input level . Not controlled by gain control
Headphone Jack	1/4" two-circuit jack, use stereo headphones to use all functions, mono headphones for most functions
Harmonic Distortion	less than 1% at rated output

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
Heterodyne Eliminator (multiple automatic notch)	entire freq. range of selected bandpass filter	Up to 50 dB, varies with noise characteristics	Adaptive	5 msec max
Heterodyne 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.			

CW FILTERS

CW filters	Bandwidth = 5 Hz to 600 Hz, 10 Hz steps. Center freq. = 200 to 2150 Hz, 5 Hz steps,	55 dB at 60 Hz outside the passband	FIR Linear phase	BW less than 20 Hz= 64 msec max BW greater 20 Hz= 40 msec max
CW Marker Tone	Sine wave at center freq. of selected CW filter.			

DATA FILTERS

RTTY, AMTOR, PacTOR, G-TOR, HF Packet	Mark/Space bandwidth 60 Hz to 100 Hz, Center Freq.= 2210 Hz plus options of 1700, 1360, 1300, 1530 or 2125 Hz	40 dB at 60 Hz outside the passband	FIR Linear phase	38 msec max
Note:	RTTY and AMTOR filters have a notch at the center frequency .			
CLOVER	2000-2500 Hz	55 dB at 75 Hz outside the passband	FIR Linear phase	21 msec max
SSTV	1100-1300 Hz & 1500-2300 Hz	50 dB at 75 Hz outside the passband	Composite FIR Linear phase	21 msec max
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 (170 or 200 Hz shift). Baud rate matches selected RTTY data mode. 2) **Sync-Nul Character (Diddle)** - Baud rate matches selected data filter.			

RTTY 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

AGC

Voice mode	36 dB
CW and Data Modes	18 dB

SIGNAL PROCESSING

A-D/D-A Converter	16 bit linear, sigma-delta conversion
Signal Processor	16 bit, 27ns Analog Devices ADSP-2181 with 80 KB of memory
Processor Speed	36.8 Million Instructions per Second (MIPS)

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	2.5 in. wide x 12 in. deep x 3.25 in. high (63.5 mm wide x 305 mm deep x 82.5 mm high) Fits inside the SP-5 and SP-6 by Yaesu
Weight	<2 lb. (0.908 Kg.)

POWER

Requirements	12-16 VDC @ 1A
Fuse	1.6A 5 mm x 20 mm

Note: RTTY, AMTOR, PacTOR, G-TOR and HF 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-59Y 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 purchase.

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.

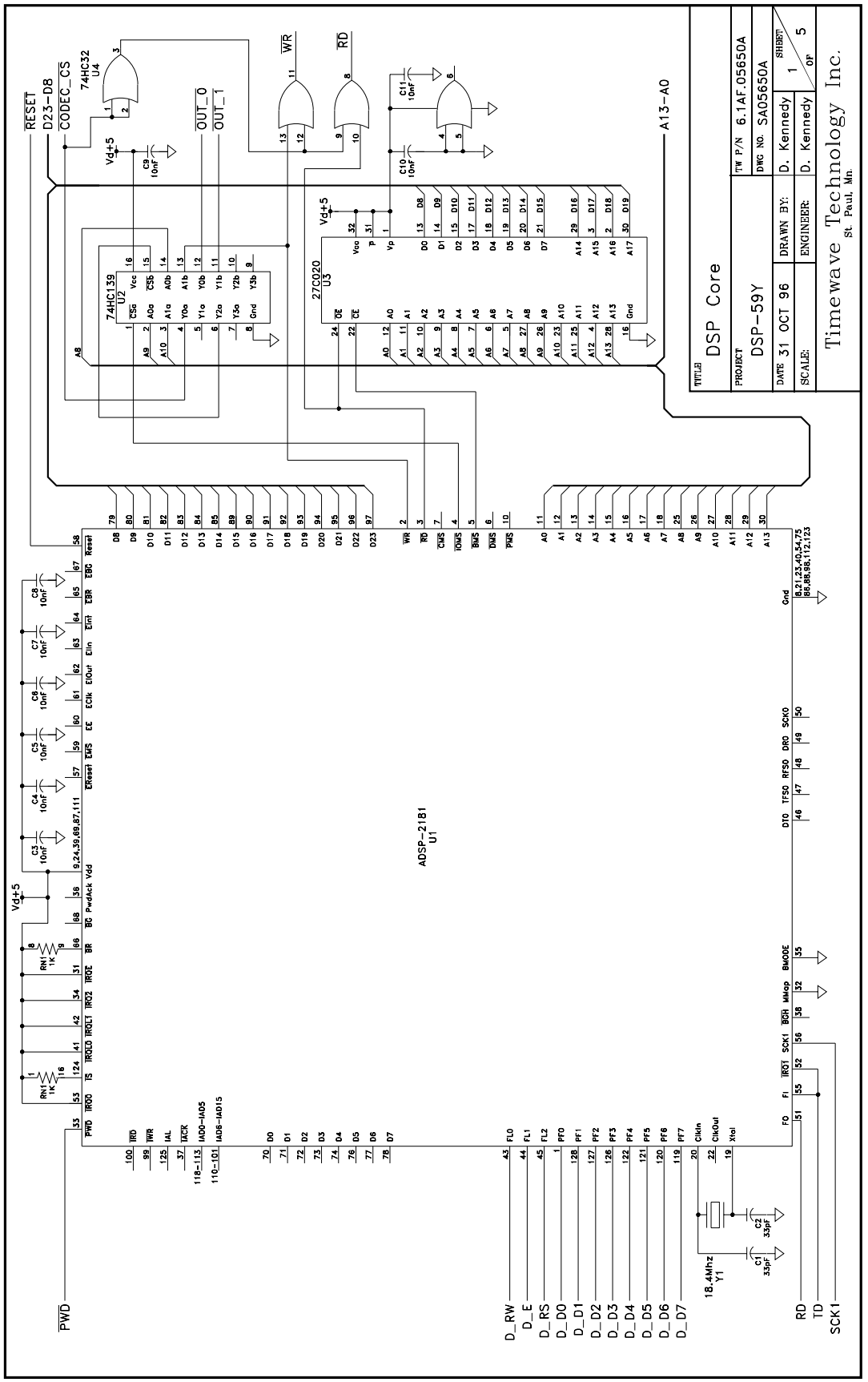
This unit has been tested to verify compliance with EMI requirements of FCC rules part 15. The following notice is required by the FCC.

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-59Y. Timewave reserves the right to make changes in the DSP-59Y at any time.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D23-D8
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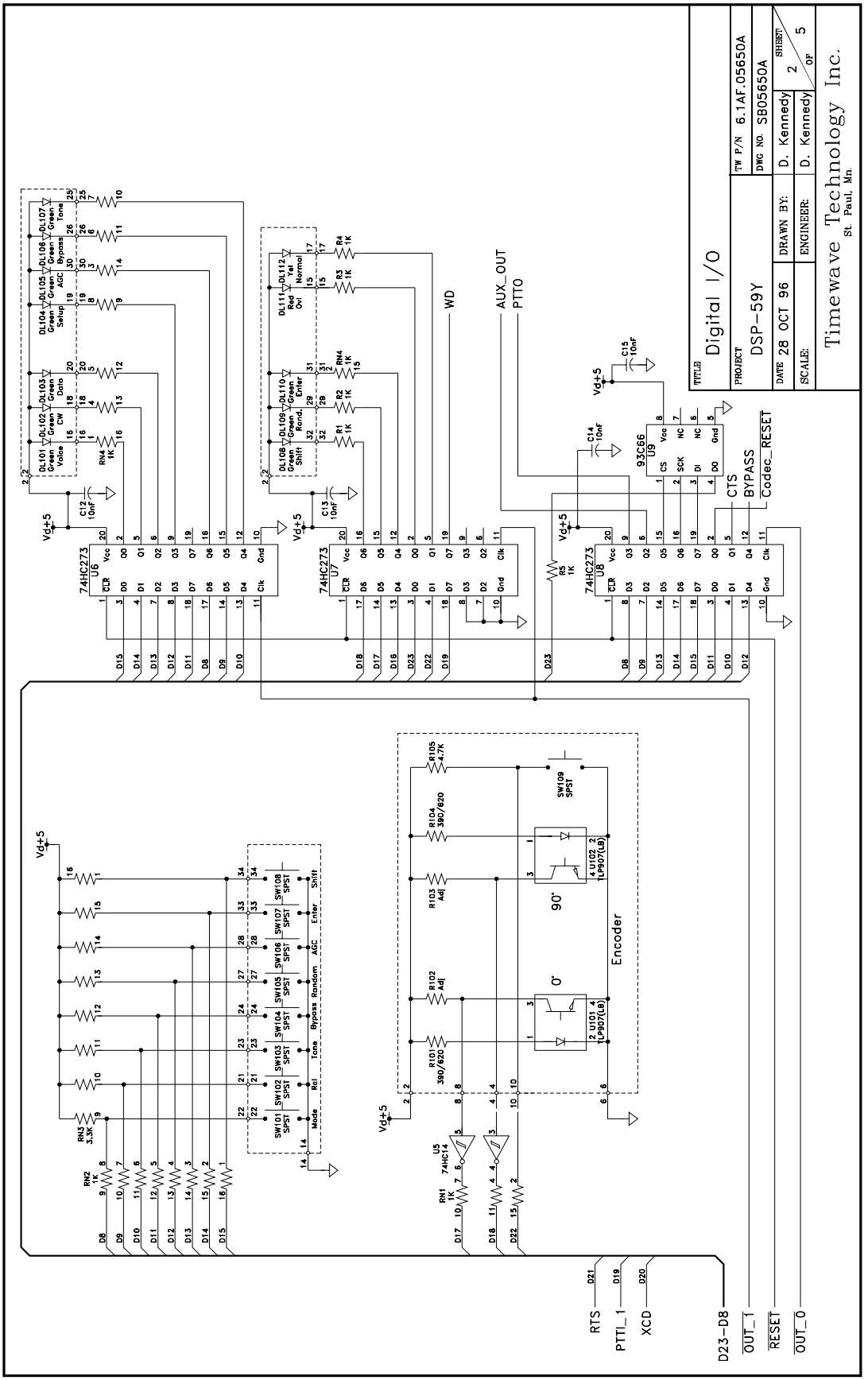
74HC32
U4
OUT_0
OUT_1
WR
RD
A13-A0
74HC139
U2
27C020
U3
ADSP-2181
U1
DSP Core
DSP-59Y
6.1AF.05650A
SA05650A
D. Kennedy
31 OCT 96
Timewave Technology Inc.
St. Paul, Mn.
PWD
D_RW
D_E
D_RS
D_D0
D_D1
D_D2
D_D3
D_D4
D_D5
D_D6
D_D7
18.4Mhz
Y1
RD
TD
SCK1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DSP-59Y
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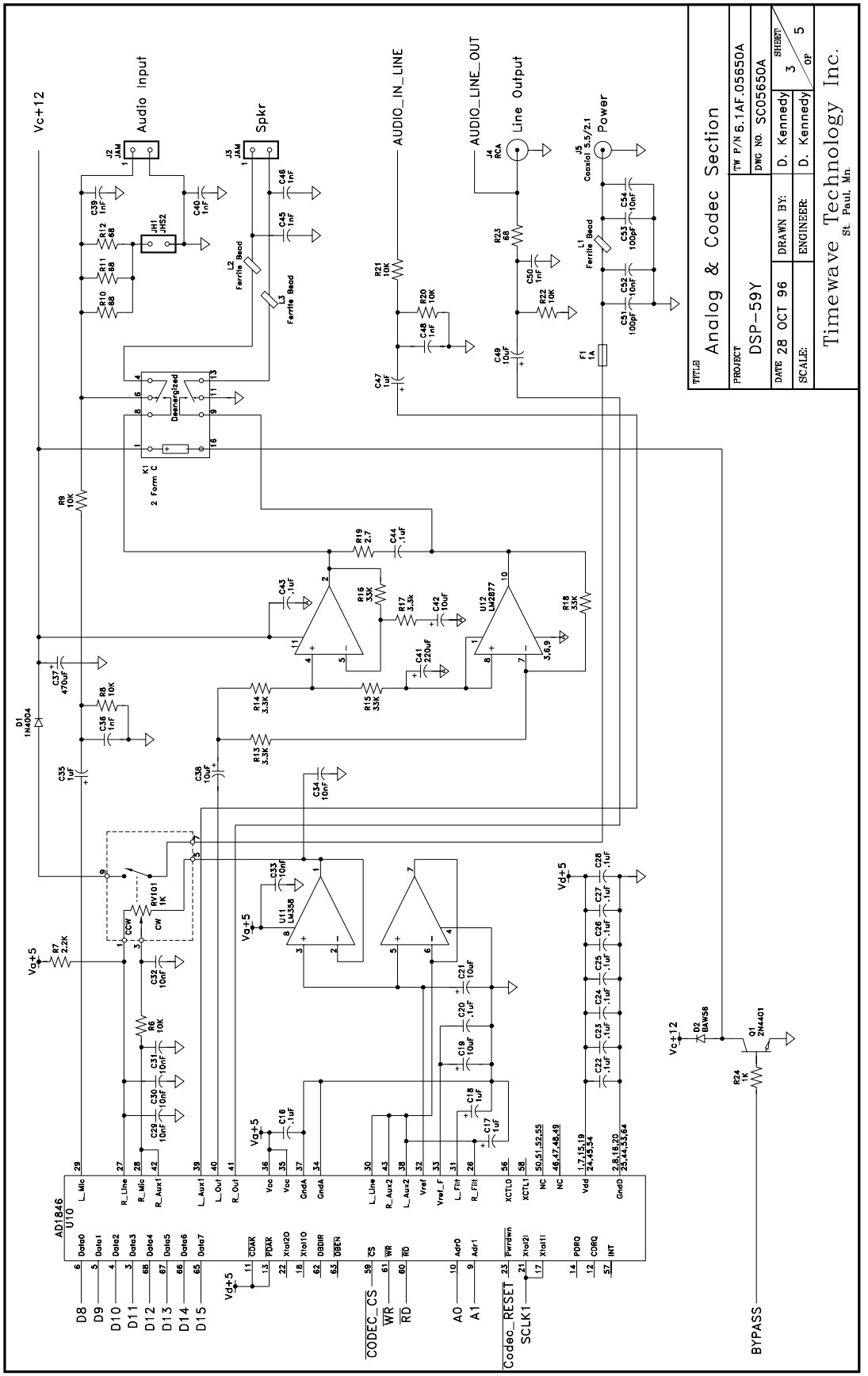
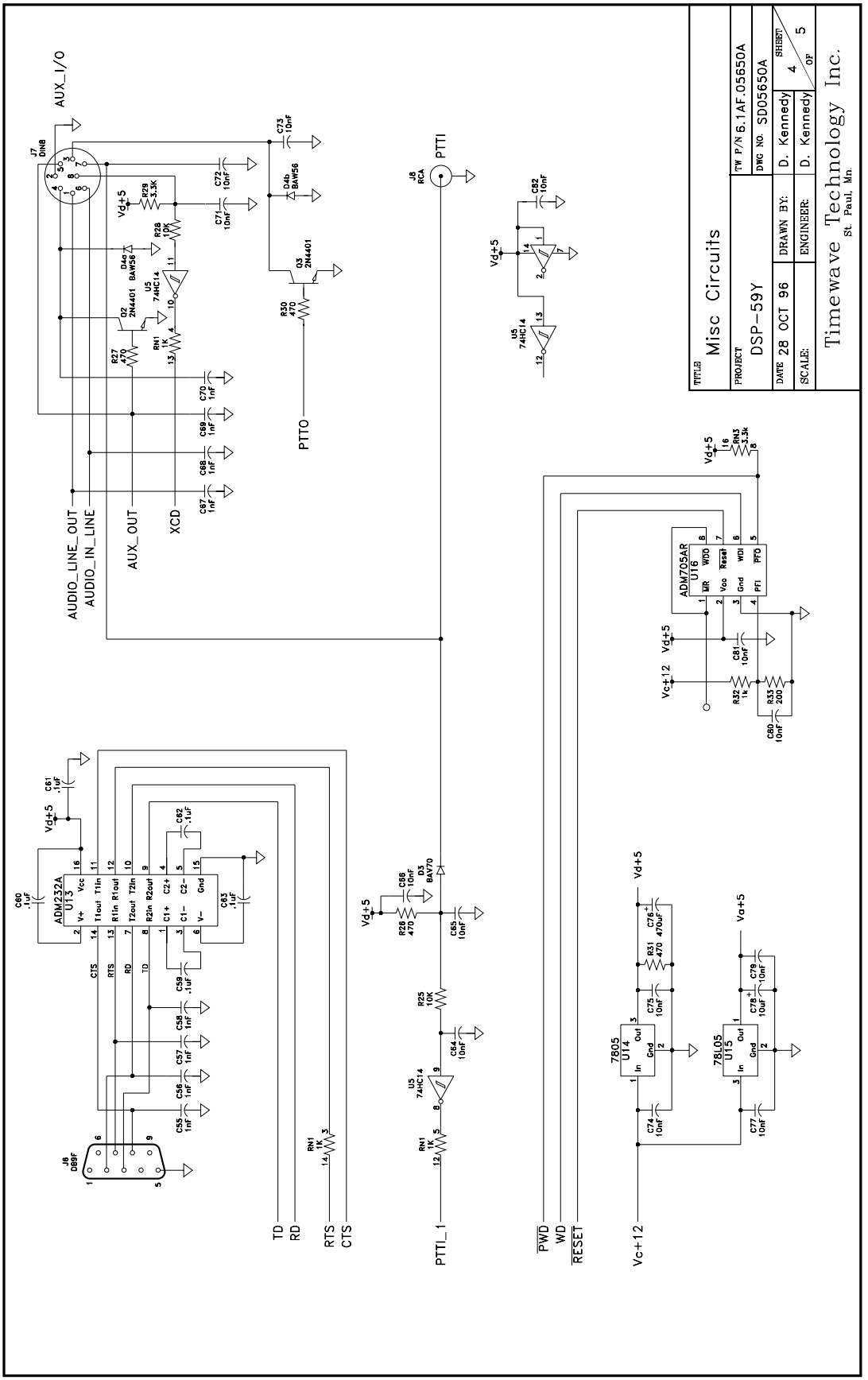
TW P/N 6.1AF.05650A
DWG NO. SB05650A
DRAWN BY: D. Kennedy
ENGINEER: D. Kennedy
DATE 28 OCT 96
SCALE:
SHEET 2 OF 5
Timewave Technology Inc.
St. Paul, Mn.
74HC273
93C66
Encoder
90°
0°
Vd+5
WD
AUX_OUT
PTTO
CTS
BYPASS
Codec_RESET
RTS
PTTI_1
XCD
D23-D8
OUT_1
RESET
OUT_0


Vc+12
Audio Input
Spkr
AUDIO_IN_LINE
AUDIO_LINE_OUT
Line Output
Power
Analog & Codec Section
DSP-59Y
TW P/N 6.1AF.056850A
DWG NO. SC05650A
DATE 28 OCT 96
DRAWN BY: D. Kennedy
ENGINEER: D. Kennedy
SHEET 3 OF 5
SCALE:
Timewave Technology Inc.
St. Paul, Mn.
AD1846
U10
U11 LM358
U12 LM2877
Vd+5
Vq+5
CODEC_CS
Codec_RESET
SCLK1
BYPASS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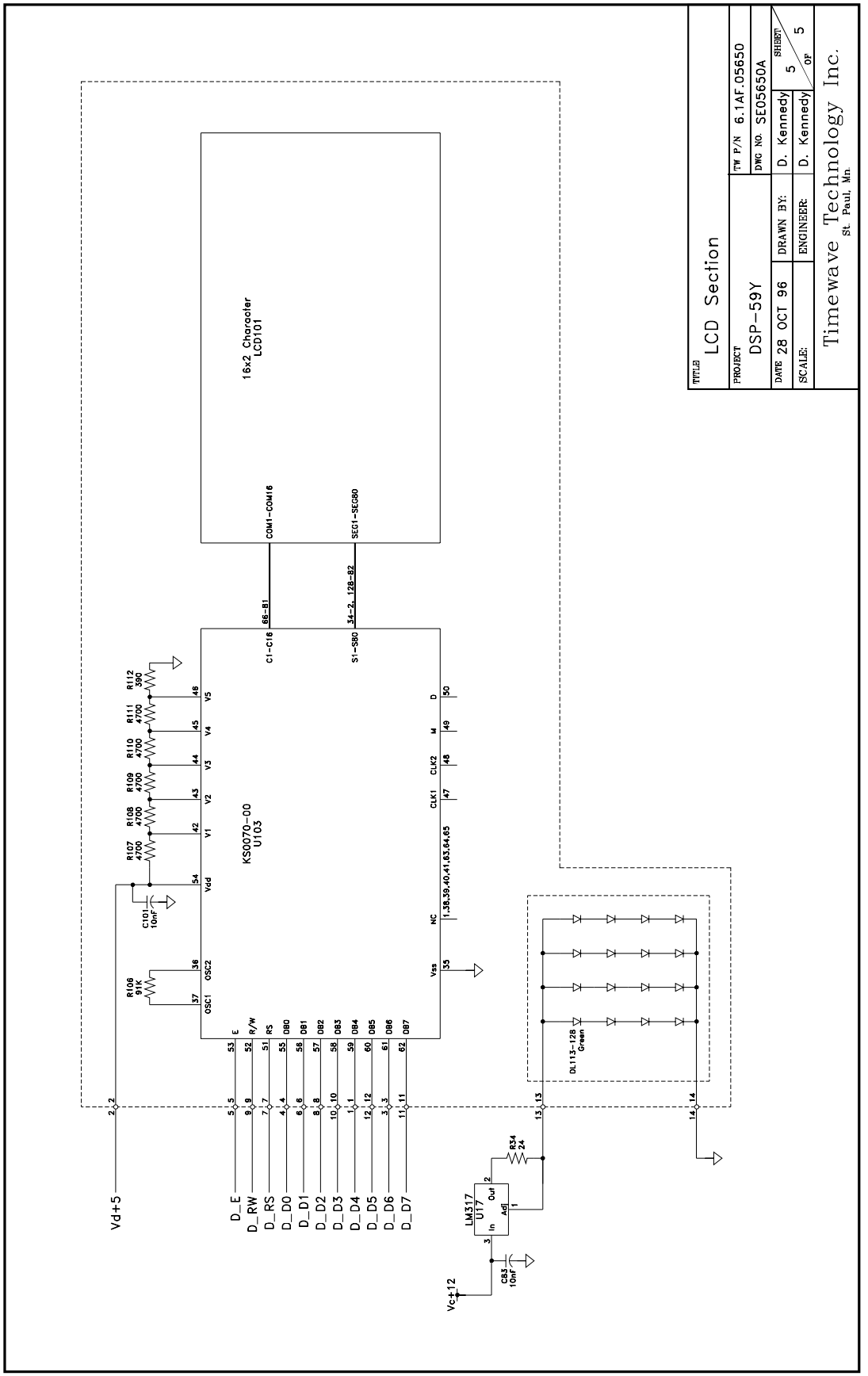
Misc Circuits
PROJECT
DSP-59Y
DATE 28 OCT 96
SCALE:
DRAWN BY: D. Kennedy
ENGINEER: D. Kennedy
TW P/N 6.1AF.05650A
DWG NO. SD05650A
SHEET 4 OF 5
Timewave Technology Inc.
St. Paul, Mn.
AUX_I/O
PTTI
PTTO
AUDIO_LINE_OUT
AUDIO_IN_LINE
AUX_OUT
XCD
TD
RD
RTS
CTS
PTTI_1
PWD
WD
RESET
Vd+5
Vc+12
ADM232A
U13
ADM705AR
U16
7805
U14
78L05
U15
74HC14
U5
U6
DB9F
J6
DIN8
J7
RCA
J8
D3 BAV70
D4a BAW56
D4b BAW56
Q2 2N4401
Q3 2N4401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LCD Section
PROJECT
DSP-59Y
TW P/N 6.1AF.05650
DWG NO. SE05650A
DATE 28 OCT 96
DRAWN BY: D. Kennedy
SHEET 5 OF 5
SCALE:
ENGINEER: D. Kennedy
Timewave Technology Inc.
St. Paul, Mn.
16x2 Character
LCD101
COM1-COM16
SEG1-SEG80
66-81
34-2, 128-82
C1-C16
S1-S80
KS0070-00
U103
R112 390
R111 4700
R110 4700
R109 4700
R108 4700
R107 4700
R106 91K
C101 10nF
V5
V4
V3
V2
V1
Vdd
OSC2
OSC1
E
R/W
RS
DB0
DB1
DB2
DB3
DB4
DB5
DB6
DB7
Vss
NC
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CLK1
CLK2
M
D
DL113-128
Green
Vd+5
D_E
D_RW
D_RS
D_D0
D_D1
D_D2
D_D3
D_D4
D_D5
D_D6
D_D7
LM317
U17
In
Out
Adj
R54
24
C83
10nF
Vc+12