

SECTION III OPERATION

3.1 INTRODUCTION

The WJ-8888 may be operated locally from the front panel or remotely by a digital computer or remote control unit. Local or remote control of the receiver parameters is suspended if the operator calls up information stored in a memory channel for display on the front panel by activating a third operating mode. These three modes of operation are described below in separate paragraphs. Also, since the power switch, the meter and meter pushbuttons, the audio level and squelch controls, and the ISB audio sideband select switch do not depend on the mode of operation, a separate paragraph describing these controls and the meter precedes the local, memory, and remote mode descriptions. Refer to the preceding Sections I and II for information relating to the various electrical inputs and outputs of the receiver. An exception to this is the I/O data word which is discussed below in paragraph 3.5.

3.2 POWER SWITCH, METER, AND AUDIO CONTROLS

These controls and the meter are not affected by a change in operating mode, and their settings are not stored in the memory, controlled by the computer, or returned to the computer as part of the data word.

- (1) **POWER SWITCH.** - To energize the receiver, press the POWER push-button switch once. The button will remain depressed and will glow to indicate that the receiver is energized. The receiver is automatically preset to the remote operating mode when power is turned on. To turn the receiver off, press the pushbutton again, so that the button light goes out as the button returns to its out position.
- (2) **LEVEL CONTROL.** - The LEVEL control varies the amplitude of the audio output signal at the rear-panel phones output (J10 pin 7) or the front panel PHONES jack. The rear panel output is disabled when the phones are plugged in to the front panel jack.
- (3) **ISB AUDIO SWITCH.** - This switch is functional only when the ISB detection mode is selected. It is used to connect the desired (upper or lower) demodulated sideband to the line audio and phones outputs.
- (4) **SQUELCH CONTROL.** - Adjusts the level below which the squelch circuit interrupts the line and phone audio outputs. The squelch function eliminates the unnecessary irritation of listening to background noise when no information is being received. The squelch control does not affect the USB or ISB audio outputs.

- (5) **METER PUSHBUTTONS.** - The front panel meter can be used to monitor either the strength of the signal to which the receiver is tuned or the level of the line audio output. The operator can choose between these two meter functions by pressing the appropriate METER button. The button corresponding to the active meter function illuminates.
- (6) **METER.** - When the signal strength is monitored on the meter, read the scale graduated from 0 to 100, representing relative signal strength. If the receiver is in the manual gain mode, the rf gain control should be adjusted such that the meter reads at the MAN SET point, to ensure that the rf level is sufficient to properly drive the IF circuitry and all of the demodulators. When line audio is monitored on the meter, read the dBm scale. Rated nominal output is 0 dBm for all detection modes.

3.3 LOCAL MODE

The local operating mode is selected by pressing the LOCAL pushbutton of the RCVR CONTROL group. The pushbutton illuminates to indicate that the local mode is active. The following paragraphs describe the controls that are active only when in the local mode.

- (1) **DETECTION MODE PUSHBUTTON GROUP AND VAR BFO CONTROL.** - The desired detection mode is selected by pressing the appropriate button in the detection mode group of pushbuttons. The eight detection modes are AM with noise limiting, AM, FM, CW fixed, CW variable, ISB, LSB, and USB. The button corresponding to the active detection mode illuminates. The VAR BFO control functions in conjunction with the CW variable detection mode.
 - (a) AM Detection Mode. - Pressing the AM button selects a standard AM detector. Any IF bandwidth and gain mode may be used in conjunction with this detection mode. Normal AGC or manual gain modes are recommended.
 - (b) AM NL Detection Mode. - Same as the standard AM detection mode except that a limiter is activated which clips high-level noise impulses.
 - (c) FM Detection Mode. - The FM button selects an FM discriminator as the detector. Any IF bandwidth and gain mode may be used when in the FM detection mode, although normal AGC or manual gain modes are recommended, and an IF bandwidth slightly greater than the maximum carrier deviation should be used to ensure near full scale output without distorting the signal.

- (d) CW FIXED Detection Mode. - When the CW fixed detection mode is active, a fixed BFO frequency at the IF center frequency is heterodyned with the IF signal to produce an audio signal. The operator should tune the receiver to a frequency slightly offset from the carrier frequency to produce an audio tone. The tone frequency will be equal to the difference between the carrier and tuned frequencies. Use of an IF bandwidth greater than the narrowest may be required to permit sufficient offset to produce the desired tone frequency.
- (e) CW VAR Detection Mode and VAR BFO Control. - When the CW VAR detection mode is active, a variable BFO frequency centered at the IF center frequency is heterodyned with the IF signal to produce an audio signal. The operator should set the receiver tuned frequency at the carrier center frequency, so that he may use the VAR BFO control to adjust for the desired tone of audio signal. The variable BFO frequency can be adjusted to up to ± 8 kHz on either side of center frequency. Use of the narrowest IF bandwidth is recommended. A special feature of the receiver is that the VAR BFO control can be locked-out so that a BFO frequency set either manually or on change of mode from memory or remote cannot be disturbed by the control. When the CW VAR mode is first activated as an initial condition upon change from another operating mode, the button steadily illuminates and the VAR BFO control is ineffective. After this initial condition is established, pressing the CW VAR button causes the button light to flash, indicating that the VAR BFO control may be used to set the BFO frequency. Pressing the button again locks out the VAR BFO control, the button steadily illuminates as before, and the BFO remains locked to the set frequency. The BFO is locked to the reference time base in 10 Hz steps.
- (f) ISB, LSB, and USB Detection Modes. - The ISB, LSB, and USB buttons select a desired single-sideband detection mode. When ISB is desired, independent LSB and USB outputs are available at rear-panel connector (J10) LSB and USB outputs, while the sideband routed to the rear-panel line audio and phones outputs (at J10) and the front-panel PHONES jack must be selected with the ISB AUDIO switch. When LSB or USB is selected, the ISB audio switch is ineffective, and the audio output is available at the corresponding LSB or USB output and at the line audio and phones outputs. The 8 kHz IF bandwidth is automatically selected when any of these detection modes are selected. In addition, Normal AGC is automatically selected and Hold AGC is disabled upon selection of the ISB detection mode. In this ISB/NAGC mode, Normal AGC is active and separate fast-attack, slow-decay AGC loops are activated which

independently control the gains of the upper and lower sidebands of the ISB signal. Manual gain may be selected while in the ISB mode, if desired, although the individual AGC loops in the ISB demodulators are active, and equalize the ISB output levels for differences in channel levels as much as 20 dB. The independent AGC loops are disabled in the USB and LSB detection modes, and for this reason it is recommended that Hold AGC be used while in these modes.

- (2) GAIN MODE PUSHBUTTON GROUP AND RF GAIN CONTROL. - The desired gain mode is selected by the operator or in some cases is selected or disabled automatically as a function of the detection mode. Selectable gain modes are Normal AGC, Hold AGC, and Manual. The button corresponding to the active gain mode illuminates. The RF GAIN control is used to set the gain when in the manual mode. In the AGC modes, the RF GAIN control remains active, and for SN ratios of 30 and higher the receiver provides a 40 dB range of manual plus automatic gain control.*
- (a) NORM AGC Gain Mode. - In the Normal AGC mode, a fast-attack, fast-decay AGC loop is active which tends to maintain a constant average predetection IF signal level if the input rf signal is above AGC threshold. As mentioned above, upon selection of the ISB detection mode, NORM AGC is automatically selected while separate fast-attack, slow-decay AGC loops are activated which independently control the gains of the upper and lower sidebands of the ISB signal.
- (b) HOLD AGC Gain Mode. - The Hold AGC function is designed primarily for use with USB and LSB single-sideband reception, although it may find use on occasion with CW detection modes. Hold AGC is the same as the normal fast AGC, except that a time delay prevents the receiver gain from increasing for two seconds after the signal drops out. This improves signal quality by preventing background noise from increasing during pauses in the signal, and by preventing the high gain "blast" that would occur at the beginnings of the first syllables or characters following the pauses. For other types of signals, except perhaps CW, a carrier is always present which maintains Normal AGC, thus rendering Hold AGC unnecessary. Most operators prefer Normal AGC with CW signals. Hold AGC is disabled for ISB reception. However, the independent LSB and USB AGC loops have slow-decay characteristics which perform essentially the same function as the Hold AGC time delay.

* Manual RF GAIN control may not be functional for AGC modes in earlier models.

- (c) MAN Gain Mode. - When the manual gain mode is active while in the local operating mode, the RF GAIN control is functional. The operator should monitor the signal strength on the meter and use the RF GAIN control to set the gain level for a meter reading at the MAN SET point. If the MAN gain button illuminates while in an operating mode other than local, the RF GAIN control will not be functional, and the rf gain will be controlled by the remote control device or remain at the level previously set.
- (3) IF BANDWIDTH kHz PUSHBUTTON GROUP. - The desired IF bandwidth is selected by pressing the appropriate button in the IF bandwidth group of pushbuttons. The button corresponding to the active IF bandwidth illuminates. The narrowest bandwidth possible should be used to avoid interference from adjacent stations. For CW signals, a bandwidth of 2 kHz or less can be used in most cases. Selection of the bandwidth for AM and FM signals will normally be influenced by the desired fidelity. Minimum bandwidth for AM signals would typically be 4 kHz, although for good reception of a high-pitched voice, for example, 8 kHz might be more desirable. The bandwidth selected for FM reception will depend on the maximum carrier deviation. Typical FSK signals require only narrow bandwidths, while voice FM will require wider bandwidths for good fidelity. For any FM signal, an IF bandwidth somewhat greater than maximum carrier deviation should be used to ensure full fidelity without distorting the signal. The 8 kHz IF bandwidth is automatically selected for SSB (ISB, LSB, and USB) detection modes, although the SSB detection bandwidth is set at 2.7 MHz by mechanical filters in the SSB demodulators.
- (4) MANUAL TUNING DIAL AND NUMERIC INDICATOR. - The tuning knob operates only while the receiver is in the local operating mode. It controls the tuned frequency, which is displayed on the seven-digit numeric display. Variable-rate tuning permits both high-resolution tuning and high-speed low-resolution tuning in one operation. When the operator rotates the tuning knob at about one revolution per second or less, frequency change is 10 Hz for every three degrees of rotation and is linearly proportional to rotational speed. For rotational rates higher than one revolution per second, frequency change is exponentially proportional to the rate of rotation. Thus slightly increased rotational rates produce intermediate tuning rates, and very rapid band-edge to band-edge tuning is easily achieved at higher rotational rates.

The tuning range over which the receiver specifications are valid is 0.500 MHz to 30.0 MHz. However, the receiver may be tuned to as high as 30.5 MHz without noticeable degradation of performance. As the tuning dial is turned clockwise, the receiver tuned frequency increases in 10 Hz steps. When the tuned frequency reaches the upper limit of 30.49999 MHz, the frequency automatically reverts to the lower limit of 0.500 MHz, and as the tuning dial is turned clockwise the frequency continues to increase

as before. Conversely, if the tuning dial is turned counter-clockwise, the receiver tuned frequency will decrease in 10 Hz steps until the lower limit of 0.500 MHz is reached. If the operator continues turning the tuning dial counter-clockwise, the frequency will automatically revert to the upper limit of 30.49999 MHz and continue downward as before.

- (5) ENTER BUTTON AND MEMORY-CHANNEL SELECT THUMBWHEEL SWITCH. - The currently effective detection mode, gain mode, IF bandwidth, tuned frequency, and rf gain and BFO frequency (if applicable) can be stored in a non-volatile memory channel selected with the thumbwheel switch by pressing the ENTER button twice. The button lights the first time pressed, warning the operator that new data is about to supersede the data presently stored in the selected memory channel. At this point the operator may change his mind by again pressing the LOCAL button. The second consecutive time the ENTER button is pressed the data is entered into the selected memory channel and the button light goes out. The contents of the memory can be recalled at any time and the receiver may be reset to the operating parameters stored in any selected memory channel by operating the receiver in the MEMORY mode and pressing the EXECUTE button, as described below. Most units are equipped with four memory channels, although eight, twelve, or sixteen memory channels may be supplied as an option.

3.4 MEMORY MODE

The memory operating mode is selected by pressing the MEMORY push-button of the RCVR CONTROL group. The receiver continues to operate with the most recent locally or remotely selected operating parameters and tuned frequency while the information stored in the memory channel selected with the CHANNEL select thumbwheel switch is displayed by the DETECTION MODE, GAIN MODE, and IF BANDWIDTH pushbuttons and by the numeric frequency display. The MEMORY button flashes to remind the operator that the information displayed on the front panel does not necessarily represent the actual operating parameters of the receiver. An exception to this is the signal strength and line audio meter readings. The buttons (with the exception of the METER buttons), the RF GAIN and VAR BFO controls, and the tuning dial are non-operable while in the memory mode. The information stored in another memory channel may be displayed simply by changing the setting of the CHANNEL select thumbwheel switch.

Normal local or remote operation of the receiver may be resumed at the current operating point by pressing the LOCAL or REMOTE button, or local operation may be resumed at the point stored in the selected memory channel by pressing the EXECUTE button. The receiver automatically reverts to the local mode when the EXECUTE button is pressed.

3.5 REMOTE MODE

The computer or remote control unit may address the receiver at any time, while in any operating mode, to monitor the current tuned frequency, signal level, and operating parameters. The operator may place the receiver in the remote operating mode by pressing the REMOTE button of the RCVR CONTROL group. The front panel controls will become inoperative but will continue to indicate the actual operating parameters and frequency of the receiver. If a trigger is received from the a remote device while the receiver is addressed and in the remote operating mode the receiver becomes receptive to data from the remote device which can change the operating parameters and tuned frequency. Special units have an option installed which permits the remote trigger to place the receiver in the remote operating mode, if addressed but not already in the remote mode when the trigger is received. If it is desired to enter computer-programmed data into a selected memory channel, the operator must press the LOCAL button and then without touching any of the controls press the ENTER button twice. He may then return the receiver to the remote operating mode.

The standard receiver is equipped with a digital-interface synchronous input/output (I/O) module. For the purpose of programming a computer, the serial synchronous I/O data word is shown in Figure 3-1. Refer to the block diagram and circuit descriptions in Section IV for further information regarding address, trigger, and clock inputs and outputs of the asynchronous data word. The asynchronous I/O option is covered in a supplement to this manual. Refer to available Watkins-Johnson application notes for further information regarding computer control.

