

# 651S-1/1A General Purpose HF Receiver



operation

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**NOTICE:** This section replaces second edition dated 1 May 1972.

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## 1. GENERAL

All the controls and indicators for manual control of the 651S-1/1A are located on the front

panel. Table 1 lists the controls and indicators and briefly describes the function of each; figure 1 shows the controls and indicators on the front panel of the 651S-1/1A.



NOTE:  
SILK-SCREEN ON BANDWIDTH SWITCH  
MAY VARY ON DIFFERENCE PART  
NUMBERS OF THE 651S-1/1A

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*Operating Controls and Indicators  
Figure 1*

*Table 1. Control or Indicator Function.*

CONTROL OR INDICATOR	FUNCTION
Battery lamp	Red battery lamp lights when the external battery (if used) is providing keep-alive power to frequency memory circuits. Battery will supply power if the POWER switch is in OPER and a temporary power outage occurs. The lamp is just left of the front panel meter (not easily visible when not lit).

Table 1. Control or Indicator Function (Cont).

CONTROL OR INDICATOR	FUNCTION
AUDIO dbm/RF db meter	Indicates level of either 600-ohm audio output of rf signal depending on the position of the METER switch.
Frequency readout	Digitally indicates operating frequency selected.
POWER OPER-OFF switch	Applies switched and keep-alive voltages to circuits when in OPER position. All voltages are off when in OFF position.
BFO FIXED-VAR switch	Applies phase-locked fixed 450-kHz signal in SSB or CW mode when set to FIXED; applies 450-kHz variable bfo signal in SSB mode or CW mode when switch set to VAR.
METER LINE-RF switch	Controls front panel meter indications; audio signal level indicated when set to LINE or rf signal level indicated when set to RF.
AGC FAST-OFF-SLOW switch	Sets AGC release time; time is 100 ms at FAST and 1000 ms at SLOW. AGC is disabled in center position.
CONTROL REMOTE-MON-LOCAL switch	Allows manual control when set to LOCAL, remote control (optional cards required) when set to REMOTE, and signals status of receiver to remote control when set to MON.
1 MHZ control	Selects frequency in 1-MHz steps.
.1 MHZ control	Selects frequency in 0.1-MHz steps.
Tuning control	Selects frequency in 0.1-kHz steps.
DIAL LOCK switch	Disables tuning control in LOCK position.
VBFO control	Varies frequency of variable 450-kHz beat frequency oscillator when BFO switch is in VAR position; $\pm 60$ Hz in 10-Hz increments in SSB and $\pm 900$ Hz in 150-Hz steps in CW.
RF GAIN control	Controls rf gain.
AF GAIN control	Controls speaker audio level.
SQUELCH control (optional)	Controls squelch level and operating point; disables squelch circuits when in extreme counterclockwise position.
MODE selector	Selects operating modes of FM, AM, SSB, CW, and ISB.
BANDWIDTH selector	Selects if bandwidth (see table 2).

Table 2. IF Filters.

NOTES	BANDWIDTH SWITCH (pos)	MODE	IF FILTER 3-dB PASSBAND	FILTER ENABLED (*)
These positions are standard on all radios	16 6 3 2.7U 2.7L	AM or FM AM or FM AM USB LSB	16 kHz 6 kHz 3 kHz 2.7 kHz 2.7 kHz	ALL BYPASSED FL6 FL3 FL5 FL7
The LSB filter is used in ISB operation	2.7L	ISB	2.7 kHz	FL7
Silk-screen for the last three clockwise positions of the BANDWIDTH SW may vary for various part no of the 651S-1	Top { 1 4 WSRT WBTY	CW CW or AM CW CW	1.1 kHz 4 kHz 1.1 kHz 1.1 kHz	} FL2  } FL1  } FL4
	Center { .5 CW 2	CW CW CW	500 Hz 500 Hz 2 kHz	
	Bottom { .2 NSRT 1	CW CW CW	200 Hz 370 Hz 1.1 kHz	
*See if filter cards A5A1 and A5A2 schematic diagram.				

2. INPUT/OUTPUT CONNECTORS

The high-impedance headset audio connector is located on the lower left front panel and will accommodate a standard phone-jack type mating connector.

The rear panel (figure 2) contains the remaining input/output connectors and terminal strips. The functions of the connectors, listed from left to right, are as follows:

IF STD  
connector .....450-kHz coaxial BNC  
if output that can be used to operate an RTTY converter, an oscilloscope, or for monitoring.

IF ISB  
connector ..... 450-kHz coaxial BNC  
independent sideband if output point for monitoring (output from LSB filter when in ISB mode).

REMOTE CONTROL

OUTPUT  
connector ..... Multipin output connector type JT02A-14-37PA (014) (mates with JT06RE-14-37SA-386) for bcd frequency information to 635U-2 Preselector.

INPUT  
connector ..... Multipin input connector type JT02A-14-37P (014) (mates with JT06RE-14-37S-386) for all types of remote control.

ANT  
connector ..... BNC coaxial input connector for receive signal.

BATT -6V  
terminal block ..... Connection point for (Available external 6-volt battery option)

**AUDIO LINES**

terminal block ..... Output points for standard and ISB audio at 600 ohms, center tapped (ISB audio is LSB audio when in ISB mode).

**SPKR 8-OHM**

jack (phono) ..... Output point for standard audio at 8 ohms.

**100 KHZ**

connector (BNC) ..... Input/output point for 100-kHz reference signal at 50 ohms. (Reserved for future use.)

**PWR**

connector ..... Multipin input connector type PT02A16-8P (mates with PT0-6A16-8S (SR) for 115/230-Vac input operating power.

**3. MANUAL OPERATION**

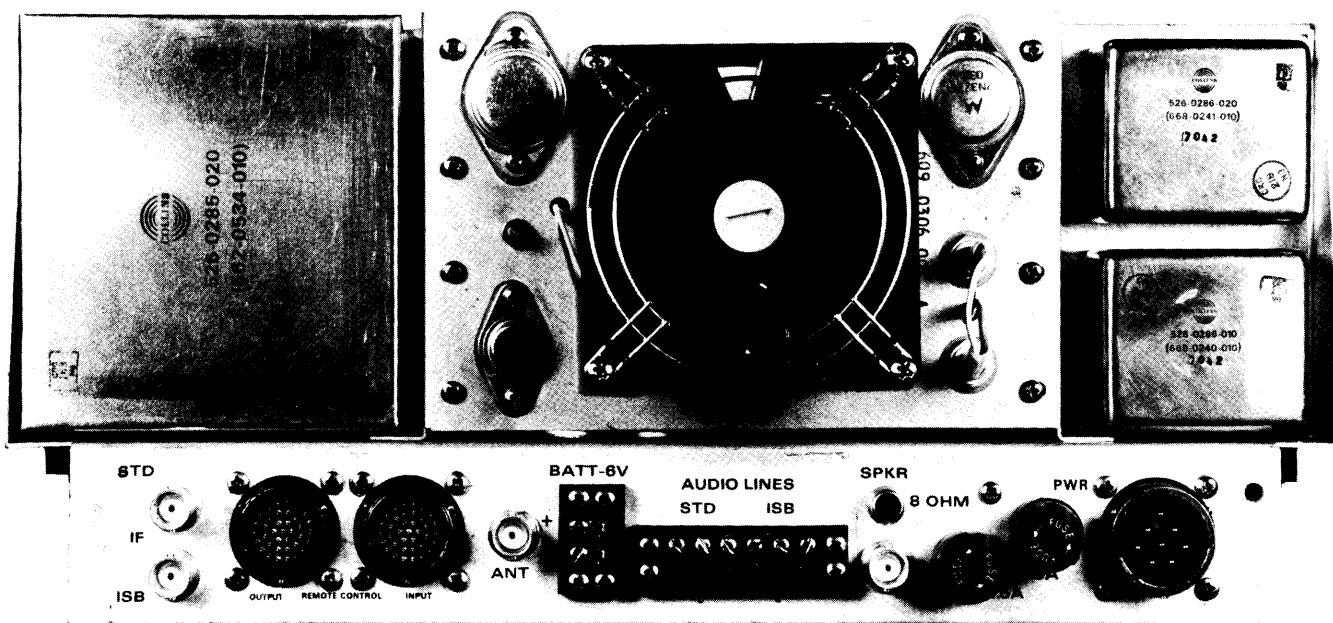
**Note**

MODE and BANDWIDTH switch settings are independent except as noted below for ISB mode operation.

**3.1 Single-Sideband Reception**

For proper single-sideband operation, perform the following steps:

- a. Ensure primary power is connected properly.
- b. Ensure rf antenna is connected to ANT jack.
- c. Ensure speaker, headset, or power amplifier system is connected to appropriate audio output points.
- d. Set POWER switch to OPER position.
- e. Set BFO switch to desired position.
- f. Set AGC switch to desired position.
- g. Set CONTROL switch to LOCAL position.
- h. Set frequency controls (1 MHZ, .1 MHZ, and large tuning knob) to desired frequency.



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Rear Panel Connectors, Cover Removed  
Figure 2

- i. Set METER switch to RF or LINE as necessary to read desired levels.
- j. Set RF GAIN control fully clockwise (maximum signal strength).
- k. Set AF GAIN control about midsetting.
- l. Set mode selector to SSB.
- m. Set BANDWIDTH switch to 2.7U or 2.7L.
- n. Set SQUELCH control (optional) fully counterclockwise to OFF position.
- o. Adjust the large tuning knob as necessary for best reception noted on meter.
- p. After signal is received, set AF GAIN for desired listening level, set RF GAIN for best signal-to-noise ratio and, if BFO is set to VAR, set VBFO control for maximum intelligibility.
- q. If squelch operation (optional) is desired, slowly turn SQUELCH control clockwise until background noise just drops out. Turning the control too far may result in blocking or reducing weak signals.

### 3.2 AM Reception

Operations for AM reception are the same as for sideband except for the following conditions:

- a. Setting of BFO and VBFO controls does not affect AM reception.
- b. Set MODE selector to AM.
- c. Set BANDWIDTH switch to 3, 6, or 16.

### 3.3 CW Reception

Operations for CW reception are the same as for sideband except for the following conditions:

- a. Set MODE selector to CW.
- b. Set BANDWIDTH switch to desired bandwidth. (See table 2.)

### 3.4 FM Reception

Operations for FM reception are the same as for AM except for the following conditions:

- a. Set MODE selector to FM.
- b. Set BANDWIDTH switch to 6 or 16.

### 3.5 ISB Reception (Optional)

Operations for ISB reception are the same as for single sideband, except for the following conditions:

- a. Optional ISB amplifier card A3 (778-2952-001) installed in radio.

- b. Set MODE selector to ISB.
- c. Set BANDWIDTH switch to 2.7U or 2.7L only.

#### Note

If it is necessary to adjust AGC or audio output controls on card A3, refer to maintenance section for adjustment procedure.

Note that the lower sideband audio and if outputs appear at the ISB audio and if output jacks at the rear of radio.

### 3.6 Frequency Scan Operation (Optional)

Frequency scan operation can be used with any type reception; operating procedures will be identical with the following exceptions:

- a. Auto scan card A9 (793-9368-001) installed in radio.

#### Note

Ensure that 651S-1 chassis sideboard is properly strapped and card is programmed for the desired frequency scan range and dwell-time (refer to paragraph 4.6 in the installation section).

- b. Set REMOTE/LOCAL switch to LOCAL.
- c. Set the lower frequency limit by selecting the desired frequency on receiver.
- d. Frequency scan is initiated by setting the REMOTE/LOCAL switch to REMOTE (SCAN) position.
- e. A pause in frequency scanning is provided by setting switch to MONITOR; scanning will be resumed when switch is returned to REMOTE position.

#### Note

The receiver frequency display will follow the discrete frequency steps as scanning is being conducted.

## 4. REMOTE CONTROL OPERATION (OPTIONAL)

### 4.1 Processor Operation

For remote control operation, perform the following steps:

- a. Ensure that optional DCFE card A8 (CPN 624-5744-001), and the appropriate optional DCU card A9 (CPN 793-9414-001, CPN 624-5781-001, or CPN 774-7842-001) are properly installed.

**Note**

If it is necessary to adjust rf gain controls on DCFE, refer to maintenance section for adjustment procedures.

- b. Strap DCU address pins (pins 10, 11, 12, 13, and 14 on rear panel REMOTE CONTROL INPUT connector J62) to the desired address. For a logic 1 in an address position, strap that pin to pin 15 in connector J62; for a logic 0, strap to pin 18.

**Note**

An all 0 address will not properly control the receiver. An all 1 address is normally reserved for teletypewriter or crt control. Any one of the remaining 30 address possibilities is permissible and allows control of up to 30 separate receivers by one processor unit.

- c. When DCU card 624-5781-001 or 774-7842-001 is installed, ensure that card is strapped for DCU address length of 5; the two clips (provided) should be installed on the two sets of posts marked 5 on the DCU card.
- d. Ensure primary power is connected properly.
- e. Ensure rf antenna is connected to ANT jack.
- f. Ensure speaker, headset, or power amplifier system is connected to appropriate audio output points.
- g. Connect processor unit to REMOTE CONTROL INPUT connector J62.
- h. Set front panel CONTROL switch to REMOTE position.
- i. Set front panel POWER switch to OPER position.
- j. Send control words using control word content and format described in tables 7 and 8 of the description and principles of operation section of this instruction book. Monitor word content and format are described in tables 8 and 9 of the description and principles of operation section.

All functions in control word II are enabled by a logic 1 in that bit position of the control word. A logic 1 in local/remote bit position 30 of control word II places the receiver in local control without changing the front panel CONTROL switch from REMOTE to LOCAL.

The receiver may be returned to remote control by placing a logic 0 in bit position 30 of control word II.

Control word III provides vbfo and rf gain or squelch level control data to the receiver. The bcd code placed in vbfo bits 24, 25, 26, and 27 produces voltage levels that correspond directly to the voltage levels produced by front panel VBFO switch S112. The bcd code should, therefore, be limited to the 13 combinations from binary 0 to binary 12 to correspond to the 13 front panel switch positions. If interpolate enable bit 15 in control word II is a logic 1, the bfo variation is  $\pm 60$  Hz in 10-Hz steps. If vbfo enable bit 16 is a logic 1, the bfo variation is  $\pm 900$  Hz. The interpolate bfo frequency produced for each binary position is shown in table 3.

If DCFE card A8 is strapped for rf gain control, word III bits 28, 29, 30, and 31 provide bcd rf gain level information to the receiver. All 16 bcd combinations may be used with all 1's producing maximum rf gain (0-dB reduction) and all 0's producing minimum rf gain (90-dB reduction). Bit position 17 in control word II must be logic 0 to provide rf gain control.

Monitor word I is returned to the processor unit after the reception of control word I, III, or IV. Bits 10 through 31 of this monitor word contain bcd frequency information. A logic 1 in bit 9 indicates a power fault.

Monitor word II is returned to the processor unit after the reception of control word II.

A logic 1 in bit 9, 10, or 11 indicates a fault. If the front panel CONTROL switch is in REMOTE position, a logic 0 appears in bits 12 and 15. If the CONTROL switch is in LOCAL position, a logic 1 appears in bit 12 and a logic 0 in bit 15. If the CONTROL switch is in MON position, a logic 1 appears in bits 12 and 15. A logic 1 in bit 13 indicates the front panel POWER switch is in OPER



Table 3. Control Word III, Interpolate BFO Frequency Generation.

SWITCH STEPS	CONTROL WORD III BIT POSITION				INTERPOLATE FREQUENCY (kHz)
	24	25	26	27	
0	0	0	0	0	449.940
1	0	0	0	1	449.950
2	0	0	1	0	449.960
3	0	0	1	1	449.970
4	0	1	0	0	449.980
5	0	1	0	1	449.990
6	0	1	1	0	450.000
7	0	1	1	1	450.010
8	1	0	0	0	450.020
9	1	0	0	1	450.030
10	1	0	1	0	450.040
11	1	0	1	1	450.050
12	1	1	0	0	450.060

position. A logic 1 in bit 14 indicates no audio output. The mode of operation is indicated by coding of bits 16, 17, 18, and 19 (refer to table 10 in the description and principles of operation section). Bits 20, 21, 22, and 23 indicate the bcd vbfo control position and bits 24 through 31 repeat the 1-kHz and 100-Hz frequency information.

#### 4.2 Operation With 514S-1 Remote Control Unit

**Note**

Refer to the 514S-1 instruction book (523-0764187) for interconnect information for the 514S-1 and 651S-1/1A.

For remote control TTY operation, perform the following steps:

- a. Replace interconnect card A8 with optional DCFE card A8 (CPN 624-5744-001), and install optional TCU card A9 (CPN 783-9480-001). (Refer to paragraph 4.7 in the

installation section for installation information for the TCU card.)

**Note**

If it is necessary to adjust rf gain controls on DCFE, refer to maintenance section for adjustment procedures.

- b. Strap TCU address pins (pins 10, 11, 12, and 13 on rear panel REMOTE CONTROL INPUT connector J62) to the desired address in hexadecimal. For a logic 1 in an address position, strap that pin to pin 15 in connector J62; for a logic 0, strap to pin 18. Strap pin 14 (all call) to pin 18 in connector J62.

**Note**

No strapping is required for a single 651S-1 receiver controlled by a 514S-1 Remote Control Unit.

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- c. Ensure primary power is connected properly.
- d. Ensure rf antenna is connected to ANT jack.
- e. Ensure speaker, headset, or power amplifier system is connected to appropriate audio output points.
- f. Connect 514S-1 Remote Control Unit to REMOTE CONTROL INPUT connector J62.
- g. Set front panel CONTROL switch to REMOTE position.
- h. Set front panel POWER switch to OPER position.
- i. Operate the 514S-1 Remote Control Unit to control the receiver. Refer to 514S-1 instruction book for operation procedures.

**Note**

If the receiver is to be remotely controlled over a greater distance than 1000 feet, TTY modems are required.