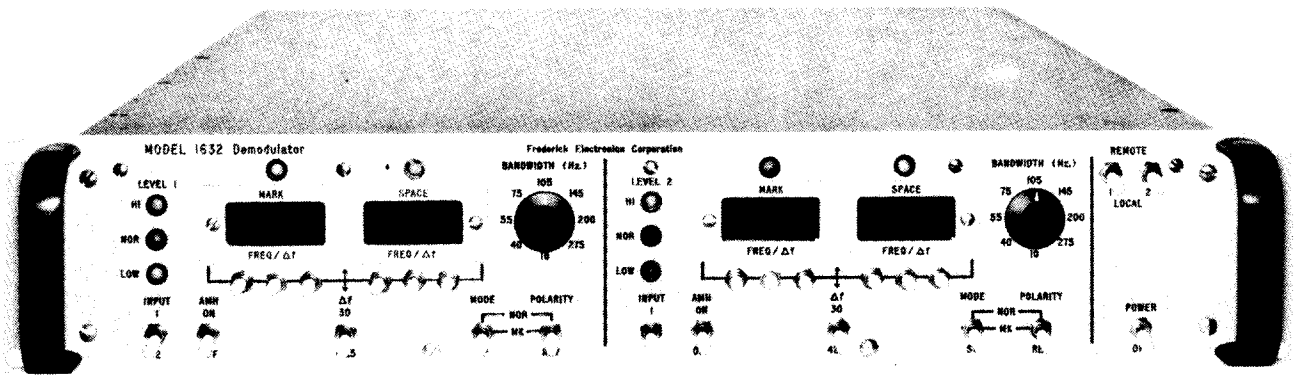
PLANTRONICS
Frederick Electronics

MODEL 1632 DEMODULATOR/

MODEL 1256 DISPLAY UNIT



MODEL 1632 DEMODULATOR

FEATURES

- Copies many CCITT compatible signals
- Copies with only one FSK tone
- Digitally controlled filters
- Fast setup with companion Model 1256

GENERAL

The Model 1632 is an extremely versatile Tone Demodulator which can be readily adjusted to receive signals from most of the FSK or on/off keyed, single or multichannel VFDM schemes presently in use. This versatility makes the device particularly well suited for surveillance, monitoring, and testing activities.

The Model 1632 chassis contains two complete demodulators, each with its own separate operating controls. Each demodulator has two bandpass filters whose center frequencies and bandpass widths are selectable. This latter feature permits independent detection of the mark and space tones which further increases the flexibility of the device, in that, as soon as one tone has been tuned, copying of data may begin. In the case of FSK, a search is then made for the cooperating tone. When located, the second tone enhances the performance of the unit.

GENERAL (cont.)

The demodulators may be automatically and rapidly set up, to predetermined values, using the Model 1256 display unit. The Model 1256 is discussed on the following pages.

DESIGN

The Model 1632 is an all solid-state device housed in an aluminum cabinet, suitable for mounting in a standard 19-inch EIA rack. A vertical rack space of 3½ inches is required.

The unit without options contains 16 printed circuit boards. Access is provided by a removable top cover. All operating controls and indicators are conveniently located on the front panel.

FREDERICK ELECTRONICS CORPORATION
Hayward Road / Post Office Box 502 / Frederick, Maryland 21701
Telephone: (301) 662-5901 / Cable: FREDCO / Telex: 893438

DATE
2/76

APPLICATIONS

SIGNALING SCHEME

Some of the commonly encountered multi-channel VFDM systems with which the Model 1632 is compatible are those which operate in accordance with CCITT Recommendations R31, R36, R37, R38-A, B and R39. The unit is also capable of demodulating on/off keying such as that covered by Recommendation R35.

Individual filters for center frequencies may be chosen in increments of either 30 Hz or 42.5 Hz, beginning at 300 Hz for the 30 Hz steps and 255 Hz for the 42.5 Hz spacing. Both of these modes have upper limits, which are detailed below. The bandpass filter widths which may be chosen are 10 Hz (for tuning only), 40 Hz, 55 Hz, 75 Hz, 105 Hz, 145 Hz, 200 Hz, and 275 Hz.

In addition to the exact center frequencies mentioned, many more "effective center frequencies" can be copied by selecting the closest exact center frequency and a wide bandpass. Single channel FSK is copied in this manner. IF signals are supplied from the output of a receiver, and the receiver has an adjustable BFO, then the exact center frequency is unimportant.

SPECIFICATIONS

DATA INPUTS

Using Front Panel Controls

ΔF = 30 Hz	300 Hz to 5970 Hz
ΔF = 42.5 Hz	255 Hz to 8457.5 Hz

Controlled from Model 1256

ΔF = 30 Hz	300 Hz to 4770 Hz
ΔF = 42.5 Hz	255 Hz to 6757.5 Hz

Maximum Baud Rate

300 baud or less depending upon bandpass used.

Input Level

+10 dbm to -40 dbm for 600 ohm circuit
1v rms for 10k ohm circuit

Number of Inputs

Two inputs. Either or both demodulators may be switched to either input.

SPECIFICATIONS (cont.)

DATA OUTPUTS

Number of Outputs

Two outputs. One per demodulator or the demodulators may be connected together for a single, diversity output.

Output Circuit Configuration

Standard - Polar voltage (nominally ±6v) compatible with MIL-STD-188C or internally strappable for EIA-RS-232-C.

Optional - Plug-in neutral or polar dry contacts (up to 100 ma at 130 vdc) of solid-state optically isolated high level keyers.

POWER REQUIREMENTS

AC Power

115/230 vac ±10%, 47 to 400 Hz, 55 watts (without optional loop power supply).

OPTIONS

Power Supply

A plug-in power supply is available for use with high level keyers.

Remote Control Input

Consists of a 5-wire, low voltage cable from Model 1256.

PHYSICAL DESCRIPTION

Chassis Dimensions

19 inches (48.3 cm) wide
3½ inches (8.89 cm) high
20 inches (50.8 cm) deep

Weight

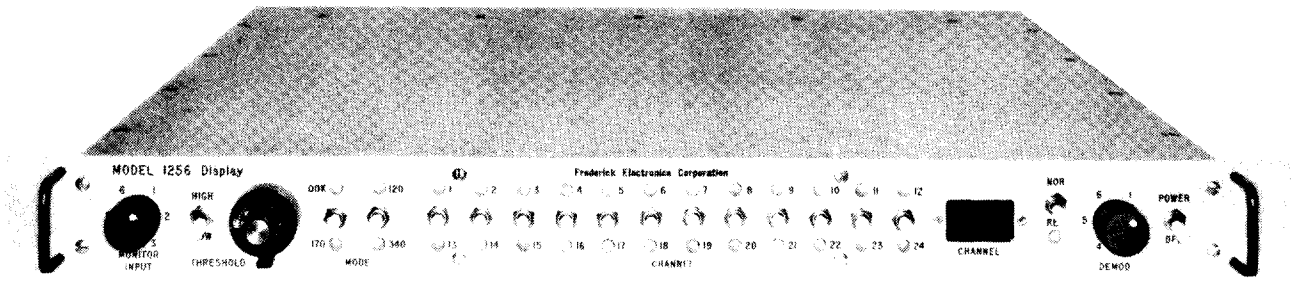
Approximately 20 pounds (9.07 kg)

Finish

Clear irridited aluminum chassis, front panel light gray with black filled engraved markings.

Operating Temperature

0° to +50°C ambient



MODEL 1256 DISPLAY UNIT

FEATURES

- Programmable for various signaling schemes
- Displays status of up to 24 channels
- Provides rapid setup of Model 1632

GENERAL

The Model 1256 scans through a programmed set of frequencies, detects the presence or either a steady state tone or keyed signals at the chosen frequencies, and displays this information on its front panel.

The scanned frequencies are normally a set of tones which form a "Voice Frequency Division Multiplex" system such as those recommended by CCITT. An operator watching this display can readily determine which channels contain traffic. A remotely connected Model 1632 demodulator may be easily and quickly set up on an active channel using the controls of the Model 1256.

Mode switches permit selection of any of four preprogrammed, on/off keying (OOK) or frequency shift keying (FSK) tone frequency sets. Six individual inputs are provided and selection is made via a rotary switch. Up to six remote demodulators may be controlled. The addresses of these units are automatically inserted into the control signal format and are dependent upon the

GENERAL (cont.)

position of a front panel switch. Control instructions are sent to the demodulator whenever one of the channel switches is activated. In addition to the address data, the control instruction contains such information as center frequency and bandwidth of the tone filters and detection mode (i.e., OOK or FSK).

When an instruction has been sent, the channel number which the demodulator is to copy within a given frequency scheme, is displayed on the front panel. Selecting a new demodulator address causes the number of the channel, which that demodulator was last instructed to copy, to be displayed.

DESIGN

The Model 1256 is an all solid-state device housed in an aluminum cabinet for mounting in a standard EIA rack. The unit contains nine printed circuit boards. Access is provided by a removable top cover. All operating controls and indicators are conveniently located on the front panel.

APPLICATIONS

SIGNALING SCHEME AND PROGRAMMING

The Model 1256 is normally programmed for the following frequency schemes:

MODE 1 - 24 channels, on-off keyed beginning at 420 Hz and spaced at 120 Hz intervals (per CCITT R-35);

MODE 2 - 24 channels, ±30 Hz FSK beginning at 420 Hz and spaced at 120 Hz intervals (per CCITT R-31);

MODE 3 - 18 channels, ±42.5 Hz FSK beginning at 425 Hz and spaced at 170 Hz intervals (per CCITT R-39);

MODE 4 - 9 channels, ±85 Hz FSK beginning at 850 Hz and spaced at intervals of 340 Hz.

Programming for other frequency schemes is possible within some limitations (available by special order and quotation only).

SPECIFICATIONS

DATA INPUTS

Input Signals

MODE 1 OOK 300-4110 Hz
MODE 2 FSK 300-4110 Hz
MODE 3 FSK 255-5652.5 Hz
MODE 4 FSK 255-5652.5 Hz
} Depending on program

Input Level

-40 dbm to +10 dbm

Number of Inputs

6 (switch selectable)

Input Impedance

10,000 ohms (balanced and isolated)

SPECIFICATIONS (cont.)

DATA INPUTS (cont.)

Frequency Increments

OOK - 30 Hz
FSK - 30 Hz and 42.5 Hz
} Or multiple thereof

Tone Channels

96 channels programmable in groups of 24

Interface To Demodulators

5-wire low voltage cable

POWER REQUIREMENTS

AC Power

115/230 vac ±10%, 47/400 Hz, 35 watts

PHYSICAL DESCRIPTION

Chassis Dimensions

19 inches (48.3 cm) wide
1-3/4 inches (4.4 cm) high
20 inches (50.8 cm) deep

Weight

Approximately 13 pounds (5.9 kg)

Finish

Clear irridited aluminum chassis, front panel light gray with black filled engraved markings

Operating Temperature

0° to 50°C ambient

ALL SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTIFICATION

MODEL 1632A
VOICE FREQUENCY CARRIER TELEGRAPH DEMODULATOR (VFCTD)

INSTRUCTION MANUAL

March 1985

TMC41100

PROPRIETARY INFORMATION

PLANTRONICS/Frederick Electronics Corporation
7630 Hayward Road, P.O. Box 502
Frederick, Maryland 21701-0502

Printed In U.S.A.

PLANTRONICS/FREDERICK ELECTRONICS CORPORATION
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Frederick, Maryland 21701-0502

MANUAL ERRATA SHEET

EQUIP MODEL NO: 1632A **MANUAL PART NO:** TMC41100 **MANUAL DATE:** MAR 85

REFERENCE	CORRECTION
Figure 6-16. Parts List	Item 6: Change MFR from SPRAGUE to KEMET. Change MFR P/N from 150D107X902082 to T310D107M020AS
--- ECN 6824 ----------	SEP 85 ----------
PROBLEM:	Auto-Mark-Hold (AMH) does not function when the input is a Frequency Division Multiplexed (FDM) signal and when 16 or more tone pairs are being used.
CAUSE:	Nominal level of the AMH was previously set at -55 dBm. The AGC action on the input AMH is not low enough because the threshold is typically 10 dB below the peak power of the bandpass filter signal. When an FDM signal is applied each individual signal may be as much as 25 dB below the composite peak. If this is the case AMH would be engaged at all input levels where the composite peak is higher than 10 to 15 dB above a single tone pairs level.
SOLUTION:	Reduce the AMH Threshold as follows - Set to -60 dBm for single tone pair operation. This will produce nominal threshold levels which would be equivalent to -40 dBm for a full composite (24) tone pairs.
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FIGURE

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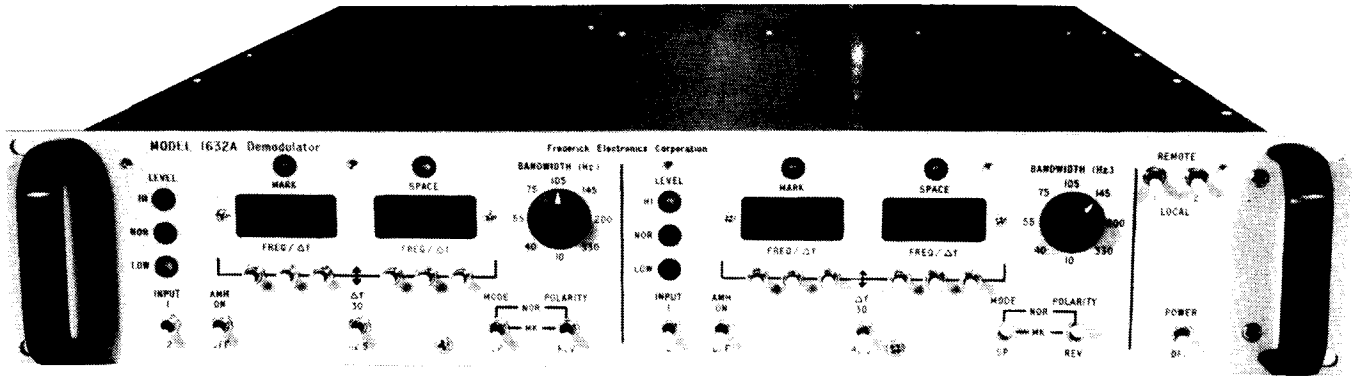


Figure 1-1. Model 1632A Voice Frequency Carrier Demodulator

SECTION I

INTRODUCTION

1.1 PURPOSE OF EQUIPMENT

The Model 1632A is a flexible voice frequency carrier demodulator that provides a means of receiving two multichannel or independent signals.

The tone frequencies and bandwidths are adjustable from the front panel and cover all standard voice frequency channels in increments of 30 or 42.5 Hz and baud rates up to 300.

The individual demodulators may be locally controlled from the front panel or remotely controlled by serial transmission of two 32-bit binary words. This feature allows a remote system to automatically establish receiving parameters that have been set up on a scheduled basis. All front panel controls except input selection and local/remote selection can be remote controlled.

Diversity capability is included so that the two demodulators may be externally tied together or to another similar demodulator.

The tone filter center frequencies are crystal controlled to ±2 Hz. The demodulator is a single conversion type with a highly stable frequency synthesizer used for the local oscillator. An AGC circuit is provided for superior performance in a multiplex environment.

Each demodulator has its own sense switch to change the mark-space polarities in the event that they are received inverted. In addition, each demodulator has an auto mark-hold feature to place the output in the mark-hold condition should both the mark and space channels fail.

1.2 PHYSICAL DESCRIPTION

The Model 1632A is an all solid-state device housed in an aluminum rack-mounting cabinet 19 inches wide by 3.5 inches high by 19 inches deep. The unit contains 17 PC boards without options. Access is provided by a removable top cover.

1.3 SPECIFICATIONS

Specifications for the Model 1632A are listed in Table 1-1.

Table 1-1. Specifications Model 1632A

ITEM	DESCRIPTION
LOCAL CONTROL FREQUENCY RANGE	Δf = 30 Hz (from 300 Hz to 5970 Hz) Δf = 42.5 Hz (from 255 Hz to 8457.5 Hz)
REMOTE CONTROL FREQUENCY RANGE	Δf = 30 Hz (from 300 Hz to 4770 Hz) Δf = 42.5 Hz (from 255 Hz to 6757.5 Hz)
TONE FREQUENCY INCREMENTS	Δf = 30 Hz Δf = 42.5 Hz
CHANNEL SPACING	Multiples of 30 Hz or 42.5 Hz depending on Δf.
MAXIMUM BAUD RATE	300 baud (dependent on filter bandwidth).
INPUT LEVEL	+10 dBm to -40 dBm for 600 ohm circuit, nominal 1 volt rms for 10K ohm circuit.
INPUT IMPEDANCE	600 ohms Unbalanced (600 ohms balanced and isolated optional) 10K ohms Unbalanced.
SIGNALLING SCHEMES	FSK or ON/OFF keyed tone.
NUMBER OF INPUTS	Two are provided, either demod may be connected to either input by a front panel switch.
LOW LEVEL	Polar keying (nominally +6V) compatible with MIL-STD-188C. May be changed to EIA-RS-232-C with jumper.
DIVERSITY	Mark and space low impedance tie points provided for each demodulator.
ENVELOPE	Post detection low-pass filter outputs provided for mark and space tones of each demodulator (10K ohm output impedance).

Table 1-1. Specifications Model 1632A (cont.)

ITEM	DESCRIPTION
MONITOR	Provision for monitoring input signals. These are buffered low impedance signals, not balanced or isolated. Buffer gain is approximately one.
HIGH LEVEL LOOP	Optional neutral or polar dry contacts with plug-in optically isolated keyers.
HIGH LEVEL LOOP SUPPLY	Optional ±65 Vdc 120 ma supply.
BANDPASS FILTER BANDWIDTHS	The available bandwidths are nominally: 10 Hz - Tuning Only 40 Hz 55 Hz 75 Hz 105 Hz 145 Hz 200 Hz 330 Hz
POWER REQUIREMENT	115/230 Vac ±10% 47/400 Hz 55 watts without optional loop supply.
POWER FAIL	9V battery maintains frequency information in storage registers.
CHASSIS DIMENSIONS	19 inches (48.3 cm) wide, 3.5 inches (8.89 cm) high, 19 inches (48.3 cm) deep, overall depth behind front panel approximately 20 inches (50.80 cm).
WEIGHT	Approximately 20 pounds (9.07 kg).
MOUNTING	Suitable for mounting into standard 19 inch (48.3 cm) wide equipment rack.
ENVIRONMENTAL OPERATING TEMPERATURE	0° to 50° C ambient

SECTION II

INSTALLATION

2.1 GENERAL

This section contains instructions for unpacking, mounting, and making all connections to the Model 1632A Demodulator Unit. The unit is adjusted and tested for correct operation prior to shipment from the factory.

2.2 UNPACKING AND INSPECTION

Open the shipping container being careful not to puncture the container with sharp/metallic objects which might damage the contents. Remove the packing and the unit from the container and inspect the unit for damage. If any damage as a result of shipping is observed, file a written claim with the shipping agency and forward a copy of the claim to:

PLANTRONICS/Frederick Electronics Corporation

7630 Hayward Road, P.O. Box 502

Frederick, Maryland 21701-0502

If packing for storage or reshipment is anticipated, replace the packing material in the shipping container and store the container for future use.

2.3 POWER REQUIREMENTS

The Model 1632A will operate on either 115 Vac, 60 Hz or 230 Vac, 60 Hz. Satisfactory operation is possible with 10% line voltage variations, and with frequencies from 47 to 400 Hz. The unit is set to operate on either 115 Vac or 230 Vac by a switch on rear panel. The unit is shipped from the factory with the switch in customer specified position.

CAUTION

The 115/230 Vac switch on the rear panel must be set to the 230 Vac position before the unit can operate on 230 Vac. Otherwise serious damage will result if the unit is connected to a 230 Vac source.

2.4 MOUNTING

The Model 1632A can be mounted in a standard 19-inch rack by inserting four screws through the front panel. A vertical rack space of 3.5 inches is required.

2.5 SIGNAL CONNECTIONS

All connections to the Model 1632A are located on the rear panel of the unit (refer to Figure 2-1). Connections are listed in Table 2-1. Those connections that do not apply to particular operating requirements should be ignored.

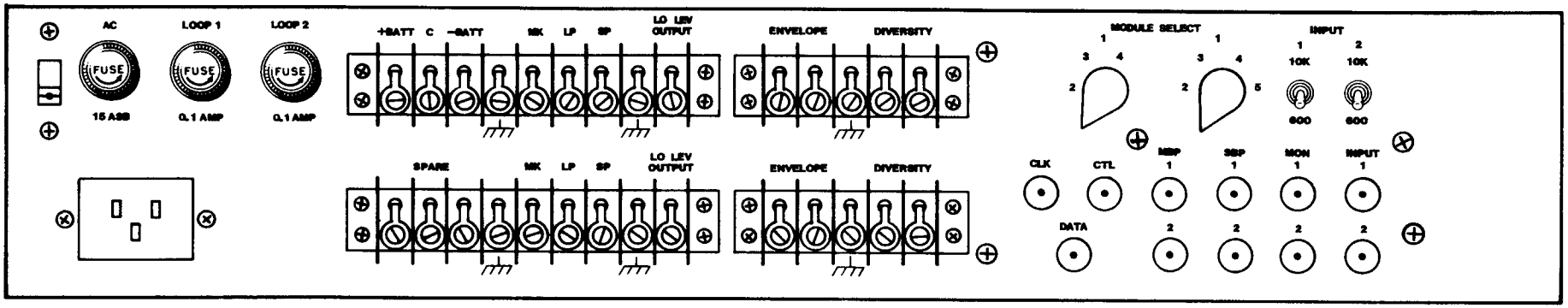


Figure 2-1. Model 1632A Rear Panel

Table 2-1. Rear Panel Connections

CONNECTOR	TERMINAL/PIN	FUNCTION
OUTPUT 1	1	+BATTERY \
	2	BATTERY COMMON > OPTIONAL
	3	-BATTERY /
	4	CHASSIS GROUND
	5	MARK LOOP 1 \
	6	LOOP COMMON 1 > OPTIONAL
	7	SPACE LOOP 1 /
	8	CHASSIS GROUND
	9	LOW LEVEL OUTPUT 1
	10	MARK ENVELOPE 1
	11	SPACE ENVELOPE 1
	12	CHASSIS GROUND
	13	MARK DIVERSITY 1
	14	SPACE DIVERSITY 1
OUTPUT 2	1	SPARE
	2	SPARE
	3	SPARE
	4	CHASSIS GROUND
	5	MARK LOOP 2 \
	6	LOOP COMMON 2 > OPTIONAL
	7	SPACE LOOP 2 /
	8	CHASSIS GROUND
	9	LOW LEVEL OUTPUT 2
	10	SPACE ENVELOPE 2
	11	MARK ENVELOPE 2
	12	CHASSIS GROUND
	13	SPACE DIVERSITY 2
	14	MARK DIVERSITY 2
CLK	BNC	REMOTE CLOCK
DATA	BNC	REMOTE DATA
CTL	BNC	REMOTE CONTROL
MBP (1 & 2)	BNC	MARK BANDPASS 1 & 2
SBP (1 & 2)	BNC	SPACE BANDPASS 1 & 2
MONITOR (1 & 2)	BNC	INPUT MONITOR 1 & 2
INPUT (1 & 2)	BNC	INPUT 1 & 2

2.6 REAR PANEL CONTROLS

Table 2-2 lists the functions of the rear panel controls.

Table 2-2. Rear Panel Controls

CONTROL	FUNCTION
MODULE SELECT 1	Six position rotary switch used to select remote control address for left hand demodulator.
MODULE SELECT 2	As above for right-hand demodulator.
INPUT 1 SWITCH 10K/600	Selects input impedance for input 1.
INPUT 2 SWITCH 10K/600	Selects input impedance for input 2.

2.7 INTERNAL ADJUSTMENTS

The following paragraphs contain the procedures to make the required adjustments to the Model 1632A. Reference Figure 2-2 for circuit board and component location.

2.7.1 Demodulator Board

2.7.1.1 MARK DIVERSITY OFFSET. A potentiometer located near Z14 is used to adjust the mark diversity offset. The adjustment is performed with the demod input switch selecting an input which is shorted. The mark diversity tie point on the rear connector is monitored with an oscilloscope and the potentiometer adjusted for minimum offset.

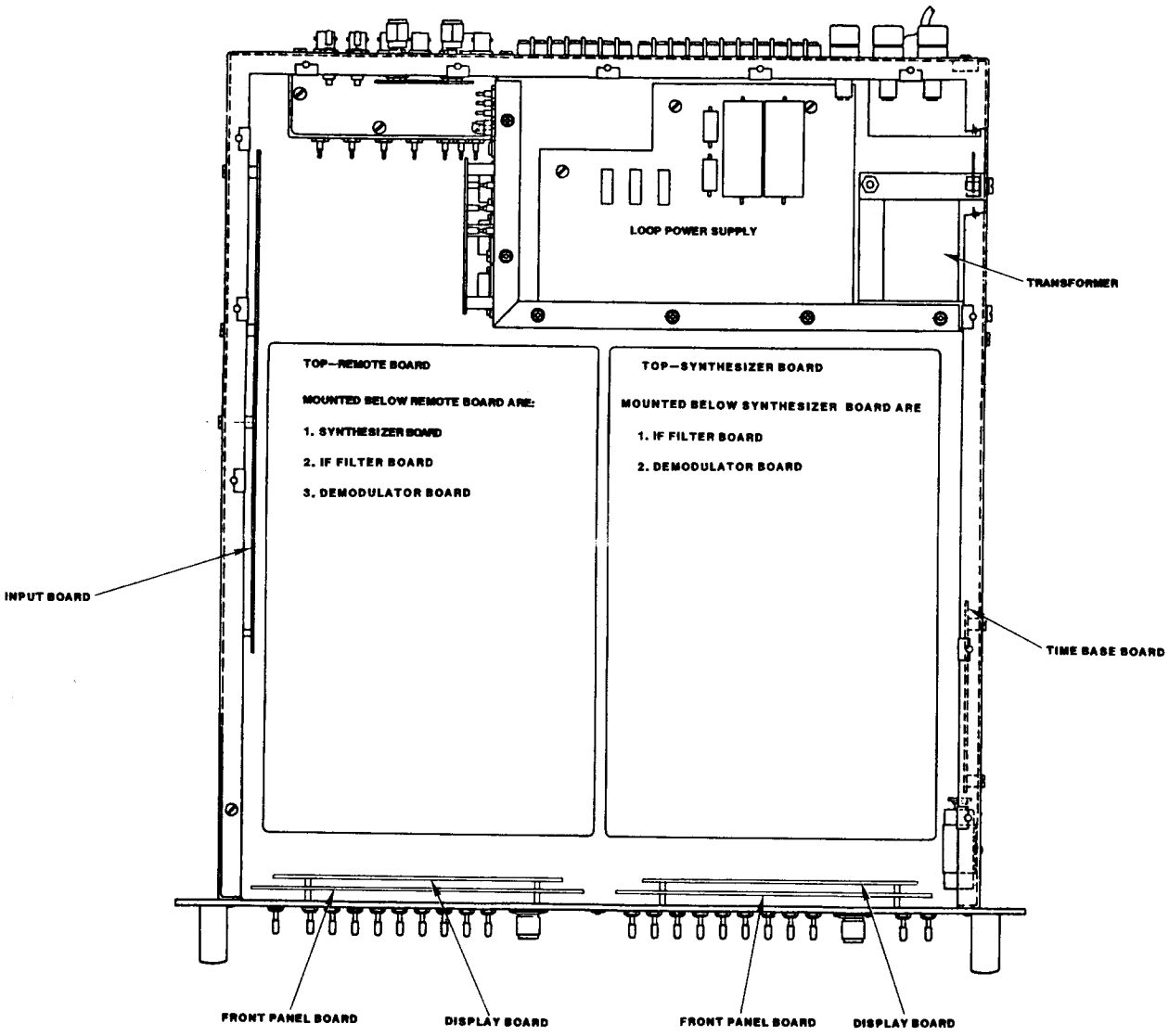


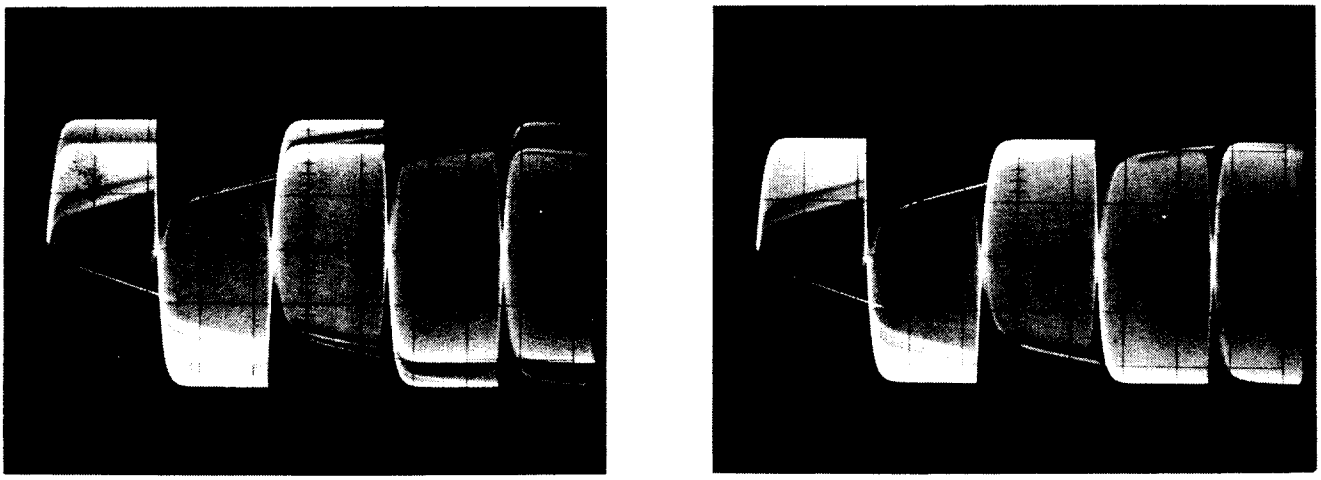
Figure 2-2. Model 1632A Internal View

2.7.1.2 SPACE DIVERSITY OFFSET. A potentiometer located near Z15 is used to adjust the space diversity offset. The adjustment procedure is exactly as above except the space diversity tie point is monitored with the oscilloscope.

2.7.1.3 AUTO MARK-HOLD THRESHOLD. A potentiometer located near Z22 is used to adjust the auto mark-hold threshold. The demodulator is connected and set up to receive an FSK signal with 600 ohm step attenuator in series with the input. Monitor TP3 with an oscilloscope, reduce the input level slowly from 0 dBm. The signal at TP3 will go from high to low when the threshold is passed. Adjust the potentiometer for the desired threshold (-55 dBm is nominal).

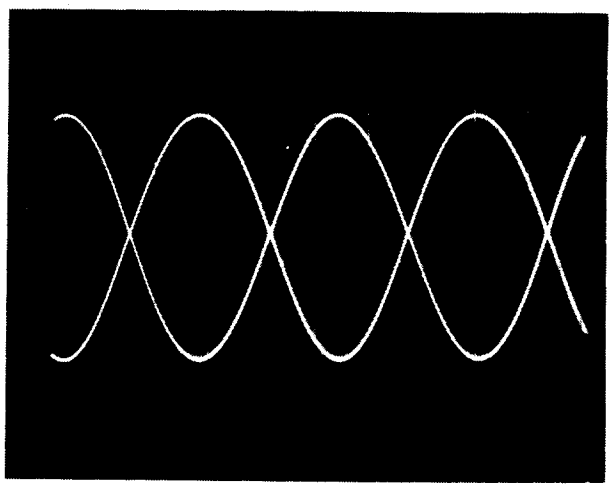
2.7.2 Synthesizer Board

2.7.2.1 MARK MIXER BALANCE. Apply an input signal to unit. Monitor mark mixer output (TP5). Adjust MX and MY pots until the maximum excursions of the signal are superimposed, see Figure 2-3. Then adjust the MZ pot until the signal is centered about zero volts. This can be accomplished by using a slower oscilloscope sweep so that a sine wave eye pattern appears on the scope and adjust for zero crossings at zero volts. Check also for symmetry of waveform, see Figure 2-4.

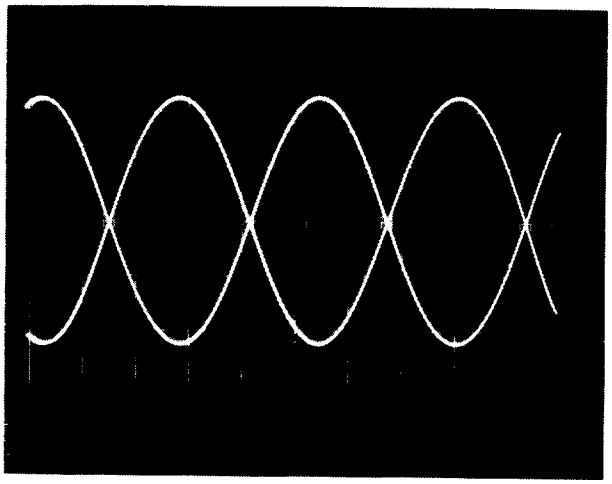


a. Not Superimposed b. Superimposed

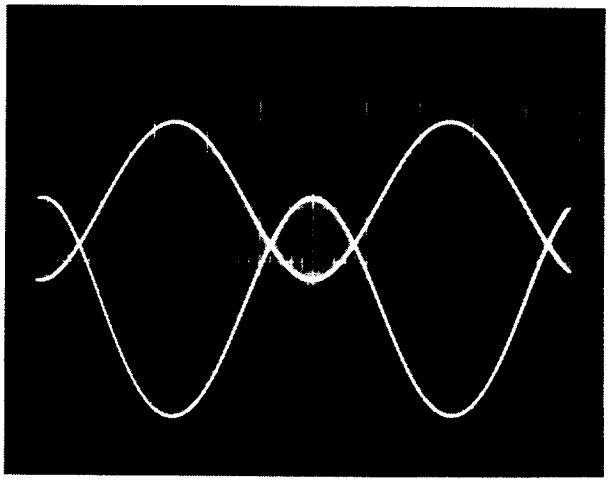
Figure 2-3. Maximum Excursions



a. Offset Eye Pattern



b. Eye Pattern Adjusted Crossings Occur At Zero Volts



c. Distorted Eye Pattern (Readjust X, Y Pots)

Figure 2-4. Sine Wave Eye Patterns

2.7.2.2 SPACE MIXER BALANCE. Repeat for space mixer. Monitor space mixer output (TP6) and adjust SX, SY and SZ pots.

2.7.3 Time Base Board

2.7.3.1 LOOP DELAY CLOCK. A jumper (eyelets A-C) on the time base is used to disable the delay clock if no high level loop keyers are installed. The jumper must be moved to eyelets A-B to enable the delay clock if high level loop keyers are to be used.

2.7.4 Computer Control

2.7.4.1 UNIT SELECT. There are four unit select jumper positions on this board. A jumper must be installed in one of these positions corresponding to the unit select address.

2.7.4.2 REMOTE INPUT THRESHOLD. A potentiometer located near Z1 is used to adjust the threshold of the input circuits. This potentiometer should be adjusted so that the voltage appearing at Z1 pin 2 is at the midpoint of the input signal voltage swing. This adjustment must be made with an oscilloscope or high input impedance VTVM.

2.7.5 Power Supply Board

2.7.5.1 LOW LEVEL OUTPUT POLARITY. There are two sets of jumpers which may be used to select the low level output of each driver to conform to either MIL-188 or RS-232 polarity. The output swing may be increased from $\pm$6V to $\pm$12V by removing one of the zener diodes between pin 2 and pin $\overline{6}$ of the output drivers.

SECTION III

OPERATION

3.1 GENERAL

This section contains a list of controls and indicators and complete operating instructions for the Model 1632A Demodulator.

3.2 CONTROLS AND INDICATORS

Table 3-1 lists the function of each control and indicator on the front panel and rear panel.

Table 3-1. Controls and Indicators

CONTROL/INDICATOR	FUNCTION
AMH ON/OFF switch	When in AMH ON position, activates circuit that places output in mark-hold condition if both mark and space channels are lost. Nominally -55 dBm.
Δf 30 Hz/42.5 Hz switch	Selects 30 Hz or 42.5 Hz frequency increments.
BANDWIDTH (Hz) switch	Selects filter bandwidth in eight increments from 10 Hz to 330 Hz, as follows: 10 Hz BW 40 Hz BW 55 Hz BW 75 Hz BW 105 Hz BW 145 Hz BW 200 Hz BW 330 Hz BW **N O T E** 10 Hz BW for tuning only.

Table 3-1. Controls and Indicators (cont.)

CONTROL/INDICATOR	FUNCTION
LEVEL 1	Indicates input 1 level.
HI LED	Level greater than Ø dBm.
NOR LED	Level between Ø dBm and -2Ø dBm.
LOW LED	Level less than -2Ø dBm.
LEVEL 2	Indicates input 2 level.
HI LED	Level greater than Ø dBm.
NOR LED	Level between Ø dBm and -2Ø dBm.
LOW LED	Level less than -2Ø dBm.
	N O T E Level indicators correspond to setting of input switch.
MARK and SPACE displays	Each may display a number from Ø to 199 and when multiplied by Δf is equal to the tone frequency. Leading zeros are blanked. The units and tens digits are blanked if the corresponding phase locked loop is out of lock.
FREQ/ Δf switches	Three switches for each tone, one corresponding to each digit displayed. Pushing switch down decrements one digit. Pushing the switch up increments one digit. Wraparound from zero to nine and from nine to zero is included for units and tens. Wraparound from zero to one and one to zero is included for the hundreds digit.
MARK and SPACE LEDS (above mark and space displays)	Indicate keying of mark and space tones.

Table 3-1. Controls and Indicators (cont.)

CONTROL/INDICATOR	FUNCTION
INPUT 1/2 switch	Selects input 1 or input 2.
MODE NOR/MK/SP switch	Selects normal mode (mark and space), mark only mode, or space only mode.
POLARITY NOR/MK/REV switch	Selects output polarity; normal polarity, mark-hold for standby operation, or Reverse polarity if signal is inverted.
REMOTE/LOCAL switches 1 and 2	Places either DEMOD under local or remote control. Switch one corresponds to the demodulator on the left, switch two, to the demodulator on the right.
POWER/OFF switch	Applies primary power to the unit.

3.3 OPERATION

3.3.1 Demodulator Controls

Since the front panel controls on each of the two demodulators are alike, their operation is described only once in the following paragraphs.

3.3.1.1 AMH ON/OFF SWITCH. The AMH ON/OFF toggle switch activates the automatic mark-hold circuit in the demodulator. Setting the switch to the ON position activates the circuit that places the output in the mark-hold condition when both the mark and space channel intelligence is lost. This prevents garbled printout by the associated teleprinter.

3.3.1.2 ΔF SWITCH. The Δf 30 Hz/42.5 Hz toggle switch is used to select the basic frequency increment of the tone frequency to be demodulated. In order to set up for a specific tone frequency, the switch must be set to the correct factor (i.e., either 30 Hz or 42.5 Hz). The following formula illustrates the weight of the frequency increment in obtaining a given frequency:

Frequency = Δf x (number dialed).

Tables 3-2 thru 3-7 list all of the possible frequencies that may be obtained.

3.3.1.3 BANDWIDTH SWITCH. The BANDWIDTH rotary switch selects the bandwidths of both the mark and space filters in eight increments ranging from 10 Hz to 330 Hz. The switch may be used in conjunction with the MARK and SPACE switches and the Δf switch to cover tone frequencies not listed in Table 3-1. For example, a FSK signal with a frequency shift of 900 Hz may place one tone at 1000 Hz, and the other at 1900 Hz. Neither of these frequencies is listed in Table 3-1. However, using 30 Hz increments one synthesizer may be tuned for a center frequency of 990 Hz and the other for 1890 Hz. A filter bandwidth somewhat wider than normal for the baud rate to be received may be selected with the BANDWIDTH switch placing the received tone frequencies well within the 3 dB points of the filters.

N O T E

MARK and SPACE filter bandwidths on a given demodulator are not independently selectable.

3.3.1.4 MARK FREQUENCY SWITCHES. The MARK frequency switches permit tuning the mark center frequency. Multiplying by the 30 Hz or 42.5 Hz frequency increment provides the mark center frequency selected.

3.3.1.5 SPACE FREQUENCY SWITCH. The SPACE frequency switches operate in the manner described above to adjust the center frequency of the space channel.

3.3.1.6 KEY INDICATORS. The MARK and SPACE KEY indicators indicate when there is mark or space keying activity by the demodulator.

3.3.1.7 NOR/MK/REV SWITCH. The NOR/MK/REV 3-position toggle switch performs two functions. The NOR and REV positions operate as a mark-space sense switch, reversing the position of the mark and space signals when these signals are received in the incorrect relationship. When set to the center (MK) position, the demodulator output is placed in the mark hold condition.

3.3.1.8 MODE SWITCH. The MODE switch is used to select one of three operating modes for the demodulator. When set to the MK, or SP positions, the switch activates only the mark or space detector, respectively. Set to NOR, it activates both the mark and space detector circuits.

3.3.2 Diversity Operation

The 1632A has the capability of being configured to a diversity system. This is easily accomplished by connecting two demodulator inputs to two receiver/antenna systems tuned to the same signal, and connecting the corresponding demodulator diversity terminals on the rear panel (separate connections for Mark and Space).

Table 3-2. List Of All Possible Tone Frequencies

FREQ/Δf SETTING	FREQ	FREQ/Δf SETTING	FREQ	FREQ/Δf SETTING	FREQ
30 Hz INCREMENTS					
00 \		46	1380 Hz	92	2760 Hz
01 |		47	1410 Hz	93	2790 Hz
02 |		48	1440 Hz	94	2820 Hz
03 > *		49	1470 Hz	95	2850 Hz
04 |		50	1500 Hz	96	2880 Hz
05 |		51	1530 Hz	97	2910 Hz
06 |		52	1560 Hz	98	2940 Hz
07 |		53	1590 Hz	99	2970 Hz
08 |		54	1620 Hz	100	3000 Hz
09 /		55	1650 Hz	101	3030 Hz
10	300 Hz	56	1680 Hz	102	3060 Hz
11	330 Hz	57	1710 Hz	103	3090 Hz
12	360 Hz	58	1740 Hz	104	3120 Hz
13	390 Hz	59	1770 Hz	105	3150 Hz
14	420 Hz	60	1800 Hz	106	3180 Hz
15	450 Hz	61	1830 Hz	107	3210 Hz
16	480 Hz	62	1860 Hz	108	3240 Hz
17	510 Hz	63	1890 Hz	109	3270 Hz
18	540 Hz	64	1920 Hz	110	3300 Hz
19	570 Hz	65	1950 Hz	111	3330 Hz
20	600 Hz	66	1980 Hz	112	3360 Hz
21	630 Hz	67	2010 Hz	113	3390 Hz
22	660 Hz	68	2040 Hz	114	3420 Hz
23	690 Hz	69	2070 Hz	115	3450 Hz
24	720 Hz	70	2100 Hz	116	3480 Hz
25	750 Hz	71	2130 Hz	117	3510 Hz
26	780 Hz	72	2160 Hz	118	3540 Hz
27	810 Hz	73	2190 Hz	119	3570 Hz
28	840 Hz	74	2220 Hz	120	3600 Hz
29	870 Hz	75	2250 Hz	121	3630 Hz
30	900 Hz	76	2280 Hz	122	3660 Hz
31	930 Hz	77	2310 Hz	123	3690 Hz
32	960 Hz	78	2340 Hz	124	3720 Hz
33	990 Hz	79	2370 Hz	125	3750 Hz
34	1020 Hz	80	2400 Hz	126	3780 Hz
35	1050 Hz	81	2430 Hz	127	3810 Hz
36	1080 Hz	82	2460 Hz	128	3840 Hz
37	1110 Hz	83	2490 Hz	129	3870 Hz
38	1140 Hz	84	2520 Hz	130	3900 Hz
39	1170 Hz	85	2550 Hz	131	3930 Hz
40	1200 Hz	86	2580 Hz	132	3960 Hz
41	1230 Hz	87	2610 Hz	133	3990 Hz
42	1260 Hz	88	2640 Hz	134	4020 Hz
43	1290 Hz	89	2670 Hz	135	4050 Hz
44	1320 Hz	90	2700 Hz	136	4080 Hz
45	1350 Hz	91	2730 Hz	137	4110 Hz

*NOTE: OPERATION IN THIS AREA IS NOT RECOMMENDED.

Table 3-2. List Of All Possible Tone Frequencies (cont.)

FREQ/Δf SETTING	FREQ	FREQ/Δf SETTING	FREQ	FREQ/Δf SETTING	FREQ
30 Hz INCREMENTS (cont.)					
138	4140 Hz	159	4770 Hz	180	5400 Hz
139	4170 Hz	160	4800 Hz	181	5430 Hz
140	4200 Hz	161	4830 Hz	182	5460 Hz
141	4230 Hz	162	4860 Hz	183	5490 Hz
142	4260 Hz	163	4890 Hz	184	5520 Hz
143	4290 Hz	164	4920 Hz	185	5550 Hz
144	4320 Hz	165	4950 Hz	186	5580 Hz
145	4350 Hz	166	4980 Hz	187	5610 Hz
146	4380 Hz	167	5010 Hz	188	5640 Hz
147	4410 Hz	168	5040 Hz	189	5670 Hz
148	4440 Hz	169	5070 Hz	190	5700 Hz
149	4470 Hz	170	5100 Hz	191	5730 Hz
150	4500 Hz	171	5130 Hz	192	5760 Hz
151	4530 Hz	172	5160 Hz	193	5790 Hz
152	4560 Hz	173	5190 Hz	194	5820 Hz
153	4590 Hz	174	5220 Hz	195	5850 Hz
154	4620 Hz	175	5250 Hz	196	5880 Hz
155	4650 Hz	176	5280 Hz	197	5910 Hz
156	4680 Hz	177	5310 Hz	198	5940 Hz
157	4710 Hz	178	5340 Hz	199	5970 Hz
158	4740 Hz	179	5370 Hz		
42.5 Hz INCREMENTS					
00 \		22	935.0 Hz	44	1870.0 Hz
01 |		23	977.5 Hz	45	1912.5 Hz
02 |		24	1020.0 Hz	46	1955.0 Hz
03 > *		25	1062.5 Hz	47	1997.5 Hz
04 |		26	1105.0 Hz	48	2040.0 Hz
05 |		27	1147.5 Hz	49	2082.5 Hz
06 |		28	1190.0 Hz	50	2125.0 Hz
07 /		29	1232.5 Hz	51	2167.5 Hz
08	340.0 Hz	30	1275.0 Hz	52	2210.0 Hz
09	382.5 Hz	31	1317.5 Hz	53	2252.0 Hz
10	425.0 Hz	32	1360.0 Hz	54	2295.0 Hz
11	467.5 Hz	33	1402.5 Hz	55	2337.5 Hz
12	510.0 Hz	34	1445.0 Hz	56	2380.0 Hz
13	552.5 Hz	35	1487.5 Hz	57	2422.5 Hz
14	595.0 Hz	36	1530.0 Hz	58	2465.0 Hz
15	637.5 Hz	37	1572.5 Hz	59	2507.5 Hz
16	680.0 Hz	38	1615.0 Hz	60	2550.0 Hz
17	722.5 Hz	39	1657.5 Hz	61	2592.5 Hz
18	765.0 Hz	40	1700.0 Hz	62	2635.0 Hz
19	807.5 Hz	41	1742.5 Hz	63	2677.5 Hz
20	850.0 Hz	42	1785.0 Hz	64	2720.0 Hz
21	892.5 Hz	43	1827.5 Hz	65	2762.5 Hz

*NOTE: OPERATION IN THIS AREA IS NOT RECOMMENDED.

Table 3-2. List Of All Possible Tone Frequencies (cont.)

FREQ/Δf SETTING	FREQ	FREQ/Δf SETTING	FREQ	FREQ/Δf SETTING	FREQ
42.5 Hz INCREMENTS (cont.)					
66	2805.0 Hz	111	4717.5 Hz	156	6630.0 Hz
67	2847.5 Hz	112	4760.0 Hz	157	6672.5 Hz
68	2890.0 Hz	113	4802.5 Hz	158	6715.0 Hz
69	2932.5 Hz	114	4845.0 Hz	159	6757.5 Hz
70	2975.0 Hz	115	4887.5 Hz	160	6800.0 Hz
71	3017.5 Hz	116	4930.0 Hz	161	6842.5 Hz
72	3060.0 Hz	117	4972.5 Hz	162	6885.0 Hz
73	3102.5 Hz	118	4015.0 Hz	163	6927.5 Hz
74	3145.0 Hz	119	5057.5 Hz	164	6970.0 Hz
75	3187.5 Hz	120	5100.0 Hz	165	7012.5 Hz
76	3230.0 Hz	121	5142.5 Hz	166	7055.0 Hz
77	3272.5 Hz	122	5185.0 Hz	167	7097.5 Hz
78	3315.0 Hz	123	5227.5 Hz	168	7140.0 Hz
79	3357.5 Hz	124	5270.5 Hz	169	7182.5 Hz
80	3400.0 Hz	125	5312.5 Hz	170	7225.0 Hz
81	3442.5 Hz	126	5355.0 Hz	171	7267.5 Hz
82	3485.0 Hz	127	5397.5 Hz	172	7310.0 Hz
83	3527.5 Hz	128	5440.0 Hz	173	7352.5 Hz
84	3570.0 Hz	129	5482.5 Hz	174	7395.0 Hz
85	3612.5 Hz	130	5525.0 Hz	175	7437.5 Hz
86	3655.0 Hz	131	5567.5 Hz	176	7480.0 Hz
87	3697.5 Hz	132	5610.0 Hz	177	7522.5 Hz
88	3740.0 Hz	133	5652.5 Hz	178	7565.0 Hz
89	3782.5 Hz	134	5695.0 Hz	179	7607.5 Hz
90	3825.0 Hz	135	5737.5 Hz	180	7650.0 Hz
91	3867.5 Hz	136	5780.0 Hz	181	7692.5 Hz
92	3910.0 Hz	137	5822.5 Hz	182	7735.0 Hz
93	3952.5 Hz	138	5865.0 Hz	183	7777.5 Hz
94	3995.0 Hz	139	5907.5 Hz	184	7820.0 Hz
95	4037.5 Hz	140	5905.0 Hz	185	7862.5 Hz
96	4080.0 Hz	141	5992.5 Hz	186	7905.0 Hz
97	4122.5 Hz	142	6035.0 Hz	187	7947.5 Hz
98	4165.0 Hz	143	6077.5 Hz	188	7990.0 Hz
99	4207.5 Hz	144	6120.5 Hz	189	8032.5 Hz
100	4250.0 Hz	145	6162.5 Hz	190	8075.0 Hz
101	4292.5 Hz	146	6205.0 Hz	191	8117.5 Hz
102	4335.0 Hz	147	6247.5 Hz	192	8160.5 Hz
103	4377.5 Hz	148	6290.0 Hz	193	8202.5 Hz
104	4420.5 Hz	149	6332.5 Hz	194	8245.0 Hz
105	4462.5 Hz	150	6375.0 Hz	195	8287.5 Hz
106	4505.0 Hz	151	6417.5 Hz	196	8330.0 Hz
107	4547.5 Hz	152	6460.0 Hz	197	8372.5 Hz
108	4590.0 Hz	153	6502.5 Hz	198	8415.0 Hz
109	4632.5 Hz	154	6545.0 Hz	199	8457.5 Hz
110	4675.0 Hz	155	6587.5 Hz		

Table 3-3. Frequencies of Voice-Frequency Frequency-Shift Telegraph Channels with Channel Spacing of 120 Hz (Frequency Deviation = ±30 Hz)

CHANNEL	FREQ/Δf SETTING	FREQ	CHANNEL	FREQ/Δf SETTING	FREQ
1 (mk)	13	390	13 (mk)	61	1830
1 (sp)	15	450	13 (sp)	63	1890
2 (mk)	17	510	14 (mk)	65	1950
2 (sp)	19	570	14 (sp)	67	2010
3 (mk)	21	630	15 (mk)	69	2070
3 (sp)	23	690	15 (sp)	71	2130
4 (mk)	25	750	16 (mk)	73	2190
4 (sp)	27	810	16 (sp)	75	2250
5 (mk)	29	870	17 (mk)	77	2310
5 (sp)	31	930	17 (sp)	79	2370
6 (mk)	33	990	18 (mk)	81	2430
6 (sp)	35	1050	18 (sp)	83	2490
7 (mk)	37	1110	19 (mk)	85	2550
7 (sp)	39	1170	19 (sp)	87	2610
8 (mk)	41	1230	20 (mk)	89	2670
8 (sp)	43	1290	20 (sp)	91	2730
9 (mk)	45	1350	21 (mk)	93	2790
9 (sp)	47	1410	21 (sp)	95	2850
10 (mk)	49	1470	22 (mk)	97	2910
10 (sp)	51	1530	22 (sp)	99	2970
11 (mk)	53	1590	23 (mk)	101	3030
11 (sp)	55	1650	23 (sp)	103	3090
12 (mk)	57	1710	24 (mk)	105	3150
12 (sp)	59	1770	24 (sp)	107	3210

Table 3-4. Frequencies of Voice-Frequency Frequency-Shift Telegraph Channels with Channel Spacing of 170 Hz (Frequency Deviation = ±42.5 Hz)

CHANNEL	FREQ/Δf SETTING	FREQ	CHANNEL	FREQ/Δf SETTING	FREQ
1 (mk)	09	382.5	10 (mk)	45	1912.5
1 (sp)	11	467.5	10 (sp)	47	1997.5
2 (mk)	13	552.5	11 (mk)	49	2082.5
2 (sp)	15	637.5	11 (sp)	51	2167.5
3 (mk)	17	722.5	12 (mk)	53	2252.5
3 (sp)	19	807.5	12 (sp)	55	2337.5
4 (mk)	21	892.5	13 (mk)	57	2422.5
4 (sp)	23	977.5	13 (sp)	59	2507.5
5 (mk)	25	1062.5	14 (mk)	61	2592.5
5 (sp)	27	1147.5	14 (sp)	63	2677.5
6 (mk)	29	1232.5	15 (mk)	65	2762.5
6 (sp)	31	1317.5	15 (sp)	67	2847.5
7 (mk)	33	1402.5	16 (mk)	69	2932.5
7 (sp)	35	1487.5	16 (sp)	71	3017.5
8 (mk)	37	1572.5	17 (mk)	73	3102.5
8 (sp)	39	1657.5	17 (sp)	75	3187.5
9 (mk)	41	1742.5	18 (mk)	77	3272.5
9 (sp)	43	1827.5	18 (sp)	79	3357.5

Table 3-5. Frequencies of Voice-Frequency On-Off-Keyed Telegraph Channels (Mark=Tone, Space=Absence of Tone)

CHANNEL SPACING: 120 Hz

CHANNEL	FREQ/ΔF SETTING	FREQ
1	14	420
2	18	540
3	22	660
4	26	780
5	30	900
6	34	1020
7	38	1140
8	42	1260
9	46	1380
10	50	1500
11	54	1620
12	58	1740
13	62	1860
14	66	1980
15	70	2100
16	74	2220
17	78	2340
18	82	2460
19	86	2580
20	90	2700
21	94	2820
22	98	2940
23	102	3060
24	106	3180

Table 3-6. Frequencies of Voice-Frequency Frequency-Shift Telegraph Channels with Channel Spacing of 240 Hz (Frequency Deviation = ±60 Hz)

CHANNEL	FREQ/ΔF SETTING	FREQ
1 (mk)	14	420
1 (sp)	18	540
2 (mk)	22	660
2 (sp)	26	780
3 (mk)	30	900
3 (sp)	34	1020
4 (mk)	38	1140
4 (sp)	42	1260
5 (mk)	46	1380
5 (sp)	50	1500
6 (mk)	54	1620
6 (sp)	58	1740
7 (mk)	62	1860
7 (sp)	66	1980
8 (mk)	70	2100
8 (sp)	74	2220
9 (mk)	78	2340
9 (sp)	82	2460
10 (mk)	86	2580
10 (sp)	90	2700
11 (mk)	94	2820
11 (sp)	98	2940
12 (mk)	102	3060
12 (sp)	106	3180

Table 3-7. Frequencies of Voice-Frequency Frequency-Shift Telegraph Channels with Channel Spacing of 340 Hz (Frequency Deviation = ±85 Hz)

CHANNEL	FREQ/ΔF SETTING	FREQ
1 (mk)	18	765
1 (sp)	22	935
2 (mk)	26	1105
2 (sp)	30	1275
3 (mk)	34	1445
3 (sp)	38	1615
4 (mk)	42	1785
4 (sp)	46	1955
5 (mk)	50	2125
5 (sp)	54	2295
6 (mk)	58	2465
6 (sp)	62	2635
7 (mk)	66	2805
7 (sp)	70	2975
8 (mk)	74	3245
8 (sp)	78	3315
9 (mk)	82	3485
9 (sp)	86	3655