

GENERAL

This revision outlines changes that have occurred since the printing of your instruction manual. Use this information to correct your manual.

INSTRUCTION MANUAL AFFECTED:

68P81069A66-B R-2001D Communications System Analyzer  
OPERATOR'S MANUAL

REVISION DETAILS:

**New Address**

The Motorola Test Equipment Service Center, serving customers in the eastern and midwestern regions of the U.S., has moved to a new location. Please make the following address changes to your manual on the inside front cover, page 1-1, and the tear-out *Test Equipment Service Request Form* on page 4-49. The telephone number remains the same.

Address all future correspondence and direct returned equipment to:

Motorola Test Equipment Service Depot  
1308 Plum Grove Road  
Schaumburg, IL 60173

**Corrections to Published Performance Specifications**

Please note the following corrections to specifications tabulated on pages vii and viii.

**Signal Generator Mode**

FREQUENCY / Stabilization Time : 2 Sec

OUTPUT / Accuracy :  $\pm 4$  dB maximum. *Unspecified for 0 dB attenuation.*

AMPLITUDE MODULATION / Range : 0 to 70% from 1 to 500 MHz

DOUBLE SIDEBAND SUPPRESSED CARRIER / Carrier Suppression : -15 dB for 1 kHz audio  
@ 0 dBm

**General**

DUPLEX GENERATOR / Frequency Accuracy :  $\pm .002\%$  within 8 seconds after turn-on

FREQUENCY COUNTER / Normal / Range : 10 Hz to 30 MHz

FREQUENCY COUNTER / Auto Tune (SCAN LOCK) / Accuracy :  $\pm 1$  Hz of actual frequency  
 $\pm$  timebase accuracy

SIGNALLING SIMULATOR / Frequency Range : 5 Hz to 19,999.9 Hz encode, 5.0 Hz to 9999.9 Hz  
decode

The following specification has been added, which is applicable to units shipped after January 1, 1987.

**SERIAL PRINTER  
INTERFACE PORT**

<b>Data Format:</b>	Serial per EIA Standard RS-232-C
<b>Connector Type:</b>	5-pin DIN
<b>Signals:</b>	Printer Data, Data Set Ready, Ground
<b>Baud Rate:</b>	Selectable; 75, 150, 300, 600, 1200, 2400, 4800, or 9600
<b>Parity:</b>	Selectable; odd, even, or no parity
<b>Stop Bits:</b>	Selectable; 1 or 2 per character
<b>Transmit Bits:</b>	Selectable; 7 or 8 per character
<b>Auto Line Feed:</b>	Selectable on or off

**New Product Features (on units shipped after  
January 1, 1987)**

All of the following changes are with respect to software revisions which included the following enhancements and new features:

- added Print Screen utility and serial printer port as a standard feature;
- added DTMF encode and decode capability as a standard feature;
- simplified system part number screen, Special Function "99", to show only system version numbers and not file version numbers.

Page 2-7. The **Ext Level** control is also used to set the output level for DTMF encode signals, in addition to controlling the modulation level produced by external inputs.

A low impedance signal generator, connected to the **Ext Mod In** BNC-type connector, will disable the DTMF encoder.

Page 2-8. In addition to setting the vertical input gain for the oscilloscope and the sensitivity for the frequency counter, the **Vert** coarse (outside) and vernier (center) control knobs also set the sensitivity of the DTMF decoder. This applies to decoding signals off-the-air as well as from the front panel vertical input (baseband mode).

Page 3-7. For Special Function "99", the system part number screen will be displayed for 7 to 8 seconds, before normal operation is resumed. Only one screen is necessary for the Main system and all possible options, where previously there was one screen for each. In addition to showing the software version numbers, this screen also shows a true checksum value for the softwares, as well as the card cage slot position in which any options are installed. An example of this screen is shown.

#### SPECIAL FUNCTION 99

SYSTEM	VERS	CHKSUM	SLOT
-----	-----	-----	-----
MAIN	02AB3 (C8C)		A14
SECOM	02AB2 (BB6)		A12

Special Functions "75" and "15", "16", and "17" are described in the following sections.

## Screen Print Operating Instructions

Special Function "75" allows you to select a specific RS-232-C configuration. The default values are given in the following example.

PRINTER INIT (SPFC 75) SEL)-  
0) EXIT

BAUD RATE SEL 5) 1200 BAUD

STOP BITS SEL 1) 1 STOP BIT

PARITY SEL 1) NO PARITY

AUTO LINE FEED 1) YES

TRANSMIT BITS/CHAR 2) 8 BITS

### Printer Port Configuration

Using Special Function "75", you can set up the System Analyzer for a specific RS-232 configuration. When you select this Special Function, the Printer Init screen is displayed, as shown above. This screen shows the default values in the System Analyzer that occur when Special Function "79" (default reset) is performed. To change any of these values, move the cursor to the line you want to change and enter the number.

The options for each of the selections are as follows:

**Baud Rate**

1 75 baud  
2 150 baud  
3 300 baud  
4 600 baud  
5 1200 baud  
6 2400 baud  
7 4800 baud  
8 9600 baud

**Stop Bits**

1 1 stop bit/character  
2 2 stop bits/character

**Parity**

1 no parity  
2 even parity  
3 odd parity

**Auto Line Feed**

1 on  
2 off

**Transmit Bits**

1 7 bits/character  
2 8 bits/character

If you change any of these values, the changes are retained in nonvolatile memory until Special Function "79" is selected.

**Printer Connection**

On the right side of the System Analyzer, at the rear, is a 5-pin DIN type printer output connector. This connection can be used to generate and receive RS-232-C signals similar to those in a personal computer. When the System Analyzer is properly connected to a printer and correctly configured (see above), you can print the data displayed on the screen.

Many types of printers can be used with the System Analyzer, including the following printers from Motorola:

RT-RX80/8143

RT-RX80/8143/220 (220 Volt version)

The printer cable accessory is a Motorola RTK-4081A. You can also use a serial printer cable for an Apple IIc®.

® Apple IIc is a registered trademark of Apple Computer Corp.

## Printing the Screen

To print a screen, simultaneously press the 0 key and the < (left cursor) key. Any characters displayed on the screen are printed directly. If a bar graph is displayed, the # character is printed to show the length of the bar. **Wave forms cannot be printed.**

If you try to print the screen when the printer is off line, a "PRINTER BUSY" message is displayed for 3 seconds (unless a waveform screen is displayed). If the System Analyzer's character buffer is full, a "WAIT" message will appear for about 3 seconds. If the printer accepts the output, you'll hear a beep from the System Analyzer's speaker.

### Page 3-11 • **SIGNALING SEQUENCE**

Dual Tone Multiple Frequency (DTMF) encode and decode capability has been added to the System Analyzer.

#### • **SIGNALING SEQUENCE MENU**

With the addition of the DTMF functions, the signaling sequence menu shown in Figure 3-21 is changed to the following:

SIGNALING SEQUENCE MODE SEL)0-

- 1] A/B ENCODE
- 2] 5/6 TN ENCODE/DECODE
- 3] SELECT V ENCODE/DECODE
- 4] PL DECODE
- 5] DPL DECODE
- 6] GENERAL SEQ ENCODE/DECODE
- 7] MOBILE TELEPHONE
- 8] DTMF ENCODE/DECODE

# DTMF Encoder/Decoder Operating Instructions

## • DTMF ENCODE

DTMF encode mode may be entered from either the Signaling Sequence screen, by entering **8** from the keypad, or by initiating Special Function "15" or "16".

The following figure shows the DTMF screen, which is used for both encode and decode mode. The lower half of the screen is for DTMF encode.

SIGNALING SEQUENCE MODE SEL) -

1) RESET DECODE

DTMF DECODE

DTMF ENCODE SEL)-

*PRESS KEY FOR DTMF TONE*

*PRESS LEFT CURSOR FOR BURST*

BURST ENCODE NUMBER

*123456789\*0#ABCD*

TONE) 0100 MS      DELAY) 0050 MS

### Manual Keypad Entry

When you move the cursor to the SEL area (opposite DTMF ENCODE), a help message, shown in italics above, automatically appears. If you press and hold a DTMF key at this time, the tone is generated and remains on until you release the key.

The active DTMF keys are digits 1 through 9 and 0, and the 6 front panel up/down selector keys immediately below the DISPLAY, FUNCTION, and MODULATION LED indicators. The normal function of these keys is disabled in the DTMF mode, so be sure to preselect the desired function and code synthesizer mode before entering the DTMF screen. (See **Setting Modulation Level** below for more information on this subject.) The DTMF symbols are screened on the front panel above these keys on current production units. For users who retrofit this feature, the symbols are assigned left to right as follows: A, B, C, D, \*, and #.

## Sequence Encoder

DTMF tone sequences are entered and generated by moving the cursor to the area under BURST ENCODED NUMBER. If a number is already displayed, as shown in italics in the example above, it will be erased when you enter the first digit of the new sequence. If you want to alter (rather than erase) the displayed number, use the left cursor key to position the cursor over the digit you want to change.

You can enter the length of the automatic tones at the bottom of the screen, by TONE. The delay between tones can also be set on this line, to the right of DELAY. The length and delay are set independently, from 1 millisecond to 9.999 seconds in 1 millisecond steps. To function properly, most systems require at least a 40 millisecond tone and delay. To start the DTMF tone sequence, move the cursor to the mid-screen position {SEL) -) and press the < (left cursor) key.

## To Exit

To exit the DTMF screen, move the cursor to the top of the screen and press 0. If a DTMF sequence is in progress when you exit the DTMF screen, the sequence will be continued until completed.

## Setting Modulation Level

Multiple modulations are possible with DTMF. Any P-L, DPL, Tone A, Tone B, or tone sequence can be activated *before* entering the DTMF screen, and will continue during DTMF generation. The level for DTMF is controlled by the **Ext Level** knob on the front panel. The level of the other tones can be set separately by the **Code Synth Lvl** knob. For example, you can set the P-L tone to its standard low deviation to access a phone interconnect system, and set the voice and DTMF to a higher level to actually use the system.

Normal speech in the microphone supplied with the System Analyzer will result in a modulation level close to that of the DTMF signal.

### NOTE

A low impedance signal generator connected to the BNC **Ext Mod In** connector will disconnect DTMF.

## Generator Deviation Setup

Setting the deviation level for DTMF modulation requires the use of a Special Function, to activate the DTMF encoder without being in the signaling sequence screen. The procedure is as follows:

1. Select the **Gen/Mon Mtr** display and switch to the **Generate** function.
2. Enable Special Function "16" by pressing both cursor control keys simultaneously and entering **16**.
3. Press and hold any DTMF key and adjust the **Ext Level** pot to the desired deviation level - typically 3 kHz peak deviation.
4. Disable Special Function "16" by entering Special Function "17".
5. Operate the manual or sequence encoder as described in the paragraphs above.

### • **DTMF DECODE**

DTMF decode mode may be entered from either the Signaling Sequence screen, by entering **8** from the keypad, or by initiating Special Function "15".

The upper half of the DTMF screen shown in the previous section applies to DTMF decode. When you have selected this screen, DTMF decode is automatic. The decoded DTMF digits are displayed sequentially under DTMF DECODE. Up to 30 digits can be displayed. To decode correctly, the length of the tones must be at least 40 milliseconds and there must be at least a 40 millisecond delay between tones. To clear the DTMF decode line, enter **1** at the top of the screen.

### DTMF Decoder Sensitivity

The DTMF decoder receives its signal from the oscilloscope's CRT input. To decode reliably, the signal amplitude must be adjusted for a peak-to-peak level of 20% to 80% of the total screen height when displayed on the oscilloscope. Use the **Vert** sensitivity controls to adjust the amplitude of the input signal. *Do this before entering the DTMF screen.*

The procedure for setting sensitivity depends upon the input source you select. The default condition is to decode the signal from the monitor receiver (off-the-air). To decode from the front panel's **Vert Input**, you need to select Special Function "11", baseband. You can cancel baseband operation by entering Special Function "10".



### Setting DTMF Decoder Sensitivity

1. Select the input port - RF or baseband, as described above - and switch to the **Monitor** function.
2. Apply the external signal to the selected port.
3. Select the **Scope AC** display (for baseband) or the **Modulation** display (for RF).
4. Calibrate the input signal by adjusting the scope **Vert** coarse (outside) and verier (center) control knobs until the trace covers between 20% and 80% of the screen.
5. Re-enter the DTMF mode.

MOTOROLA, INC.  
 COMMUNICATIONS SECTOR  
 TEST EQUIPMENT SERVICE DEPOT  
 1308 PLUM GROVE ROAD  
 SCHAUMBURG, ILLINOIS 60173

MOTOROLA, INC.  
 COMMUNICATIONS SECTOR  
 TEST EQUIPMENT SERVICE CENTER  
 2333 B. UTAH AVENUE EL SEGUNDO, CA

**TEST EQUIPMENT SERVICE REQUEST FORM**

This completed form must accompany equipment returned for service.

CUSTOMER'S PURCHASE ORDER NO.		DATE	
MODEL NUMBER		SERIAL NUMBER	
DESCRIPTION OF PROBLEM:			
REQUESTED SERVICE:			
SHIP TO ADDRESS:			
SHIP VIA:			

Providing the information below will reduce the turnaround time on your Test Equipment Service.

MOTOROLA CUSTOMER NUMBER	BILL TAG	SHIP TAG	INTERNAL MOTOROLA ACCOUNT NO.

SIGNED: \_\_\_\_\_

023	$\overline{047}$	114	$\overline{712}$	147	$\overline{074}$	315	$\overline{423}$	445	$\overline{043}$	631	$\overline{606}$
025	$\overline{244}$	115	$\overline{152}$	205	$\overline{263}$	331	$\overline{465}$	464	$\overline{026}$	632	$\overline{624}$
026	$\overline{464}$	116	$\overline{754}$	223	$\overline{134}$	343	$\overline{532}$	465	$\overline{331}$	654	$\overline{743}$
031	$\overline{627}$	125	$\overline{365}$	226	$\overline{411}$	346	$\overline{612}$	466	$\overline{662}$	662	$\overline{466}$
032	$\overline{051}$	131	$\overline{364}$	243	$\overline{351}$	351	$\overline{243}$	503	$\overline{162}$	664	$\overline{311}$
043	$\overline{445}$	132	$\overline{546}$	244	$\overline{025}$	364	$\overline{131}$	506	$\overline{073}$	703	$\overline{565}$
047	$\overline{023}$	134	$\overline{223}$	245	$\overline{072}$	365	$\overline{125}$	516	$\overline{432}$	712	$\overline{114}$
051	$\overline{032}$	143	$\overline{412}$	251	$\overline{165}$	371	$\overline{734}$	532	$\overline{343}$	723	$\overline{431}$
054	$\overline{413}$	152	$\overline{115}$	261	$\overline{732}$	411	$\overline{226}$	546	$\overline{132}$	731	$\overline{155}$
065	$\overline{271}$	155	$\overline{731}$	263	$\overline{205}$	412	$\overline{143}$	565	$\overline{103}$	732	$\overline{261}$
071	$\overline{306}$	156	$\overline{265}$	265	$\overline{156}$	413	$\overline{054}$	606	$\overline{631}$	734	$\overline{371}$
072	$\overline{245}$	162	$\overline{503}$	271	$\overline{065}$	423	$\overline{315}$	612	$\overline{346}$	743	$\overline{654}$
073	$\overline{506}$	165	$\overline{251}$	306	$\overline{071}$	431	$\overline{723}$	624	$\overline{632}$	754	$\overline{116}$
074	$\overline{174}$	172		311	$\overline{064}$	432		627	$\overline{031}$		

Table 4-2 List of Current DCS Codes

**NOTE**

The bar above the number represents the binary complement. DO NOT use a number and its complement in the same system.