

TECHNICAL MANUAL

OPERATOR'S AND UNIT MAINTENANCE MANUAL

SIGNAL GENERATOR:

SG-01288/G

(NSN 6625-01-276-9421) (EIC: KIC)

WARNING – This document contains technical data whose export is restricted by the Arms Export Control Act (Title 22, U. S. C., Sec 2751 et seq) or the Export Administration Act 1979, as amended, Title 50, U.S.C., App. 2401 et seq.. Violations of these export laws are subject to severe criminal penalties. Disseminate in accordance with provisions of DOD Directive 5230.25.

DISTRIBUTION STATEMENT D – Distribution authorized to Department of Defense and DoD contractors only to protect critical technical data on systems or hardware. This determination was made Oct 1986. Other requests shall be referred to: Program Manager, TMDE, ATTN: SFAE-CS-FT-T-TEMOD, Redstone Arsenal, AL 35898-5000.

DESTRUCTION NOTICE – Destroy by any method that will prevent disclosure of contents or reconstruction of the document.



5

SAFETY STEPS TO FOLLOW IF SOMEONE IS THE VICTIM OF ELECTRICAL SHOCK

1

DO NOT TRY TO PULL OR GRAB THE INDIVIDUAL

2

IF POSSIBLE, TURN OFF THE ELECTRICAL POWER

3

IF YOU CANNOT TURN OFF THE ELECTRICAL POWER, PULL, PUSH, OR LIFT THE PERSON TO SAFETY USING A DRY WOODEN POLE OR A DRY ROPE OR SOME OTHER INSULATING MATERIAL

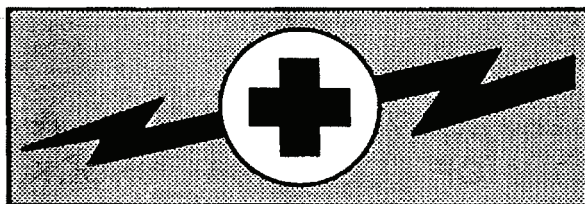
4

SEND FOR HELP AS SOON AS POSSIBLE

5

AFTER THE INJURED PERSON IS FREE OF CONTACT WITH THE SOURCE OF ELECTRICAL SHOCK, MOVE THE PERSON A SHORT DISTANCE AWAY AND IMMEDIATELY START ARTIFICIAL RESPIRATION

WARNING



HIGH VOLTAGE

is used in the operation of this equipment

DEATH ON CONTACT

may result if personnel fail to observe safety precautions

Never work on electronic equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment and who is competent in administering first aid. When technicians are aided by operators, they must warn them about dangerous areas.

Whenever possible, the power supply to the equipment must be shut off before beginning work on the equipment. Take particular care to ground every capacitor likely to hold a dangerous potential. When working inside the equipment, after the power has been turned off, always ground every part before touching it.

Be careful not to contact high-voltage connections of 115-volt ac input when installing or operating this equipment.

Whenever the nature of the operation permits, keep one hand away from the equipment to reduce the hazard of current flowing through vital organs of the body.

WARNING

Do not be misled by the term "LOW VOLTAGE". Potentials as low as 50 volts may cause death under adverse conditions.

For Artificial Respiration refer to FM 4-25.11.

CHANGE }
No. 3 }

Headquarters
Department of the Army
Washington, D.C., 24 February 2006

**OPERATOR'S AND UNIT MAINTENANCE MANUAL
FOR
SIGNAL GENERATOR
SG-1288/G
(NSN 6625-01-276-9421) (EIC: KIC)**

HAZARDOUS MATERIAL INFORMATION – This document has been reviewed for the presence of solvents used as cleaning solutions containing hazardous materials defined by the EPCRA 302 and 313 lists by the AMCOM G-4 (Logistics) Environmental Division. As of the base document through Change 1, dated 1 April 1989, all references to solvents containing hazardous materials have been removed from this document by substitution with non-hazardous or less hazardous materials where possible.

OZONE DEPLETING CHEMICAL INFORMATION – This document has been reviewed for the presence of Class I ozone depleting chemicals by AMCOM G-4 (Logistics) Environmental Division. As of the base document through Change 1, dated 1 April 1989, all references to Class I ozone depleting chemicals have been removed from this document by substitution with chemicals that do not cause atmospheric ozone depletion.

DISTRIBUTION STATEMENT D – Distribution authorized to Department of Defense and DoD contractors only to protect critical technical data on systems or hardware. This determination was made Oct 1986. Other requests shall be referred to: Program Manager, TMDE, ATTN: SFAE-CS-T-TEMOD, Redstone Arsenal, AL 35898-5000.

WARNING – This document contains technical data whose export is restricted by the Arms Export Control Act (Title 22, U. S. C., Sec 2751 et seq) or the Export Administration Act 1979, as amended, Title 50, U.S.C., App. 2401 et seq. Violations of these export laws are subject to severe criminal penalties. Disseminate in accordance with provisions of DOD Directive 5230.25.

DESTRUCTION NOTICE – Destroy by any method that will prevent disclosure of contents or reconstruction of the document.

TM 11-6625-3198-12 dated 1 April 1989, is changed as follows:

1. Remove old pages and insert new pages as indicated below. New or changed material is indicated by a vertical bar in the outer margin of the page.

Remove Pages

A, B
C/(D Blank)
i, ii
1-1, 1-2
3-1, 3-2
A-1/(A-2 blank)

Insert Pages

A, B
C/(D Blank)
i, ii
1-1, 1-2
3-1, 3-2
A-1/(A-2 blank)

2. File this change sheet in front of the publication for reference purposes.

By Order of the Secretary of the Army:

Official:



SANDRA R. RILEY

*Administrative Assistant to the
Secretary of the Army*

0601705

PETER J. SCHOOMAKER
*General, United States Army
Chief of Staff*

Distribution:

To be distributed in accordance with the initial distribution number (IDN) 368094,
requirements for TM 11-6625-3198-12.

CHANGE }
No. 2 }

Headquarters
Department of the Army
Washington, D.C., 15 September 2005

OPERATOR'S AND UNIT MAINTENANCE MANUAL
FOR
SIGNAL GENERATOR:
SG-01288/G
(NSN 6625-01-276-9421)
(EIC: KIC)

DISTRIBUTION STATEMENT D – Distribution authorized to Department of Defense and DoD contractors only to protect critical technical data on systems or hardware. This determination was made Oct 1986. Other requests shall be referred to: Program Manager, TMDE, ATTN: SFAE-CS-T-TEMOD, Redstone Arsenal, AL 35898-5000.

WARNING – This document contains technical data whose export is restricted by the Arms Export Control Act (Title 22, U. S. C., Sec 2751 et seq) or the Export Administration Act 1979, as amended, Title 50, U.S.C., App. 2401 et seq.. Violations of these export laws are subject to severe criminal penalties. Disseminate in accordance with provisions of DOD Directive 5230.25.

DESTRUCTION NOTICE – Destroy by any method that will prevent disclosure of contents or reconstruction of the document.

TM 11-6625-3198-12, dated 1 April 1989 is changed as follows:

1. Remove old pages and insert new pages as indicated below. New or changed material is indicated by a vertical bar in the outer margin of the page.

Remove Pages

2-13, 2-14
Cover Page
DA Forms 2028-2

Insert Pages

C/(D blank)
2-13, 2-14
Cover Page
DA Forms 2028

2. File this change sheet in front of the publication for reference purposes.

By Order of the Secretary of the Army:

Official:



SANDRA R. RILEY
*Administrative Assistant to the
Secretary of the Army*
0524904

PETER J. SCHOOMAKER
*General, United States Army
Chief of Staff*

Distribution:

To be distributed in accordance with the initial distribution number (IDN) 368094,
requirements for TM 11-6625-3198-12.

Change

No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 1 December 1992**Operator's and Unit
Maintenance Manual****SIGNAL GENERATOR SG-1288/G
(NSN 6625-01-276-9421 (EIC: N/A))**

TM 11-6625-3198-12, 1 April 1989, is changed as follows:

1. Remove old pages and insert new pages as indicated below. New or changed material is indicated by a vertical bar in the margin of the page. Added or revised illustrations are indicated by a bar adjacent to the identification number or by a miniature pointing hand.

Remove pages

1-5 and 1-6

Insert pages

1-5 and 1-6

2. File this change sheet in front of the manual for reference purposes.

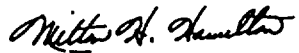
Distribution authorized to the Department of Defense and DOD contractors only for official use or for administrative or operational purposes. This determination was made on 1 August 1988. Other requests for this document will be referred to Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: AMSEL-LC-LM-LT, Fort Monmouth, New Jersey 07703-5007.

DESTRUCTION NOTICE - Destroy by any method that will prevent disclosure of contents or reconstruction of the document.

By Order of the Secretary of the Army:

GORDON R. SULLIVAN
General, United States Army
Chief of Staff

Official:



MILTON H. HAMILTON
Administrative Assistant to the
Secretary of the Army

03320

Distribution:

To be distributed in accordance with DA Form 12-36-E, block 8094,
requirements for TM 11-6625-3198-12.

INSERT LATEST CHANGED PAGES. DESTROY SUPERSEDED PAGES.

LIST OF EFFECTIVE PAGES

NOTE

ON CHANGED PAGES, THE PORTION OF THE TEXT AFFECTED BY THE LATEST CHANGE IS INDICATED BY A VERTICAL LINE OR OTHER CHANGE SYMBOL IN THE OUTER MARGIN OF THE PAGE.

Date of issue for original and changed pages are:

Original	0	1 April 1989
Change	1	1 December 1992
Change	2	15 September 2005
Change	3	24 February 2006

Total number of pages in this publication is 92 consisting of the following:

Page No.	*Change No.
Cover	2
A	0
B	3
C / (D blank).....	3
i	3
ii, iii.....	0
1-1, 1-2	3
1-3, 1-4	0
1-5.....	1
1-6 thru 1-10	0
2-1 thru 2-13	0
2-14.....	2
2-15 thru 2-23 / (2-24 blank).....	0
3-1.....	0
3-2.....	3
3-3 thru 3-8	0
A-1 / (A-2 blank)	3
B-1 thru B-7 / (B-8 blank).....	2
C-1, C-2	0
D-1 / (D-2 blank)	0
E-1 / (E-2 blank)	0
F-1 thru F-7 / (F-8 blank)	0
Index-1 thru Index-2	0
Index-3 / (Index-4 blank).....	0

* Zero in this column indicates an original page.

Technical Manual
No. 11-6625-3198-12



Headquarters
Department of the Army
Washington, D.C., 1 April 1989

**OPERATOR'S AND UNIT MAINTENANCE MANUAL
FOR
SIGNAL GENERATOR SG-1288/G
(NSN 6625-01-276-9421) (EIC: KIC)**

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms) directly to: Commander, U. S. Army Aviation and Missile Command, AMSAM-MMC-MA-NP, Redstone Arsenal, AL 35898-5000. A reply will be furnished to you. You may also provide DA Form 2028 information to AMCOM via email, fax or the World Wide Web. Our fax number is: DSN 788-6546 or Commercial 256-842-6546. Our email address is: 2028@redstone.army.mil. Instructions for sending an electronic 2028 may be found at the back of this manual immediately preceding the hardcopy 2028. For the World Wide Web use: <https://amcom2028.redstone.army.mil>.

HAZARDOUS MATERIAL INFORMATION

This document has been reviewed for the presence of solvents used as cleaning solutions containing hazardous materials defined by the EPCRA 302 and 313 lists by the AMCOM G-4 (Logistics) Environmental Division. As of the base document through Change 1, dated 1 April 1989, all references to solvents containing hazardous materials have been removed from this document by substitution with non-hazardous or less hazardous materials where possible.

OZONE DEPLETING CHEMICAL INFORMATION

This document has been reviewed for the presence of Class I ozone depleting chemicals by AMCOM G-4 (Logistics) Environmental Division. As of the base document through Change 1, dated 1 April 1989, all references to Class I ozone depleting chemicals have been removed from this document by substitution with chemicals that do not cause atmospheric ozone depletion.

WARNING – This document contains technical data whose export is restricted by the Arms Export Control Act (Title 22, U. S. C., Sec 2751 et seq) or the Export Administration Act 1979, as amended, Title 50, U.S.C., App. 2401 et seq.. Violations of these export laws are subject to severe criminal penalties. Disseminate in accordance with provisions of DOD Directive 5230.25.

DISTRIBUTION STATEMENT D – Distribution authorized to Department of Defense and DoD contractors only to protect critical technical data on systems or hardware. This determination was made Oct 1986. Other requests shall be referred to: Program Manager, TMDE, ATTN: SFAE-CS-FT-T-TEMOD, Redstone Arsenal, AL 35898-5000.

DESTRUCTION NOTICE – Destroy by any method that will prevent disclosure of contents or reconstruction of the document.

TABLE OF CONTENTS

		Page
	HOW TO USE THIS MANUAL.....	iii
Chapter	1. INTRODUCTION.....	1-1
Section	I. General Information.....	1-1
	II. Equipment Description.....	1-2
	III. Technical Principals of Operation.....	1-9
Chapter	2. OPERATING INSTRUCTIONS.....	2-1
Section	I. Description and Use of Operators Controls Indicators and Connectors.....	2-1
	II. Operator Preventive Maintenance Checks and Services (PMCS).....	2-12
	III. Operation Under Usual Conditions.....	2-14
Chapter	3. UNIT MAINTENANCE.....	3-1
Section	I. Repair Parts, Special Tools, TMDE, and Support Equipment.....	3-1
	II. Service Upon Receipt.....	3-1
	III. Troubleshooting.....	3-3
	Symptom Index.....	3-3
	IV. Maintenance Procedures.....	3-6
	V. Preparation for Storage or Shipment.....	3-8
APPENDIX	A. REFERENCE.....	A-1
	B. MAINTENANCE ALLOCATION CHART.....	B-1
	C. COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LIST.....	C-1
	D. ADDITIONAL AUTHORIZATION LIST.....	D-1
	E. EXPENDABLE SUPPLIES AND MATERIALS LIST.....	E-1
	F. REMOTE OPERATION.....	F-1
	SUBJECT INDEX.....	INDEX-1

HOW TO USE THIS MANUAL

This manual tells about the Signal Generator SG-1288/G and contains instructions about how to use it during maintenance on other electronic equipment.

The technical manual for the electronic equipment being maintained will tell where to make certain connections and when to use various accessories which are part of the SG-1288/G.

When first receiving the SG-1288/G, start at the front of the manual and go all the way through to the back. Become familiar with every part of the manual and the SG-1288/G.

This manual has an edge index which will help find specific information in a hurry. Simply spread the pages on the right edge of the manual until the printed blocks can be seen. Open the manual where the block on the edge of the page lines up with the selected topic printed on the front cover block.

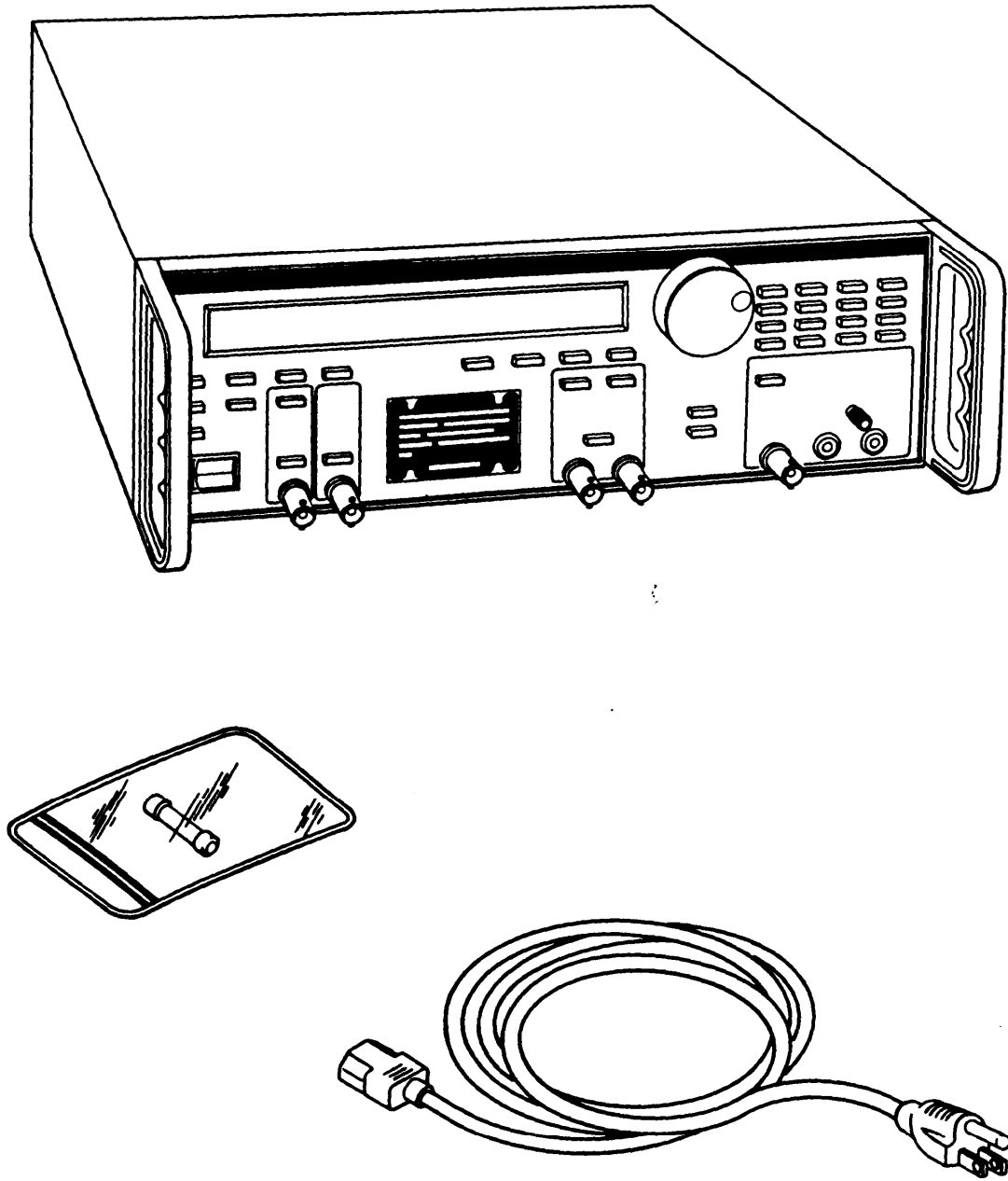


Figure 1-1. Signal Generator SG-1288/G.

CE10D001

**CHAPTER 1
INTRODUCTION**

	Para	Page
Administrative Storage	1-4	1-1
Consolidated Index of Army Publications and Blank Forms.....	1-2	1-1
Destruction of Army Electronics Materiel to Prevent Enemy Use	1-5	1-1
Equipment Characteristics, Capabilities, and Features	1-10	1-2
Equipment Data	1-11	1-3
General Functional Description	1-12	1-9
List of Abbreviations	1-9	1-2
Maintenance Forms, Records, and Reports	1-3	1-1
Nomenclature Cross-Reference List	1-8	1-2
Reporting Equipment Improvement Recommendations (EIR)	1-6	1-1
Scope	1-1	1-1
Warranty information	1-7	1-2

Section I. GENERAL INFORMATION

1-1. SCOPE.

- a. Type of Manual: Operator's and Unit Maintenance Manual.
- b. Equipment Name and Model Number: Signal Generator SG-1288/G
- c. Purpose of Equipment: The Signal Generator is designed to provide a precision source of sine, triangle, and variable symmetry (ramp and pulse) waveforms for use in the installation and maintenance of radio receivers, transmitters, and associated electronic equipment.

1-2. CONSOLIDATED INDEX OF ARMY PUBLICATIONS AND BLANK FORMS.

Refer to the latest issue of DA Pam 25-30 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

1-3. MAINTENANCE FORMS, RECORDS, AND REPORTS.

- a. Reports of Maintenance and Unsatisfactory Equipment. Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA Pam 750-8.
- b. Report of Item and Packaging Deficiencies. Fill out and forward SF 364 (Report of Discrepancy) (ROD) as prescribed in AR 735-11-2/DLAR 4140.55/NAVMATINST 4355.18/AFR400-54/MCO 4430.3J.
- c. Transportation Discrepancy Report (TDR)(SF 361). Fill out and forward Transportation Discrepancy Report (TDR)(SF 361) as prescribed in DA Pam 25-30/NAVSUPINST 4610.33C/AFR 75-18/MCO P4610.19D DLAR 4500.15.

1-4. ADMINISTRATIVE STORAGE.

Administrative storage of equipment issued to and used by Army activities will have preventive maintenance performed in accordance with the PMCS charts before storing. When removing the equipment from administrative storage, the PMCS should be performed to assure operational readiness. Disassembly and repacking of equipment for shipment or limited storage are covered in paragraph 3-9.

1-5. DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE.

Destruction of Army materiel to prevent enemy use is described in TM 750-244-2.

1-6. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR).

If your Signal Generator SG-288/G needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design or performance. Put it on an SF 368 (Product Quality Deficiency Report). Mail it to us at: Commander, U.S. Army Aviation and Missile Command, ANSAM-MMC-MA-NM, Redstone Arsenal, AL. 35898-5000. We'll send you a reply.

1-7. WARRANTY INFORMATION

The Signal Generator is warranted by Wavetek San Diego for one year. Warranty starts on the date of shipment to the original buyer. Report all defects in material or workmanship to your supervisor who will take appropriate action.

1-8. NOMENCLATURE CROSS-REFERENCE LIST.

Common names will be used when the Signal Generator SG-1288/G is mentioned in this manual.

NOTE

Official nomenclature must be used when filling our report forms or looking up technical manuals.

<i>Common Name</i>	<i>Official Nomenclature</i>
Signal Generator	Signal Generator SG-1288/G
SG-1288/G	Signal Generator SG-1288/G

1-9. LIST OF ABBREVIATIONS.

This list identifies abbreviations and descriptions that are used in this manual.

dBc	dB relative to carrier
dBm	dB relative to 1 milliwatt
fc	carrier frequency
fm	modulating frequency
GPIB	General Purpose Interface Bus
VCF	Voltage Controlled Frequency
VFD	Vacuum Fluorescent Display

Section II. EQUIPMENT DESCRIPTION

1-10. EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES.

a. CHARACTERISTICS.

- Allows for repair and testing of:
 - Communication receivers and transmitters.
 - Video Systems.
 - Servo Systems
 - Amplifiers.
 - Oscilloscopes.
 - Analyzers.
- Designed for bench top use.

b. CAPABILITIES AND FEATURES.

- Pushbutton control allows for easy operation of equipment.
- Indicator lights on front panel for constant equipment status.
- Large 16 character (14 segments/character) display for all parameters.
- Programmable Sine, Triangle, Square, and dc outputs.
- Variable symmetry provides pulse and ramp waveforms.
- Balanced and unbalanced outputs.
- Built-in fault analysis programs with extensive self-adjustment.
- Battery backup for saving system setups.
- Programmed interface for remote operation.

1-11. EQUIPMENT DATA.

WEIGHTS AND DIMENSIONS

Net Weight	25 lb (11.4 kg)
Shipping Weight	30 lb (13.6 kg)
Depth	17.00 in. (43.2 cm)
Width	14.00 in. (35.6 cm)
Height	5.22 in. (13.3 cm)

POWER REQUIREMENTS

Voltage:

100Vac operation	90 to 108Vac
120Vac operation	108 to 126Vac
220Vac operation	198 to 231Vac
240Vac operation	216 to 252Vac

Frequency	48 to 440Hz
Power	60 VA maximum

Fuse Rating:

100/120Vac operation	0.750 amp, 250 volt
220/240Vac operation	0.375 amp, 250 volt

ENVIRONMENTAL

Operating temperature range	0 to +50°C
Storage temperature range	- 40 to +75°C

Relative humidity:

+25°C	95% maximum
+40°C	75% maximum
+50°C	45% maximum

Operating altitude	0 to 10,000 feet (3,048 m)
Storage altitude	0 to 40,000 feet (12,195 m)
Vibration (operating)	5 to 55 Hz at 0.013 in. level (2 g accel at 55 Hz)
Shock (non-operating)	30 g, 11 ms (half-sine)

PERFORMANCE

Frequency:

Range:

50 Ω , 75 Ω unbalanced	2 mHz to 20 MHz 20 Hz to 20 MHz synthesized)
135 Ω balanced.....	2 mHz to 1 MHz
600 Ω Balanced or unbalanced	2 mHz to 1 MHz

Accuracy:

2 mHz to 20 Hz	\pm 3% of reading
----------------------	---------------------

FM and Sweep Modes:

20 mHz to 20 MHz	\pm 3% of reading
------------------------	---------------------

CW and AM Modes:

20 Hz to 1 MHz	\pm 0.05% of reading
1 MHz to 20 MHz	\pm 0.1% of reading

Resolution (200 to 2000 counts in the display)	3 1/2 digits
--	--------------

Spurious Signals (> \pm 200 Hz offset):

1 MHz	- 60 dBc
1 MHz to 10 MHz	- 40 dBc
10 MHz to 20 MHz	- 36 dBc

Stability:

Time:

Within 10 min:

\leq 20 Hz (or in FM and Sweep Mode)	\pm 0.1%
20 Hz to 20 MHz (CW and AM Mode)	\pm 0.05%

Within 24 hours:

\leq 20 Hz (or in FM and Sweep Mode)	\pm 0.5%
20 Hz to 20 MHz (CW and AM Mode)	\pm 0.1%

Line Voltage:

For \pm 10% variation:

\leq 20 Hz (or in FM and Sweep Mode)	\pm 0.1%
20 Hz to 20 MHz (CW and AM Mode)	\pm 0.01%

Temperature:

\leq 20 Hz (or in FM and Sweep Mode)	< 100 ppm/ $^{\circ}$ C
20 Hz to 20 MHz (CW and AM Mode)	< 50 ppm/ $^{\circ}$ C

Output Level Variations:

\leq 20 Hz (or in FM and Sweep Mode)	< \pm 0.1%
20 Hz to 20 MHz (CW and AM Mode)	\pm 0.01%

Amplitude:

Range:

Open circuit	2 mVp-p to 30 Vp-p
Terminated	1 mVp-p to 15 Vp-p

Resolution:

Open circuit:

2 mVp-p to 20 Vp-p	3 digits
≤ 30 Vp-p	3 1/2 digits

Terminated:

1 mVp-p to Vp-p	3 digits
≤ 15 Vp-p	3 1/2 digits

Sine Wave Accuracy:

Unbalanced Output:

2 MHz to 49.99 Hz	± 2% of reading
50 Hz to 99.99 kHz, from 0.001 Vp-p to 20.0 Vp-p open circuit	± 2% of reading
50 Hz to 99.99 kHz, from 20.0 Vp-p to 30.0 Vp-p open circuit	± 3% of reading
100 kHz to 1 MHz	± 4% of reading

Unbalanced Output (50 and 75 Ω):

1 MHz to 5 MHz	± 5% of reading
5 MHz to 15.99 MHz	± 12% of reading
16 MHz to 19.99 MHz	± 30% of reading

NOTE

To all Sine Wave percentages, add the following offsets to open circuit voltages:

- ± 10 mV for 1 Vp-p to 30 Vp-p
- ± 2 mV for 100 mVp-p to 999 mVp-p
- ± 1 mV for 1 mVp-p to 99.9 mVp-p

Square/Triangle Accuracy:

Unbalanced Output:

2 MHz to 100 kHz	± 3% of reading
100 kHz to 1 MHz	± 5% of reading

Unbalanced Output (50 and 75 Ω):

1 MHz to 5 MHz	± 6% of reading
5 MHz to 20 MHz	± 12% of reading

NOTE

To all Square/Triangle percentages, add the following offsets to open circuit voltages:

- ± 20 mV for 10 Vp-p to 30 Vp-p
- ± 10 mV for 1 mVp-p to 9.99 mVp-p
- ± 4 mV for 100 mVp-p to 999 mVp-p
- ± 3 mV for 10 mVp-p to 99.9 mVp-p
- ± 2 mV for 1 mVp-p to 9.99 mVp-p

Output Configuration:

Balanced:

Impedance (≤ 1 MHz) $135 \Omega \pm 0.5\%$ or $600 \Omega \pm 1\%$
 Connector Dual banana (differential) with binding post center tap (ct)

Unbalanced:

Impedance:

20 MHz $50 \Omega \pm$ or $75 \Omega 1\%$
 1 MHz $600 \Omega \pm 1\%$

Connector Type BNC female

Waveforms:

Sine:

Unbalanced Output (THD):

2 mHz to 20 Hz $< 1\%$ (- 40 dB)
 20 Hz to 100 kHz $< 0.5\%$ (- 46 dB)
 100 kHz to 1 MHz $< 1\%$ (- 40 dB)

Unbalanced Output (THD) ($< 10V_{p-p}$, 50 and 75 Ω):

1 MHz to 6 MHz - 34 dBc
 6 MHz to 8 MHz - 32 dBc
 8 MHz to 10 MHz - 30 dBc
 10 MHz to 20 MHz - 28 dBc

Unbalanced Output (THD) (2 $10V_{p-p}$, 50 and 75 Ω):

1 MHz to 6 MHz - 34 dBc
 6 MHz to 8 MHz - 30 dBc
 8 MHz to 10 MHz - 27 dBc
 10 MHz to 20 MHz - 26 dBc

Balanced Output (THD):

10 Hz to 100 kHz $< 1\%$ (- 40 dB)
 100 kHz to 1 MHz $< 1.78\%$ (- 35 dB)

Square:

10 to 90% Rise/Fall Time (at full output into 50 Ω) < 13 ns
 Overshoot and Ringing $< (5\% \pm 20$ mV) of peak to peak amplitude
 Symmetry 5 to 95% in 1% steps to 2 MHz linearly decreasing to 50% fixed at 20 MHz
 Accuracy $< \pm (1\% + 20$ ns)
 Pulse Width 100 ns to 450 sec

Triangle:

Non-Linearity (10 to 90%):

2 mHz to 99.99 kHz $\pm 1\%$
 100 kHz to 1.99 MHz $\pm 2\%$
 2 MHz to 5 MHz $\pm 10\%$

Symmetry 5 to 95% in 1% steps to 2 MHz linearly decreasing to 50% fixed at 20 MHz
 Accuracy $< \pm (1\% + 20$ ns)

DC Offset:

Resolution 3 digits
 Range (variable):
 Open Circuit ±10V
 Terminated..... ±5V

Accuracy (open circuit):

0.5V to 10V ± 1% of reading +20 mV
 1 mVp-p to 500 mVp-p ±.1% of reading +5 mV

Operational Modes:

Continuous (CW):

Range 2 MHz to 20 MHz
 Amplitude (open circuit) 2 mVp-p to 30 Vp-p

Amplitude Modulation (AM):

Frequency Response DC to 100 kHz
 Sensitivity 4 Vp-p into 10k Ω for 100% modulation
 Range 0.1 Hz to 20 MHz
 Modulation Depth 0 to 100%
 Distortion (1 MHz fc, 1 kHz fm) 2% at 70% sine modulation
 Amplitude (open circuit) 1 mVp-p to 15 Vp-p

Frequency Modulation (FM and VCF):

Frequency Bandwidth DC to 100 kHz deviation rate
 Frequency Control (VCF) Variable over a 1000:1 range
 Slew Rate (VCF) > 0.06 volts per μ s
 Voltage Range 10 Vp-p for 1000:1 frequency control
 Range Three decades (1000:1)
 Distortion (10 MHz fc, 1 kHz fm) -35 dB at 10% modulation

Sweep:

Time 100 ms to 100 sec ± 1%
 Width Programmable over a 3 decade range (1000:1)
 Start and Stop frequency Front panel selectable
 Start and Stop frequency accuracy < ± 3%
 Waveforms Sine and all 50% symmetrical waveforms

External Inputs:

Ext Freq In:

Frequency Range (sinewave) 20 Hz to 20 MHz
 Phase Offset Frequency Range 50 Hz to 10.0 MHz
 Voltage Range (sinewave)..... 600 mVp-p to 30 Vp-p
 Phase Offset Range ± 180°
 Resolution 1°
 Accuracy ± (4° + 20 ns)
 Lock Indication Front panel LED
 Impedance 10 k Ω ±2%
 Connector Type BNC female

Mod/VCF In:

Frequency Response DC to 100 k Hz
 Maximum input 20 Vp-p
 Impedance 10k Ω , ± 2%
 Input Connector Type BNC female

Outputs:

Sync Out:

Signal Pulse waveform at the programmed frequency and symmetry
 Voltage (into 50 Ω) > 1 Vp-p and <2.5 Vp-p
 Transition Time (10 to 90%) <13 ns
 ConnectorType BNC female

Sweep Out:

Signal Ramp output indicating sweep position
 Voltage (into 600 Ω approx) 0 to +5V linear ramp
 Impedance 600 Ω
 Connector..... Type BNC female

Digital Interface

Addresses 00 to 30
 Remote indication Front panel indicator (LED)
 Subsets SH1, AH1, SRI, RL1, PP0, DC1, DT0, C0, T6, L4, TE0, LE0, and E1
 Type IEEE Standard 488-1978

Display

Type . . 16 digit Vacuum Fluorescent Display (VFD) with 14 segment alpha-numeric characters
 Display Readout Accuracy ± 1 least significant digit

Frequency:

Units mHz, Hz, kHz, and MHz
 Resolution 3 1/2 digits

Time Period:

Units SEC, ms, μ s, and ns
 Resolution5 digits

Sine Amplitude:

Units dBm and V/mV (peak, peak-to-peak, and RMS)
 Resolution (dBm)0.1 dBm

Triangle/Square (50% symmetry) units V, mV, RMS, and dBm

Symmetry:

Units Percent
 Resolution (minimum) 10 counts

Sweep Time units. SEC or ms (with at least 100 counts)
 Offset Display Vdc or mVdc

External Phase:

Units Degrees or radians

Resolution:

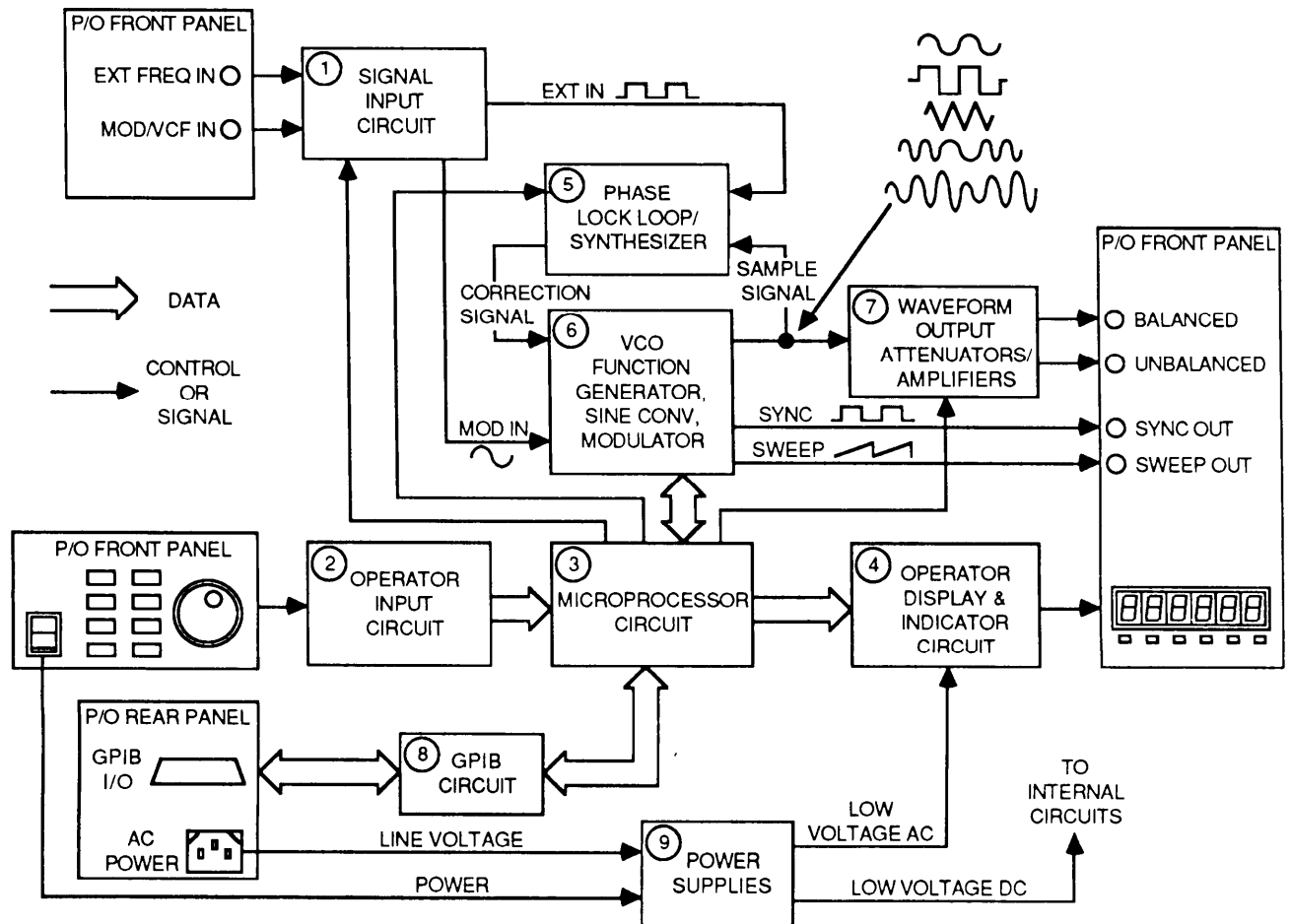
Degrees 1°
 Radians 4 digit

Section III. TECHNICAL PRINCIPLES OF OPERATION

1-12. GENERAL FUNCTIONAL DESCRIPTION.

The Signal Generator (fig. 1-2) provides a highly stable output signal from 2 mHz to 20 MHz. This signal can be externally amplitude or frequency modulated, or internally swept. Sine, Triangle, and Square waveforms are available.

Output signal information, entry information, and error messages are shown in the display. Various LED indicators provide additional instrument status.



CE10D002

Figure 1-2. Signal Generator SG-1288/G Simplified Block Diagram.

- ① The Signal Input Circuit block processes input signals connected to front panel MOD/VCF IN and EXT FREQ IN connectors. The MO D/VCF IN signal is routed to the Function Generator, Sine Converter, and Modulator Circuit block unchanged. The EXT FREQ IN signal is voltage shifted and squared, and routed to the Phase Lock Loop/Synthesizer Circuit block.
- ② The Operator Input Circuit block allows the operator to communicate with the Signal Generator. When the Control Knob is moved or one of the 36 front panel keys are pressed, the information is processed and sent to the Microprocessor Circuit block. The Keypad input allows the operator to enter new data values and select various operational parameters. The Control Knob allows the operator to change certain existing values.
- ③ Microprocessor Circuit block provides overall control of the internal circuitry in the Signal Generator. Data and control signals are sent to/received from all the other blocks as required to perform all Signal Generator operations (except the Power Supplies block).
- ④ The Operator Display and Indicator Circuit block section provides measurement information and instrument status to the operator. Under control of the Microprocessor Circuit block, the 16 digit Vacuum Fluorescent Display (VFD) and LED indicators show data, modes, and functions selected.
- ⑤ The Phase Lock Loop/Synthesizer block provides frequency accuracy and stability control for Signal Generator operations. The output signal frequency/phase are sampled and compared to the frequency reference signal, and a correction signal is generated. This signal is routed to the Function Generator, Sine Converter Modulator block to correct the output frequency. The frequency reference is either the EXT IN signal from the Signal Input Circuit block or a synthesized signal generated in this block.
- ⑥ The Function Generator, Sine Converter, Modulator block generates the various Signal Generator output waveforms. Control is provided by the Microprocessor Circuit block. The Function Generator subsection generates the triangle and square waveforms. The Sine Converter subsection produces the sine waveform. The Modulator subsection provides amplitude and frequency modulation to the generated sine wave using the MOD IN signal from the Signal Input Circuit block. The waveform outputs from this block are routed to the Waveform Output Attenuators/Amplifiers block. A TTL pulse is provided to the front panel SYNC OUT connector, and a ramp voltage corresponding to the selected sweep frequency is provided to the front panel SWEEP OUT connector.
- ⑦ The Waveform Output Attenuators and Amplifiers provide the Signal Generator output waveform to the front panel. Under control of the Microprocessor Circuit block, the desired waveform is selected from the Function Generator, Sine Converter, Modulator block. The signal is then adjusted (attenuated/amplified), and correct output impedance is provided. The conditioned signal is then routed to the front panel BALANCED or UNBALANCED connector.
- ⑧ The GPIB Circuit block allows the Signal Generator to be operated remotely using an external controller connected to the rear panel GPIB connector. All functions except Power Switch and Address key are programmable using the interface.
- ⑨ The Power Supply section provides the internal operating voltages for the Signal Generator. Fuse protection is provided on the rear panel. During normal operation, regulated +5 Vdc, -12 Vdc, +12 Vdc, -22 Vdc, and +22 Vdc are provided to all the blocks for operation. $\pm 8V_{rms}$ is provided for the Vacuum Fluorescent Display (VFD) in the Operator Display and Indicator Circuit block.

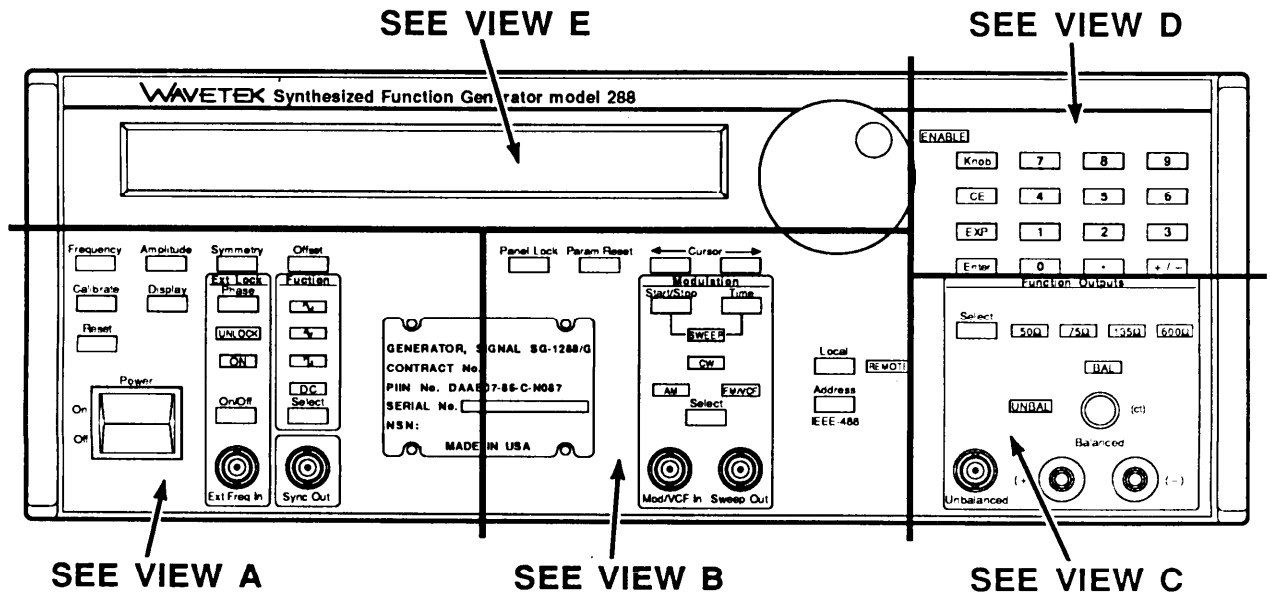
CHAPTER 2 OPERATING INSTRUCTIONS

	Para	Page
Amplitude Modulation (AM)	2-11	2-17
Continuous Wave (CW)	2-9	2-15
Frequency Modulation (FM)	2-12	2-18
General	2-2	2-12
Introduction (Section I)	2-1	2-1
Introduction (Section III)	2-4	2-12
Maintenance Messages and Error Codes	2-7	2-14
Operating Procedures	2-8	2-14
PMCS Procedures	2-3	2-12
Preparation for Use	2-5	2-12
Sweep Modulation	2-10	2-16
Turn-On Procedure	2-6	2-13
Voltage Controlled Frequency (VCF)	2-13	2-21

Section I. DESCRIPTION AND USE OF OPERATOR'S CONTROLS, INDICATORS, AND CONNECTORS

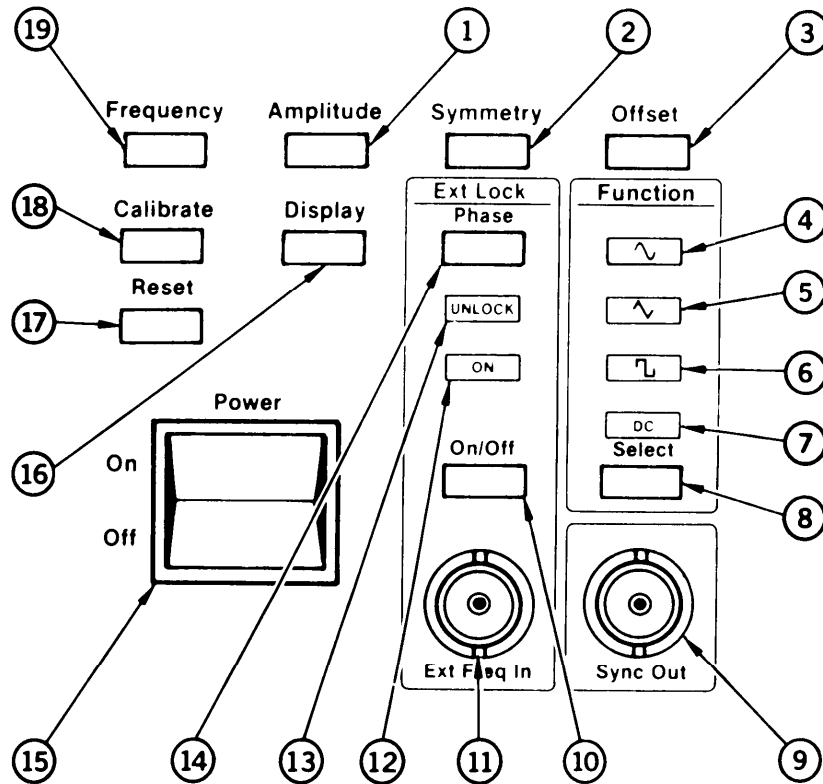
2-1. INTRODUCTION.

This section describes all of the operator controls, indicators, and connectors for the Signal Generator. Due to the large number of controls, indicators, and connectors on the front panel, it is necessary to separate the panel into five different portions. Figure 2-1 (views A thru E) shows each portion of the front panel. The rear panel is shown in figure 2-2.






CE10D003

Figure 2-1. Operator's Controls, Indicators, and Connectors, front view.

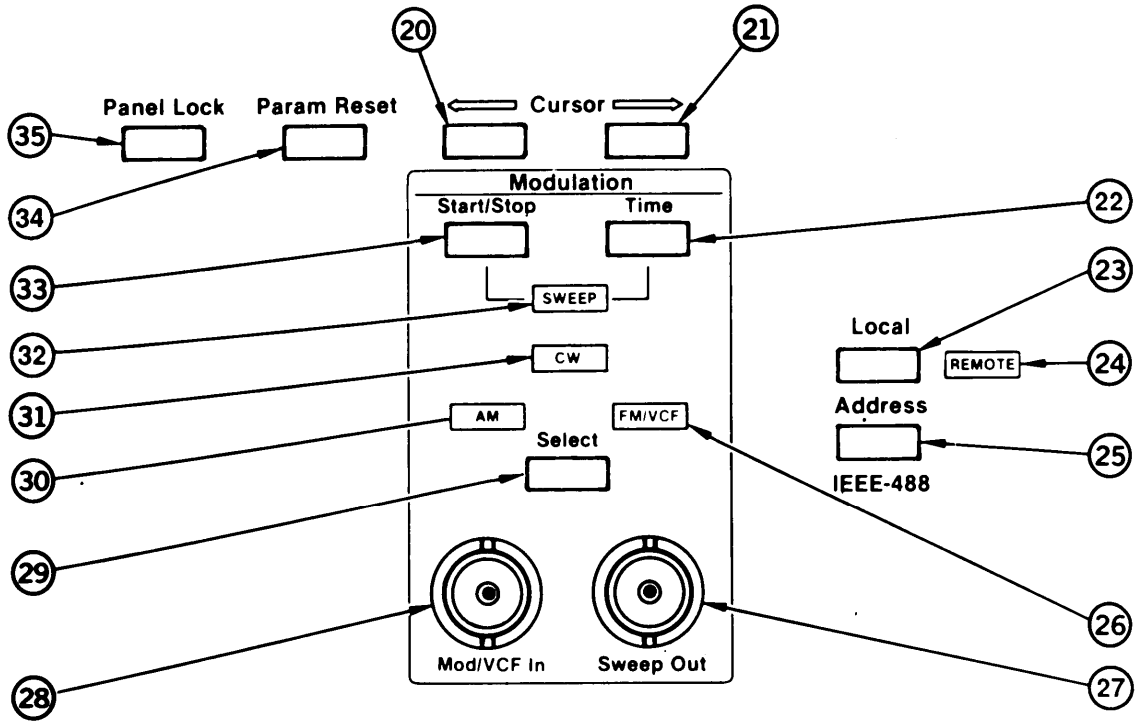


VIEW A

KEY	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
1	AMPLITUDE key	Used to display and enter output amplitude. Displayed units in Vp-p, Vp, Vrms, or dBm. To enter a new value, press key until desired units are displayed. Use CURSOR keys/CONTROL KNOB or NUMERIC/ENTER keys to enter a new value. All units reflect new value. Range from 0.001 to 15.0Vp-p, 0.0005 to 7.5 Vp, 0.0004 to 5.3 Vrms, and -56.0 dBm to +27.5 dBm. Defaults to 5Vp-p. Restrictions: If SYMMETRY not 50% and/or DC Offset is not 0Vdc, can select only units of Vp-p and Vp with decreased range.
2	SYMMETRY key	Used to display and enter output waveform symmetry from 5% to 95%. Press to display present value. Use CONTROL KNOB or NUMERIC/ENTER keys to enter a new value in 1% increments. Defaults to 50%. Restrictions: Fixed at 50% when BAL, FM/VCF, or SWEEP are selected. Linearly increases (from 5%) and decreases (from 95%) at frequencies above 2 MHz to 50% at 20 MHz.

KEY	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
3	OFFSET key	Used to display and enter DC offset value from +5.000 to -5.000V. In DC function, controls signal output polarity and level. In SINE, TRIANGLE, and SQUARE functions, controls reference level of output waveform. Press to display present value. Use CURSOR keys/CONTROL KNOB or NUMERIC/ENTER keys to enter a new value. Defaults to 0Vdc. Restrictions: Fixed at 0Vdc when BAL selected. When SWEEP, CW, and FM/VCF are selected, range limited at amplitudes >5Vdc. When AM is selected, range limited at amplitudes \geq 2.5Vdc.
4	 (SINE) indicator	When on, indicates SINE function is active. Provides an operator defined sine waveform from Unbalanced or Balanced output connectors. To activate, press function SELECT key until indicator lights. Defaults to SINE. Restrictions: Locked in when BAL and/or AM selected.
5	 (TRIANGLE) indicator	When on, indicates TRIANGLE function is active. Provides an operator defined triangle waveform from Unbalanced connector. To activate, press function SELECT key until indicator lights. Restrictions: Locked out when BAL and/or AM selected,
6	 (SQUARE) indicator	When on, indicates SQUARE function is active. Provides an operator defined square waveform from Unbalanced connector. To activate, press function SELECT key until indicator lights. Restrictions: Locked out when BAL and/or AM selected.
7	DC indicator	When on, indicates DC function is active. Provides an operator defined DC voltage level from Unbalanced connector. To activate, press function SELECT key until indicator lights. Restrictions: Locked out when BAL, AM, and/or phase lock ON is selected.
8	Function SELECT key	Used to select SINE, TRIANGLE, SQUARE, or DC function. Press until desired indicator lights. Restrictions: See SINE, TRIANGLE, SQUARE, and DC indicators.
9	SYNC OUT connector	BNC female connector with capacity of driving 50 Ω . Provides a 1 to 2.5Vp-p TTL pulse at output waveform frequency. Signal is used when synchronizing Signal Generator to external equipment. Signal symmetry same as square wave. Signal in phase with square wave but leads sine and triangle waveforms 90°. Restrictions: Signal not present in DC function.
10	Ext Lock ON/OFF key	Used to select the external reference frequency signal connected to the EXT FREQ IN connector. OFF activates internal frequency reference signal. ON deactivates internal frequency reference and an external signal must be used. Press for on (Ext Lock ON indicator on), press for off (Ext Lock ON indicator off). Restrictions: Locked out when frequency <20 Hz, and when DC, SWEEP, and/or FM/VCF selected.

KEY	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
11	EXT FREQ IN connector	BNC female connector with 10k Ω input impedance accepts 20 Hz to 20 MHz sinewave from 600mVrms to 30Vp-p signal. Frequency must be set to Signal Generator output frequency \pm 3%. Used to connect an external frequency reference to the Signal Generator for increased accuracy and stability.
12	Ext Lock ON indicator	When on, indicates signal connected to EXT FREQ IN connector is to be used for reference frequency. Does not indicate signal is present at EXT FREQ IN connector. See Ext lock ON/OFF key for further explanation.
13	UNLOCK indicator	When flashing, indicates problem with internal or external frequency reference signal, causing Signal Generator output frequency to be inaccurate. Normally off.
14	PHASE key	Used to display and enter output signal phase. Phase relationship compared to an external signal connected to EXT FREQ IN connector. Displayed units in +/- degrees or +/- radians. To enter a new value, press key until desired units are displayed. Use CURSOR keys/CONTROL KNOB or NUMERIC/ENTER keys to enter a new value. Both units reflect new value. Range from +180° to -180° or +3.14 to -3.14 radians. Defaults to 0°.
15	POWER switch	Used to turn Signal Generator on or off. ON when button rocked up, OFF when button rocked down.
16	DISPLAY key	Used to display and adjust intensity of DISPLAY from 00 to 31. 31 is brightest setting. Press to display present value. Use CONTROL KNOB or NUMERIC/ENTER keys to enter a new value. Defaults to 16.
17	RESET key	Used to set Signal Generator parameters to default condition (para 2-6). GPIB address remains unchanged. Press to activate.
18	CALIBRATE key	Used to perform Signal Generator self check. Performs 20 second functional check/fine tune of certain internal circuits. DISPLAY indicates CALIBRATING during self check, and AUTO CALIBRATED after successful self check. Press to activate. Restrictions: Requires 20 minute warm-up each time power is applied.
19	FREQUENCY key	Used to display and enter output frequency/period. Displayed frequency units in mHz, Hz, kHz, and MHz. Displayed period units in SEC and ms. To enter a new value, press key until desired units are displayed. Use CURSOR keys/CONTROL KNOB or NUMERIC/ENTER keys to enter a new value in Hz or SEC. Both units reflect new value. Range from 0.002 Hz to 20.00 MHz or 500.0 SEC to 0.00005ms. Defaults to 1.000 kHz. Restrictions: Frequencies >2 MHz limited when SYMMETRY not 50%. Frequencies <20 Hz locked out when phase lock ON selected. Frequencies >1 MHz locked out when BAL, 135 Ω , and/or 600 Ω selected. Frequencies <0.1 Hz locked out when AM selected.

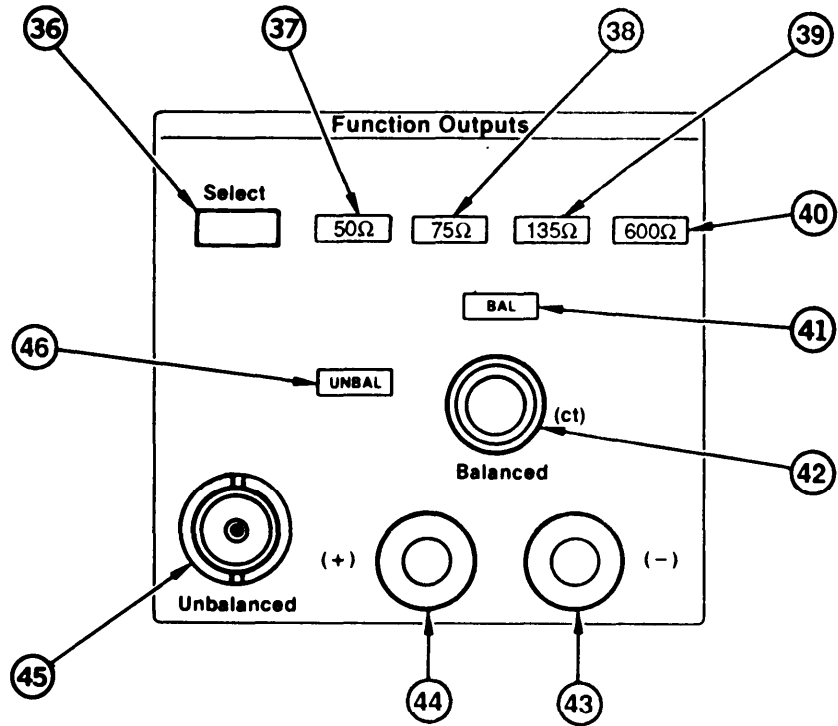


VIEW B

KEY	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
20	<— CURSOR key	Used to change display setting. Moves selectable digit to left through all possible display combinations. Press key until desired digit flashes, then use CONTROL KNOB to change value. Restrictions: Not used for DISPLAY, PHASE, SYMMETRY, and ADDRESS keys.
21	CURSOR —> key	Used to change display setting. Moves selectable digit to right through all possible display combinations. Press key until desired digit flashes, then use CONTROL KNOB to change value. Restrictions: Not used for DISPLAY, PHASE, SYMMETRY, and ADDRESS keys.
22	TIME key	Used to display and enter time or rate for one complete sweep. Only used during SWEEP modulation. Displayed units in SEC or Hz. To enter a new value, press key until desired units are displayed. Use CURSOR keys/CONTROL KNOB or NUMERIC/ENTER keys to enter a new value. Both units reflect new value. Range from 0.1 to 100 SEC or 10 to 0.01 Hz. Defaults to 1 SEC.
23	LOCAL key	Used to return Signal Generator to front panel control from remote (GPIB) operation. Displays GO TO LOCAL. Press to activate. Restrictions: Will not select if Local Lockout set by external Controller during remote operation.

KEY	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
24	REMOTE indicator	When on, indicates Signal Generator is in remote (GPIB) operation using external Controller. Front panel controls may be used only to read instrument settings, and not to change entered values.
25	ADDRESS key	Used to display and enter GPIB address from 00 to 30. Press to display present value. Use CONTROL KNOB or NUMERIC/ENTER keys to enter a new value. Defaults to 09. Restrictions: Will not select if Local Lockout set by external Controller during remote operation.
26	FM/VCF indicator	When on, indicates FM/VCF modulation mode is active. Provides an operator defined frequency modulated waveform from Unbalanced or Balanced output connectors. An external signal source connected to MOD/VCF IN connector is required for FM/VCF operation. External signal amplitude (0 to 10Vp-p) controls deviation. External signal frequency (DC to 100 kHz) controls rate. To activate, press modulation SELECT key until indicator lights. Restrictions: Locked out when SYMMETRY not 50% and/or when phase lock ON selected.
27	SWEEP OUT connector	BNC female connector with 600 Ω output impedance. Provides a 0 to +5V or +5 to 0V linear ramp voltage from start to stop frequency at sweep time selected. Signal is used for sweeping an external signal source. Restrictions: Signal only present during SWEEP modulation mode.
28	MOD/VCF IN connector	BNC female connector with 10k Ω input impedance. Used to connect an externally supplied DC to 100 kHz signal for modulation of Unbalanced and Balanced output signals. Maximum input is 20Vp-p. Input amplitude controls AM depth and FM/VCF deviation. Input frequency controls AM and FM/VCF modulation rate.
29	Modulation SELECT key	Used to select SWEEP, CW, AM, or FM/VCF modulation. Press until desired indicator lights. Restrictions: See SWEEP, CW, AM, or FM/VCF indicators.
30	AM indicator	When on, indicates AM modulation mode is active. Provides an operator defined amplitude modulated waveform from Unbalanced or Balanced output connectors. An external signal source connected to MOD/VCF IN connector is required for AM operation. External signal amplitude (0 to 4Vp-p) controls depth. 4Vp-p provides 100% depth. External signal frequency (DC to 100 kHz) controls rate. To activate, press modulation SELECT key until indicator lights. Restrictions: Locked out when TRIANGLE, SQUARE, or DC function selected, frequency set to <0.1 Hz, and/or the sum of AMPLITUDE (Vp-p) and OFFSET (Vdc) exceeds 7.5.

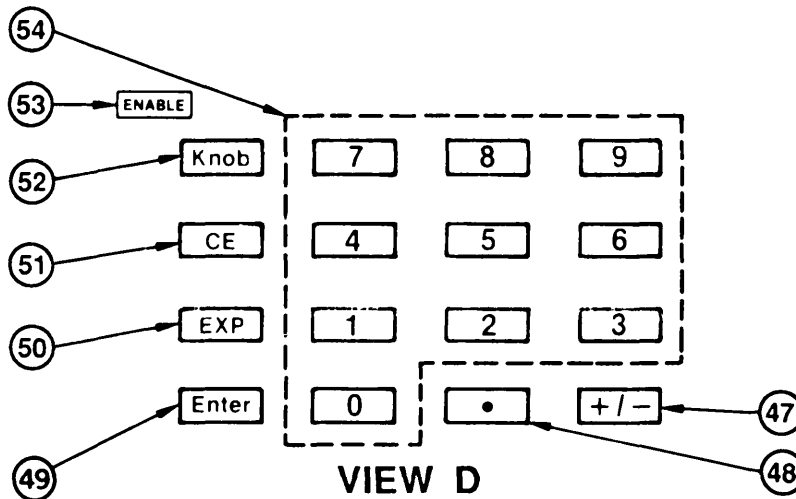
KEY	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
31	CW indicator	<p>When on, indicates CW modulation mode is active. Provides an operator defined continuous waveform from Unbalanced or Balanced output connectors. To activate, press modulation SELECT key until indicator lights. Defaults to CW.</p> <p>Restrictions: Locked in when TRIANGLE, SQUARE, and Ext lock ON. AMPLITUDE and/or SYMMETRY selections lock out SWEEP, AM, and FM/VCF modes.</p>
32	SWEEP indicator	<p>When on, indicates SWEEP modulation mode is active. Provides an operator defined swept waveform from Unbalanced or Balanced output connectors. To activate, press modulation SELECT key until indicator lights and SWEEP RUN is shown in DISPLAY.</p> <p>Restrictions: Locked out when SYMMETRY not 50%, when Ext lock ON selected, and/or when combination of START/STOP frequencies exceed range limits.</p>
33	START/STOP key	<p>Used to display and enter start and stop frequencies for SWEEP modulation mode. Displayed units in mHz, Hz, kHz, and MHz. Press for start frequency, and again for stop frequency. If SWEEP indicator on, pressing again will cause swept output (DISPLAY indicates SWEEP RUN). To enter a new value, press key until desired parameter is displayed. Use CURSOR keys/CONTROL KNOB or NUMERIC/ENTER keys to enter a new value. Range from 2 mHz to 20 MHz. Defaults are 2.0 Hz start and 2 kHz stop.</p> <p>Restrictions: If SWEEP selected while entering start and stop frequencies, will automatically change value entered first to provide sweep within acceptable range limits,</p>
34	PARAM RESET key	<p>Used to reset only parameter currently shown in DISPLAY to default value. Does not change non-displayed parameters. Press to activate.</p>
35	PANEL LOCK key	<p>Used to disable all front panel key selections, except POWER switch. Does not affect signals at output connectors. Press to activate, press again to deactivate. DISPLAY indicates PANEL LOCKED or PANEL UNLOCKED to show status.</p> <p>Restrictions: If panel is locked when POWER is set to OFF, it will remain locked when POWER is set to ON; however, the DISPLAY will not indicate locked status.</p>



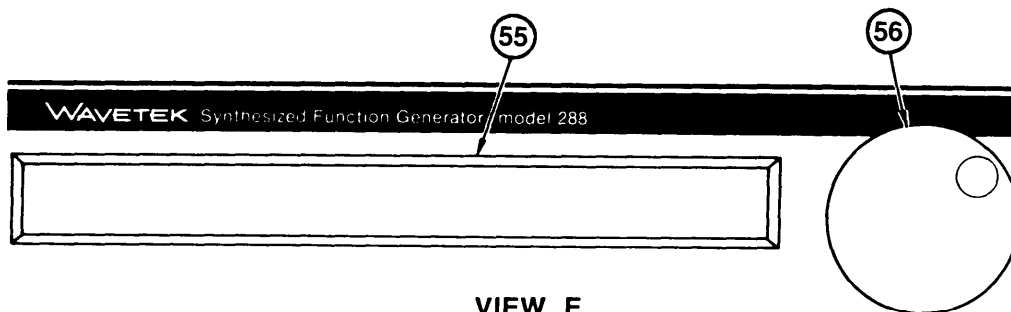
VIEW C

KEY	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
36	Function output SELECT key	Used to select desired output impedance (50 Ω, 75 Ω, 135 Ω, or 600 Ω) and output connector (UNBAL or BAL) combination. Press until desired indicators light. Restrictions: See 50 Ω, 75 Ω, 135 Ω, 600 Ω, UNBAL, or BAL indicators.
37	50 Ω indicator	When on, indicates 50 Ω output impedance. Select to match 50 Ω load impedance. Provides signal output with 50 Ω impedance at the UNBALANCED output connector. To activate, press function output SELECT key until 50 Ω and UNBAL indicators light. Defaults to 50 Ω /UNBAL.
38	75 Ω indicator	When on, indicates 75 Ω output impedance. Select to match 75 Ω load impedance. Provides signal output with 75 Ω impedance at the UNBALANCED output connector. To activate, press function output SELECT key until 75 Ω and UNBAL indicators light.
39	135 Ω indicator	When on, indicates 135 Ω output impedance. Select to match 135 Ω load impedance. Provides signal output with 135 Ω impedance at the BALANCED output connector. To activate, press function output SELECT key until 135 Ω and BAL indicators light. Restrictions: Locked out for frequencies >1 MHz. See BAL indicator for further restrictions.

KEY	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
40	600 Ω indicator	When on, indicates 600 Ω output impedance. Select to match 600 Ω load impedance. Provides signal output with 600 Ω impedance at the UNBALANCED or BALANCED output connectors. To activate, press function output SELECT key until 600 Ω and BAL, or 600 Ω and UNBAL indicators light. Restrictions: Locked out for frequencies >1 MHz. See BAL indicator for further restrictions.
41	BAL indicator	When on, indicates BALANCED output connectors are providing an operator defined balanced output signal. Impedance is selectable from 135 Ω or 600 Ω . To activate, press function output SELECT key until 135 Ω and BAL, or 600 Ω and BAL indicators light. Restrictions: Locked out for frequencies >1 MHz, for TRIANGLE, SQUARE, or DC functions, for OFFSET other than 0Vdc, and/or SYMMETRY other than 50%.
42	BALANCED (ct) terminal	Captive screw binding post used as neutral center tap with BALANCED (-) and BALANCED (+) jacks.
43	BALANCED (-) jack	Female banana jack with 135 Ω or 600 Ω output impedance. Provides a balanced output from 2 mHz to 1 MHz when used as negative signal lead with BALANCED (+) jacks. Selected when BAL indicator on.
44	BALANCED (+) jack	Female banana jack with 135 Ω or 600 Ω output impedance. Provides a balanced output from 2 mHz to 1 MHz when used as positive signal lead with BALANCED (-) jacks. Selected when BAL indicator on.
45	UNBALANCED connector	BNC female connector with 50 Ω , 75 Ω , or 600 Ω output impedance. Provides an unbalanced output from 2 mHz to 20 MHz (2 mHz to 1 MHz for 600 Ω). Selected when UNBAL indicator on.
46	UNBAL indicator	When on, indicates UNBALANCED output connector is providing an operator defined unbalanced output signal. Impedance is selectable from 50 Ω , 75 Ω , or 600 Ω . To activate, press function output SELECT key until 50 Ω and UNBAL, 75 Ω and UNBAL, or 600 Ω and UNBAL indicators light. Defaults to 50 Ω / UNBAL. Restrictions: 600 Ω UNBAL locked out for frequencies >1 MHz.



KEY	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
47	+/- key	Used to enter a positive or negative sign for numeric data entry. Used for standard and exponent entry. Blank indicates positive, - indicates negative. Press to change sign.
48	. (DECIMAL) key	Used to enter a decimal for numeric data entry.
49	ENTER key	Used to terminate entries from NUMERIC keypad, Pressing after numeric data entry transfers DISPLAY contents to Signal Generator internal circuits. Values entered not within specifications are disregarded. Values exceeding resolution are rounded or entered to nearest available value.
50	EXP key	Used to enter an exponent digit. To enter an exponent, use NUMERIC keypad to enter prefix, press EXP key, then exponent value using NUMERIC key 0 to 9. Exponent can be entered as a negative by pressing +/- key.
51	CE key	Used to clear DISPLAY of numeric entry error when using NUMERIC keys. Unwanted data must be cleared before pressing ENTER key. Press once to clear numeric entry.
52	KNOB key	Used to enable or disable CONTROL KNOB. When on, selecting appropriate parameter key activates CONTROL KNOB (ENABLE indicator ON). When off, CONTROL KNOB is deactivated (ENABLE indicator remains OFF). Press for ON, press again for OFF. Defaults to ON.
53	ENABLE indicator	When on, indicates CONTROL KNOB will change flashing digit in DISPLAY, Press KNOB key to activate Restrictions: ENABLE indicator will light only when selecting a parameter that can use the CONTROL KNOB as input.
54	NUMERIC keypad (0 — 9)	Used to enter a 0, 1, 2, 3, 4, 5, 6, 7, 8, or 9 for numeric data entry. Used with +/-, DECIMAL, ENTER, EXP, and CE keys to enter data. Press desired digit.



KEY	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
55	DISPLAY	Indicates output signal information, entry information, operator messages, and error codes. Variable brightness 16-digit alphanumeric display with decimal point and minus sign.
56	CONTROL KNOB	Used to change numeric value of flashing digit as selected by CURSOR keys shown in DISPLAY. CW rotation increases value, CCW rotation decreases value. Active when ENABLE indicator is ON.

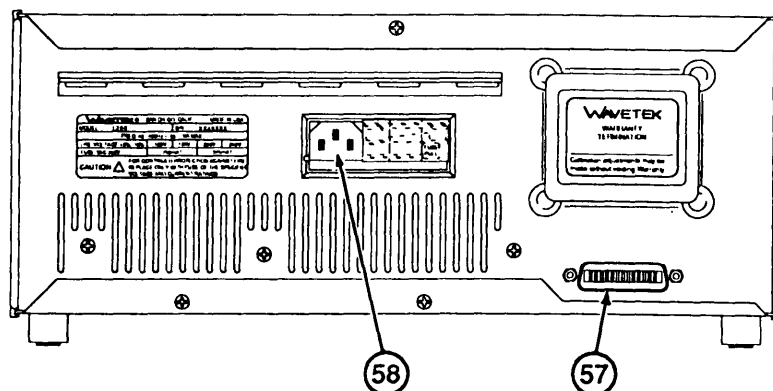


Figure 2-2. Operator's Controls, Indicators, and Connectors, rear view.

CE10D004

KEY	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
57	GPIB connector	Used to connect an external Controller to Signal Generator during remote operation. Connector has 24 pins and threaded posts conforming to IEEE-488-1978.
58	INPUT POWER connector	Used as AC power input connector for Signal Generator. Also contains line fuse and voltage selection facilities. Voltage selection from 100/120/220/240Vac. Number visible in window indicates nominal line voltage for which Signal generator is set to operate. Power input connector accepts female end of power cable (supplied). Protective grounding conductor connects Signal Generator through this connector. Line power fuse is 0.75 amp, 250V for 100/120Vac and 0.375 amp, 250V for 220/240Vac operation.

Section II. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES

2-2. GENERAL.

To be sure that the equipment is always ready for the mission, perform scheduled preventive maintenance checks and services (PMCS). When doing any PMCS or routine checks, keep in mind the WARNINGS and CAUTIONS about electrical shock and bodily harm.

2-3. PMCS PROCEDURES.

a. Tools, Materials, and Equipment Required for Preventive Maintenance. No tools or equipment are required for operator preventive maintenance. Cleaning materials required are listed in Appendix E, items 2 and 3.

b. PMCS for Signal Generator is limited to routine checks such as shown below.

- cleaning,
- dusting,
- wiping,
- checking for frayed cables,
- storing items not in use,
- covering unused receptacles,
- checking for loose nuts, bolts, and screws.

c. Perform these routine checks anytime they must be done.

Section III. OPERATION UNDER USUAL CONDITIONS

2-4. INTRODUCTION.

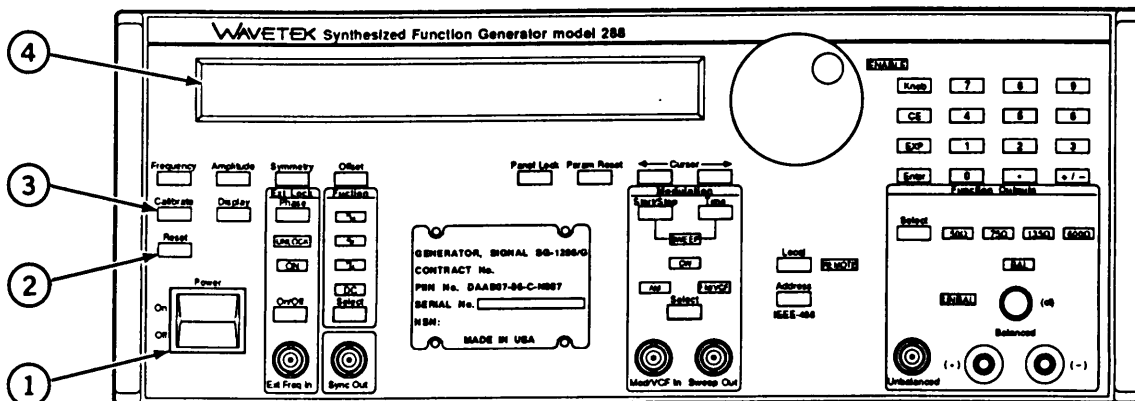
This section provides the information required to set up and operate the Signal Generator. Information required for operation in the remote mode is provided in Appendix F. Operation is divided into five separate procedures. Individual operating procedures for Continuous Wave (CW), Amplitude Modulation (AM), Frequency Modulation (FM), Sweep Modulation, and Voltage Controlled Frequency (VCF) are provided.

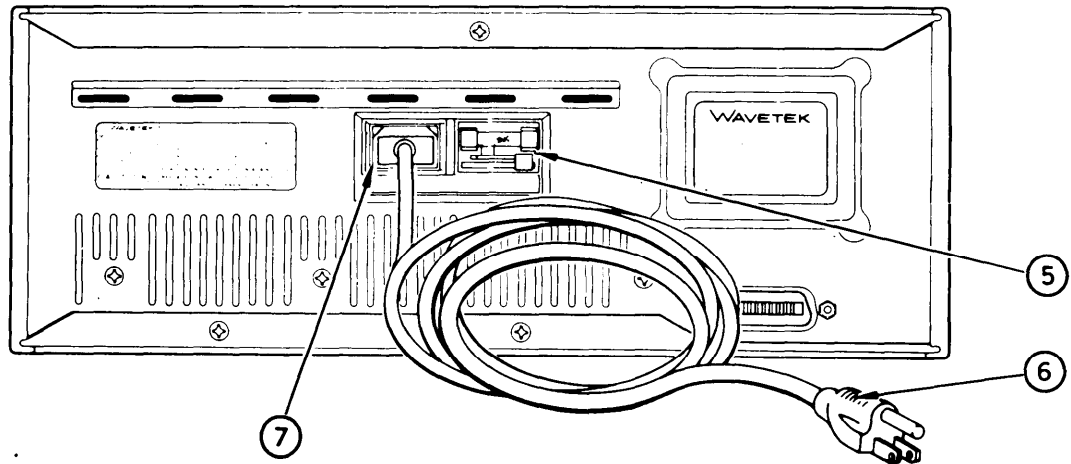
Table 2-1 lists maintenance messages and error codes along with the probable cause and corrective action.

2-5. PREPARATION FOR USE.

WARNING

The Signal Generator is equipped with a three-wire power cable. When connected to a grounded AC power receptacle, this cable grounds the instrument front panel and cabinet. Do not use extension cords or AC adapters without a ground.





- a. Verify that POWER switch (1) is set to OFF.
- b. Verify VOLTAGE SELECTION card (5) on rear panel indicates line voltage available in your area. Connect power cable (6) to AC POWER connector (7) on rear panel.

2-6. TURN-ON PROCEDURE.

- a. Verify that only the power cable (6) is connected to Signal Generator, All other cables should be disconnected.
- b. Set POWER ON/OFF switch (1) from OFF to ON. Verify that the DISPLAY (4) indicates "WAVETEK SG1288/G".

NOTE

If a maintenance message or error code is shown in display, see table 2-1 for probable cause and corrective action.

- c. Press RESET key (2). Verify the following front panel condition exists:

DISPLAY
 FUNCTION
 MODULATION
 FUNCTION OUTPUTS
 All other displays and indicators
 • FREQUENCY
 • AMPLITUDE

• DISPLAY
 • SYMMETRY
 • PHASE
 • OFFSET
 • START/STOP
 • TIME
 • ADDRESS

- Press key to display default value(s).

RESET (VX.XX)
 ~ (sine) indicator ON
 CW indicator ON
 50 Ω and UNBAL indicators ON
 OFF
 FREQ 1 KHZ/PER 1 MILLISEC
 AMPL 5VPP/AMPL 2.5 VP/
 AMPL 1.77 VRMS/AMPL 18DBM
 INTENSITY 16
 SYMM 50 PCT
 PHASE 0 DEG/PHASE 0 RAD
 DCOFF 0 VDC
 START 2 HZ/STOP 2 KHZ
 SWPTIME 1 SEC/SWPRATE 1 HZ
 ADDRS 00 to 30

d. Allow Signal Generator 20 minutes warm-up time.

NOTE

- Whenever the power cable has been disconnected, or the POWER switch has been in the OFF position, the Signal Generator requires a 20 minute waiting/warm-up period before CALIBRATE key can be selected. If CALIBRATE key is selected before 20 minutes, DISPLAY will indicate WA IT XX. XX MIN to show time remaining.
- The CALIBRATE key performs only a 20 second self-check, and does not replace calibration performed in accordance with the technical bulletin listed in TB 43-180 for this equipment.

e. Press CALIBRATE key (3). Verify DISPLAY (4) indicates CALIBRATING.

f. Wait approximately 20 seconds. Verify the DISPLAY (4) indicates AUTOCALIBRATED.

g. If all above conditions are correct, Signal Generator is ready for operation. If indication is incorrect, notify next higher level maintenance.

2-7. MAINTENANCE MESSAGES AND ERROR CODES.

Some internal circuit failures cause maintenance messages or error codes to appear in the display. See table 2-1 for a list of possible maintenance messages/error codes and probable cause.

NOTE

If an indication appears that is not listed in table 2-1, notify next higher level maintenance.

Table 2-1. Maintenance Messages and Error Codes.

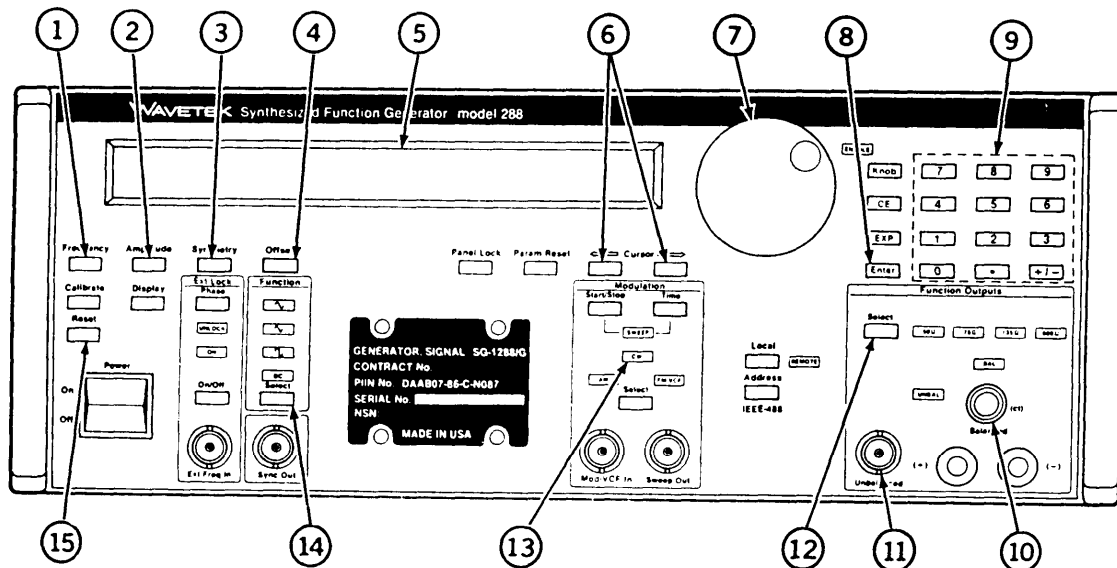
DISPLAY	PROBABLE CAUSE	CORRECTIVE ACTION
ERR XXXXXXXXX	Improper self-check/unit failure.	Press CALIBRATE key. •If AUTOCALIBRATED displayed, unit is operational. •If different error displayed, press CALIBRATE key again. •If identical error is displayed, notify, next higher level maintenance.
LOW BATT X.XXX V	Internal battery voltage low.	Unit available for immediate operation. Notify next higher level maintenance immediately after use.

2-8. OPERATING PROCEDURES.

Operation of Signal Generator is provided in paragraphs 2-9 thru 2-13. Refer to paragraph 2-1 for a further description of the controls, indicators, and connectors,

2-9. CONTINUOUS WAVE (CW).

Perform the following steps to provide a continuous wave output signal from 2 mHz to 20 MHz at from 1.0mVp-p to 15Vp-p.



1. Press RESET key (15). Verify CW indicator (13) is on.
2. Select desired output waveform (\sim / \wedge / \sqcap /DC)using function SELECT key (14).
3. Press the following keys and then enter desired value. Use CURSOR keys (6) and CONTROL KNOB (7), or NUMERIC keypad (9) and ENTER key (8). Entry will appear in DISPLAY (5).
 - Press FREQUENCY key (1) and enter desired output frequency (Hz) or period (SEC).
 - Press AMPLITUDE key (2) and enter desired output amplitude in Vp-p, Vp, Vrms, or dBm.
 - Press SYMMETRY key (3) and enter desired output waveform symmetry in percent.
 - Press OFFSET key (4). If \sim , \wedge , or \sqcap selected (14), enter desired output waveform reference level in volts DC. If DC selected (14), enter desired DC output level in volts DC.
4. Select desired output impedance (50 Ω /75 Ω /135 Ω / 600 Ω) and connector (BAL/UNBAL) using function outputs SELECT key (12) to match load termination.

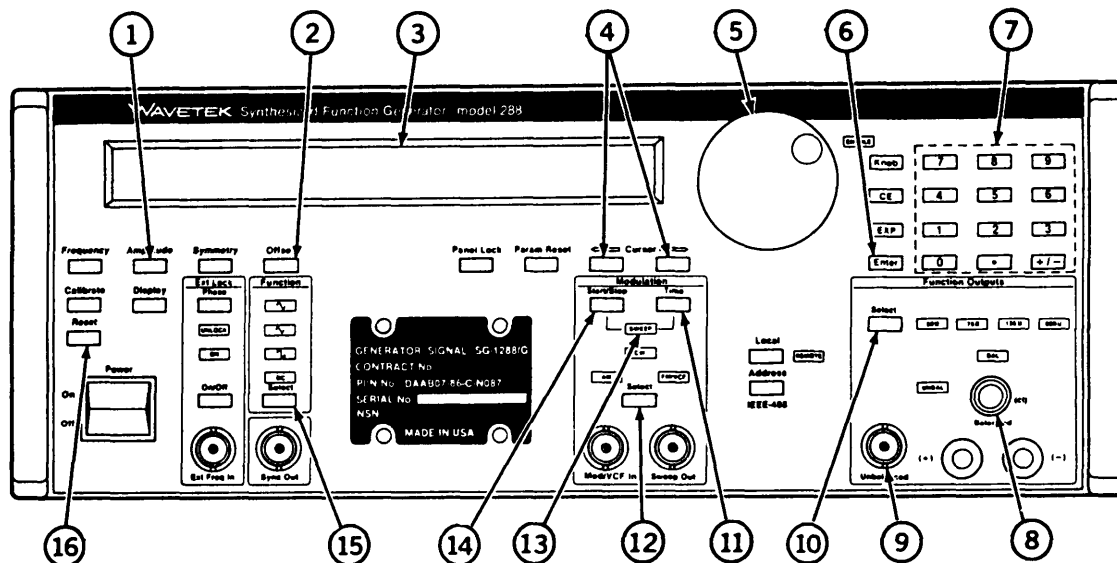
NOTE

- When connecting Signal Generator output connector to the load, use cable with closest impedance (50 Ω / 75 Ω) for the output selected.
- Balanced output connector is internally connected to the shield of all other Signal Generator BNC connectors. When connecting to external equipment whose connector shields are at chassis ground, a ground loop will be formed that may adversely affect the BALANCED output signal.

5. Connect selected output BALANCED (10) or UNBALANCED (11) connector to load.

2-10. SWEEP MODULATION.

Perform the following steps to provide a swept output signal from 0.002 Hz to 20 MHz at 1.0mVp-p to 15Vp-p with sweep rate from 0.1 to 100 seconds.



1. Press RESET key (16). Select SWEEP indicator (13) using modulation SELECT key (12).
2. Select desired output waveform (\sim / \wedge / \square) using function SELECT key (15).
3. Press the following keys and then enter desired value. Use CURSOR keys (4) and CONTROL KNOB (5), or NUMERIC keypad (7) and ENTER key (6). Entry will appear in DISPLAY (3).
 - Press TIME key (11) and enter desired sweep time in SEC or Hz.
 - Press START/STOP key (14) until START X HZ displayed and enter desired sweep START frequency in Hz.
 - Press START/STOP key (14) until STOP X KHZ displayed and enter desired sweep STOP frequency in Hz

NOTE

If entered start and/or stop frequency exceeds Signal Generator sweep limits, one parameter will be adjusted. Press START/STOP key (14) as required to verify entered frequencies.

- Press AMPLITUDE key (1) and enter desired swept output amplitude in Vp-p, Vp, Vrms, or dBm.
 - Press OFFSET key (2) and enter desired swept output waveform reference level in volts DC.
4. Select desired output impedance (50 Ω /75 Ω /135 Ω /600 Ω) and connector (BAL/UNBAL) using function outputs SELECT key (10) to match load termination.

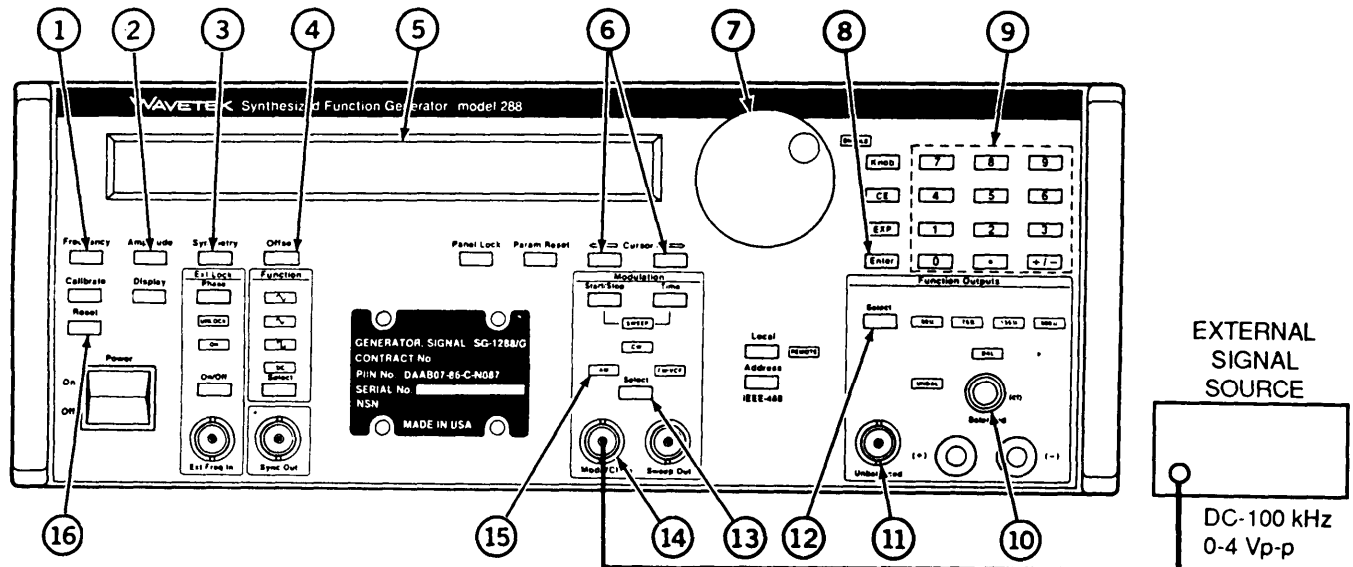
NOTE

- When connecting Signal Generator output connector to the load, use cable with closest impedance (50 Ω / 75 Ω) for the output selected.
- Balanced ct connector is internally connected to the shield of all other Signal Generator BNC connectors. When connecting to external equipment whose connector shields are at chassis ground, a ground loop will be formed that may adversely affect the BALANCED output signal.

5. Press START/STOP key (14) until SWEEP RUN is displayed.
6. Connect selected output BALANCED (8) or UNBALANCED (9) connector to load.

2-11. AMPLITUDE MODULATION (AM).

Perform the following steps to provide an amplitude modulated output signal from 0.1 Hz to 20 MHz at 1.0mVp-p to 7.5Vp-p with modulation rate from DC to 100 kHz and modulation depth from 0 to 100%.



1. Press RESET key (16). Select AM indicator (15) using modulation SELECT key (13).
2. Press the following keys and then enter desired value. Use CURSOR keys (6) and CONTROL KNOB (7), or NUMERIC keypad (9) and ENTER key (8). Entry will appear in DISPLAY (5).
 - Press FREQUENCY key (1) and enter desired output carrier frequency (Hz) or period (SEC).
 - Press AMPLITUDE key (2) and enter desired output carrier amplitude in Vp-p, Vp, Vrms, or dBm.
 - Press SYMMETRY key (3) and enter desired output carrier waveform symmetry in percent.
 - Press OFFSET key (4) and enter desired output carrier waveform reference level in volts DC.
3. Connect external signal source sinewave to MOD/VCF IN connector (14).
4. Set external signal source to desired frequency from DC to 100 kHz. This is the rate at which the Signal Generator will modulate the output signal.
5. Set external signal source to desired amplitude from 0 to 4Vp-p. This is the depth at which the Signal Generator will modulate the output signal. Modulation depth is directly proportional to input signal amplitude.

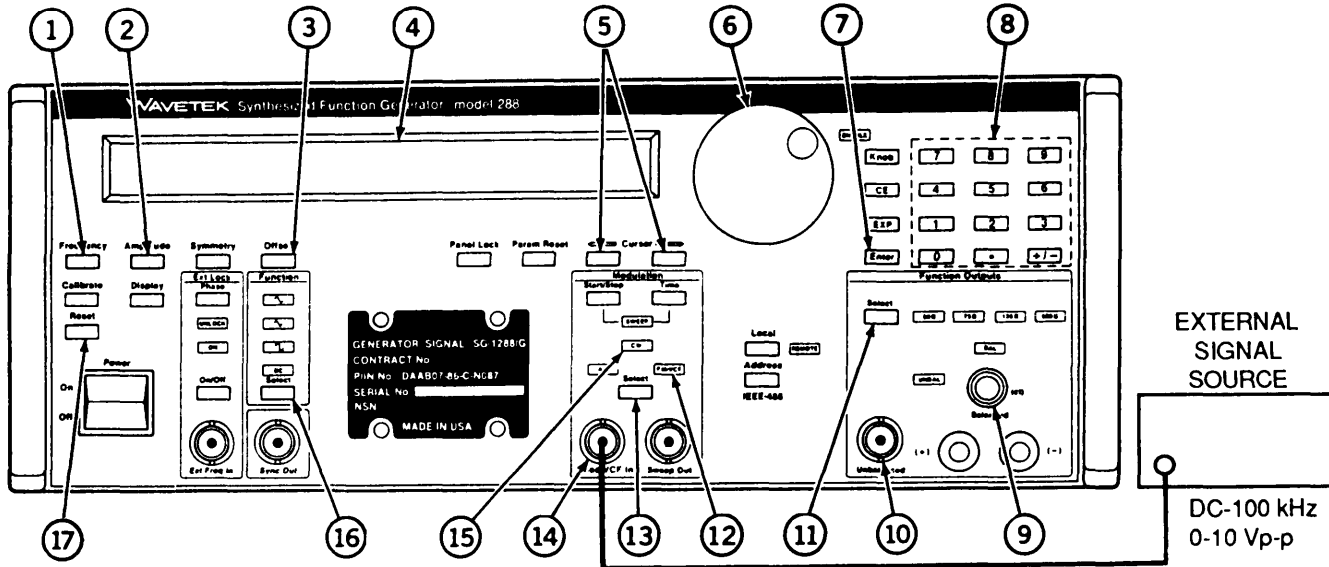
example: 4Vp-p input provides 100% depth, 2Vp-p input provides 50% depth, etc.
6. Select desired output impedance (50 Ω / 75 Ω / 135 Ω / 600 Ω) and connector (BAL/UNBAL) using function outputs SELECT key (12) to match load termination.

NOTE

- When connecting Signal Generator output connector to the load, use cable with closest impedance (50 Ω / 75 Ω) for the output selected.
 - Balanced output connector is internally connected to the shield of all other Signal Generator BNC connectors. When connecting to external equipment whose connector shields are at chassis ground, a ground loop will be formed that may adversely affect the BALANCED output signal.
7. Connect selected output BALANCED (10) or UNBALANCED (11) connector to load.

2-12. FREQUENCY MODULATION (FM).

Perform the following steps to provide a frequency modulated output signal from 0.002 Hz to 20 MHz at 1.0mVp-p to 15Vp-p with modulation rate from DC to 100 kHz and deviation as specified below.



1. Press RESET key (17). Verify CW indicator (15) is on.
2. Calculate and record upper and lower modulation limit frequencies required as follows:
 - UPPER LIMIT = CTRF + PEAK DEVIATION
 - LOWER LIMIT = CTRF - PEAK DEVIATION
 where:
 - UPPER LIMIT is upper modulation limit required
 - LOWER LIMIT is lower modulation limit required
 - CTRF is desired center frequency
 - PEAK DEVIATION is desired positive OR negative deviation
 example:
 - Desired Center Frequency = 200k Hz
 - Peak Deviation = ± 25k Hz
 - Upper Limit = 200k Hz + 25 kHz = 225k Hz
 - Lower Limit = 200 kHz - 25 kHz = 175 kHz
3. Using the table below, find and record the range number that contains the calculated upper limit (step 2). Verify calculated lower limit (step 2) is within limits of table for range selected.
 - example: Upper limit of 225 kHz is range number 8. Calculated lower limit within range (range 8 lower limit 2.0 kHz and calculated lower limit 175 kHz).

NOTE

Exceeding lower limit will cause output signal distortion.

Range Number	Modulation Upper Limit Range	Modulation Lower Limit	Deviation per volt
9	2.01 MHz to 20 MHz	20 kHz	2 MHz
8	201 kHz to 2.0 MHz	2.0 kHz	200 kHz
7	20.1 kHz to 200 kHz	200 Hz	20 kHz
6	2.01 kHz to 20 kHz	20 Hz	2 kHz
5	201 Hz to 2 kHz	2 Hz	200 Hz
4	20.1 Hz to 200 Hz	200 mHz	20 Hz
3	2.01 Hz to 20 Hz	20 mHz	2 Hz
2	201 mHz to 2 Hz	2 mHz	200 mHz
1	20.1 mHz to 200 mHz	2 mHz	20 mHz
0	2 mHz to 20 mHz	2 mHz	2 mHz

4. Calculate and record the external source amplitude (Vp-p) as follows:

$$\text{OUT AMP} = \text{P-P DEVIATION} + \text{DEVIATION PER V}$$




where: OUT AMP is external source amplitude (Vp-p)
P-P DEVIATION is desired positive AND negative deviation
DEVIATION PER V from table above using range number recorded in step 3

example:

$$\text{P-P Deviation} = 50 \text{ kHz (+ and - 25 kHz)}$$

$$\text{Deviation per volt} = 200 \text{ kHz (from table, range 8)}$$

$$\text{Output Amplitude} = 50 \text{ kHz} + 200 \text{ kHz} = 0.25\text{Vp-p}$$

5. Press FREQUENCY key (1) and enter calculated upper limit frequency (step 2) in Hz using CURSOR keys (5) and CONTROL KNOB (6), or NUMERIC keypad (8) and ENTER key (7). Entry will appear in DISPLAY (4).
6. Select FM/VCF indicator (12) using modulation SELECT key (13).
7. Select desired output waveform ( /  / ) using function SELECT key (16).
8. Press the following keys and then enter desired value. Use CURSOR keys (5) and CONTROL KNOB (6), or NUMERIC keypad (8) and ENTER key (7). Entry will appear in DISPLAY (4).
 - Press FREQUENCY key (1) and enter center frequency used in calculation (step 2) in Hz.
 - Press AMPLITUDE key (2) and enter desired output carrier amplitude in Vp-p, Vp, Vrms, or dBm.
 - Press OFFSET key (3) and enter desired output carrier waveform reference level in volts DC.
9. Connect external signal source sinewave to MOD/VCF IN connector (14)
10. Set external signal source to desired frequency from DC to 100 kHz. This is the rate at which the Signal Generator will modulate the output signal.
11. Set external signal source to calculated amplitude (step 4) from 0 to 10Vp-p. This is the deviation at which the Signal Generator will modulate the output signal.

12. Select desired output impedance (50 Ω / 75 Ω / 135 Ω / 600 Ω) and connector (BAL/UNBAL) using function outputs SELECT key (11) to match load termination.

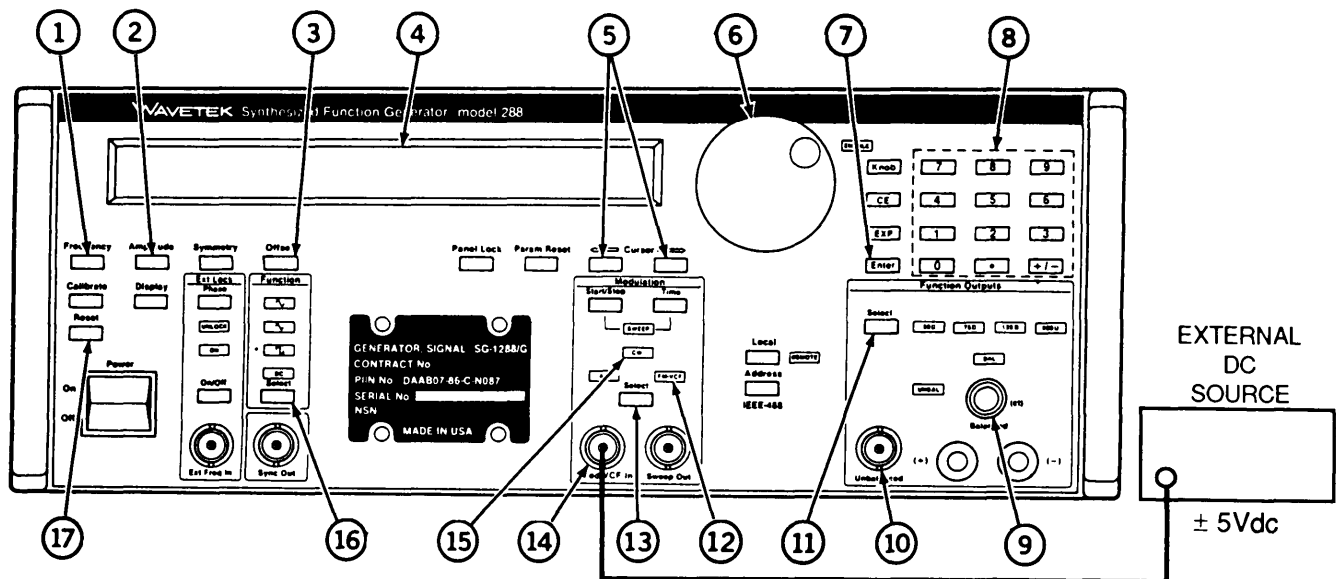
NOTE

- When connecting Signal Generator output connector to the load, use cable with closest impedance (50 Ω / 75 Ω) for the output selected.
- Balanced ct connector is internally connected to the shield of all other Signal Generator BNC connectors. When connecting to external equipment whose connector shields are at chassis ground, a ground loop will be formed that may adversely affect the BALANCED output signal.

13. Connect selected output BALANCED (9) or UNBALANCED (10) connector to load.

2-13. VOLTAGE CONTROLLED FREQUENCY (VCF).

Perform the following steps to provide a voltage controlled frequency output signal from 0.002 Hz to 20 MHz at 1.0mVp-p-to 15Vp-p.



1. Press RESET key (17). Verify CW indicator (15) is on.

2. Calculate and record upper and lower frequency limits required as follows:

$$\text{UPPER LIMIT} = \text{INT} + \text{FREQ CHG}$$

$$\text{LOWER LIMIT} = \text{INT} - \text{FREQ CHG}$$

where: UPPER LIMIT is upper frequency limit required
 LOWER LIMIT is lower frequency limit required
 INT is desired initial frequency
 FREQ CHG is desired positive or negative frequency change

example:

Desired Initial Frequency = 200k Hz
 Frequency Change = (+25k Hz) and (-10 kHz)

Upper Limit = 200 kHz + 25 kHz = 225 kHz
 Lower Limit = 200 kHz - 10 kHz = 190 kHz

3. Using the table below, find and record the range number that contains the calculated upper limit (step 2). Verify calculated lower limit (step 2) is within limits of table for range selected.

example: Upper limit of 225 kHz is range number 8. Calculated lower limit within range (range 8 lower limit 2.0 kHz and calculated lower limit 190 kHz).

NOTE

Exceeding lower limit will cause output signal distortion.

Range Number	Upper Limit Range	Lower Limit	Change per Volt
9	2.01 MHz to 20 MHz	20 kHz	2 MHz
8	201 kHz to 2.0 MHz	2.0 kHz	200 kHz
7	20.1 kHz to 200 kHz	200 Hz	20 kHz
6	2.01 kHz to 20 kHz	20 Hz	2 kHz
5	201 Hz to 2 kHz	2 Hz	200 Hz
4	20.1 Hz to 200 Hz	200 mHz	20 Hz
3	2.01 Hz to 20 Hz	20 mHz	2 Hz
2	201 mHz to 2 Hz	2 mHz	200 mHz
1	20.1 mHz to 200 mHz	2 mHz	20 mHz
0	2 mHz to 20 mHz	2 mHz	2 mHz

4. Calculate and record the external DC source level (Vdc) as follows:

$$\text{OUT VOLT} = \text{FREQ CHG} + \text{CHG PER V}$$

where: OUT VOLT is external source voltage (+ or - Vdc)
 FREQ CHG is desired positive or negative frequency change
 CHG PER V from table above using range number recorded in step 3




example:

Frequency Change = +25 kHz and -10 kHz
 Change per volt = 200 kHz (from table, range 8)

$$\text{Output Voltage} = +25 \text{ kHz} \div 200 \text{ kHz} = +0.125 \text{ Vdc}$$

and

$$\text{Output Voltage} = -10 \text{ kHz} \div 200 \text{ kHz} = -0.05 \text{ Vdc}$$

5. Press FREQUENCY key (1) and enter calculated upper limit frequency (step 2) in Hz using CURSOR keys (5) and CONTROL KNOB (6), or NUMERIC keypad (8) and ENTER key (7). Entry will appear in DISPLAY (4).
6. Select FM/VCF indicator (12) using modulation SELECT key (13).
7. Select desired output waveform {  /  /  } using function SELECT key (16).
8. Press the following keys and then enter desired value. Use CURSOR keys (5) and CONTROL KNOB (6), or NUMERIC keypad (8) and ENTER key (7). Entry will appear in DISPLAY (4).
 - Press FREQUENCY key (1) and enter initial frequency used in calculation (step 2) in Hz.
 - Press AMPLITUDE key (2) and enter desired output amplitude in Vp-p, Vp, Vrms, or dBm.
 - Press OFFSET key (3) and enter desired output waveform reference level in volts DC.
9. Connect external DC source DC level to MOD/VCF IN connector (14).
10. Set external DC source to calculated level (step 4) from -5 to +5 Vdc.

11. Select desired output impedance (50 Ω / 75 Ω / 135 Ω /600 Ω) and connector (BAL/UNBAL) using function outputs SELECT key (11) to match load termination.

NOTE

- When connecting Signal Generator output connector to the load, use cable with closest impedance (50 Ω / 75 Ω) for the output selected.
- Balanced ct connector is internally connected to the shield of all other Signal Generator BNC connectors. When connecting to external equipment whose connector shields are at chassis ground, a ground loop will be formed that may adversely affect the BALANCED output signal.

12. Connect selected output BALANCED (9) or UNBALANCED (10) connector to load.

CHAPTER 3 UNIT MAINTENANCE

	Para	Page
Common Tools and Equipment	3-1	3-1
Environment	3-11	3-8
Packaging	3-9	3-8
Preliminary Servicing and Adjustment of Equipment	3-5	3-2
Repair Parts	3-3	3-1
Replace Control Knob	3-8	3-7
Replace Fuse	3-7	3-6
Service Upon Receipt of Material	3-4	3-1
Special Tools, TMDE, and Support Equipment	3-2	3-1
Troubleshooting Table	3-6	3-3
Types of Storage	3-10	3-8

Section I. REPAIR PARTS, SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

3-1. COMMON TOOLS AND EQUIPMENT.

Common tools and equipment required for unit maintenance of Signal Generator SG-1288/G are listed in the Maintenance Allocation Chart (MAC) (Appendix B).

3-2. SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT.

There are no special tools, TMDE, or support equipment required.

3-3. REPAIR PARTS.

Repair parts are listed and illustrated in the Repair Parts and Special Tools List, TM 11-6625-3198-24P.

Section II. SERVICE UPON RECEIPT

3-4. SERVICE UPON RECEIPT OF MATERIAL.

a. Unpacking. Special design reusable packing material inside this shipping carton provides maximum protection for Signal Generator. Avoid damaging carton and packing material during equipment unpacking. Use the following steps for unpacking Signal Generator:

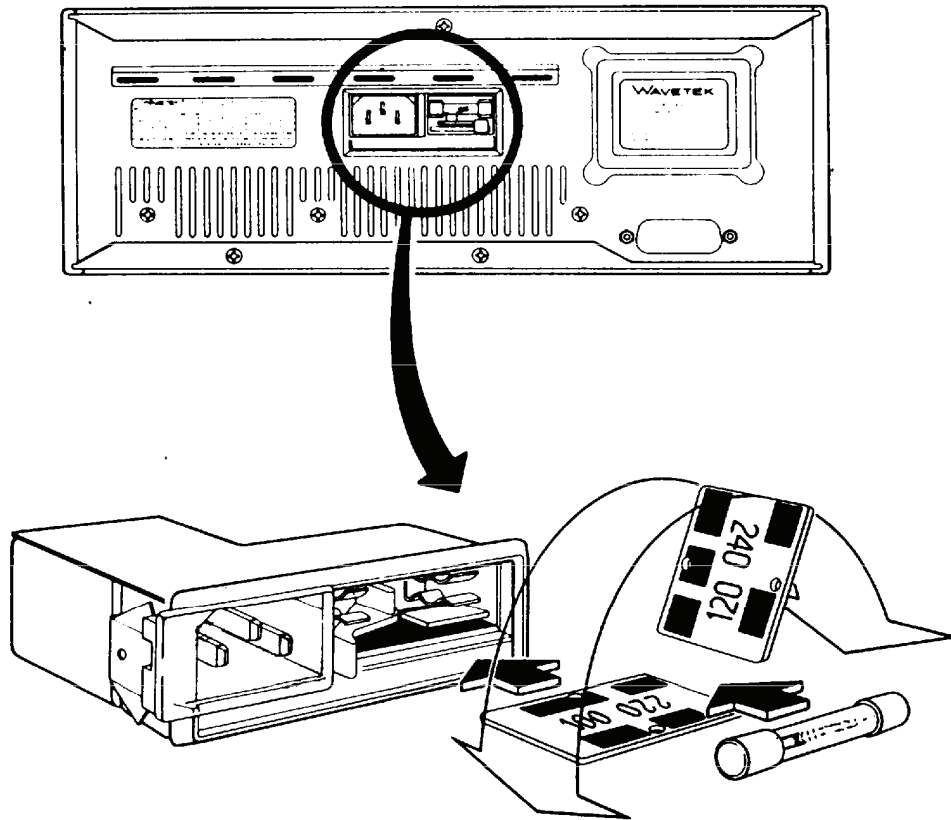
- Cut and remove paper sealing tape on carton top and open carton.
- Grasp Signal Generator firmly while restraining shipping carton and lift equipment and packing material vertically.
- Place Signal Generator and end cap packing material on a suitable flat clean and dry surface.
- Remove end cap packing material while firmly supporting Signal Generator.
- Remove protective plastic bag from Signal Generator. Place desiccant bags back inside protective plastic bag.
- Place protective plastic bag and end cap packing material inside shipping carton.
- Return shipping carton to supply system.

b. Checking Unpacked Equipment.

- Inspect the equipment for damage incurred during shipment. If the equipment has been damaged, report the damage on SF 364, Report of Discrepancy (ROD).
- Check the equipment against the packing slip to see if the shipment is complete. Report all discrepancies in accordance with the instructions of DA Pam 750-8
- Check to see whether the equipment has been modified.

3-5. PRELIMINARY SERVICING AND ADJUSTMENT OF EQUIPMENT.

a. Remove fuse (para 3-7). Check that fuse and voltage selection card are correct for the line voltage available in your area.



Input Voltage	Voltage Selection Card Position	Fuse
90 to 108	100	3/4 amp slo-blo
108 to 126	120	3/4 amp slo-blo
198 to 231	220	3/8 amp slo-blo
216 to 252	240	3/8 amp slo-blo

b. Perform turn on procedures (para 2-6).

Section III. TROUBLESHOOTING

SYMPTOM INDEX

Signal Generator Symptom	Page
1. SIGNAL GENERATOR NOT OPERATING	3-3
2. SIGNAL GENERATOR DISPLAYS ERRORS/MAINTENANCE MESSAGES	3-4
3. DISPLAY BLANK	3-4
4. ONE OR MORE FRONT PANEL INDICATORS INOPERATIVE	3-4
5. ONE OR MORE FRONT PANEL KEYS INOPERATIVE	3-4
6. CONTROL KNOB INOPERATIVE	3-5

3-6. TROUBLESHOOTING TABLE.

Table 3-1 lists common malfunctions which you may find during operation or maintenance of the Signal Generator. You should perform the tests/inspections and corrective actions in the order listed.

NOTE

- This manual cannot list all malfunctions that may occur, nor all tests or inspections and corrective actions. If a malfunction is not listed or is not corrected by listed corrective actions, notify next higher level maintenance.
- The calibration referenced below does not replace the calibration performed in accordance with the technical bulletin listed in TB 43-180 for this equipment,

Table 3-1. Troubleshooting.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
1. SIGNAL GENERATOR NOT OPERATING.	Step 1. Check to see if fuse is blown or broken. <ul style="list-style-type: none"> • Replace fuse (para 3-7). Step 2. Verify voltage selection card is installed and set for correct voltage. <ul style="list-style-type: none"> • Install voltage selection card for correct voltage (para 3-5). Step 3. Check to see if voltage selection card etched metal pads are missing, burned, or broken. <ul style="list-style-type: none"> • Notify next higher level maintenance. 	

Table 3-1. Troubleshooting—Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
2. SIGNAL GENERATOR DISPLAYS ERRORS/MAINTENANCE MESSAGES.	ERR XXXXXXXXX displayed.	Press CALIBRATE key. <ul style="list-style-type: none"> •If AUTO CALIBRATED displayed, unit is operational. •If different error appears, press CALIBRATE key again. •If identical error appears, notify next higher level maintenance.
	CAL REQUIRED displayed.	<ul style="list-style-type: none"> •Notify next higher level maintenance.
	LOW BATT X.XXX V displayed.	<ul style="list-style-type: none"> •Notify next higher level maintenance.
3. DISPLAY BLANK.	Step 1. Press RESET key.	<ul style="list-style-type: none"> •If DISPLAY blank, proceed with step 2.
	Step 2. Press PANEL LOCK, then RESET keys.	<ul style="list-style-type: none"> •If display remains blank, notify next higher level maintenance.
4. ONE OR MORE FRONT PANEL INDICATORS INOPERATIVE.	Step 1. Press PANEL LOCK key until display indicates PANEL UNLOCKED.	
	Step 2. Verify REMOTE indicator is off.	<ul style="list-style-type: none"> •If on, press LOCAL key. If display indicates LOCAL LOCKOUT, disconnect GPIB cable on rear panel. •If off, notify next higher level maintenance.
5. ONE OR MORE FRONT PANEL KEYS INOPERATIVE.	Step 1. Press PANEL LOCK key until display indicates PANEL UNLOCKED.	
	Step 2. Verify REMOTE indicator is off.	<ul style="list-style-type: none"> •If on, press LOCAL key. If display indicates LOCAL LOCKOUT, disconnect GPIB cable on rear panel. •If off, notify next higher level maintenance.

Table 3-1. Troubleshooting—Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
6. CONTROL KNOB INOPERATIVE.	Step 1. Press PANEL LOCK key until display indicates PANEL UNLOCKED. Step 2. Verify REMOTE indicator is off.	<ul style="list-style-type: none"> • If on, press LOCAL key. If display indicates LOCAL LOCKOUT, disconnect GPIB cable on rear panel.
	Step 3. Verify ENABLE indicator on.	<ul style="list-style-type: none"> • Press Knob key and select parameter that activates CONTROL KNOB.
	Step 4. Verify that Control Knob is not loose on shaft.	<ul style="list-style-type: none"> • Tighten as required (para 3-8). • If correct, notify next higher level maintenance.

Section IV. MAINTENANCE PROCEDURES

3-7. REPLACE FUSE.

DESCRIPTION

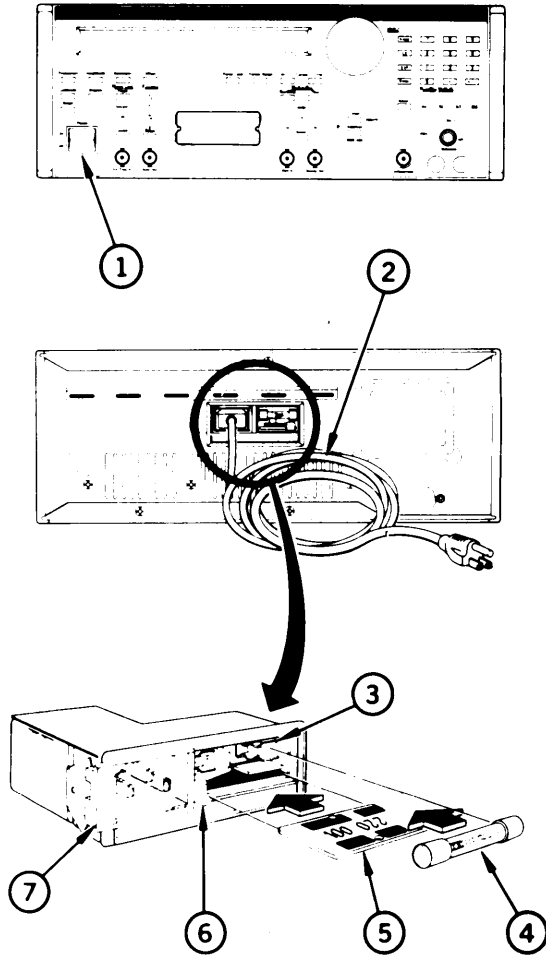
This procedure covers: Remove. Install.

REMOVE

1. Set POWER switch (1) to OFF.
2. Unplug power cable (2).
3. Slide plastic window (7) to left side.
4. Pull fuse (4) out of fuseholder (3) using extractor (6).
5. Verify that voltage selection card (5) and fuse (4) are correct for line voltage being used (para 3-5).

INSTALL

1. Push extractor (6) to closed position.
2. Insert fuse (4) into fuseholder (3) and press into place.
3. Slide plastic window (7) over fuseholder (3).
4. Install power cable (2).
5. Set POWER switch (1) to ON.



END OF TASK

3-8. REPLACE CONTROL KNOB.**DESCRIPTION**

This procedure covers: Remove. Install.

REMOVE

1. Set POWER switch (1) to OFF.
2. Carefully pry cover (2) from knob base (5).
3. Hold knob base (5) firmly and loosen nut (3) counterclockwise,
4. Remove nut (3) and washer (4).
5. Remove knob base (5) straight out from shaft (7).
6. Remove threaded sleeve (6).

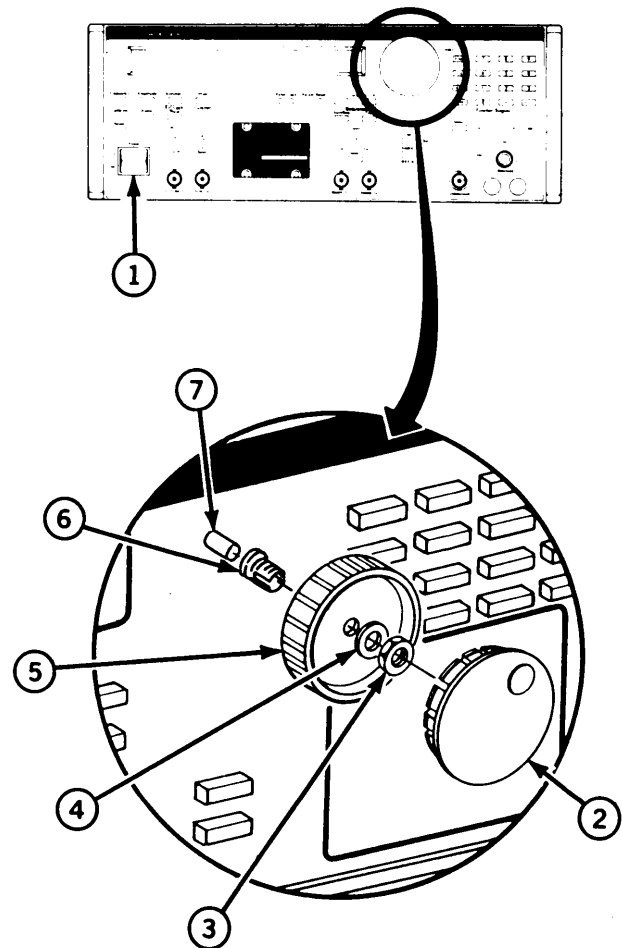
INSTALL

1. Install threaded sleeve (6) onto shaft (7).
2. Install knob base (5) onto threaded sleeve (6).

NOTE

Knob alignment is not required,

3. Install washer (4) and nut (3).
4. Hold knob base (5) firmly and tighten nut (3) clockwise.
5. Press cover (2) onto knob base (5).
6. Set POWER switch (1) to ON.



END OF TASK

Section V. PREPARATION FOR STORAGE OR SHIPMENT

3-9. PACKAGING.

Package Signal Generator in original shipping container. When using packing materials other than the original, use the following guidelines:

- Wrap Signal Generator in plastic packing material.
- Use double-wall cardboard shipping container.
- Protect all sides with shock-absorbing material to prevent Signal Generator movement within the container.
- Seal the shipping container with approved sealing tape.
- Mark "FRAGILE" on all sides, top, and bottom of shipping container.

3-10. TYPES OF STORAGE.

- Short-Term (administrative)=1 to 45 days.
- Intermediate=46 to 180 days.
- Long term=over 180 days. After long term storage, perform turn-on procedure (para 2-6). If this procedure fails, notify next higher level maintenance.

3-11. ENVIRONMENT.

The Signal Generator should be stored in a clean, dry environment. In high humidity environments, protect the Signal Generator from temperature variations that could cause internal condensation. The following environmental conditions apply to both shipping and storage:

Temperature	-40° F to +158° F (- 40° C to +75° C)
Relative Humidity (sea level)	less than 95% at +25°C
Altitude	less than 40,000 feet (12,195 meters)
Vibration	less than 2 g
Shock	less than 30 g

APPENDIX A REFERENCES

A-1. SCOPE.

This appendix lists all forms, field manuals, technical manuals, and miscellaneous publications referenced in this manual.

A-2. FORMS.

Equipment Inspection and Maintenance Worksheet	DA Form 2404
Product Quality Deficiency Report	Form SF 368
Recommended Changes to Publications and Blank Forms	DA Form 2028
Report of Discrepancy (ROD)	Form SF 364
Transportation Discrepancy Report (TDR)	Form SF 361

A-3. TECHNICAL MANUALS.

Procedures for Destruction of Electronics Materiel to Prevent Enemy Use (Electronics Command)	TM 750-244-2
The Army Maintenance Management System (TAMMS)	DA Pam 750-8
Unit and Intermediate Direct Support and General Support Repair Parts and Special Tools List, for Signal Generator SG-1288/G	TM 11-6625-3198-24P

A-4. MISCELLANEOUS.

Abbreviations for Use on Drawings, Specifications, Standards and in Technical Documents	MIL-STD-12
Common Table of Allowances	CTA 50-970
Consolidated Index of Army Publications and Blank Forms	DA Pam 25-30
First Aid for Soldiers	FM 4-25.11
Safety Precautions for Maintenance of Electrical/Electronic Equipment	TB 385-4

APPENDIX B

MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

B-1. GENERAL.

a. This appendix provides a general explanation of all maintenance and repair functions authorized at various maintenance levels for the SG-1288/G.

b. The Maintenance Allocation Chart (MAC) in Section II designates overall authority and responsibility for the performance of maintenance functions on the identified end item or component. The application of the maintenance functions to the end item or component will be consistent with the capacities and capabilities of the designated maintenance levels.

c. Section III lists the tools and test equipment (both special tools and common tool sets) required for each maintenance function as referenced from section II.

d. Section IV contains supplemental instructions and explanatory notes for a particular maintenance function.

B-2. MAINTENANCE FUNCTIONS.

Maintenance functions will be limited to and defined as follows:

a. *Inspect.* To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination.

b. *Test.* To verify serviceability and to detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. *Service.* Operations required periodically to keep an item in proper operating condition, i. e., to clean (includes decontaminate, when required), preserve, drain, paint, or to replenish fuel, lubricants, chemical fluids, or gases.

d. *Adjust.* Maintain or regulate within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to the specified parameters.

e. *Align.* To adjust specified variable elements of an item to bring about optimum or desired performance.

f. *Calibrate.* To determine the cause and corrections to be made or adjusted on instruments or test measuring and diagnostic equipment used in precision measurement. This consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. *Remove/Install.* To remove and install the same item when required to perform service on other maintenance functions. Install may be the act of emplacing, seating, or fixing into position an item, part, module (component or assembly) in a manner to allow the proper functioning of the equipment or system.

h. *Replace.* To remove an unserviceable item and install a serviceable counterpart in its place. Replace is authorized by the MAC and is shown as the 3d position code of the SMR code.

i. Repair. The application of maintenance services (inspect, test, service, adjust, align, calibrate, and/or replace) including fault location/troubleshooting, removal/installation, and disassembly/assembly procedures, and maintenance actions (welding, grinding, riveting, straightening, facing, remachining, or resurfacing) to identify troubles, and restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), and item or system.

j. Overhaul. That periodic maintenance effort (service/action) prescribed to restore an item to a completely serviceable/operational condition as required by maintenance standards in appropriate technical publications (i. e., DMWR) . Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. Rebuild. Consists of those services/ actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of material maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours, miles, etc.) considered in classifying Army equipment/components.

B-3. EXPLANATIONS OF COLUMNS IN THE MAC, SECTION II.

a. Column 1, Group Number. Column 1 lists functional group code numbers, the purpose of which is to identify maintenance significant components, assemblies, subassemblies and modules with the next higher assembly. End item group number shall be "00".

b. Column 2, Component/Assembly. Column 2 contains the noun names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. Column 3, Maintenance Function. Column 3 lists the functions to be performed on the item listed in column 2.

d. Column 4, Maintenance Level. Column 4 specifies, by the listing of a work time figure in the appropriate subcolumn (s), the level of maintenance authorized to perform the function listed in column 3. This figure represents the active time required to perform that maintenance function at the indicated level of maintenance. If the number or complexity of the tasks within the listed maintenance function vary at different levels, appropriate work time figures will be shown for each level. The work time figure represents the average time required to restore an item (assembly, subassembly, component, module, end item or system) to a serviceable condition under typical field operating conditions. This time includes preparation time (including any necessary disassembly/assembly time), troubleshooting/fault location time and quality assurance/ quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart. The symbol designations for the various maintenance levels are as follows:

UNIT

C — Operator/ Crew
O — Unit Maintenance

INTERMEDIATE

F — Direct Support Maintenance
H — General Support Maintenance
L — Specialized Repair Activity

DEPOT

D — Depot Maintenance

e. Column 5, Tools and Equipment. Column 5 specifies by code, those common tool sets (not individual tools) and special tools, TMDE, and support equipment required to perform the designated function.

f. Column 6, Remarks. This column shall, when applicable, contain a letter code, in alphabetic order, which shall be keyed to the remarks contained in Section IV.

B-4. EXPLANATIONS OF COLUMNS IN THE TEST EQUIPMENT REQUIREMENTS, SECTION III.

a. *Column 1, Reference Code.* The tool and test equipment code correlates with a code used in the MAC, Section II, Column 5.

b. *Column 2, Maintenance Level.* The lowest level of maintenance authorized to use the tool or test equipment.

c. *Column 3, Nomenclature.* Name or identification of the tool or test equipment.

d. *Column 4, National Stock Number.* The National Stock Number of the tool or test equipment.

e. *Column 5, Tool Number.* The manufacturer's part number.

B-5. EXPLANATIONS OF COLUMNS IN REMARKS, SECTION IV.

a. *Column 1, Reference Code.* The code recorded in column 6, Section II,

b. *Column 2, Remarks.* This column lists information pertinent to the maintenance function being performed as indicated in the MAC, Section II.

**Section II. MAINTENANCE ALLOCATION CHART
FOR
SIGNAL GENERATOR SG-1288/G**

(1) GROUP NUMBER	(2) COMPONENT / ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL			(5) TOOLS AND EQPT.	(6) REMARKS
			UNIT	INTERMEDIATE	DEPOT		
00	Signal Generator SG-1288/G	Inspect	0.1			1	A
		Test	0.2				B
		Repair	0.2				C
		Inspect			0.1	3-21 2-23	D
		Test			0.8		E
		Repair			2.0		
01	Front Panel / Display / Keyboard	Replace			0.4	2	
02	Phase Lock Loop CCA	Replace			0.2	2	
03	Function Generator CCA	Replace			0.2	2	
04	Output CCA	Replace			0.2	2,8	F
		Repair			0.8		
05	Motherboard CCA	Replace			0.4	2	G
		Repair			1.5	2,8	
06	Rear Panel Assembly	Replace			0.4	2	

**Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS
FOR
SIGNAL GENERATOR SG-1288/G**

(1)	(2)	(3)	(4)	(5)
TOOL / TEST EQUIPMENT REF CODE	MAINT LEVEL	NOMENCLATURE	NATIONAL / NATO STOCK NUMBER	TOOL NUMBER
1	O	Tool Kit, Electronic Equipment	5180-00-064-5178	TK-101/G
1	O	Tool Kit, Electronic Equipment	5180-00-064-5178	TK-101/G
2	H	Tool Kit, Electronic Equipment	4931-01-073.3845	TK-17AL
3	H	Oscilloscope, Mainframe	6625-01-034-3269	Tek 5440
4	H	Plug-in Unit, Amplifier	6625-01-008-1480	Tek 5A48
5	H	Plug-in Unit, Time Base Delay	6625-01-008-1480	Tek 5B42
6	H	Oscilloscope Probe (2 each)	6625-00-098-8141	Tek 6201A
7	H	Frequency Counter	6625-00-531-4752	Tek 5345A
8	H	Digital Multi meter	6625-00-557-8305	HP 3490A
9	H	Probe, High Voltage	6625-01-023-6253	HPK25- 3490A
10	H	Distortion Analyzer		HP C41 - 334A
11	H	Signal Generator	6625-00-566-3067	HP 8640 B- H66
12	H	Electronic Synthesizer (Or Equivalent)	6625-01-158-2607	HP 3325A
13	H	Cable, Coaxial, 50 Ω BNC, 4 FT (4 each) (Or Equivalent)		POM BNC-C-48
14	H	Adapter, BNCT (Or Equivalent)		POM 3284
15	H	Termination, Feed thru, BNC 50 Ω (2 Each) (Or Equivalent)		POM4119- 50
16	H	Cable, Coaxial, 75 Ω BNC, 4 FT (Or Equivalent)		POM BNC-E-48
17	H	Termination, Feedthru, BNC 75 Ω (Or Equivalent)		POM4119- 75
18	H	Adapter, BNC to Double Banana Plug (Or Equivalent)		POM 1269
19	H	Double Banana Plug (2 each) (Or Equivalent)		POM 1330-ST-2

**Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS
FOR
SIGNAL GENERATOR SG-1288/G — CONTINUED**

(1)	(2)	(3)	(4)	(5)
TOOL / TEST EQUIPMENT REF CODE	MAINT LEVEL	NOMENCLATURE	NATIONAL/ NATO STOCK NUMBER	TOOL NUMBER
20	H	Termination, Feed thru, BNC 600 Ω (Or Equivalent)		POM 4119-600
21	H	Cable Assembly, High Impedance (Or Equivalent) SPECIAL TOOLS		POM 2BB- BNC-48
22	H	Extender Board (40 pin) (23338) 1100-00-3016		
23	H	Extender Board (24 pin) (23338) 1100-00-3015		

**Section IV. REMARKS
FOR
SIGNAL GENERATOR SG-1288/G**

(1)	(2)
REFERENCE CODE	REMARKS
A	External visual inspection.
B	Perform turn-on procedure (para 2-6).
C	Repair limited to replacement of front panel knob and/or rear panel fuse.
D	Performance tests.
E	Repair limited to replacement of feet, handles, and/or subassemblies.
F	Repair is limited to replacement of Q18 thru Q23.
G	Repair is limited to replacement of BT1, CR40, J15 to J19, Q7, Q10, VR3, VR4, VR7, and VR8.

APPENDIX C

COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LIST

Section I. INTRODUCTION

C-1. SCOPE.

This appendix lists components of the end item and basic issue items for the Signal Generator SG-1288/G to help you inventory items required for safe and efficient operation.

C-2. GENERAL.

The components of End Item and Basic Issue Items List (BII) are divided into the following sections:

a. Section II — Components of End Item. This listing is for information purposes only and is not authority to requisition replacements. These are part of the end item but are removed and/or separately packaged for transportation or shipment. As part of the end item, these items must be with the end item whenever it is issued or transferred between property accounts. Illustrations are furnished to assist you in identifying the items.

b. Section III — Basic Issue Items. These are the minimum essential items required to place the Signal Generator SG-1288/G in operation, to operate it, and to perform emergency repairs. Although shipped separately packaged, BII must be with the Signal Generator SG-1288/G during operation and whenever it is transferred between property accounts. This manual is your authority to request/requisition replacement BII, based on TOE/MTOE authorization of the end item.

C-3. EXPLANATION OF COLUMNS.

a. Column (1) — Illustration Number (Illus Number). This column indicates the number of the illustration in which the item is shown.

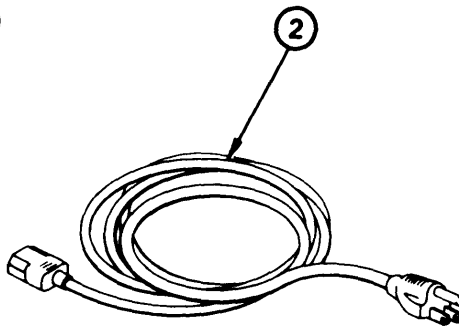
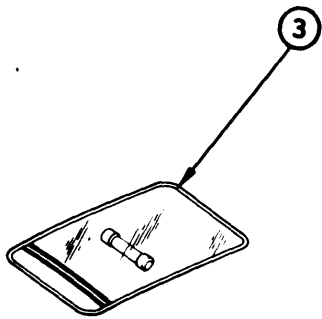
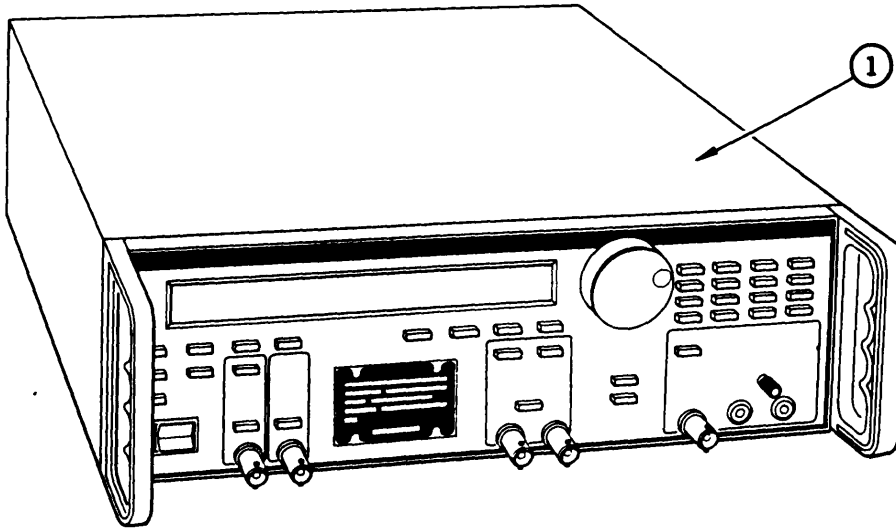
b. Column (2) — National Stock Number. This column indicates the national stock number assigned to the item and will be used for requisitioning purposes.

c. Column (3) — Description. This column indicates the federal item name and, if required, a minimum description to identify and locate the item. The last line for each item indicates the FSCM (in parentheses) followed by the part number.

d. Column (4) — Unit of Measure (U/M). This column indicates the measure used in performing the actual operation/maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e. g., ea, in, pr).

e. Column (5) — Quantity Required (Qty Rqr). This column indicates the quantity of the item authorized to be used with/on the equipment.

Section II. COMPONENTS OF END ITEM



(1) ILLUS NUMBER	(2) NATIONAL NUMBER	(3) DESCRIPTION FSCM and PART NUMBER	(4) QUANTITY	(5) REQ
①		SIGNAL GENERATOR (23338) 288	1	
②		CABLE ASSEMBLY, POWER (23338) 6001-80-009	1	
③	5920-00-229-13	FUSE, CARTRIDGE, 3 250V SLO-BLO (75915) 313-375	1	AMP

APPENDIX D

ADDITIONAL AUTHORIZATION LIST

Section I. INTRODUCTION

D-1. SCOPE.

This appendix lists additional items you are authorized for the support of the Signal Generator SG-1288/G.

D-2. GENERAL.

This list identifies items that do not have to accompany the Signal Generator SG-1288/G and that do not have to be turned in with it. These items are all authorized to you-by CTA, MTOE, TDA, or JTA.

D-3. EXPLANATION OF LISTING.

National stock numbers, descriptions, and quantities are provided to help you identify and request the additional items you require to support this equipment. The items are listed in alphabetical sequence by item name under the type document (i. e., CTA, MTOE, TD, or JTA) which authorized the item(s) to you.

Section II. ADDITIONAL AUTHORIZATION LIST

(1) NATIONAL STOCK NUMBER	(2) DESCRIPTION FSCM and PART NUMBER USABLE ON CODE	(3) U/M	(4) QTY AUTH
5920-00-229-1317	FUSE, CARTRIDGE 3/8 AMP 250V SLO-BLO (75915) 313-375	EA	1
5920-00-232-3699	FUSE, CARTRIDGE 3/4 AMP 250V SLO-BLO (75915) 313-750	EA	1

APPENDIX E

EXPENDABLE SUPPLIES AND MATERIALS LIST

Section I. INTRODUCTION

E-1. SCOPE.

This appendix lists expendable supplies you will need for maintenance on Signal Generator SG-1288/G. These items are authorized to you by CTA 50-970, Expendable items (Except Medical, Class V, Repair Parts, and Heraldic Items).

E-2. EXPLANATION OF COLUMNS.

a. *Column (1)—Item Number.* This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e. g., "Use cleaning compound, item 5, App. D").

b. *Column (2)—Level.* This column identifies the lowest level of maintenance that requires the listed item.

C - Operator/Crew.

O - Unit Maintenance.

c. *Column (3)—National Stock Number.* This column indicates the national stock number assigned to the item and will be used for requisitioning purposes.

d. *Column (4)—Description.* This column indicates the federal item name and if required, a minimum description to identify the item. The last line for each item indicates the FSCM (in parentheses) followed by the part number.

e. *Column (5)—Unit of Measure (U/M).* This column indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e. g., EA, IN, PR). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

Section II. EXPENDABLE SUPPLIES AND MATERIALS LIST

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
1	O	6810-00-753-4993	Alcohol, Isopropyl, 8OZ Can, MIL-A-10428, Grade A (81349)	CN
2	C	8305-00-267-3015	Cloth, Cheesecloth, Cotton, Lintless, CCC-C-440, Type II, Class 2 (81349)	YD
3	C		Detergent, Mild, Liquid	OZ

APPENDIX F

REMOTE OPERATION

F-1. SCOPE.

This appendix describes Signal Generator SG-1288/G remote operation (GPIB) procedures using an external controller. GPIB Digital Interface conforms to IEEE 488-1978 subsets SH1, AH1, SR1, RL1, PP0, DC1, DT0, CO, T6, L4, TE0, LE0, and E1.

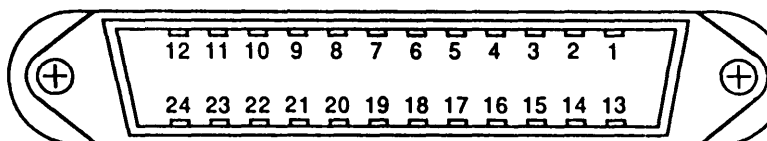
F-2. GENERAL.

Remote operation of the Signal Generator is very similar to local operation, except the commands are entered and received using an external controller, and not by pressing keys and observing the display and indicators on the front panel. The GPIB connector permits remote control of all functions except POWER switch and ADDRESS key. Refer as necessary to Chapter 2 for descriptions of controls, indicators, and connectors (para 2-1), and individual operating procedures (para 2-8 through 2-13). Restrictions listed under controls, indicators, and connectors are different for remote and operation. Under local operation, the command is disregarded and not executed. Under remote operation, the command may be allowed and executed; however, an SRQ message is generated. Rear panel GPIB connector input and output information is supplied below.

Logic Levels

1=Low= $\leq +0.8V$

0=High= $\geq +2.0V$



Pin	Assignment	Nomenclature	Description
1	DIO1	Data In/Out Bit 1 (LSB)	Data Line*
2	DIO2	Data In/Out Bit 2	Data Line*
3	DIO3	Data In/Out Bit 3	Data Line*
4	DIO4	Data In/Out Bit 4	Data Line*
5	EOI	End or Identify	Interface Line***
6	DAV	Data Valid	Handshake Line**
7	NRFD	Not Ready for Data	Handshake Line**
8	NDAC	Not Data Accepted	Handshake Line**
9	IFC	Interface Clear	Interface Line***
10	SRQ	Service Request	Interface Line***
11	ATN	Attention	Interface Line***
12	SHIELD		
13	DIO5	Data In/Out Bit 5	Data Line*
14	DIO6	Data In/Out Bit 6	Data Line*
15	DIO7	Data In/Out Bit 7	Data Line*
16	DIO8	Data In/Out Bit 8	Data Line*
17	REN	Remote Enable	Interface Line***
18	GND, (6)		Ground
19	GND, (7)		Ground
20	GND, (8)		Ground
21	GND, (9)		Ground
22	GND, (10)		Ground
23	GND, (11)		Ground
24	GND, (5-17)		Ground

- * Data lines are used to transfer data from one instrument to another.
- ** Handshake lines operate in a proper time sequence for complete communication between instruments.
- *** Interface lines are used to provide an orderly flow of information between units.

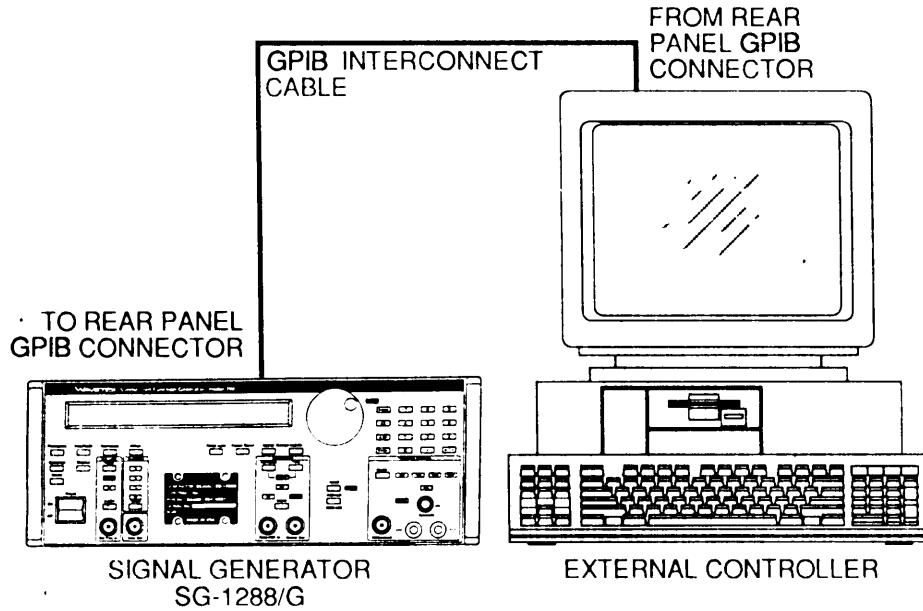
F-3. OPERATING PROCEDURES.

Perform the following steps for remote operation of Signal Generator.

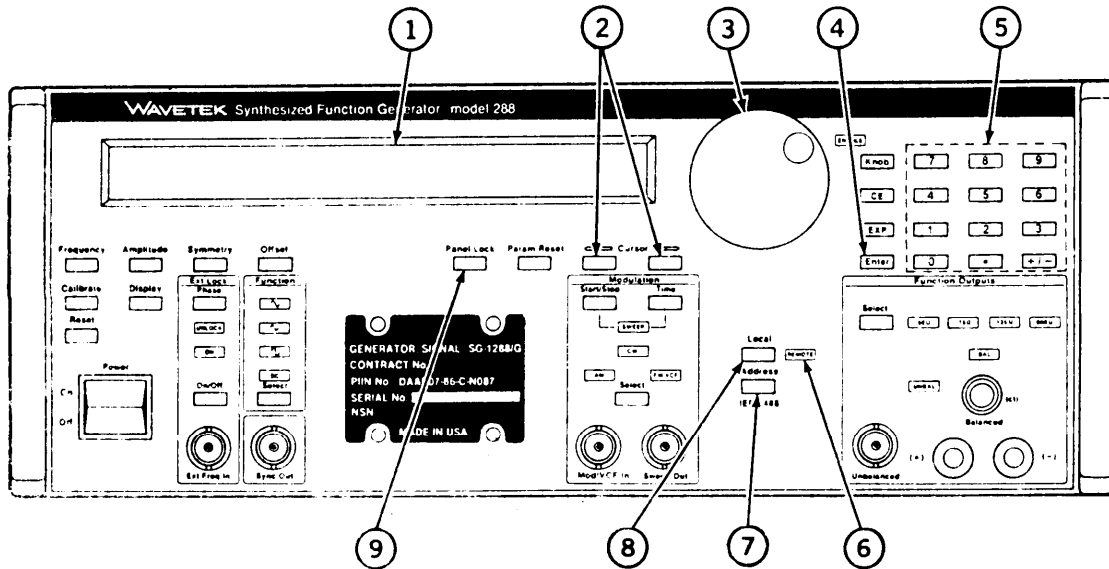
1. Connect the equipment as shown below.

NOTE

Keep GPIB interconnect cable length below 6.6 feet (2 m)



2. Perform turn-on procedure (para 2-6).



3. On Signal Generator front panel:

- Press LOCAL key (8) and verify DISPLAY (1) indicates GOTO LOCAL, and REMOTE indicator (6) is out.
- Press ADDRESS key (7) and enter desired CONTROL KNOB (3), or NUMERIC keypad (5) and ENTER key (4). Entry will appear in DISPLAY (1). Default address 09.
- Press PANEL LOCK key (9) if desired.

F-4. SG-1288/G COMMANDS.

The Signal Generator may be sent four types of commands:

- Parameter commands specify a particular numerical value within a continuous range of values. This command is held until an Execute command is given.
- Enumerated commands provide a list of distinct choices. This command is held until an Execute command is given.
- Direct commands (such as Reset or Execute) make the Signal Generator perform an immediate action.
- Query command tells the Signal Generator to send information to the controller.

F-5. COMMAND SYNTAX.

A general syntax for a command string is: <HEADER> SPACE< VALUE> TERMINATION,

The header is the command name (full, partial or fully abbreviated) from the device dependant command table listed in paragraph F-8. The value is the numeric setting from the RANGE column of the table.

Parameter values may use exponential (E) notation. Enumerated commands can use either the name or the numerical value (AM may be set by sending either "MA; E" or "M 1; E"). The controller may send just the command name without a value and the Signal Generator will display that parameter's current value in its display. Replacing the numerical value with a "?" (query) will make the Signal Generator both display and send the parameter's current value to the controller as a string of characters. Do not send an Execute command after a query command. The query command will instruct the Signal Generator to send specific information after the controller has addressed it to talk. The Execute command should be sent at the end of a string of commands to put them into effect after testing for correctness of the whole set up.

F-6. TERMINATORS.

When the controller sends the SG-1288/G more than one command in a string, then individual commands should have semicolons (;) inserted between them as terminators. The Signal Generator will accept either spaces or semicolons, but the semicolons work better in program debugging. If spaces are used, the Signal Generator will copy (and ignore) all commands after the first defective command into the SRQ buffer. With semicolons, all good commands are accepted and only defective ones are put into the SRQ buffer. The closing quote terminates the final command.

F-7. INSTRUMENT PRESET.

The Reset or "R" command resets the Signal Generator to initialized condition described in para 2-6.

F-8. COMMAND LIST.

Operator commands are programmed using an external controller and GPIB commands listed in the table below. The help (H?) command (HELP) also allows a print out of a simplified command listing over the GPIB.

NOTE

Talkmode allows control of the messages the Signal Generator will send when addressed as a talker. This does the same thing as the query commands and will not be needed by the operator.

COMMAND	ABBREVIATION	RANGE/VALUE		DESCRIPTION
		MIN	MAX	
Amplitude Amplitude?	A A?	1E-3	15	Set Amplitude Request current Amplitude setting
AutoCalibrate Calibrationdump? Execute	AC C E			Start Auto-Calibrate Displays stored calibration data Execute previous commands
FRequency FRequency?	FR FR?	2E -3	20E6	Set Frequency Request current Frequency setting
FUnction DC Sine Square Triangle	EU D SI SQ T	0 3 0 2 1	3	Set Function Set dc Function Set Sine Function Set Square Function Set Triangle Function
FUnction? Help?	FU? H?			Request current Function setting Request this Command list
Modulation mode A m C w F m	M A C F	0 1 0 2	5	Set Modulation mode Set to AM modulation mode Set to CW modulation mode Set to FM/VCF Modulation
Sweep Sweep StArt SweepStOp	S SSA SSO	5 3 4		Set to Sweep Modulation mode Set to Sweep start Set to Sweep stop
Modulationmode? MainParameters?	M ? MNP?			Request current Modulation type Request current main parameters
Offset Offset?	OF OF?	-5	5	Set Offset voltage Request current Offset value
OUtputtype Balanced 135 Balanced 600 Unbalanced 50 Unbalanced 75 Unbalanced 600	OU B1 B6 U5 U7 U6	0 4 3 0 1 2	4	Set Output type Set Output to 135 Ω Balanced Set Output to 600 Ω Balanced Set Output to 50 Ω Unbalanced Set Output to 75 Ω Unbalanced Set Output to 600 Ω Unbalanced
OUtputtype? PhaseLock External Internal	OU? PL E I	0 1 0	1	Request current Output type Set Phase lock source Set Phase lock source to external Set Phase lock source to internal
PhaseLock?	PL?			Request current Phase lock source
Phase	P	- 180	180	Set phase against external source
Phase? PANellock Off ON	P? PAN OFF ON	0 0 1	1	Request current phase value Set Panel lock Set Panel to unlocked Set Panel to locked
PARAmeterreset	PAR			Reset previously transmitted parameter
RANgelock Off ON	RA OFF ON	0 0 1	1	Sets selection of frequency ranges Normal ranging Locks to currently selected
Reset	R			Reset parameters except GPIB address
SYMmetry SYMmetry?	SY Sy?	5	95	Set Symmetry value Request current Symmetry value
SWEEP StArtfreq SWEEP StArtfreq?	SWSA S WSA?	2E -3	20E6	Set Sweep start frequency Request current Sweep start frequency
SWEEP StOpfreq SWEEP StOpfreq?	S WSO S WSO?	2E-3	20E6	Set Sweep stop frequency Request current Sweep stop frequency
SWEEP Time SWEEP Time?	SWT SWT?	100E-3	100	Set Sweep time Request current Sweep time value
SRQMask SRQMask?	SRQM SRQM?	0	255	Set Service Request Mask value Request current SRQ Mask value

COMMAND	ABBREVIATION	RANGE/VALUE		DESCRIPTION
		MIN	MAX	
SRQ? SStatus Byte ? SErialNumbers? STARTCALibration Talkmode Version?	STB? SE? STARTCAL T V?	0	10	Request current SRQ value Request current Status Byte value Request instrument serial numbers Initiate maintenance calibration Set instrument to send a value Request software version number

F-9. UNIVERSAL AND ADDRESSED COMMANDS.

Universal and addressed (U/A) commands make most GPIB instruments perform generally accepted standard functions. Usually, universal commands control all of the instruments on the bus, while addressed commands control individual instruments at specific addresses on the bus. The Signal Generator accepts the DCL, GET, GTL, LLO, and SDC commands (these are generic names, consult with the Controller's specifications).

F-10. SERVICE REQUEST (SRQ).

The Signal Generator can set the SRQ line to the controller whenever:

- A programming error has occurred.
- A hardware error has occurred.
- An event has been completed.
- Phase lock has changed states.
- A message is given to the calibration operator.

SRQ enablement may also be inhibited (masked). SRQMask (SRQM) makes the Signal Generator selectively ignore one or more of the above five types of conditions which can make it produce service requests. These five conditions are shown by their bit positions in the Status Byte in paragraph F-11. A given condition is inhibited by sending the SRQM command followed by the decimal value for its bit position (or sum of values for more than one condition). The SRQM? command sends this number back. The SRQ? command makes the Signal Generator send the contents of the SHQ buffer over the bus. It sends the data in the format SRQ=MESSAGES, where MESSAGES represents a string of messages. Reading the SRQ buffer clears it.

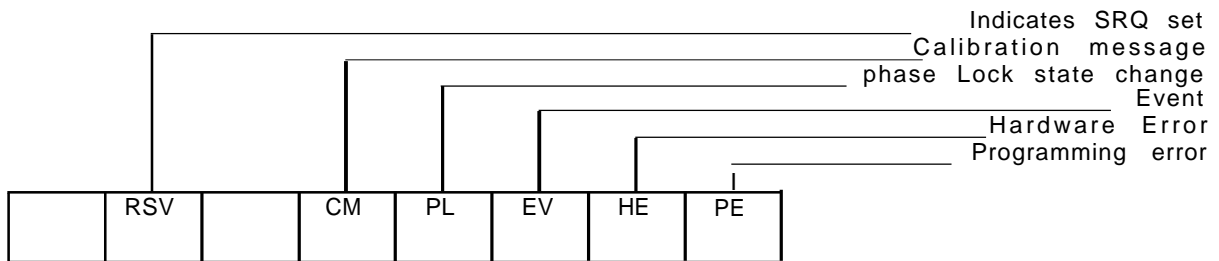
F-11. STATUS BYTE.

When the controller sends the Signal Generator the STB? command, or when the controller initiates a serial poll by sending the SPE command and addresses the Signal Generator as a talker, the Signal Generator sends its current Status Byte. The Status Byte informs the controller of the unit's status. The Status Byte format is STB=## where ## is the decimal equivalent of the byte. STB? reads, but does not reset the Status Byte. A serial poll does. The Status Byte bit positions are as follows:

Function	DIO Line
PE - programming error	1
HE- hardware error	2
EV - event	3
PL - phase lock state change	4
CM- calibration message	5

F-12. SRQ MESSAGES.

SRQ message format is shown below.



Calibration SRQ Messages (maintenance calibration only) are listed below:

- ./CM:1:<cal index><cal name>/ Information message usually requesting a manual operation. <cal index> is a number associated with the calibration parameter or step that needs attention. <cal name> is an archaic name associated with the calibration parameter or step that needs attention.
- ./CM:2:<cal index>:<number><cal name>/ Information message having an unchangeable number associated with it. <number> is that number.
- ./CM:3:<cal index>:<number><cal name>/ Request for a numeric calibration parameter. <number> is the previous value of this parameter.
- ./CM:4:CALIBRATION BUTTON NOT PUSHED/ An attempt has been made to enter the calibration procedure without the internal calibration enable button pushed.

Phase lock state SRQ messages are listed below:

- ./PL:0 PLL UNLOCKED/ Phlase lock loop has changed from a locked state to an unlocked state.
- ./PL:0 PLL LOCKED/ Phase lock loop has changed from an unlocked state to a locked state.

Event SRQ messages are listed below:

- ./EV:0 AUTOCALIBRATION COMPLETE/ Autocalibration complete.
- ./EV:1 EXECUTE COMPLETE/ Execute complete. After an execute command the Signal Generator will send either this service request or a PE:2 (assuming both PE and EV SRQ'S are enabled by the SRQ mask).

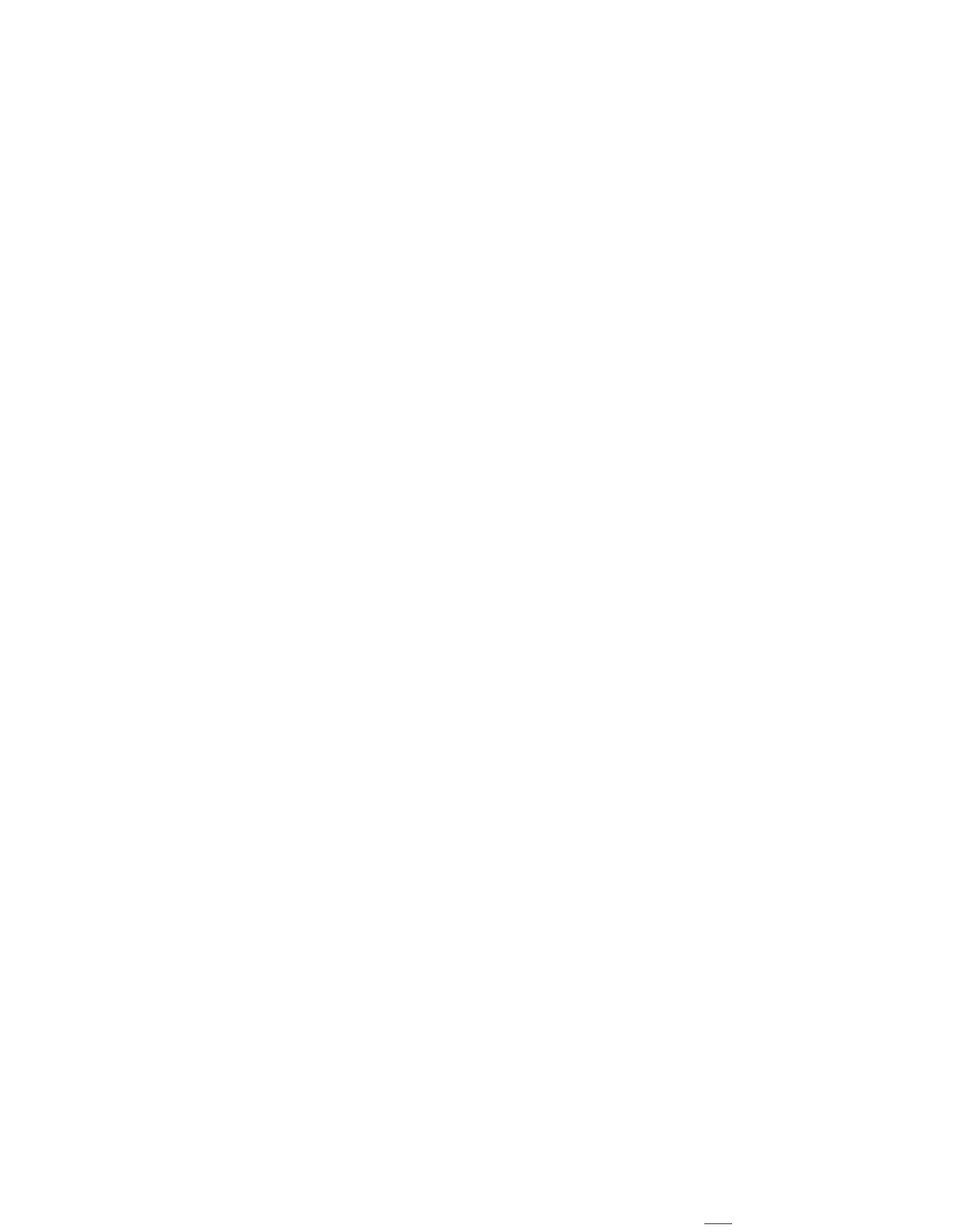
Hardware error SRQ messages are listed below:

- ./HE:0:<cal index><cal name> AUTOCAL ERROR/ This is a failure to complete an autocal step. <cal index> is a number associated with the calibration parameter that failed adjustment. ccal name> is an archaic name associated with the calibration parameter that failed adjustment.
- ./HE:1 WAIT <time>MIN/ This means an autocal was attempted before the required 20 min warm-up. <time> is the time(in minutes) remaining before an autocal can be performed.

Programming error SRQ messages are listed below:

- ./PE:0:<defective command string>/ The Signal Generator did not recognize the command it received <defective command string> is whatever garbage was received over the bus.
- ./PE:1:<parameter header>/ This is a limit error, an attempt was made to set a. setting to an illegal value. <parameter header> is the maximum header string, e.g. "FREQUENCY or "SWEEPS TO PFREQ".
- /PE:2<param #>:<param name><param name>CONFLICT/ This is a setting conflict error. This service request will occur after an EXECUTE command if there are conflicting settings. It will only flag the first conflict it finds. <param #> and <param name> are redundant and are as follows:

<param#>	<param name>
1	FREQUENCY
2	AMPLITUDE
3	OFFSET
4	SYMMETRY
5	PHASE
6	FUNCTION
7	MODULATION
8	EXTLOCK
9	OUTPUT
10	SWP START
11	SWP STOP
12	SWP TIME
13	AMPLITUDE-OFFSET
14	RANGE LOCK



INDEX

Subject	Paragraph Figure, Table, Number
A	
Abbreviations	1-9
Adjustment and Servicing of Equipment, Preliminary	3-5
Administrative Storage	1-4
Amplitude Modulation (AM)	2-11
Army Publications	1-2
B	
Blank Forms	1-2
Block Diagram, Signal Generator	F1-2
C	
Capabilities, Equipment	1-10
Characteristics, Equipment	1-10
Common Tools and Equipment	3-1
Connectors	F2-1, F2-2
Consolidated Index of Army Publications and Blank Forms	1-2
Continuous Wave (CW)	2-9
Control Knob Replacement	3-8
Controls	F2-1, F2-2
Cross-Reference List, Nomenclature	1-8
D	
Data, Equipment	1-11
Description, Functional	1-12
Destruction of Army Electronics Materiel to Prevent Enemy Use	1-5
E	
EIR (Reporting Equipment Improvement Recommendations)	1-6
Electronics Materiel, Destruction of to Prevent Enemy Use	1-5
Environment	3-11
Equipment Characteristics, Capabilities, and Features	1-10
Equipment Data	1-11
Equipment, Common	3-1
Equipment, Special	3-2
Error Codes	2-7, T2-1
F	
Features, Equipment	1-10
Forms	1-3
Frequency Modulation (FM)	2-12
Functional Description, General	1-12
Fuse Replacement	3-7
G	
General Functional Description	1-12
Generator, Signal	F1-1

INDEX — Continued

Subject	Paragraph Figure, Table, Number
I	
Index of Army Publications and Blank Forms	1-2
Indicators	F2-1, F2-2
L	
List of Abbreviations	1-9
M	
Maintenance Forms, Records, and Reports	1-3
Maintenance Messages	2-7, T2-1
Modulation, Amplitude	2-11
Modulation, Frequency	2-12
Modulation, Sweep	2-10
N	
Nomenclature Cross-Reference List	1-8
O	
Operating Procedures	2-8
Operator: Controls, Indicators, and Connectors, front view	F2-1
Operators Controls, Indicators, and Connectors, rear view	F2-2
P	
Packaging	3-9
PMCS Procedures	2-3
Preliminary Servicing and Adjustment of Equipment	3-5
Preparation for Use	2-5
Procedures, Operating	2-8
Procedures, PMCS	2-3
Procedures, Turn-On	2-6
R	
Receipt of Material, Service Upon	3-4
Records	1-3
Repair Parts	3-3
Replace Control Knob	3-8
Replace Fuse	3-7
Reporting Equipment Improvement Recommendations (EIR)	1-6
Reports	1-3

INDEX — Continued

Subject	Paragraph Figure, Table, Number
S	
Service Upon Receipt of Material	3-4
Servicing and Adjustment of Equipment, Preliminary	3-5
Signal Generator SG-1288/G	F1-1
Signal Generator SG-1288/G Simplified Block Diagram	F1-2
Simplified Block Diagram, Signal Generator	F1-2
Special Tools, TM DE, and Support Equipment	3-2
Specifications	1-11
Storage, Administrative	1-4
Storage, Types of	3-10
Support Equipment, Special	3-2
Sweep Modulation	2-10
T	
TMDE, Special	3-2
Tools, Common	3-1
Tools, Special	3-2
Troubleshooting	3-6, T3-1
Turn-On Procedure	2-6
Types of Storage	3-10
V	
Voltage Controlled Frequency	2-13
W	
Warranty Information	1-7

By Order of the Secretary of the Army:

Official:

CARL E. VUONO
General, United States Army
Chief of Staff

WILLIAM J. MEEHAN II
Brigadier General, United States Army
The Adjutant General

Distribution:

To be distributed in accordance with special list.

These are the instructions for sending an electronic 2028

The following format must be used if submitting an electronic 2028. The subject line must be exactly the same and all fields must be included; however only the following fields are mandatory: 1, 3, 4, 5, 6, 7, 8, 9, 10, 13, 15, 16, 17, and 27.

From: "Whomever" <whomever@wherever.army.mil>

To: 2028@redstone.army.mil

Subject: DA Form 2028

1. **From:** Joe Smith
2. **Unit:** home
3. **Address:** 4300 Park
4. **City:** Hometown
5. **St:** MO
6. **Zip:** 77777
7. **Date Sent:** 19-OCT-93
8. **Pub no:** 55-2840-229-23
9. **Pub Title:** TM
10. **Publication Date:** 04-JUL-85
11. **Change Number:** 7
12. **Submitter Rank:** MSG
13. **Submitter FName:** Joe
14. **Submitter MName:** T
15. **Submitter LName:** Smith
16. **Submitter Phone:** 123-123-1234
17. **Problem:** 1
18. **Page:** 2
19. **Paragraph:** 3
20. **Line:** 4
21. **NSN:** 5
22. **Reference:** 6
23. **Figure:** 7
24. **Table:** 8
25. **Item:** 9
26. **Total:** 123
27. **Text:**

This is the text for the problem below line 27.

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS <small>For use of this form, see AR 25-30; the proponent agency is ODISC4.</small>	Use Part II (reverse) for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM)	DATE <h2 style="text-align: center;">8/30/02</h2>
--	--	--

TO: (Forward to proponent of publication or form)(Include ZIP Code) Commander, U.S. Army Aviation and Missile Command ATTN: AMSAM-MMC-MA-NP Redstone Arsenal, 35898	FROM: (Activity and location)(Include ZIP Code) MSG, Jane Q. Doe 1234 Any Street Nowhere Town, AL 34565
--	--

PART 1 - ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER <h3 style="text-align: center;">TM 9-1005-433-24</h3>	DATE <h3 style="text-align: center;">16 Sep 2002</h3>	TITLE Organizational, Direct Support, And General Support Maintenance Manual for Machine Gun, .50 Caliber M3P and M3P Machine Gun Electrical Test Set Used On Avenger Air Defense Weapon System
--	--	---

ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO. *	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON
1	WP0005 PG 3		2			Test or Corrective Action column should identify a different WP number.

EXAMPLE

* Reference to line numbers within the paragraph or subparagraph.

TYPED NAME, GRADE OR TITLE <h3 style="text-align: center;">MSG, Jane Q. Doe, SFC</h3>	TELEPHONE EXCHANGE/ AUTOVON, PLUS EXTENSION <h3 style="text-align: center;">788-1234</h3>	SIGNATURE
--	---	-----------

TO: (Forward direct to addressee listed in publication) Commander, U.S. Army Aviation and Missile Command ATTN: AMSAM-MMC-MA-NP Redstone Arsenal, 35898	FROM: (Activity and location) (Include ZIP Code) MSG, Jane Q. Doe 1234 Any Street Nowhere Town, AL 34565	DATE 8/30/02
---	--	------------------------

PART II - REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION NUMBER			DATE	TITLE				
PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

PART III - REMARKS (Any general remarks, corrections, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)

EXAMPLE

TYPED NAME, GRADE OR TITLE MSG, Jane Q. Doe, SFC	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION 788-1234	SIGNATURE
---	--	-----------

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS <small>For use of this form, see AR 25-30; the proponent agency is ODISC4.</small>						Use Part II (reverse) for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM)	DATE
TO: (Forward to proponent of publication or form)(Include ZIP Code) Commander, U.S. Army Aviation and Missile Command ATTN: AMSAM-MMC-MA-NP Redstone Arsenal, AL 35898						FROM: (Activity and location)(Include ZIP Code)	
PART 1 - ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS							
PUBLICATION/FORM NUMBER						DATE	TITLE
ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO. *	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON	
<small>* Reference to line numbers within the paragraph or subparagraph.</small>							
TYPED NAME, GRADE OR TITLE						TELEPHONE EXCHANGE/ AUTOVON, PLUS EXTENSION	SIGNATURE

TO: (Forward direct to addressee listed in publication) Commander, U.S. Army Aviation and Missile Command ATTN: AMSAM-MMC-MA-NP Redstone Arsenal, AL 35898	FROM: (Activity and location) (Include ZIP Code)	DATE
--	---	-------------

PART II - REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION NUMBER			DATE	TITLE				
PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

PART III - REMARKS (Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)

--

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

