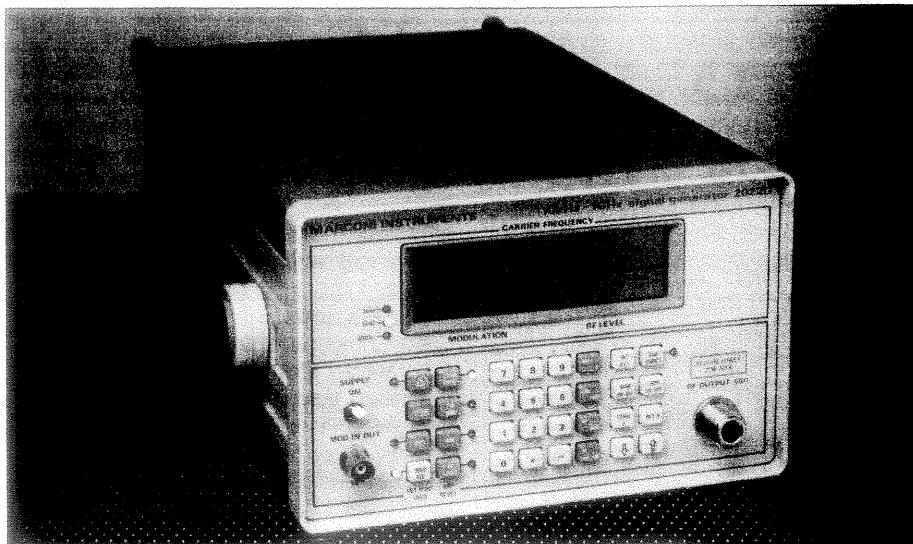


10 kHz to 1 GHz AM/FM Signal Generator

2022D



- **Wide frequency coverage:**
10 kHz to 1 GHz
- **+13 dBm output**
- **Small, light and rugged for portability**
- **Non-volatile memory with 100 settings**
- **Powerful second functions for rapid fault finding and calibration**
- **Comprehensive amplitude, frequency and phase modulation**
- **Simple operation**
- **Reverse power protection up to 50 W**
- **Choice of output calibration units**
- **Optional GPIB programmability**

2022D Signal Generator is a compact, lightweight unit offering frequency, phase and amplitude modulation over the frequency range 10 kHz to 1 GHz. Output levels from -127 dBm up to +13 dBm are provided and the unit is designed for a wide range of applications in research, development, production and maintenance. Microprocessor control provides simple and rapid operation via direct keyboard entry of settings. The non-volatile memory, which can store up to one hundred settings, further reduces measurement time. Full GPIB programmability adds greater flexibility and faster throughput in systems applications.

SIMPLE OPERATION

A simple keyboard layout ensures easy operation. All parameters are set using the numeric keys, while up and down keys allow the values to be varied in steps of any size. A TOTAL SHIFT key displays the deviation from the original setting and a RETURN key returns the selected parameter to the original value. All front-panel functions are available from GPIB when the optional GPIB interface board is fitted. Frequency, phase and amplitude modulation are selected by operation of the appropriate key and, for rapid measurements of received signal-to-noise ratio, the

modulation can be switched on and off using the MOD ON-OFF key. Provision is made for operation with an external reference frequency of 1 MHz, 5 MHz or 10 MHz as required.

DISPLAY

Measurement settings are indicated on a large liquid crystal display, offering clarity and low power consumption. The display features 7-digit resolution for carrier frequency, 3 digits for modulation and 4 for RF level, with units annunciators for unambiguous reading. Status and diagnostic information are also shown. Carrier frequency, modulation and RF level are all shown together.

OUTPUT

RF output levels up to +13 dBm can be set on the 2022D in all modulation modes by direct keyboard entry or via the GPIB with a resolution of at least 0.1 dB over the entire range. Total level accuracy is ± 1 dB for output levels above -10 dBm and ± 2 dB below -10 dBm. Levels are indicated on a four-digit liquid crystal display with units annunciators and levels can be incremented in steps of any size.

Calibration data held in memory

A choice of seven calibration units is

available to the operator and provision is made for the simple conversion of units (eg dBm to μ V). Calibration data for the output level is held in the memory and may be altered from the front panel or over the interface bus.

Offset facility

The output level can be offset by up to ± 2 dB from the calibrated value to compensate for cable or switching losses external to the generator. The operator may also use this facility as a means of deliberately offsetting the output level to ensure that all generators in an area give identical measurements. While using the offsetting facility the main calibration of the generator is not lost and may be returned to at any time.

REVERSE POWER PROTECTION

An electronic trip protects the generator output against reverse power of up to 50 W, preventing damage to output circuits when RF or DC power is accidentally applied. This feature contributes to long unit life and low cost-of-ownership.

MODULATION

Comprehensive AM, FM and ϕ M facilities are provided for testing all types of receivers. Three modulation frequencies are provided as standard and a MOD ON-OFF key is fitted to allow signal-to-noise ratio checks to be made.

FM, AM and phase modulation

The wider range frequency modulation facility provides FM deviation up to a maximum of 999 kHz depending on modulation and carrier frequency, and excellent FM accuracy is assured by the storage of calibration values in the memory. Phase modulation is available with a deviation range of up to 9.99 radians and amplitude modulation is provided with steps of 0.5% up to 99.5% depth.

External modulation

External modulation is possible with a wide band input of 50 Hz to 50 kHz for FM, 50 Hz to 10 kHz for ϕ M and 20 Hz to 15 kHz (DC coupled) for AM. The characteristics of the FM input allow the digital signals commonly used in mobile radio to be handled. A modulation levelling function is included which can be disabled when not required. HI and LO indications show when the input level is outside the range of the ALC system.

Auxiliary modulation input

2022D is fitted with a rear panel auxiliary modulation input socket which allows an external modulation signal (eg a sub-audible signalling tone) to be mixed with the internal signal.

Modulation oscillator

2022D offers a choice of three internal modulation frequencies, 400 Hz, 1 kHz and 3 kHz, saving the need for external modulation signals in many routine applications.

INCREMENTING

All parameters can be incremented or decremented in steps of any size, which may be simply entered via the keyboard or GPIB. If no step size is entered for a parameter the steps are pre-set to 1 kHz for carrier frequency, 1 kHz for FM deviation, 1 radian for ϕM deviation, 1% for AM depth and 1 dB for output level.

Single key operation

A single tap on either the UP or DOWN key moves the parameter by one step. If the key is held down the parameter steps once, waits one second and then moves at three steps per second. For search purposes it is possible to reverse this stepping direction without the one second delay.

NON-VOLATILE MEMORY

The inclusion of a true non-volatile semiconductor memory for storage of up to twenty complete generator settings and a further eighty carrier frequencies ensures that settings are retained even when the generator is switched off, without relying on a battery. Any of the sets of data can be instantly recalled when required for later use and the UP/DOWN keys may be used to step through a sequence of tests. A further feature enables a single group of preset measurement values to be recalled automatically at switch-on.

Stored calibration data

In addition to storage and recall of measurement settings, non-volatile memory contains other useful data. Calibration data – on RF level, FM accuracy and RF calibration units – are retained in these stores and may be altered using protected Second Functions. Output level offset values are also retained in the instrument's memories and may be selected or deselected by Second Function operation.

Stored status information

Status information stored includes: internal/external standard; GPIB address; type and serial number. Elapsed time indicators are also accessed via the internal memories. One stores the number of operational hours since the instrument was manufactured and cannot be altered. The other records the number of elapsed hours since the clock was last reset; re-settings being accomplished using a secure Second Function.

Stored user-defined information

In GPIB operation the non-volatile memory may be used to store a user-defined string. Up to 32 ASCII characters may be written to, or read from the unit, for example to record the instrument's inventory information, date of last calibration, normal instrument location etc.

PROGRAMMING

2022D can be simply fitted at any time with the optional GPIB interface so that all functions can be controlled over the bus. The instruments function as talker as well as listener. In the listen mode the generator's functions are set by simple instructions, and in the talk mode strings of information containing details of the instrument's settings can be sent back over the bus, allowing the controller to learn settings for later use.

Ease of programming

Ease of programming is ensured by careful selection of mnemonics. For example to send a carrier frequency of 123.456 MHz, an FM deviation of 3.5 kHz and an output level of 1.74 μV , and to place these settings in store 10 of the memory, it is only necessary to send over the bus the instruction:

CF123.456MZ, FM3.5KZ, LV1.74UV, ST10.

The use of commas as delimiters in the instruction string is not essential but often aids interpretation of program lines.

Controlled service requests

Service requests (SRQs) are sent for a variety of reasons including reverse power protection tripped and illegal characters received. SRQs may be inhibited if desired by setting flags in the generator using a Second Function.

SECOND FUNCTIONS

The front panel Second Function key gives access to a number of different features available with 2022D. Some of these are related to maintenance, calibration and programmable operation via GPIB. To prevent accidental interference with the contents of internal memories, those Second Functions that enable the internal data to be altered are protected by a secure key sequence.

Protected calibration data

Two levels of protection are offered, appropriate to the Second Function being accessed. The most secure is reserved for Second Functions that alter the instrument's calibration data, change its identity string, protect its store settings or blank the displays when memories are

recalled, less severe is the first level of protection, which enables the user to access those Second Functions that do not affect the fundamental calibration, but which may be relevant to normal operation. Examples include the selection of RF level calibration units, RF level offsets, external standard frequency and switch-on status.

Additional operating features

In addition, unprotected Second Functions provide a range of additional operating features, such as the ability to display status information, elapsed time and the type and serial number.

MAINTENANCE AND CALIBRATION

The Second Function mode provides powerful fault diagnostic facilities from the front panel or via the GPIB by allowing the operator to send data directly to individual latches in the instrument. The resulting changes in output conditions can be monitored and the area in which the fault lies can be localized quickly.

Automatic calibration

RF level, FM accuracy and frequency accuracy can be adjusted without removing the instrument's covers. Level and FM accuracy can be adjusted over the GPIB, leading to fully automated calibration routines.

Rapid repair

Careful mechanical design of the instrument ensures rapid access to all circuits for PCB or component replacement. The main RF assemblies are easily removed for inspection and repair. Printed boards interconnect by means of plugs and sockets, so simplifying first-line maintenance.

SPECIFICATION

GENERAL DESCRIPTION

2022D is a synthesized signal generator covering the frequency range 10 kHz to 1 GHz. The output may be amplitude, phase or frequency modulated using either the built-in AF source or an external signal. All control settings are entered from a front panel keyboard. A single liquid crystal display gives simultaneous readout of frequency, modulation and output level. Remote control via the General Purpose Interface Bus is available as an accessory.

CARRIER FREQUENCY

Range

10 kHz to 1 GHz.

Selection

By keyboard entry.

Indication

7 digit LCD with units annunciators.

Displayed Resolution

10 Hz up to 100 MHz, 100 Hz above 100 MHz.

Accuracy

Equal to the frequency standard accuracy. See FREQUENCY STANDARD.