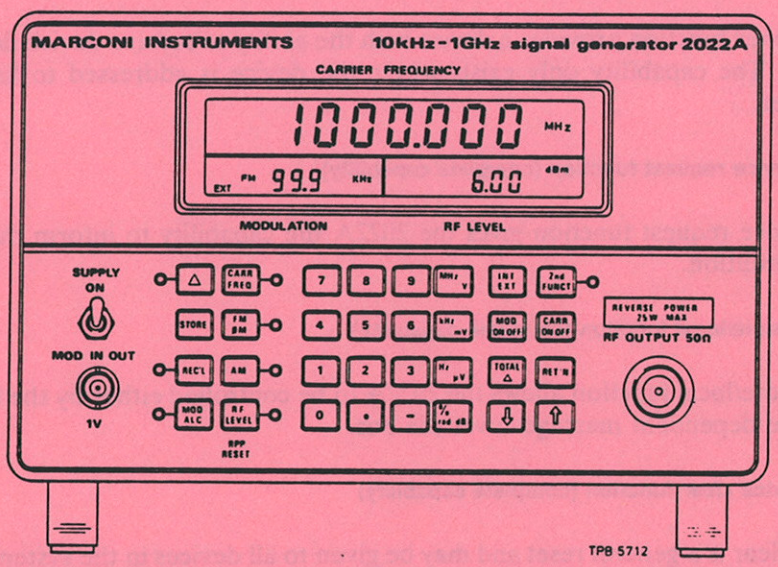
Marconi
Instruments

2022A

10kHz-1GHz
AM/FM SIGNAL GENERATOR



Operating Manual

GPIB FUNCTIONS

The GPIB interface, offered as an optional accessory, allows the instrument to be coupled to a controller. The essential purpose of the GPIB functions is described below. Further information on the general features and applications of the GPIB system can be obtained from 'The GPIB Manual' offered as an optional accessory.

The 2022A has both talker and listener capabilities. One address is used for both talking and listening and is set via the front panel or via the GPIB using second function 2. The instrument can request service (assert SRQ) on certain error conditions under the control of an SRQ mask which is set using second function 4.

SH1 : Source handshake (complete capability)

The source handshake sequences the transmission of each data byte from the instrument over the bus data lines. The sequence is initiated when the function becomes active, and the purpose of the function is to synchronize the rate at which bytes become available to the rate at which accepting devices on the bus can receive the data.

AH1 : Acceptor handshake (complete capability)

The acceptor handshake sequences the reading of the data byte from the bus data lines.

T6 : Talker function (no talk only function)

The talker function provides the 2022A with the ability to send device dependent messages over the bus to other devices. The ability of any device to talk exists only when it has been addressed as a talker.

L4 : Listener function (no listen only function)

The listener function provides a device with the ability to receive device dependent messages over the bus. The capability only exists where the device is addressed to listen via the bus by the controller.

SR1 : Service request function (complete capability)

The service request function gives the 2022A the capability to inform the controller when it requires attention.

RL1 : Remote/local function (complete capability)

The remote/local function allows the 2022A to be controlled either by the local front panel keys or by device dependent messages over the bus.

DC1 : Device clear function (complete capability)

Device clear is a general reset and may be given to all devices in the system simultaneously (DCL) or only to addressed devices (SDC). 2022A resets to the default power-up mode, that is:

Maximum carrier frequency (1000 MHz)
No AM, FM or ΦM
Minimum RF level (−127 dBm or equivalent)
Internal modulation

Increment settings:
Carrier frequency: 1 kHz
Modulation: 1 kHz FM, 0·1 rad ΦM or 1% AM
RF level: 1 dB

Before these conditions are set, a checksum is calculated for the calibration data (FM tracking and RF level) and referred to a number held in the non-volatile memory. If this test of calibration validity fails, the instrument responds by asserting SRQ. The status byte will contain the error number 7 to signal a calibration data fault in addition to the 'SRQ asserted' bit. In order to continue with the device clear (and normal operation thereafter) the instrument must be restarted by sending any valid instruction code (e.g. "CF"). This serves only as a reset and will not be interpreted in the normal way.

E1 : Open collector drivers

The GPIB drivers fitted to 2022A have open collector, rather than tristate, outputs.

Setting the GPIB address

The instrument's talk/listen address is selected by means of second function 2. Acceptable addresses (00 to 30) can be set by this means and the instrument's internal address register will be updated by reading the address at power-on and on receipt of a device clear message. The current GPIB address is shown in the frequency display window when the interface is correctly installed.

GPIB programming codes

Functions	Miscellaneous functions
CF Carrier frequency FM Frequency modulation AM Amplitude modulation PM Phase modulation LV RF level DE Delta (Increment/Decrement) SF Second function (see notes on page 3-10) RS Reset RPP QU Query – send current function setting to GPIB buffer	ST Store } followed by RC Recall } a number 00–99 IS Internal freq. standard XS External freq. standard IM Internal modulation XM External modulation C0 Carrier off C1 Carrier on UP Increment up DN Increment down RT Return

Units		MOD OSC/ALC
MZ Megahertz KZ Kilohertz HZ Hertz PC Percentage RD Radians	VL Volts MV Millivolts UV Microvolts DB Decibels	L0 Mod ALC off L1 Mod ALC on M0 Mod off M1 Mod on

Listening function

The 2022A is remotely controlled over the GPIB by strings of two-character codes and digits sent in upper case ASCII format. Where possible these codes correspond directly to the front panel keys; however, where the normal front panel control requires a knowledge of the previous state of the instrument (e.g. toggling controls such as on/off), special codes are provided to simplify programming.

In order to improve the readability of control strings, the codes may be separated by commas or spaces after each code pair or data group. These are ignored by the instrument. When data is entered, the syntax is the same over the GPIB as that used in control from the front panel. For example to enter a complex string of instructions such as a carrier frequency of 123·45 MHz with an increment of 25 kHz and an RF level of 1·2 μV the string can be sent as follows:

"CF 123·45 MZ, DE CF 25 KZ, LV 1·2 UV".

Similarly, if it is required to change the RF level units setting to dBm (second function 14, level unit code 4), the following string should be sent:

"SF 14,4, ST".

Selection of a second function via the GPIB will result in a display of the SF number being shown in the instrument's RF LEVEL display.

The MOD ON/OFF, CARR ON/OFF and INT/EXT controls operate on the function currently active for data entry. This may be specified, e.g. "FM M1"; "AM XM" or implied, e.g. "FM 1·5 KZ, IM" but it is recommended that the function is specified within the string to ensure that the string will always have the same result.

Talking function

On receipt of the QU command the current function setting (e.g. CF,FM) is transferred to the GPIB output buffer in a format corresponding to the GPIB commands needed to set the instrument to the current state. RF level will be displayed in log. or linear units but without a specific reference since this information cannot be re-entered directly. Increment settings are also available if QU is sent whilst in DELTA mode with a current function LED lit. The following tables give the format for each type of string.

TABLE 3-1 MODULATION STRING (16 characters)

Number of characters in field						
2	2	4	2	2	2	2
DE **	FM PM AM	3 digits or leading spaces plus decimal point or space	MZ KZ HZ PC RD	M0 M1	IM XM	L0 L1 **

*Represents a space which is used when the field has no relevance such as the levelling field when internal modulation is selected.

e.g. DE FM 1·00 KZ M1 IM **

TABLE 3-2 FREQUENCY STRING (17 characters)

Number of characters in field				
2	2	9	2	2
DE **	CF	7 digits or leading spaces plus decimal point or space	MZ KZ	IS XS

e.g. ** CF 123·4567 MZ IS

TABLE 3-3 RF LEVEL STRING (14 characters)

Number of characters in field						
2	2	1	1	4	2	2
DE **	LV	– *	1 0 *	3 digits or leading spaces plus decimal point or space	DB VL MV UV	C0 C1

e.g. ** LV * 100·0 MV C1

Provision for talking second function values can also be made by a similar use of QU when the function is engaged, the format being numeric strings only for calibration data etc., e.g. FM tracking, and a numeric string representing hours for the elapsed time indicator. Three further data strings are available, Status string, Identity string and a User string, which are accessed by means of second function controls and the QU function.

The external modulation input level status indicated by the modulation window HI and LO is also accessed. The current status, if outside the specified limit, is transferred to the GPIB output by means of an error message:

Error No. 9 – input too low
Error No. 10 – input too high

Requesting a string to be output will overwrite any string data waiting to be sent. Addressing the instrument to talk without specifying a string to be sent or re-addressing to talk after a string has been completed will result in an error (and SRQ if not masked).

SF1, QU Status string

When accessed by SF1, QU the status of the instrument is sent to the controller, each data field being delimited by one space in the following format:–

XX	X	X	X	X	X	X
GPIB ADDRESS	OFFSETS ON/OFF	LEVEL UNITS CODE	STORES OFFSETS LOCKING	DISPLAY BLANKING	PROTECTION LEVEL	FREQ STD 1, 5 or 10 MHz

GPIB address:	00 to 30
Offsets:	'0' = off '1' = on
Level units code:	0 to 9 (see second function 14)
Stores/offsets locking:	'0' = stores and offsets unlocked '1' = stores locked, offsets unlocked '2' = stores unlocked, offsets locked '3' = stores and offsets locked (see second function 196 in Service Manual)
Display blanking of recalled stores:	'0' = off '1' = on (see second function 197 in Service Manual)
Protection level:	'0' = unprotected '1' = first level '2' = second level
Ext. frequency standard:	1, 5 or 10 MHz (see second function 10)

SF11, QU Identity string (read only)

The identity string accessed by SF11, QU allows instrument type number, software issue number and serial number to be read by the controller. The information is stored in non-volatile memory. The string is displayed as described in second function 11. Each data field is delimited by one space.

SF12, User string write facility

Up to 32 ASCII characters can be stored in non-volatile memory by the user. This bus only facility is useful for recording such information as the date the next calibration is due, test gear numbers etc. The string is terminated by the LINEFEED character <lf>, (ASCII code 10) which is included as the last character stored. If an attempt is made to store too many characters then <lf> is automatically inserted as the 32nd.

SF13, QU User string read facility

This facility provides a means of reading back data set by means of SF12 write facility and is again a bus only facility.

Service requests (SRQ)

The 2022A can request service to warn the controller of certain error conditions. In response to a serial poll after asserting the SRQ line, the 2022A will provide a status word (8 bits) in which bit 6 is set to indicate an SRQ request and the first five bits (0 to 4) indicate an error number. The error number is also displayed briefly in the carrier frequency window. Errors 06 and 08 will result in the instrument not functioning. Error 07 can be overridden with a restart command (any function code or digit).

Error numbers

No.	Error condition	Action taken
00	NO ERROR	
01	REQUEST OUTSIDE LIMITS	
02	INCORRECT KEY CODE SEQUENCE	
03	TOO MANY DIGITS	
04	INCORRECT UNIT	
05	RPP TRIP	Wait for reset instruction (RS)
06	RAM CHECK FAILURE (IC9)	
07	EAROM CHECKSUM FAILURE (IC10)	Wait for restart instruction (any function code or digit)
08	EPROM CHECKSUM FAILURE (IC5–IC8)	
09	EXTERNAL MODULATION OUTSIDE ALC RANGE (LOW)	
10	EXTERNAL MODULATION OUTSIDE ALC RANGE (HIGH)	
11	EXT STD SELECTED BUT NOT APPLIED	None
12	EXT STD FREQ NOT LOCKING	None
13	LATCH WRITE ERROR	
14	EAROM WRITE ERROR	
15	EAROM RECALL ERROR	
16	GPIB BUS ERROR	
17	UNRECOGNIZED GPIB MNEMONIC/ CHARACTER	Ignore both characters: e.g. if the string "P,CF,M0" was received, the Q,C would result in error 17 being displayed and the rest of the string would be interpreted as "FM,0".
18	ATTEMPT TO WRITE TO PROTECTED STORE	

SRQ mask

The SRQ response to the errors listed above can be suppressed by setting a 3-page 6-bit mask, via second function 4. The bits of the mask refer directly to the errors, i.e. the left-most bit set indicates no response to error 1, the second from left no response to error 2, etc.

The mask is displayed by selection of second function 4, and may be changed by entering '1's and '0's via the keyboard. The STORE key is pressed to finalize a change. The SRQ mask is *not* stored in the non-volatile memory when power is removed. When the instrument is initially switched on the mask is set to all '0's.

Reverse power protection

When tripped by an overload applied to the RF OUTPUT socket, the GPIB SRQ line is asserted, and the status byte (obtainable by the controller conducting a serial poll) will contain the value 69 (decimal). The RPP can be reset via the bus by sending the RS command.

Note ...

If error 05 has been masked using second function 4 the service request action will not be initiated.

Clear, switch on, and return to local

SDC and DCL clear 2022A to the following state:–

Maximum carrier frequency (1000 MHz)
No AM, FM or ΦM
Minimum RF level (−127 dBm or equivalent)
Internal modulation
Increment settings:
Carrier frequency: 1kHz
Modulation: 1 kHz FM, 0·1 rad ΦM or 1% AM
RF level: 1 dB

To revert from GPIB to front panel control, press the RET'N key.
If a local lock out command has been given the RET'N key operation will be ignored.

Notes ...

(1) INT/EXT frequency standard selection, the GPIB address and instrument stores are unaffected by the SDC and DCL commands.

(2) Switching on clears the 2022A to the same state as SDC or DCL unless 'Recall STORE 10 at switch on', conditions apply.