GPIB OPERATION

GENERAL PURPOSE INTERFACE BUS (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 separate GPIB Manual offered as an optional accessory (see Chap. 1, Accessories).

Setting the GPIB address

The instrument's talk and listen addresses can be selected on the rocker switch bank illustrated in Fig. 3-13. This is positioned on the GPIB unit to the right of the connector and is accessible at the rear panel. GPIB switch settings are summarized in Table 3-3.

Note...

If the address is changed, the instrument must be switched off then back on to enable the instrument to read the new GPIB address.

For talk and listen mode: Set switch 6 to 0 e.g. XXXXX0 where X = 0 or 1 to form an address in the range 0 to 30 decimal.

For talk only mode: Set switch 6 to 1 and switches 1 and 2 as required for the following:–

Switch 1	2	3	4	5	6	
0	0	X	X	X	1	Upper and lower case, <CR> suppressed.
0	1	X	X	X	1	Upper and lower case, <CR> not suppressed.
1	0	X	X	X	1	Upper case only, <CR> suppressed.
1	1	X	X	X	1	Upper case only, <CR> not suppressed.
				X =		Don't care.

Note...

If any switch position is changed, the instrument must be switched off and then back on to enable the instrument to read the new setting.

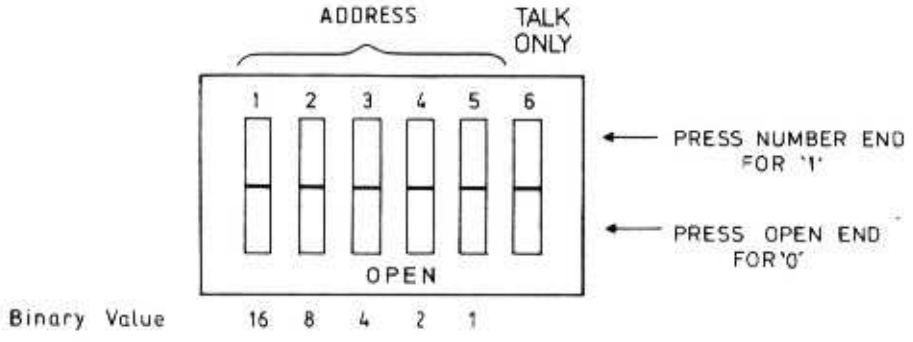


Fig. 3-13 GPIB address rocker switch bank

* *Where GPIB is Marconi Instruments implementation of the General Purpose Interface Bus in accordance with IEEE Standard 488-1978 and IEC Publication 625-1 (First Edition).*

TABLE 3-3 GPIB SWITCH SETTINGS

Switch	Bit	Function	
		Talker/Listener	Talk only
1	4	MS address bit	Upper case characters only (for machines with upper case only)
2	3	Address bit	Suppress carriage return in output (for dedicated printer units)
3	2	Address bit	Not used
4	1	Address bit	Not used
5	0	LS address bit	Not used
6	5	0 = talker/listener	1 = talk only

Capability identification codes

These are defined by IEEE Std. 488-1978. The capabilities are as follows:–

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.

T5: Talker function (complete capability)
The talker function provides the 2955 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 designated as a talker by the controller.

TE0: Extended talker (no capability)
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 ability of any device to listen exists only when it has been designated as a listener by the controller.

LE0: Extended listener (no capability)
SR1: Service request function (complete capability)
The service request function gives the 2955 the capability to inform the controller when it requires attention.

RL1: Remote/local function (complete capability)
The remote/local function allows the 2955 to be controlled either by the local front panel keys or by device dependent messages over the bus.

PP0: Parallel poll function (no capability)
DC1: Device clear function (complete capability)
Device clear is a general reset and may be given to all devices in the system simultaneously (DCL). 2955 resets to the power-up mode.

DT1: Device trigger function (complete capability)
Device trigger is used by the 2955 to initiate a sequential tone sequence.

C0: Controller function (no capability)

E1: Open collector drivers
The GPIB drivers have open collector, rather than tri-state outputs.

Display annunciators

During GPIB operation, the following announcements are made on the screen:-

Remote: Once the instrument has received a remote enable and has been addressed, it will enter the remote state. This is annunciated by REM appearing in reverse field in the bottom right-hand corner of the screen.

Addressed: When in the remote condition and the instrument is addressed to either talk or listen, this is annunciated by ADR appearing in reverse field in the bottom right-hand corner of the screen.

Service request: When in the remote condition and enabled, a service request is raised, this is annunciated by SRQ appearing in reverse field in the bottom right-hand corner of the screen.

Local: When in the remote condition and Local Lockout (LLO) has not been sent, this is annunciated by LCL appearing next to the HELP key. Pressing HELP will then cause the instrument to enter a Go To Local (GTL) condition.

Note that the Go To Local condition is not the same as the power-on condition since the remote enable (REN) line from the controller will still be active.

GPIB commands

Commands take the form of a two-character alphabetic pair which may be followed by amplifying, non-exponential numeric data. Separators are required for multiple data and for multiple commands forming a string.

Command format

This takes the form of <HEADER><DATA><TERMINATOR/SEPARATOR>

<HEADER>	– A two-character command identifier.
<DATA>	– In form NR1 (integer) or NR2 (fixed decimal point), i.e. exponential formats are not allowed. Where there is more than one item of data, separators must be used.
<TERMINATOR/SEPARATOR>	– Used to delimit commands in command strings. Can be omitted if unambiguous.
<;> <,><CR>	– Command separators.
<LF> <ETX> <ETB> <EOI>	– Command string delimiters/terminators. Note that <EOI> must only be sent with the last character.
<SPACE>	– Ignored by the system – used for intelligibility only.

The example which follows shows the format of a command string where the data items are separated by commas, the commands are delimited by semicolons and the string is terminated by EOI:-

PO40,3 ; PO41,5 ; <EOI> – POke 3 and 5 to memory locations 40 and 41 respectively.

Notes...

(1) Certain commands cause the instrument to output more data than it can store in its output buffer, e.g. SV and RD39, see 'Non-keyboard commands' below. The result is that the data is held off from entering the buffer and hence the instrument stops.

To prevent locking up the instrument, a 2 second timeout takes effect. If data output has not been started, or is read out slower than 1 character per 2 seconds, then a buffer overflow error is raised and the instrument aborts the command.

(2) The input buffer length is 128 characters. If the buffer overflows, then the GPIB is held off until further space is available. If however, the buffer does not contain a command delimiter then the data is lost and an error is raised. This is because command interpretation, and hence buffer unloading, does not occur until a command string delimiter is received.

(3) If a syntax error is detected, then that command and all subsequent commands up to the next command separator are aborted and an error is raised.

(4) When Device Clear is used, it is recommended that a 0.5 s wait period follows while re-initialization of the instrument occurs. This avoids corruption or loss of GPIB commands.

Data output format

Every request for data will cause a response from the instrument. The form of the response will be that outlined below. Note that if no data is available the default response is NULL. Each reading will have its own terminator sequence but the <EOI> terminator is only sent once the output buffer is empty.

The format takes the form of <HEADER> <DATA FIELD> <TYPE FIELD> <TERMINATOR>

<HEADER> – Data is only sent in this field if a description is necessary, e.g. WHOLE PAGE.

<DATA FIELD> – This field contains the reading, it may be a numerical or alpha string. There is no fixed format except that numerical data will conform to NR1 or NR2 data types (i.e. non-integer).

<TYPE FIELD> – Data is only sent in this field if the data in the data field requires qualifying e.g. MHz, dBm, etc.

<TERMINATOR> – All readings are terminated with <CR> <LF>. This enables minimum interaction between a controller and a printer. Note that <ETX> <EOI> is sent when the output buffer is empty and ETX is selected.

Keyboard-equivalent commands

Below are listed the GPIB commands that perform the functions of the keys named alongside. Note however, that for the numeric, minus sign and decimal point keys, the normal ASCII equivalents are used. The commands are summarized in Fig. 3-14.

Command	Key	Function
TX	TX	Transmitter mode
RX	RX	Receiver mode
DX	DX	Duplex mode
TN	TONES	Tones mode
BC	BAR CHART	Bar chart
SC	SCOPE	Oscilloscope (if requested in duplex then the lower half of the screen is cleared and the bar charts are disabled)
HDn	HOLD DISPLAY	Hold display [off,on : n=0,1]
HP	HELP	Help
AG	AF GEN	AF generator
RT	RX=TX FREQ	Set RX to TX frequency
RG	RF GEN	RF generator
SM	SET MOD	Set modulation
MDn	MOD ON/OFF	Modulation switch [off, on : n=0,1]
SNn	SINAD S/N DIST'N	Off, default (SINAD or S/N), non-default (SINAD or S/N), distortion [n=0,1,2,3]
AC	AC/DC	AC coupling
DC	AC/DC	DC coupling

Command	Key	Function
FR	FREQ	Frequency
LV	LEVEL	Level
DI	△ INCR	Increment/decrement
STnn	STORE	Store settings [nn=01 to 38]
RCnn	RECALL	Recall settings [nn=00 to 38]
MZ	MHz/V	Megahertz
KZ	kHz/mV	Kilohertz
HZ	Hz/μV	Hertz
VL	MHz/V	Volts
MV	kHz/mV	Millivolts
UV	Hz/μV	Microvolts
DB	dB	Decibels
DM	dBm	Decibels relative to 1 mW
FM	FM	Frequency modulation
AM	AM%	Amplitude modulation
PM	øM RAD	Phase modulation
FIn	BAND PASS	BP filter [300 Hz–3.4 kHz : n=0]
FIn	LOW PASS	LP filter [15/50 kHz, 300 Hz : n=1,2]
FU	FREQ ↑	Frequency increment
FD	FREQ ↓	Frequency decrement
LU	LEVEL ↑	Level increment
LD	LEVEL ↓	Level decrement
SW	SINGLE	Scope single sweep and arm
RP	REP	Scope repetitive sweep
VD		Scope vertical scale increment
VU		Scope vertical scale decrement
TD		Scope horizontal timebase increment
TU		Scope horizontal timebase decrement
IPn	SELECT	Input socket select [BNC, N-type, one port duplex: n=0,1,2]
XA	TX	Soft key A
XB	RX	Soft key B
XC	DX	Soft key C
XD	TONES	Soft key D
XE	BAR CHART	Soft key E
XF	SCOPE	Soft key F
XG	HOLD	Soft key G

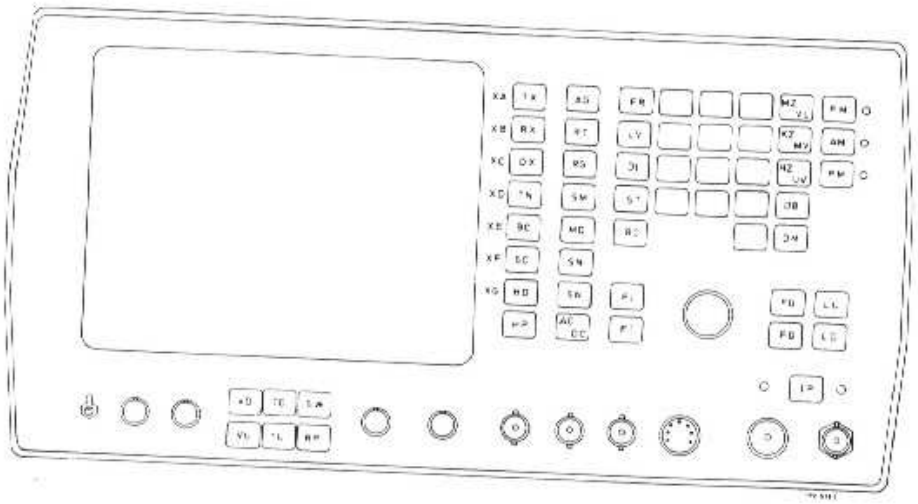


Fig. 3-14 Keyboard equivalent commands used in GPIB operation.

Non-keyboard commands

Below are listed the GPIB commands that provide functions additional to those for the keyboard.

SETTINGS

Command	Function
PD	Set instrument into potential difference mode.
EM	Set instrument into e.m.f. mode.
EV	Enable VARIABLE control
DV	Disable VARIABLE control
SE	Store/poke enable.
SD	Store/poke disable.
SQn	Service request [inhibit, error only, enable: n=0,1,2]
UC	Upper case only in terminator strings, e.g. DBM.
LC	Mixed case terminator strings, e.g. dBm.
WRc,r, <CSD>	Write data following command until a recognized delimiter is seen, e.g. EOI, ETX, <LF>. Start location on screen is c = column, r = row. Note that <CR> has the effect of <CR><LF>. Details on the use of this command are found under 'WR (WRite) command' later on in this chapter.

The ASCII values of screen characters are:–

ASCII (decimal)	Function
0,1	Graphics characters
2	Reverse field '0'
*3	EXT <CSD>
4-9	Reverse field '1' to '6'
*10	Linefeed
11,12	Reverse field '8' and '9'
*13	Carriage return
14-18	Graphics characters

ASCII (decimal)	Function
19	Reverse field '7'
20	'$'
21	'#'
22	Bell character
23	Graphics character (unused)
24	'?'
25	'@'
26	Copyright symbol
27	Graphics character (unused)
28	'('
29	'['
30	']'
31	Reverse field space
*32	Space
33	's'
34	'z'
35	Underline
36	'μ'
*37	'%'
38	'Ω'
39	'm'
40	'd'
41	'k'
42	'ø'
*43	'+'
*44	','
*45	'–'
*46	'.'
*47	'/'
*48-57	'0' to '9'
*58	':'
59	Reverse field top
60	Graphics character (unused)
61-64	Box characters
*65-90	'A' to 'Z'
91,92	Box characters
93	')'
94,95	Box characters
96	Pointer character
97-122	Reverse field 'A' to 'Z'
123-125	Graticule characters
126	Down arrow
127	Up arrow
128	Graphics character (unused)
129-191	Scope graticule characters
192	Flashing graphics character
193-218	Flashing 'A' to 'Z'
219-223	Flashing graphics characters
224-255	Dim bar chart characters

*Denotes standard ASCII characters.

Command	Function
DS	Disable screen output
ES	Enable screen output
CS	Clear screen
RS	Restore screen

Details on the use of these commands are given under 'Screen commands' later on in this chapter.

PG	Purges output buffer. Clears data available flag but SRQ remains raised.
POm,n	Pokes data n into location m. Note that this command includes a 10 ms delay for EEPROMs. Data cannot be poked to the display since it is not memory mapped (use the WR command).
DUm,n, n	As for PO but continues storing bytes until a terminator is received or a maximum of 64 bytes. Note that this command includes a 10 ms delay for EEPROMs.
TF	Tells instrument to record sequential tone frequencies.
TE	Tells instrument to record sequential tone numbers and errors.
LF	This causes the instrument to send <EOI> with <LF>. This is the default condition and will suit most controllers. However, care should be taken when there are multiple readings in the output buffer as data could be lost.
EX	This causes the instrument to send <EOI><ETX> when the output buffer is empty. <LF> is sent embedded between readings.
ET	Enable r.f. directional power head if fitted.
DT	Disable r.f. directional power head.
PR	Select peak envelope power for r.f. directional power head.
CR	Select CW power for r.f. directional power head.
SP	Suppress GPIB annunciators (cleared by RS).
BXn,m	Put up soft key boxes (used to arrow the mode keys). Where n = box pattern, m= length of box. Details on the use of this command are found under 'BX (BoX) command' later on in this chapter.
BP	Beep, sound a tone in the loudspeaker. Note that the loudness is determined by the VOLUME control setting.

READINGS

SV	When next addressed to talk, will send a data string which, when sent back to the instrument, will restore current settings see note (1) under 'Command format'.
PEm	When addressed to talk, will send data at location m. Note that variable areas only can be accessed.
RDn	When addressed to talk, will send reading or setting specified in n as follows:-

1	RF counter frequency	Reading
2	RF power	Reading
3	Modulation frequency	Reading
4	Modulation level	Reading
5	AF counter frequency	Reading
6	AF level	Reading
7	RX distortion; SINAD; S/N	Reading
8	TX distortion	Reading
9	Modulation peak; +ve deviation	Reading
10	Modulation trough; −ve deviation	Reading
11	RF forward power	Reading
12	RF reflected power	Reading

13	VSWR; return loss	Reading
14	Sequential tone 1	Reading
15	Sequential tone 2	Reading
16	Sequential tone 3	Reading
17	Sequential tone 4	Reading
18	Sequential tone 5	Reading
19	Sequential tone 6	Reading
20	Sequential tone 7	Reading
21	Sequential tone 8	Reading
22	Sequential tone 9	Reading
23	Sequential tone 10	Reading
24	Sequential tone 11	Reading
25	Sequential tone 12	Reading
26	Sequential tone standard	Setting
27	RF generator frequency	Setting
28	RF generator level	Setting
29	AF generator frequency	Setting
30	AF generator level	Setting
31	Modulation frequency	Setting
32	Modulation level	Setting
33	RF frequency increment	Setting
34	RF level increment	Setting
35	AF frequency increment	Setting
36	AF level increment	Setting
37	Mod frequency increment	Setting
38	Mod level increment	Setting
39	Whole page readings and settings (RX,TX and DX only)–see Note (1) under 'Command format' above).	

ER — When next addressed to talk, will send the code for the last error detected.

VN — When next addressed to talk, will send the software version number.

SK — When next addressed to talk, will send an ASCII character corresponding to the last key pressed. The ASCII characters corresponding to the keys are shown in Fig. 3-15.

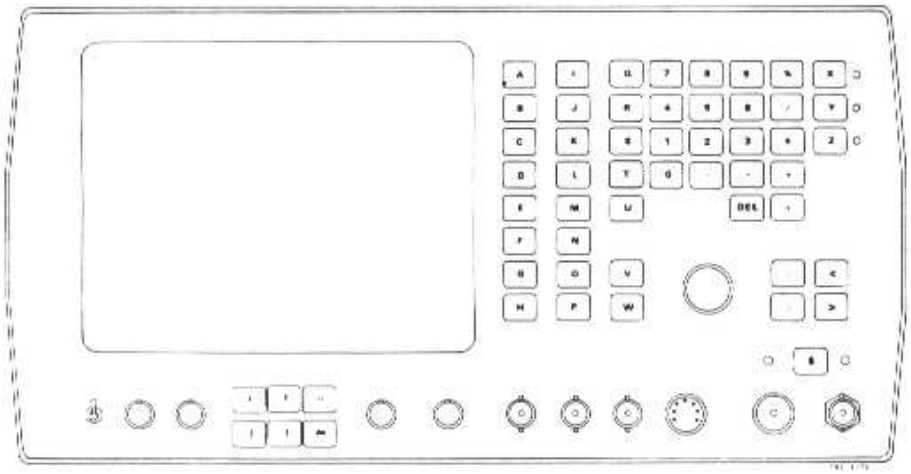


Fig. 3-15

ASCII characters sent (corresponding to last key pressed) when SK command is used in GPIB operation.

Operating example

Set the signal generator to 123.5 MHz (with increment/decrement step set to 100 kHz) at a level of −30 dBm modulated by 1.0 kHz a.m. at 50%, preparatory to measuring signal to noise ratio. The following string is sent after addressing the instrument as a listener:–

RX;RG;FR123.5MZ;DI100KZ;LV–30DM;SM;FR1KZ;LV50AM;MD1;AC;SN2<LF>

This breaks down as follows:–

RX	Receiver test
RG	RF generator
FR123.5MZ	Frequency 123.5 MHz
DI100KZ	Delta increment 100 kHz
LV–30DM	Level −30 dBm
SM	Set modulation
FR1KZ	Frequency 1 kHz
LV50AM	Level 50% a.m.
MD1	Modulation on
AC	AC coupled
SN2	Signal/noise

When ready, the level and distortion results can be selected for reading by sending the following:–

RD6<LF>RD7<LF>

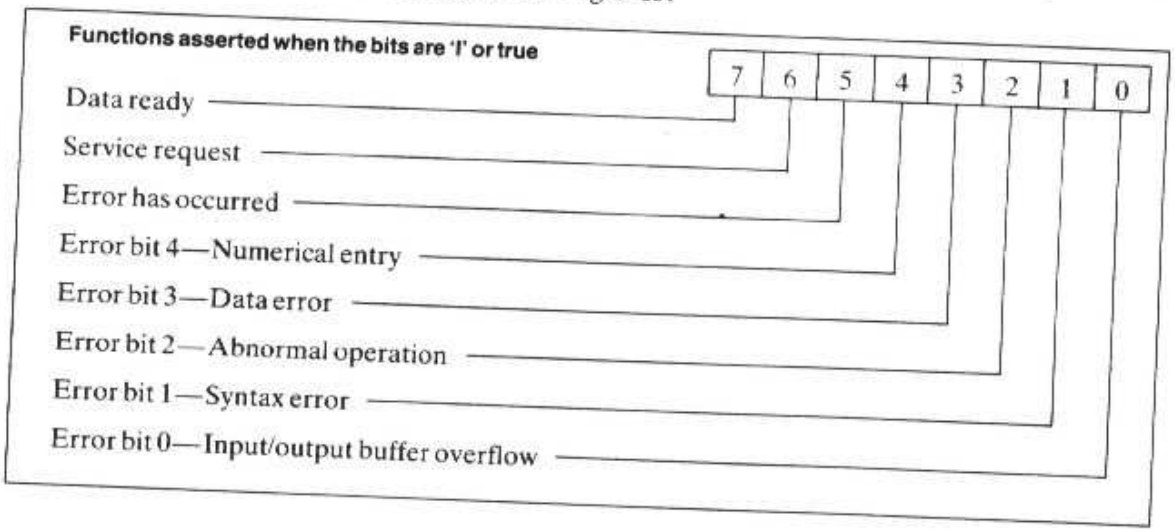
Then the instrument is addressed as a talker to receive the result.

Trigger

The bus trigger system can be used to start the transmission of a tone burst whilst the instrument is in the RX mode. However, the tone sequence must have been previously set up. Typical trigger commands include Selective Device Trigger (SDT) and Group Execute Trigger (GET).

Service requests (SRQ) and status byte

When enabled, the 2955 can request service to indicate to the controller that data is ready or to warn of an error condition. In response to a serial poll after asserting SRQ, the 2955 provides a status byte whose bits are allocated as shown in Fig. 3-15.



Notes...

(1) DATA READY and ERROR bits are cleared after the next time the instrument is addressed to talk.

(2) The SERVICE REQUEST bit is cleared after a serial poll.

CREATING A DISPLAY

The addition of the GPIB unit enables a display to be created to your own requirements. To make this as easy as possible, the instrument is programmed with a number of specialized screen commands as well as having a comprehensive character set stored in memory.

Screen commands

The operations involved in creating a display are: firstly to clear the current display; secondly to show the user-configured display with the selected measurements appearing when and where required; thirdly to return to measurement mode. The following commands are used for these purposes:–

CS—Clear Screen: This clears the screen but allows measurement results to be displayed.

DS—Disable Screen output: Stops measurements from being displayed on the screen.

ES—Enable Screen output: Enables measurement results to be written on the screen.

HD—Hold Display: Used to halt instrument operation.

RS—Restore Screen: Returns display to measurement mode.

The above commands may be used to operate the instrument in two modes: one in which the instrument is halted; and one in which the instrument is still running.

Instrument halted example:

COMMANDS	COMMENTS
"HD1CS" "WR——" "BX——" "SK——" ↓ "RS"	(1) Keyboard GPIB commands are ignored. (2) Readings held are those at time of "HD".

Instrument running example:

COMMANDS	COMMENTS
"CSDS" "ES,WR——"<LF>"DS" "ES,BX——DS" ↓ "RS"	(1) Keyboard GPIB commands are responded to. (2) New readings are valid and readable.

Printing on the screen

To print on the screen the BX and WR commands are used.

BX (BoX) command

This command is used to position and define the boxes (arrows) on the screen pointing to the mode keys. The command has the form BX n,m where n = box pattern and m = length of box. A display example is shown in Fig. 3-16.

Box pattern (n): The boxes appear in fixed positions on the screen against the 8 mode keys. These positions are binary coded—1 for a box, 0 for no box—and are binary weighted from top to bottom. For example, for boxes to appear next to the DUPLEX, BAR CHART and HOLD DISPLAY keys then n = binary 01010100, which (reading conventionally from right to left) = 84.

Length of box (m): This is the number of characters in the box to a maximum of 31. To produce the box to take 'PRESS WHEN READY' then m = 16 (spaces included). If boxes of different lengths are required, sequential BX commands must be sent.

Note...

The rightmost two squares are used for the point of the arrow and are not available for characters. Thus a box of length 6 to contain, e.g. RETURN will have an apparent length of 8.

To print a box of length 10 as shown in Fig. 3-16 but against the SCOPE key, the command string would be:–

"BX32,10"

To clear the screen prior to the boxes being printed, add 64 to m. For the example above m = 10 + 64 = 74.

Since CONTINUE and RETURN are commonly used for menu displays, the facility exists to call these labels up by simply adding fixed values to m. Note that the position of each arrow is fixed, i.e. CONTINUE against the SCOPE key, and RETURN against the HOLD DISPLAY key.

CONTINUE: To call up the CONTINUE label, add 32 to m. But ensure that there is sufficient room for the word in the box, i.e. m must be at least 32 + 8 = 40 otherwise CONTINUE will not be printed. Thus to display CONTINUE in a box of length 6 against the BAR CHART key, the command string would be "BX16,40".

RETURN: To call up the RETURN label against the HOLD DISPLAY key, add 128 to m. Ensure that m is at least 128 + 6 = 134 otherwise RETURN will not be printed. Fig. 16 shows an example of the use of this facility.

To print inside a box, other than for CONTINUE and RETURN which appear at fixed positions, use the WR command.

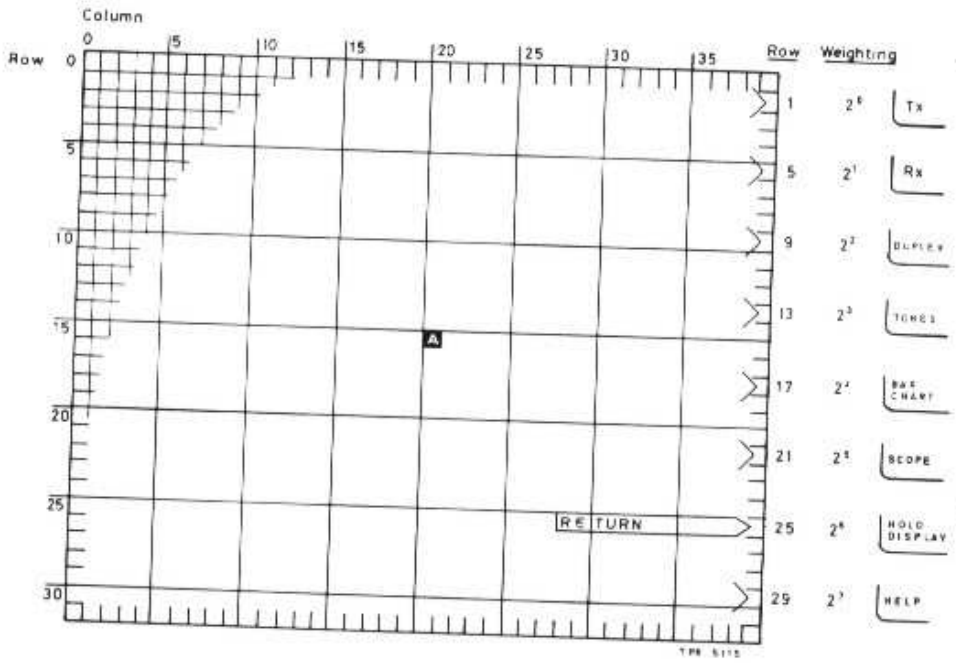


Fig. 3-16 Screen addressing example. Sending "WR20,15,a" will print the reverse field A positioned at the centre of the 40 x 32 display area. The arrowheads show the assigned positions of boxes. Sending BX64,138 will print RETURN as shown in a box of length 10 opposite the HOLD DISPLAY key.

WR (WRite) command

This command is used to write the data following the command until a delimiter is seen. The start location is c = column and r = row. For example, to print a reverse field A at the centre of the screen at column 20, row 15 as shown in Fig. 3-16 use:–

"WR20,15,";CHR$(97) or "WR20,15a"

Note that anything immediately following WRc,r is treated as a literal. Thus for multiple WR statements, end each one with <LF> or other terminator, e.g.

"WR20,15,a":CHR$(10)"WR20,16,b":CHR$(10) *not* "WR20,15,a,WR,20,16,b";CHR$(10)

The command is also used to print a label inside a box produced using the BX command. Refer to Fig. 3-16 to find the column (variable) and the row (fixed). For example, to print RETURN as shown in Fig. 3-16 but against the SCOPE key the command string would be:–

"WR28,21RETURN"

or inside a box:–

"BX32,10WR28,21RETURN"

Character set

The complete set of characters for the instrument is shown in Fig. 3-17. These characters may be used with the WR command to print onto the screen. Note that with the principal exception of the alphanumerics—A to Z, 0 to 9—the characters are not standard ASCII. Because of this, when a lower case letter is sent (in standard ASCII) from the controller it is interpreted by the 2955 as a reverse field upper case letter.

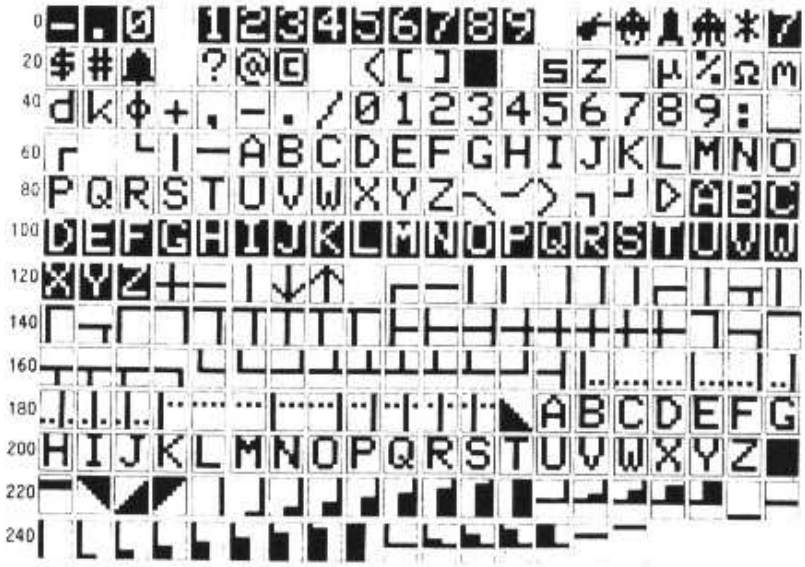


Fig. 3-17 Character set for 2955. Characters are written on the screen using the WR command. The characters shown blank are either unallocated or are machine functions, e.g. 32 is space. Note that character 10—reverse field 7—is not available. Use character 19 instead.

Reverse field characters

Many of the reverse field characters, by their structure, have an open top. For characters which have a bar at the top e.g. E,F,T this is particularly noticeable. A more pleasing appearance may be given to such a character by printing a reverse field top character (ASCII 59) directly above it. For example the reverse field E sent by:-

"WR10,15e"

is improved by adding:-

"WR20,14";CHR$(59)

Worksheet

Fig. 3-18 is provided as a worksheet for defining the screen addresses and plotting the screen layout.

Graticule characters

Some caution is required in the use of characters 128 to 191 since these are used to form the oscilloscope graticule. When the instrument recognizes a graticule character it also switches on the oscilloscope trace for the duration of that character. This may cause strange affects when these characters are used to form a user-defined display. Because of the method of triggering, no trace will be observed as long as these characters are not used in a vertical sequence (the screen is scanned from top to bottom). This means that, for instance, horizontal lines of these characters may be drawn as long as they are staggered i.e. chequerboard or alternate lines.

To detect the presence, or otherwise, of the trace in a user-defined display, check for any movement in the display while adjusting the oscilloscope POSITION controls.

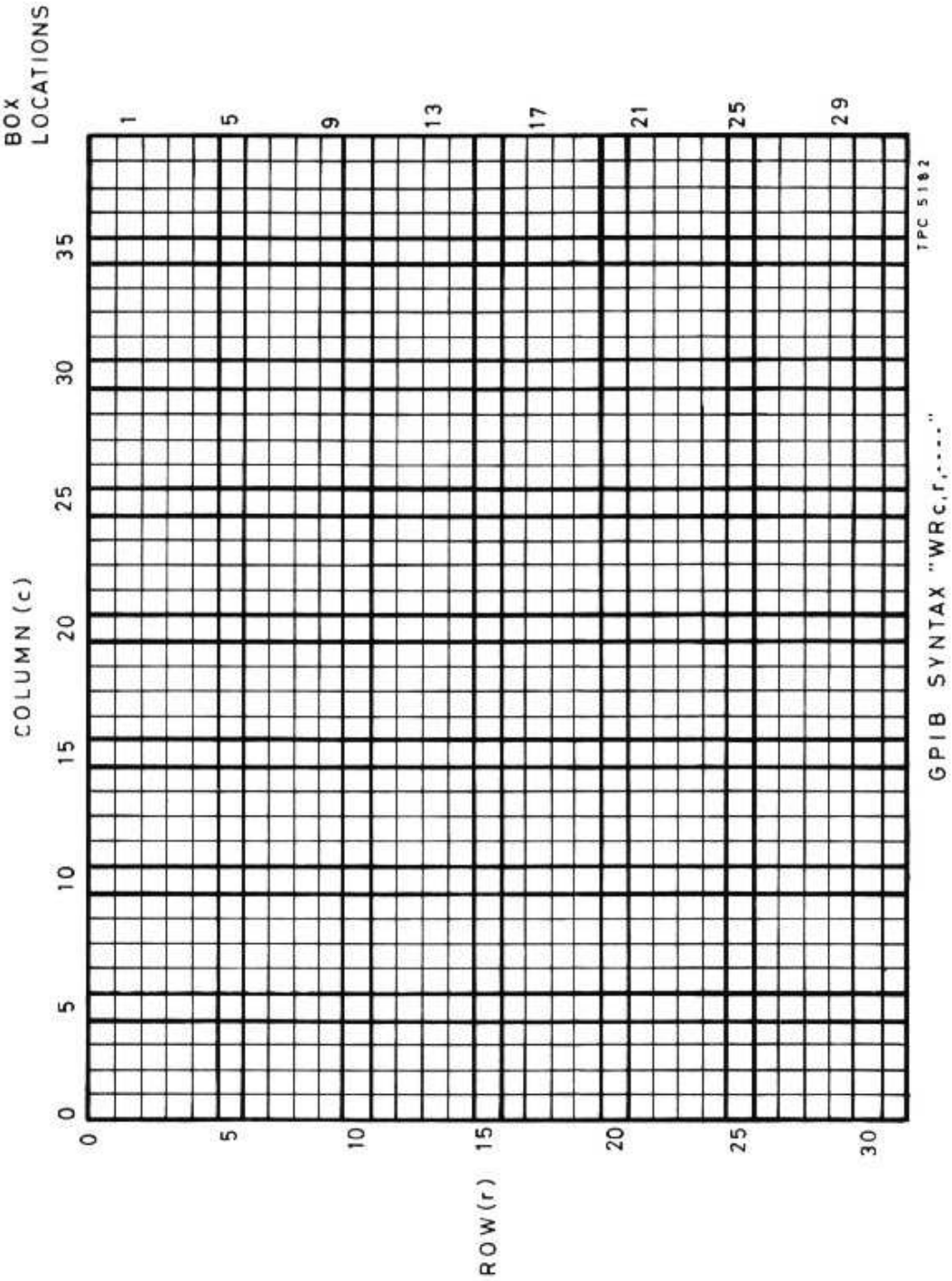
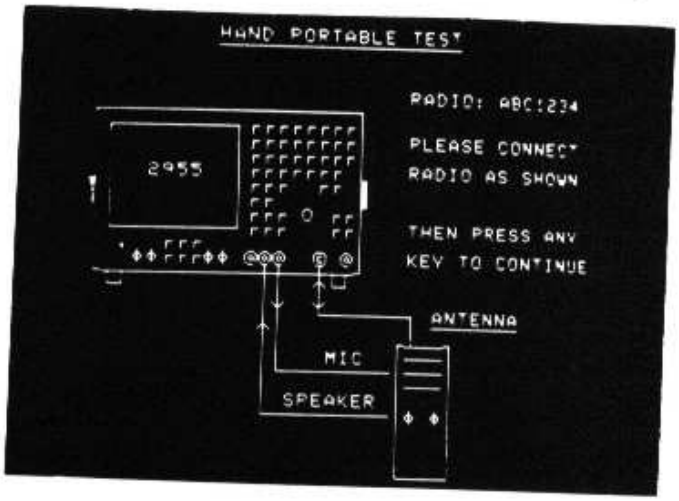


Fig. 3-18 Screen address worksheet

Display example

A typical application of a user-created display is shown in Fig. 3-19, which features an interconnection diagram. The accompanying program was written using an HP 9816 Personal Computer.




```
!000 Start:          DIM A$[!00]
!010                 Addr=706
!020                 REMOTE Addr
!030                 RESTORE Radio
!040                 GOSUB Displaypage
!050                 STOP
!060 Radio:          DATA 11,0,HAND PORTABLE TEST
!070                 DATA 11,1,####################
!080                 DATA 0,4,"                                  RADIO: ABC!234"
!090                 DATA 0,5,"  <@@@@@@@@@@@@@@@@@@@@^"
!100                 DATA 0,6,"  ?<@@@@@@@@^<<<<<<<<?"
!110                 DATA 0,7,"  ??          ?<<<<<<<<?   PLEASE CONNECT"
!120                 DATA 0,8,"  ??          ?<<<<<<<<?"
!130                 DATA 0,9,"  ??  2955    ?<<<<<<< ?   RADIO AS SHOWN"
!140                 DATA 0,10,"  ¦?          ?<<<   << O"
!150                 DATA 0,11,"  ¦?          ?<<        O"
!160                 DATA 0,12,"  ??          ?<<< O <<?"
!170                 DATA 0,13,"  ?>@@@@@@@@_<<<    <<?   THEN PRESS ANY"
!180                 DATA 0,14,"  ?    <<<             ?"
!190                 DATA 0,15,"  ?  **<<<**     ?   KEY TO CONTINUE"
!200                 DATA 0,16,"  >  !!!!!!!!!!<<!!<  _"
!210                 DATA 0,17,"  >_           }}  >_"
!220                 DATA 0,18,"                 }"  "
!230                 DATA 0,19,"                 }}  >@@@@@@" ANTENNA"
!240                 DATA 0,20,"                 }          } #######"
!250                 DATA 0,21,"                 }}         <!!!"
!260                 DATA 0,22,"                 }}   MIC  ?@@@?"
!270                 DATA 0,23,"                 }>@@@@@@@@?@@@?"
!280                 DATA 0,24,"                 }          ?@@@?"
!290                 DATA 0,25,"                 } SPEAKER ?   ?"
!300                 DATA 0,26,"                 >@@@@@@@@@?* *?"
!310                 DATA 0,27,"                            ?   ?"
!320                 DATA 0,28,"                            ?   ?"
!330                 DATA 0,29,"                            ?   ?"
!340                 DATA 0,30,"                            >@@@_"
!350                 DATA -10,0,0
!360                 !
!370                 !
!380                 !
!390 Displaypage:    OUTPUT Addr USING "K";"HD!ESC5"              ! CLEAR SCREEN
!400                 READ X,Y,A$
!410                 IF X<0 THEN RETURN                           ! PAGE COMPLETE?
!420                 OUTPUT Addr USING "K";"WR";X;",";Y;",";A$
!430                 GOTO !400
!440                 !
!450                 !
!460                 !
!470                 END
```

Fig. 3-19 Display example—Interconnections

PRINTER

General

Any listen only printer may be used with the 2955. A printer designed for use with the instrument is offered as an optional accessory (see 'Accessories', Chap. 1).

Power supplies

When operating with the 2955, the printer offered as an optional accessory uses the ACCESSORY socket for its power supply. For stand-alone operation, it requires a supply of ±12 V at 2 A peak. If any other printer is used it would normally need to have its own power supply. However, the ACCESSORY socket may be used (pin 2 supplies ±12 V at approx. 100 mA continuous), but if so the low amount of power supplied must be taken into consideration.

GPIB cable

The GPIB cable is connected between the printer and the GPIB interface unit fitted at the rear of the 2955. For cables with the IEC connectors, the IEEE to IEC adapters (see 'Accessories', Chap. 1) may be used for conversion purposes.

Operation

For use as a ticket printer for printing out measurement results proceed as follows:–

(1) Make the power supply and GPIB cable connections as given earlier.

(2) Set TALK ONLY (switch 6 to 1) on the 2955 GPIB address switch. Set switches 1 and 2 respectively as follows:–

00 = Upper and lower case, <CR> suppressed
01 = Upper and lower case, <CR> not suppressed
10 = Upper case only, <CR> suppressed
11 = Upper case only, <CR> not suppressed

Note that in TALK ONLY mode, switches 3,4,5 are inoperative.

(3) Switch the 2955 off then back on to enable the instrument to read the new switch settings.

(4) Press the HOLD DISPLAY key. HOLD OFF is displayed against the SCOPE key and PRT appears against the HELP key.

(5) Press the key arrowed by PRT. This starts the printer and results in a printout of the major settings and readings shown in the top half of the display (see example in Fig. 3-20). Note that once printout has started there is no way to abort it.

(6) When using the ACCESSORY socket for power, the screen may be affected (sides drawn in) due to power drain, especially when printing rows of dots. This is unimportant and will not affect measurement results since these are already frozen.

Fig. 3-20 Transmitter test printout example.

For additional printing information, refer to the appropriate printer instruction manual.