HP 3235 Switch/Test Unit

HP 3235
Quick Reference Guide

Loveland Instrument Division
P.O. Box 301, Loveland, Colorado 80539

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Module Addressing

Before sending a plug-in module command, you must specify an address to designate which module will receive the command and, if applicable, which relay or channel will respond to the command. The address is of the form *esnn,* where *e* is the mainframe or extender number (0 = mainframe, 1 - 7 = extenders), *s* is the slot number (0 - 9), and *nn* is the relay or channel number.

Commands That Address a Slot (es00)

Commands such as **CTYPE** and **CRESET** apply to a module as a whole and do not reference a particular relay or channel. Commands of this type contain a *slot#* or *slot_list* parameter in their syntax statement. When using this type of command, you specify only the *e* and *s* digits and set the *nn* digits to 00. For commands using a *slot#* parameter you can specify only one slot per command. For example, to direct the **CTYPE** command to the module in mainframe slot 100, send:

```
OUTPUT 709; "CTYPE 0100"
```

For convenience, when using a slot in the mainframe, you can omit the *e* digit. For example, the following program statement also directs the **CTYPE** command to the module in mainframe slot 100:

```
OUTPUT 709; "CTYPE 100"
```

For commands using a *slot_list* parameter, you can specify a single slot (*es00*), multiple slots (*es00,es00, ...*), sequential slots (*es00-es00*), groups of sequential slots (*es00-es00, es00-es00*), or any combination of slots and groups. For example, to direct the **CRESET** command to the plug-in modules in slots 100, 300, 400, 500, and 700 of the mainframe, and slot 800 of extender 1, send:

```
OUTPUT 709; "CRESET 100,300-500,700,1800"
```

Commands That Address a Relay or Channel (esnn)

Commands such as **CLOSE** and **OPEN** apply to individual relays or channels on a plug-in module. Commands of this type contain a *relay#*, *relay_list*, *ch#*, *ch_list*, or *connector#* parameter in their syntax statement. When using one of these commands, you specify the complete four digit address (you can omit the first digit when addressing a module in the mainframe). Refer to the appropriate plug-in module manual for a particular module's relay or channel numbers.

For commands using a *relay#* or *ch#* parameter, you can specify only one relay or channel per command. For example, to query the state of channel 12 on the module in mainframe slot 200, send:

```
OUTPUT 709; "CLOSE? 212"
```

Module Addressing (cont)

For commands using a *relay_list* or *ch_list* parameter, you can specify singles (*esnn*), multiples (*esnn, esnn, ...*), sequentials (*esnn-esnn*), groups of sequentials (*esnn-esnn, esnn-esnn*), or any combination of these. For example, to close channels 2 through 5 on the module in mainframe slot 100 and channels 1 and 3 on the module in mainframe slot 200, send:

```
OUTPUT 709; "CLOSE 102-105,201,203"
```

Commands Requiring a Predefined Address

Commands that are specifically for the HP 34520 Multimeter or the HP 34522 Digital I/O Module do not specify an address in their command statements. These commands do not have any kind of *slot*, *relay*, *channel*, or *connector* parameter in their command syntax. Before sending a command to one of these modules, send the **USE** command to designate which module (*use device*) will receive commands. After designating a *use device*, all subsequent digital I/O or multimeter commands are sent to that slot. The *use device* is remembered by the mainframe and remains active until another **USE** command is executed or power is cycled.

Whenever power is applied to the mainframe, it searches its slots and the extender slots for installed multimeter modules. If it finds only one multimeter module, it designates that module as the *use device*. If it finds more than one multimeter module, it designates the one in the lowest numbered slot as the *use device*. If no multimeter module is found at power-on, the mainframe does not designate a *use device*. The power-on *use device* remains in effect until you change it by executing the **USE** command.

You can use the optional control panel to specify a different use device than that specified by the controller (over the HP-IB). If you do this, commands sent from the optional control panel go to the device that was specified from the control panel and commands sent from the controller go to the device specified by the controller. This is useful when an operator is interactively controlling one of the use devices from the control panel.

Designating a Multimeter Module

When designating a multimeter module as the *use device*, you specify the *e* and *s* digits and set the *nn* digits to 00. A multimeter module occupies two slots and is always addressed using the lowest of the two slot numbers. For example, to designate the multimeter in slots 800 and 900 of the mainframe, send:

```
OUTPUT 709; "USE 800"
```

Designating a Digital I/O Module

When designating a digital I/O module as the *use device*, you specify the *e* and *s* digits and specify one of four ports with the *nn* digits (*nn* = 00, 10, 20, or 30). For example, to select port 10 on the digital I/O module in slot 700 of the mainframe, send:

```
OUTPUT 709; "USE 710"
```

Syntax Rules

- Command keywords may be entered in upper or lower case.

- Parameters may be entered in upper case, lower case, or as a numeric variable for some commands. Numeric parameters may be in either integer, floating-point, or exponential format. Numbers in floating-point format are rounded to the nearest integer if the command requires an integer.

- Command keywords and parameters must be separated by either a space or a comma. Extra commas or spaces are ignored.

- Command parameters enclosed in square brackets (e.g., [*slot_list*]) are optional and may be omitted when executing the command. Parameters which are not enclosed in square brackets are required parameters and must be specified each time (e.g., *relay_list*).

- The carriage return (*cr*), line feed (*lf*), semicolon (;), or EOI sent concurrent with the last character indicate the end of message (command termination) to the HP 3235. The "Enter" key signals the end of a command entered from the control panel keyboard.

- To regain control of the HP-IB bus and the system controller immediately after sending a command, suppress the *cr*, *lf*, or both when sending a command. For HP Series 200/300 computers, use the following format to regain use of your controller:

```
OUTPUT 709; "TEST;";
```

  In the above program line, the first semicolon indicates the end of the command to the HP 3235 and the second semicolon suppresses the carriage return and line feed.

  When using other controllers, use a formatted I/O statement to suppress the line feed or carriage return/line feed. For example, the HP Series 80 controllers use the following format to suppress the *cr lf*:

```
OUTPUT 709 USING "#,K"; "TEST;"
```

  In the above program line, the # image specifier suppresses the *cr lf*. The K image specifier suppresses trailing or leading spaces and outputs the command in free-field format. The semicolon following the **TEST** command indicates the end of the command to the HP 3235 and must be present when you suppress the *cr lf*.

- Multiple commands separated by semicolons (;) may be used in one command statement. For example:

```
OUTPUT 709; "CLOSE 202;OPEN 202"
```

Commands by Functional Group

Mainframe Commands

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SCAN
STRIG
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Power-On/Reset States

Item	State	Item	State
ACBAND	Slow mode	LSENSE	HIGH
ARANGE	ON	NPLC	10 Power Line Cycles
AUTOTB	ON	NRDGS	AUTO
AZERO	ON	OCOMP	OFF
BEEP	ON	OFORMAT	ASCII
BLOCKOUT	ON	OUTBUF	OFF
CHCLOSED	OFF	PONSRQ	Most recent value stored in continuous memory
DELAY	Automatic		
DISP	ON		
DRIVEBPn	OFF	PULLUP	ENABLE (totem-pole)
DRIVEETBn	OFF	RANGE	AUTO
DRIVEEXT	OFF	SADV	AUTO (or SCAN)
DRIVETBn	OFF	SERIAL	ON
DSP	ON	SET CLKSRC	INT
EDGE	LH	SET COUNT	65535
END	OFF	SET OUTPUT	OFF
FIXEDZ	OFF	SET TIME	0.0
FSOURCE	ACV	SRTRIG	INT
FUNC	DCV	STRIG	AUTO (or SCAN)
HP-IB Address	Not Changed	TBUFF	OFF
HSTIME	2E-6	TERM	FRONT
HSTYPE	NONE	TIMER	1 second
INBUF	OFF	TRIG	AUTO
KEYS	OFF	VMCMPLT	OFF
LFREQ	Multimeter Switch Setting	XFERMODE	LIVE
		XFERWIDTH	Four 8-bit ports
LOCK	OFF		

Command Summary

In the following command summary, command keywords are shown in upper case print and parameter names are in italics. Optional parameters are enclosed in square brackets ([ ]). Unless otherwise noted, the default values for optional parameters are shown in bold print.

ABORT

Halts execution of any **RUN** subroutine and returns control to the system controller or control panel.

ABS (argument)

Returns the absolute value of the specified argument.

argument: Number or numeric expression.

ACAL [*type*]

Performs autocalibration (autocal) routines on the HP 34520 Multimeter in the current **USE** slot.

type: **ALL (1)**, AC (2), OHMS (3).

ACBAND [*frequency*]

Selects the slow or fast AC measurement mode for the HP 34520 Multimeter in the current **USE** slot.

frequency: < **400** = slow mode, ≥ 400 = fast mode.

ACBAND?

Returns "100" if the HP 34520 Multimeter's slow AC measurement mode (**ACBAND** command) is selected or "1E+6" if the fast AC measurement mode is selected.

ADDR?

Returns the HP-IB address of the HP 3235. Valid addresses are 0 through 30. Factory Setting = 09.

ALLOW [*combination*,] *relay_list*

or

ALLOW ALL

Allows closures of prohibited relays, channels, or bits.

combination: **ANYOF**, TWOOF, ALLOF.
relay_list: List of relay, channel, or bit numbers ("esnn").
ALL: Execute **ALLOW ALL** to cancel all prohibited closures.

argument AND *argument*

Returns a "0" or "1" based upon the logical AND of the specified arguments.

argument: Number or numeric expression.

ARANGE [*control*]

Enables or disables the autorange function on the HP 34520 Multimeter in the current **USE** slot.

control: OFF (0), **ON (1).**

ARANGE?

Returns "OFF" if the HP 34520 Multimeter's autorange function is disabled (**ARANGE OFF**) or "ON" if the autorange function is enabled (**ARANGE ON**).

ATN (*argument*)

Returns the value of the angle (in radians) which has a tangent equal to the argument.

argument: Number or numeric expression.

AUTOTB *mode*

Enables or disables automatic trigger bus connections between the mainframe and extenders.

mode: OFF, ON.

AUXERR?

Returns the weighted sum of all bits set in the HP 34520 Multimeter's auxiliary error register and clears the bits.

Decimal Value	Bit Number	Description
1	0	Isolation Error.
2	1	Slave processor self-test failure.
4	2	Isolation self-test failure.
8	3	Integrator convergence error.
16	4	Front-end zero-measurement error.
32	5	Current source, gain selection input divider failure.
64	6	Amps self-test failure.
128	7	AC amplifier's DC offset test failure.
256	8	AC flatness check.
512	9	Ohms precharge failure during autocal.
1024	10	Backplane interface check failure.
2048	11	Outguard ROM Checksum.
4096	12	Outguard reset failure.
8192	13	Trigger bus and hard-ware trigger failure.
16384	14	Calibration RAM failure.

AZERO [*control*]

Enables or disables the autozero function on the HP 34520 Multimeter in the current **USE** slot.

control: OFF (0), **ON (1)**, ONCE (2).

AZERO?

Returns "OFF" if the HP 34520 Multimeter's autozero function is disabled (**AZERO OFF/ONCE**) or "ON" if the autozero function is enabled (**AZERO ON**).

BBREAD *slot#, register#*

Returns the decimal equivalent of the specified register on the HP 34523 Breadboard Module.

slot#: Slot number ("es00").
register#: Register number between 0 and 31.

BBWRITE *slot#, register#, value*

Writes a decimal value to the specified register on the HP 34523 Breadboard Module.

slot#: Slot number ("es00").
register#: Register number between 0 and 31.
value: Two's complement integer in the range -32768 to +32767.

BEEP [*mode*]

Controls the HP 3235's beeper.

mode: OFF, ON, **ONCE**.

BINAND (*argument, argument*)

Returns the value of the bit-by-bit logical AND of the specified arguments.

argument: Number or numeric expression in the range -32768 to +32767.

BINCMP (*argument*)

Returns the binary complement of the specified argument.

argument: Number or numeric expression in the range -32768 to +32767.

BINEOR (*argument, argument*)

Returns the value of the bit-by-bit logical Exclusive-OR of the specified arguments.

argument: Number or numeric expression in the range -32768 to +32767.

BINIOR (*argument, argument*)

Returns the value of the bit-by-bit logical Inclusive-OR of the specified arguments.

argument: Number or numeric expression in the range -32768 to +32767.

BIT (*argument, bit_position*)

Returns a "0" or "1" representing the logic value of the specified bit of the argument.

argument: Number or numeric expression in the range -32768 to +32767.
bit_position: Bit position in the range 0 (lsb) to 15 (msb).

BLOCKOUT mode

Enables or disables the binary output mode.

mode: OFF, ON.

BPOUT *bus* [,*frame#*]

Designates which backplane trigger bus signal, in the specified frame, sources a signal into the switching network for that frame.

bus: A "0" specifies backplane trigger bus 0 and "1" specifies backplane trigger bus 1.
frame#: Specifies mainframe (0 = default) or extenders (1 - 7).

CAL

Service-related command for the HP 34520 Multimeter. Refer to the HP 3235 Service Manual for details.

CALEN?

Service-related command for the HP 34520 Multimeter. Refer to the HP 3235 Service Manual for details.

CALL *sub_name*

Executes the named subroutine and waits for completion before executing other commands.

sub_name: Mainframe subroutine name.

CALNUM?

Returns "-9999".

CALSTR

Service-related command for the HP 34520 Multimeter. Refer to the HP 3235 Service Manual for details.

CALSTR?

Service-related command for the HP 34520 Multimeter. Refer to the HP 3235 Service Manual for details.

CAT

Returns a catalog list of all user-defined arrays, variables, subroutines, and stored states.

CHCLOSED *port*

Specifies the source for the ***channel closed*** signal used with scanning. The specified source outputs a high-to-low pulse when the relays have closed and settled during a **MEAS, PSCAN, SCAN,** or **VERIFY** command.

port: EXT, TB0, TB1, OFF.

CLEAR EVENT *bit#*

Clears a single stored event bit on the HP 34522 Digital I/O Module in the current **USE** slot.

bit#: Event bit number in the range 0 to 7.

CLEAR EVENTERR *bit#*

Clears event error detection on a single event bit on the HP 34522 Digital I/O Module in the current **USE** slot.

bit#: Event bit number in the range 0 to 7.

CLOSE *relay_list*

Switching Modules: closes the specified relays or channels.
HP 34522 Digital I/O: clears the specified bits (logic "0").

relay_list: List of relay, channel, or bit numbers ("esnn").

CLOSE? *relay#*

Switching Modules: returns the state of the specified relay or channel. 0 = Open, 1 = Closed.
HP 34522 Digital I/O: returns the state of the specified bit. 0 = Set, 1 = Cleared.

relay#: Single relay, channel, or bit number ("esnn").

CLR

Device clear.

CLROUT

Clears the data in the HP-IB output buffer.

COMPRESS *sub_name*

Removes the text of the specified subroutine from mainframe memory. This saves space in mainframe memory but eliminates the ability to list or step the subroutine.

sub_name: Mainframe subroutine name.

CONNECT [ONLY,] *connector#, connector#*

or

CONNECT [ONLY,] *ch#*, AB*n*

HP 34506 Coaxial Matrix Module: connects the specified row to the specified column.
32-Channel Multiplexer Modules: closes the required relays to make connection between the specified channel and analog bus.

ONLY: Ensures that all relays on the module are open before making the connection.
connector#: Row or column number on the Coaxial Matrix.
ch#: Single channel number ("essn").
AB*n:* Analog bus 0, 1, 2 or 3. Can also specify a backplane relay number ("es9n").

CONT

Continues execution of a paused or stepped subroutine executed with the **RUN** command.

COS (*argument*)

Returns the cosine of the angle (in radians) represented by the argument.

argument: Number or numeric expression in the range ±2.98156824429204 E+8.

CRESET *slot_list*

Places the plug-in modules in the specified slots to their reset states.

slot_list: List of slot numbers ("es00").

CTYPE *slot#*

See the **CTYPE?** Command.

CTYPE? *slot#*

Returns an abbreviated model number of the plug-in module in the specified slot. Abbreviation: **CTYPE.**

Data Returned	Description
0	No module installed in slot.
1	HP 34501 Armature Relay Mux.
2	HP 34502 Reed Relay Mux.
3	HP 34503 GP Relay Mux.
4	HP 34504 Coaxial Mux.
5	HP 34505 RF Mux.
6	HP 34506 Coaxial Matrix.
7	HP 34507 Mercury Relay Mux.
20	HP 34520 Multimeter Module.
22	HP 34522 Digital I/O Module.
48-63	HP 34523 Breadboard Module.
99	HP 34560 System Expansion Card.

slot#: Slot number ("es00").

DEFKEY *key, string*

or

DEFKEY DEFAULT

Assigns a user-defined string to the specified number, shifted letter, or shifted punctuation key for use from the control panel. All user-defined key definitions are stored in continuous memory.

key: Any control panel number key (0-9), shifted letter key (A-Z), or shifted punctuation key (?,<,>,:,etc.).
string: String to be assigned to key. Number keys may be redefined up to 80 characters and shifted letter/punctuation keys may be redefined up to 10 characters.
DEFAULT: Returns all shifted letter and punctuation keys to their original HP definition. This parameter has no effect on the number keys.

DEFKEY? *key*

Returns the contents of a user-defined key.

key: Any control panel number key (0-9), shifted letter key (A-Z), or shifted punctuation key (?,<,>,:,etc.).

DELAY [*time*]

Specifies the time interval inserted before a measurement on the HP 34520 Multimeter in the current **USE** slot.

time: 0 to 2100 seconds. Default = automatically determined by function, range, resolution, and AC bandwidth.

DELAY?

Returns the present delay time, in seconds, for the HP 34520 Multimeter in the current **USE** slot.

DELSUB *sub_name*

Deletes the specified subroutine from mainframe memory.

sub_name: Mainframe subroutine name.

DIAG

Service-related command for the HP 34520 Multimeter. Refer to the HP 3235 Service Manual for details.

DIM *array_name(max_index)*[,*array_name(max_index)*,...]

Reserves mainframe memory space to store real arrays.

array_name: Mainframe array name.
max_index: Maximum index of the array (range = 0 through 32767).

DISABLE ERROR

Disables the plug-in module in the current **USE** slot from generating an HP 3235 error state when a plug-in module error occurs.

DISABLE EVENT *bit#*

Disables event detection on a single event bit on the HP 34522 Digital I/O Module in the current **USE** slot.

bit#: Event bit number in the range 0 to 7.

DISABLE EVENTERR *bit#*

Disables event error detection on a single event bit on the HP 34522 Digital I/O Module in the current **USE** slot.

bit#: Event bit number in the range 0 to 7.

DISABLE INTR [TIMER*n*]

Disables internal (mainframe) interrupts from the plug-in module in the current **USE** slot or from the specified timer channel.

TIMER*n:* Specifies timer channel 0 (TIMER0) or timer channel 1 (TIMER1).

DISABLE INTR SYS

Disables interrupts from the plug-in modules.

DISCONN *connector#, connector#*

or

DISCONN *ch#* ,AB*n*

HP 34506 Coaxial Matrix Module: disconnects the specified row from the specified column.
32-Channel Multiplexer Modules: opens all relays required to disconnect the specified channel from the analog bus.

connector#: Row or column number on the Coaxial Matrix.
ch#: Single channel number ("esnn").
AB*n:* Analog bus 0, 1, 2 or 3. Can also specify a backplane relay number ("es9n").

DISP *mode*

or

DISP [MSG,] [*message*]

Enables or disables the control panel display. This command can also display a string, the contents of a variable, a number, or a numeric expression. Abbreviation: **DSP.**

mode: ON, OFF.
MSG: Indicates to the HP 3235 that a message is to be displayed.
message: Quoted string of characters to be displayed.

DISP?

Returns a quoted string containing the contents of the control panel display. Abbreviation: **DSP?.**

numerator DIV *denominator*

Returns the integer portion of a division.

numerator: Number or numeric expression.
denominator: Number or numeric expression NOT equal to zero.

DRIVEBP*n source* [,*frame#*]

Selects the source to drive the trigger bus in the specified mainframe or extender with **AUTOTB OFF.**

n: Specifies trigger bus 0 or trigger bus 1.
source: OFF, ETB0, ETB1, EXTIN, TIMER0, TIMER1, LOW, HIGH.
frame#: Specifies the mainframe (0 = default) or an extender (1 - 7).

DRIVEETB*n source* [,*frame#*]

Specifies the frame and source in that frame to drive the extender trigger bus between frames with **AUTOTB OFF.**

n: Specifies trigger bus 0 or trigger bus 1.
source: OFF, BP, ETB0, ETB1, EXTIN, TIMER0, TIMER1, LOW, HIGH.
frame#: Specifies the mainframe (0 = default) or an extender (1 - 7).

DRIVEEXT *source*

Selects the source to drive the External Trigger Out BNC connector on the mainframe.

source: OFF, TB0, TB1, EXTIN, TIMER0, TIMER1, LOW, HIGH.

DRIVETB*n source*

Selects the source (other than a plug-in module) to drive the specified trigger bus in all frames from the mainframe with **AUTOTB ON.**

n: Specifies trigger bus 0 or trigger bus 1.
source: OFF, EXTIN, TIMER0, TIMER1, LOW, HIGH, TRG.

DSP *mode*

or

DSP [MSG,] [*message*]

See the **DISP** Command.

DSP?

See the **DISP?** Command.

DTEST [*slot_list*]

Performs a "data test" on the plug-in modules in the specified slots. Abbreviation: **DTST.**

slot_list: List of slot numbers ("es00"). Default = all slots.

DTST [*slot_list*]

See the **DTEST** Command.

ECHO *string*

Tests communication between the HP 3235 and the system controller.

string: Quoted string of characters.

EDGE *bit#, transition*

Specifies which edge (rising or falling) is detected for event interrupts on the HP 34522 Digital I/O Module in the current **USE** slot.

bit#: Event bit number in the range 0 to 7.
transition: LH (rising edge), HL (falling edge).

ENABLE ERROR

Enables the plug-in module in the current **USE** slot to generate an HP 3235 error state.

ENABLE EVENT *bit#*

Enables a single event bit for event detection on the HP 34522 Digital I/O Module in the current **USE** slot.

bit#: Event bit number in the range 0 to 7.

ENABLE EVENTERR *bit#*

Enables event error detection on a single event bit on the HP 34522 Digital I/O Module in the current **USE** slot.

bit#: Event bit number in the range 0 to 7.

ENABLE INTR [TIMER*n*]

Enables internal (mainframe) interrupts from the plug-in module in the current **USE** slot or from the specified timer channel.

TIMER*n*: Specifies timer channel 0 (TIMER0) or timer channel 1 (TIMER1).

ENABLE INTR SYS

Enables the HP 3235 to acknowledge interrupts from the plug-in modules.

END *control*

Enables or disables the HP-IB ***End or Identify*** (EOI) function.

control: OFF, ON, ALWAYS.

END IF

Last statement of an **IF...THEN** loop.

END WHILE

Last statement of a **WHILE** loop.

ERR?

Returns the error code of the most recent error, deletes that error code from the error register, and clears the error bit in the status register when all errors are read.

ERRSTR?

Returns the error code and string of the most recent error, deletes that error from the error register, and clears the error bit in the status register when all errors are read.

argument EXOR *argument*

Returns a "0" or "1" based upon the logical Exclusive-OR of the specified arguments.

argument: Number or numeric expression.

EXP (*argument*)

Raises base *e* (2.718281828) to the power of the argument.

argument: Number or numeric expression.

EXTEND?

Returns seven integers indicating the frame addresses of any extenders connected to the mainframe. Each of the seven integers is either a "0" or a specific extender number (1 - 7).

FETCH *variable* *expression* *string*

Returns the value of the specified variables, expressions, or displays a quoted string.

variable: Mainframe variable name.
expression: Number or numeric expression (enclosed in parentheses).
string: Quoted ASCII string to be displayed on control panel.

FILL *array_name, list*

Places the specified values into a previously dimensioned mainframe array.

array_name: Mainframe array name.
list: Any list of numbers, channels, relays, slots, etc.

FILLBIN *array_name, block_data*

Places the specified binary values into a previously dimensioned mainframe array.

array_name: Mainframe array name.
block_data: A block in IEEE-728 Block A format.

FIXEDZ [*control*]

Enables or disables the fixed input resistance function for DC voltage measurements on the HP 34520 Multimeter in the current **USE** slot.

control: OFF (0), **ON (1).**

FIXEDZ?

Returns "OFF" if the HP 34520 Multimeter's fixed resistance function is disabled (**FIXEDZ OFF**) or "ON" if the fixed resistance function is enabled (**FIXEDZ ON**).

FIXTURE?

Returns the status of the mainframe quick interconnect fixture. 0 = Open, 1 = Closed.

FOR *counter* = *initial_value* TO *final_value* [STEP *step_size*]
program segment
NEXT *counter*

Defines a loop which is repeated until a loop counter passes a specified value within an HP 3235 subroutine.

counter: Variable name which acts as the loop counter.
initial_value: Number or numeric expression which is the beginning value of the loop counter.
final_value: Number or numeric expression which is the ending value of the loop counter.
step_size: Number or numeric expression which specifies the amount the loop counter is incremented for each pass through the loop. Negative values decrement the loop counter.

FSOURCE [*source*]

Configures the HP 34520 Multimeter to accept either AC voltage, AC+DC voltage, AC current, or AC+DC current as the input signal for frequency or period measurements.

source: **ACV (2),** ACDCV (3), ACI (7), ACDCI (8).

FSOURCE?

Returns a string representing the present frequency source on the HP 34520 Multimeter in the current **USE** slot (see **FSOURCE**).

FTEST [*slot_list*]

Performs a fixtured self-test on a group of plug-in modules or the entire HP 3235 system. Abbreviation: **FTST.**

slot_list: List of slot numbers ("es00"). Default = all slots.

FTEST SYS [*test*]

Performs a fixtured self-test of the system. Abbreviation: **FTST SYS.**

test: **0**, 1

FTST [*slot_list*]

See the **FTEST** Command.

FTST SYS [*test*]

See the **FTEST SYS** Command.

FUNC [*function* [,*max_input* [,*%_resolution*]]]

Selects measurement type (AC volts, DC current, etc.), range, and resolution for the HP 34520 Multimeter in the current **USE** slot.

function: **DCV** (1), ACV (2), ACDCV (3), OHM (4), OHMF (5), DCI (6), ACI (7), ACDCI (8), FREQ (9), PER (10).
max_input:
For Voltage: **AUTO** or 0 - 300.
For AC Current: **AUTO** or 0 - 1.
For DC Current: **AUTO** or 0 - 1.5.
For Ohms: **AUTO** or 0 - 3E9.
%_resolution: percentage of ***max_input*** (default set by the **NPLC** command).

FUNC?

Returns a string representing the present function of the HP 34520 Multimeter in the current **USE** slot (see **FUNC**).

HELP [HELP] [TOPIC] [*topic*] [*command*] [*parameter*]

Help Function.

HELP: Responds with: "HELP is available for the following topics: SWITCHING, DMM, DIGIO, SYSTEM, HPIB, SUBS, and MATH".
TOPIC: Same response as **HELP HELP.**
topic: Lists all commands related to a specific topic.
command: Type **HELP** ***command*** for help on a specific command.
parameter: Type **HELP** ***parameter*** for help on a specific parameter.

HSDONE?

Returns a number indicating the status of the present HP 34522 Digital I/O output handshake type. 0 = handshake in progress, 1 = handshake complete.

HSTIME *seconds*

Sets the handshake delay time for the HP 34522 Digital I/O Module in the current **USE** slot.

seconds: Handshake time in the range 2E-6 to 15E-3 seconds.

HSTYPE *mode*

Selects the handshake type used for data transfers on the HP 34522 Digital I/O Module in the current **USE** slot.

mode: NONE, FULL1, FULL2, FULL3, PARTIAL, STROBE.

ID? [*slot#*]

Returns "HP3235" or the plug-in module number and name:

"00000 Empty Slot"
"34501 Armature Relay Multiplexer"
"34502 Reed Relay Multiplexer"
"34503 General Purpose Relay"
"34504 Switched-Shield Coaxial Multiplexer"
"34505 RF Multiplexer"
"34506 Switched-Shield Coaxial Matrix"
"34507 Mercury-Wetted Multiplexer"
"34520 Multimeter"
"34522 Digital I/O"
"34523 Breadboard"
"34560 Expansion Card"

slot#: Slot number ("es00"). Default = entire system.

IDN?

Returns the manufacturer's name (HEWLETT PACKARD), the model number (3235), the serial number (always 0), and the firmware revision date (of the form: "yyww").

IF *expression* THEN

program segment
[ELSE]
[program segment]
END IF

Provides conditional branching within an HP 3235 subroutine.

expression: Number or numeric expression.

INBUF *mode*

Enables or disables the HP 3235 input buffer.

mode: OFF, ON.

INTEGER *name* [(*max_index*)] [,*name* [(*max_index*)], ...]

Reserves mainframe memory space to store integer variables or arrays.

name: Mainframe variable or array name.
max_index: Maximum index of the array (range = 0 through 32767).

INTR?

Returns the address of the most recent slot ("es00") to interrupt and be serviced. If no interrupt has been serviced since power-on or a reset, "-1" is returned.

KEYS *mode*

Enables the HP 3235 to send messages, entered from the control panel, to the system controller.

mode: ON, OFF.

LCL

See the **LOCAL** Command.

[LET] ***variable*** **=** ***expression***

Assign values to numeric variables. The keyword **LET** is optional.

variable: Mainframe variable name.
expression: Number or numeric expression.

LFREQ **[***value***]**

Temporarily changes the HP 34520 Multimeter's A/D converter line frequency reference. When power is cycled or when the multimeter is reset, the reference frequency returns to that selected by the line frequency selector switch on the multimeter.

value: 50, 60 (Hz).

LFREQ?

Returns the value of the line reference frequency ("50" or "60" Hz) being used by the HP 34520 Multimeter's A/D converter.

LGT ***(argument)***

Returns the logarithm (base 10) of the argument.

argument: Number or numeric expression greater than zero.

LIMIT ***test_value, lower_limit, upper_limit***

Tests a single value (number or variable) or an array to determine if the value is between the specified lower and upper limits.

test_value: Value to be tested against lower and upper limits.
lower_limit: Lower limit number, numeric expression, or array.
upper_limit: Upper limit number, numeric expression, or array.

LINE?

Returns the setting of the line frequency switch ("50" or "60") on the HP 34520 Multimeter in the current **USE** slot.

LIST ***sub_name***

Lists the specified subroutine to the system controller or control panel display.

sub_name: Mainframe subroutine name.

LOCAL

Returns the HP 3235 to the local mode and enables the control panel Local key. Abbreviation: **LCL.**

LOCK ***mode***

Enables or disables the HP 3235 control panel keyboard.

mode: OFF, ON.

LOG ***(argument)***

Returns the natural logarithm (base *e*) of the specified argument.

argument: Number or numeric expression greater than zero.

LSENSE ***line, sense***

Specifies the logic sense, positive or negative true, for the data lines and handshake lines (CTL and FLG) on the HP 34522 Digital I/O Module.

line: DATA, CTL, FLG.
sense: HIGH, LOW.

MEAS **[***function***,]** **[ABn,]** **[FRONT,]** **[FAST,]** ***ch_list***

Scans a channel list using the HP 34520 Multimeter in the current **USE** slot for the measurement.

function: **DCV**, ACV, ACDCV, DCI, ACI, ACDCI, OHM, OHMF, FREQ, PER.
AB*n:* Analog bus 0, 1, 2, or 3. Default = AB0.
FRONT: Use front terminals of HP 34520 Multimeter.
FAST: Closes all backplane relays required to make connection to the specified analog bus before the scan starts (useful only for HP 34502, 34507).
ch_list: List of channels ("esnn").

MEM **OFF** / ***variable*** / ***array_name*** **[** ***(start_index)*** **]**

Specifies a variable or array to store data from commands which return numeric results. This command cannot store ASCII (string) results.

OFF: Returns the memory output mode to normal operation (results go to output buffer).
variable: Mainframe variable name.
array_name: Mainframe array name.
start_index: Starting location of the array (range = 0 through 32767, Default = 0).

MEMAVAIL?

Returns the size (in bytes) of the largest volatile and continuous memory blocks available within HP 3235 memory.

numerator **MOD** ***denominator***

Returns the remainder portion of a division.

numerator: Number or numeric expression.
denominator: Number or numeric expression NOT equal to zero.

MON **HPIB** / ***ch#*** / **ALL** / **STATE,** ***slot#*** / **STATE ALL** / **OFF**

Displays (on the control panel) command keywords entered over the HP-IB, results from a scan, or the state of one or all plug-in modules.

HPIB: Displays command keywords, with parameters, as the HP 3235 receives them from the system controller and executes them.
ch#: Single channel number ("esnn").
ALL: Displays multimeter readings from each channel during a **MEAS** or **VERIFY** scanning sequence.
STATE, ***slot#:*** Displays the state of the plug-in module in the specified slot ("esnn").
STATE ALL: Displays the state of the most recent plug-in module to be modified by a command.
OFF: Disables the monitor mode.

NOT ***argument***

Returns a "0" or "1" based upon the logical complement of the specified argument.

argument: Number or numeric expression.

NPLC [*power_line_cycles*]

Designates the minimum integration time for the HP 34520 Multimeter's A/D converter.

power_line_cycles: 0 - **0.0005**, 0.005, 0.1, 1, 10, 100.

NPLC?

Returns the present number of power line cycles (PLCs) of integration time used by the HP 34520 Multimeter's A/D converter (see **NPLC**).

NRDGS [*count* [,*event*]]

Specifies the number of readings per trigger and the event (sample event) which initiates each reading on the HP 34520 Multimeter in the current **USE** slot.

count: 1 - 32767.
event: **AUTO** (1), EXT (2), TIMER (6), TB0 (7), TB1 (8), EXTBAR (9).

NRDGS?

Returns two values indicating the number of readings per trigger and the sample event for the HP 34520 Multimeter in the current **USE** slot (see **NRDGS**).

OCOMP [*control*]

Enables or disables the offset compensated ohms function for the HP 34520 Multimeter in the current **USE** slot.

control: OFF (0), **ON (1)**.

OCOMP?

Returns "OFF" if the HP 34520 Multimeter's offset compensation function is disabled (**OCOMP OFF**) or "ON" if the offset compensation function is enabled (**OCOMP ON**).

OFF *event*

Prevents the action of a service subroutine when an enabled event interrupt occurs or when the count on the specified timer channel reaches zero.

event: INTR, TIMER0, TIMER1.

OFORMAT *format*

Designates the output format (ASCII or Binary) for HP 3235 commands that generate data.

format: ASCII, BINARY.

ON *event* **CALL** *sub_name*

Executes the named subroutine when an enabled event interrupt occurs or when the count on the specified timer channel reaches zero.

event: INTR, TIMER0, TIMER1.
sub_name: Mainframe subroutine name.

OPEN *relay_list*

Switching Modules: opens the specified relays or channels.
HP 34522 Digital I/O: sets the specified bits (logic "1").

relay_list: List of relay, channel, or bit numbers ("esnn").

argument **OR** *argument*

Returns a "0" or "1" based upon the logical OR of the specified arguments.

argument: Number or numeric expression.

OUTBUF *mode*

Enables or disables the HP 3235 output buffer. Output buffer capacity is 2048 bytes.

mode: OFF, ON.

PAUSE

Pauses the most recent subroutine executed with the **RUN** command.

PAUSED?

Returns "1" if the current subroutine is paused or "0" if the subroutine is running (or finished running). Only subroutines executed with the **RUN** command can be paused.

PFCLOSE *relay_list*

Closes the specified relays when power fails. Valid for: HP 34501 Armature Relay Mux.

relay_list: List of relay or channel numbers ("esnn").

PFCLOSE? *relay#*

Returns one of three numbers indicating the programmed power fail state. Valid for: HP 34501 Armature Relay Mux, HP 34504 Coaxial Mux, HP 34506 Coaxial Matrix.

0 = Relay Open (**PFOPEN** command).
1 = Relay Closed (**PFCLOSE** command).
2 = Relay Same (**PFSAME** command).

relay#: Single relay or channel number ("esnn").

PFOPEN *relay_list*

Opens the specified relays or channels when power fails. Valid for: HP 34501 Armature Relay Mux, HP 34504 Coaxial Mux, HP 34506 Coaxial Matrix.

relay_list: List of relay or channel numbers ("esnn").

PFSAME *relay_list*

Leaves the designated relays or channels in the same state when power fails. Valid for: HP 34501 Armature Relay Mux, HP 34504 Coaxial Mux, HP 34506 Coaxial Matrix.

relay_list: List of relay or channel numbers ("esnn").

PONSRQ *mode*

Enables or disables assertion of the HP-IB SRQ line at power-on.

mode: ON, OFF. Default = most recent value stored in continuous memory. Factory setting = OFF.

PROHIBIT [*combination*,] *relay_list*

Prevents closures of the specified plug-in module relays, channels, or bits.

combination: **ANYOF**, TWOOF, ALLOF.
relay_list: List of relay, channel, or bit numbers ("esnn").

PROHIBIT?

Returns a list of all prohibited relays and relay combinations (see **PROHIBIT** command).

PSCAN [**AB***n*, [**AB***n*,] **FAST**,] *ch_list*

Connects channel pairs to the specified analog buses for measurement by an external instrument.

AB*n:* Analog buses 0, 1, 2, or 3. Default = no analog bus connection.
FAST: Closes all backplane relays required to make connection to the specified analog bus before the scan starts (useful only for HP 34502 and HP 34507).
ch_list: List of channel numbers ("esnn").

PULLUP *mode*

Configures the HP 34522 Digital I/O Module (current **USE** port) for either totem-pole or open-collector output ports.

mode: ENABLE (totem-pole), DISABLE (open-collector).

PULSE **TIMER***n*, *width*

Outputs a low-to-high pulse from the specified timer channel.

TIMER*n:* Specifies timer channel 0 (TIMER0) or timer channel 1 (TIMER1).
width: 0.625E-6 - 0.081918 seconds or 1 - 65535 clock pulses (one clock pulse = 1.25 μS).

PURGE *name*

Deletes the specified stored state (**SSTATE** command) from HP 3235 memory.

name: Mainframe stored state name.

RANGE [*max_input* [,*%_resolution*]]

Selects measurement range or the autorange mode for the HP 34520 Multimeter in the current **USE** slot.

max_input:

For Voltage: **AUTO** or 0 - 300.
For AC Current: **AUTO** or 0 - 1.
For DC Current: **AUTO** or 0 - 1.5.
For Ohms: **AUTO** or 0 - 3E9.

%_resolution: percentage of *max_input* (default set by the **NPLC** command).

RANGE?

Returns the present measurement range for the HP 34520 Multimeter in the current **USE** slot. If AUTO (autorange) is selected, "-1" is returned.

RBIT *bit#*

Returns the logic value ("0" or "1") of a single bit on the HP 34522 Digital I/O Module in the current **USE** slot.

bit#: Numbered 0-7 for 8-bit ports, 0-15 for 16-bit ports, and 0-31 for 32-bit ports.

READ (multimeter)

Transfers each reading made using a hardware trigger from the HP 34520 Multimeter to the HP-IB output buffer or to a memory location.

READ (digital I/0)

Reads a single word from the HP 34522 Digital I/O port selected by the **USE** command.

READBLK *array_name* [,*length*]

Reads a series (a block) of words from the HP 34522 Digital I/O Module in current **USE** slot and stores them into a mainframe integer array.

array_name: Mainframe array name.
length: Number of words to be read from port. Default = entire array.

READ COUNT **TIMER***n*

Reads the current counter value on the specified timer channel.

TIMER*n:* Specifies timer channel 0 (TIMER0) or timer channel 1 (TIMER1).

READY?

Returns "1" when the HP 3235 is ready to execute a new command. Most useful with **INBUF ON.**

REAL *name* [(*max_index*)] [,*name* [(*max_index*)], ...]

Reserves mainframe memory space to store real variables or arrays.

name: Mainframe variable or array name.
max_index: Maximum index of the array (range = 0 through 32767).

RESET [*slot_list*]

Resets the entire HP 3235 system or places the specified plug-in modules in their reset states. Abbreviation: **RST.**

slot_list: List of slot numbers ("es00"). Default = entire system.

RETURN

Returns program execution from a subroutine to the program line following the **CALL** statement. For subroutines executed with the **RUN** command, this command terminates execution of the subroutine.

REV?

Returns the HP 3235 firmware revision date code in the form "yyww", where "yy" is the year minus 1960, and "ww" is the week of the year.

RFLG

Returns the logic state of the FLG (flag input) handshake line on the HP 34522 Digital I/O port specified in the **USE** command. This command is useful only with **HSTYPE NONE.**

RLEVENT

Returns the decimal equivalent of the "live" bit pattern of the eight event bits on the HP 34522 Digital I/O Module.

RMT

Executes a soft local lockout which disables the control panel Local key while in remote.

ROTATE (*argument*, *bit_displacement*)

Returns an integer obtained by rotating the argument a specified number of positions with bit wraparound.

argument: Number or numeric expression in the range -32768 to +32767.
bit_displacement: Specifies the number of positions the bits are rotated. Positive values rotate the argument toward the LSB and negative values rotate the argument toward the MSB.

RQS *unmask_value*

Sets bits in the RQS mask register to determine which conditions assert the SRQ line and status bit.

unmask_value:

Bit Number	Decimal Value	Description
0	1	Data Available.
1	2	Not Used.
2	4	User Service Request.
3	8	Local.
4	16	Ready.
5	32	Error.
6	64	SRQ Sent.
7-8	—	Not Used.
9	512	Backplane Event Interrupt.
10	1024	Device-Under-Test Limit Failure.
11	2048	Fixture Open.
12	4096	Interrupt on TIMER 0.
13	8192	Interrupt on TIMER 1.
14-15	—	Not Used.

RQS?

Returns the numeric sum of all conditions which are enabled for SRQ interrupts by the **RQS** command.

RSEVENT

Performs a non-destructive read of the event bits on the HP 34522 Digital I/O Module and returns the decimal equivalent of the bits which have detected events.

RSEVERR

Performs a non-destructive read of the event error register on the HP 34522 Digital I/O Module and returns the decimal equivalent of the bits in the register.

RST [*slot_list*]

See the **RESET** Command.

RSTATE *name* [,*slot_list*]

Recalls the state of the HP 3235 or the specified plug-in modules as set by the **SSTATE** (store state) command.

name: Mainframe stored state name.
slot_list: List of slot numbers ("es00"). Default = store entire instrument state.

RUN *sub_name*

Executes the named subroutine in parallel with other commands.

sub_name: Mainframe subroutine name.

SADV [*source*]

Specifies the scan advance signal for scanning using **MEAS**, **PSCAN**, **SCAN**, and **VERIFY**.

source: **AUTO** or **SCAN**, EXTIN, TB0, TB1, HOLD, SGL.

SCAN [AB*n*,] [FAST,] *ch_list*

Connects a channel list to the specified analog bus for measurement by an external instrument.

AB*n*: Analog buses 0, 1, 2, or 3. Default = no analog bus connection.
FAST: Closes all backplane relays required to make connection to the specified analog bus before the scan starts (useful only for HP 34502 and HP 34507).
ch_list: List of channel numbers ("esnn").

SCRATCH [CONT]

Deletes (scratches) all user-defined arrays, variables, subroutines, and stored states from HP 3235 volatile and continuous memory.

CONT: If CONT is used, the contents of continuous memory are deleted. If not used, only the contents of volatile memory are deleted.

SELECT *ch_list*

Switching Modules: opens all channels in the associated bank, waits for the relays to settle, and then closes the specified channels.
HP 34522 Digital I/O: sets ("1") all bits on the current **USE** port and then clears ("0") the specified bits.

ch_list: List of channel numbers ("esnn").

SER?

Returns "0000A00000"

SERIAL *mode*

Enables or disables serial command execution.

mode: ON, OFF.

SET *block_data*

Instructs the HP 3235 to accept a block of binary data, from the system controller, specifying the HP 3235's internal hardware setup state (use **SET?** to load state into controller).

block_data: Block of data in IEEE-728 Block A format.

SET?

Dumps the complete instrument state, in IEEE-728 Block A format, to the system controller (use **SET** to restore the state).

SET CLKSRC TIMER*n*, *source*

Sets the clock source for the specified timer channel.

TIMER*n*: Specifies timer channel 0 (TIMER0) or timer channel 1 (TIMER1).
source: INT, BP, ETBO, ETB1, EXTIN.

SET COUNT TIMER*n*, *value*

Sets the counter value for the specified timer channel. The count is decremented from the specified value when clock pulses are received. The first clock pulse that occurs after the counter reaches 0 reloads the counter with the given value.

TIMER*n*: Specifies timer channel 0 (TIMER0) or timer channel 1 (TIMER1).
value: 0 - 65535.

SET OUTPUT TIMER*n*, *mode*

Enables or disables outputs from the specified timer channel. Disabled timer channel outputs go to 0V.

TIMER*n:* Specifies timer channel 0 (TIMER0) or timer channel 1 (TIMER1).
mode: ON, OFF.

SET TIME *seconds*

Sets the HP 3235 internal clock in number of seconds since midnight. The time is stored in volatile memory and is lost when power is removed.

seconds: Seconds since midnight in the range 0 through 86399.9 (resolution = 0.01 seconds).

SETTLE

Ensures that all relays or channels have settled from a previous command before processing another command. Useful only with **SERIAL OFF**.

SHIFT (*argument, bit_displacement*)

Returns an integer obtained by shifting the argument a specified number of positions without bit wraparound.

argument: Number or numeric expression in the range -32768 to +32767.
bit_displacement: Specifies the number of positions the bits are shifted. Positive values shift the argument toward the LSB and negative values shift the argument toward the MSB.

SIN (*argument*)

Returns the sine of the angle (in radians) represented by the argument.

argument: Number or numeric expression in the range ± 2.98156826 E+8.

SIZE? *array_name*

Returns the number of elements in the specified array.

array_name: Mainframe array name.

SQR (*argument*)

Returns the square root of the specified argument.

argument: Number or numeric expression greater than or equal to zero.

SQWAVE TIMER*n*, *period*

Outputs a continuous square wave from the specified timer channel.

TIMER*n:* Specifies timer channel 0 (TIMER0) or timer channel 1 (TIMER1).
period: 2.5E-6 - 0.16384124 seconds or 2 - 131070 clock pulses (one clock pulse = 1.25 μS). Clock pulses are rounded up to the next even number.

SRQ

Sets bit 6 in the HP 3235's status register and sets the HP-IB SRQ line true.

SRTRIG *source*

Specifies the second rank trigger source for buffered output transfers on the HP 34522 Digital I/O Module.

source: INT, EXT, EXTBAR, TB0, TB1, EVENT, LOW, HIGH.

SSTATE *name* [,*slot_list*] [,CONT]

Stores the hardware state of the entire HP 3235 system or the plug-in modules in the specified slots. The state may be stored in volatile or continuous memory.

name: Mainframe stored state name.
slot_list: List of slot numbers ("es00").
CONT: If the CONT parameter is used, the state is stored in continuous memory. If not used, the state is stored in volatile memory.

STA?

Returns the system status word which is the weighted sum of all bits set in the status register.

Bit Number	Decimal Value	Description
0	1	Data Available.
1	2	Not Used.
2	4	User Service Request.
3	8	Local.
4	16	Ready.
5	32	Error.
6	64	SRQ Sent.
7-8	—	Not Used.
9	512	Backplane Event Interrupt.
10	1024	Device-Under-Test Limit Failure.
11	2048	Fixture Open.
12	4096	Interrupt on TIMER 0.
13	8192	Interrupt on TIMER 1.
14-15	—	Not Used.

STB?

Returns the system status byte which is the weighted sum of the lower eight bits in the status register.

Bit Number	Decimal Value	Description
0	1	Data Available.
1	2	Not Used.
2	4	User Service Request.
3	8	Local.
4	16	Ready.
5	32	Error.
6	64	SRQ Sent.
7	—	Not Used.

STEP [*sub_name*]

Steps through the specified subroutine, line by line, to verify its operation.

sub_name: Mainframe subroutine name. Default = most recent subroutine to be stepped or paused.

STRIG [*source*]

Specifies the scan trigger signal for scanning with **MEAS, PSCAN, SCAN,** and **VERIFY.**

source: **AUTO** or **SCAN,** EXTIN, TB0, TB1, HOLD, SGL.

SUB *sub_name*

Instructs the HP 3235 to store all subsequent commands, until the **SUBEND** command, in the named subroutine.

sub_name: Mainframe subroutine name.

SUBEND

Identifies where the subroutine ends and also terminates the subroutine entry. All commands between **SUB** and **SUBEND** become part of the subroutine.

TBDRIVE **TB***n*, *source*

Specifies the source to drive one of the mainframe or extender trigger buses from the HP 34522 Digital I/O Module.

TB*n:* Specifies trigger bus 0 (TB0) or trigger bus 1 (TB1).
source: OFF, SRTRIG, SRACK, EXT, EXTBAR, EVENT, LOW, HIGH.

TB*n***?** [*frame#*]

Returns the logic level ("0" or "1") of the backplane trigger bus in the specified frame.

n: Specifies trigger bus 0 or trigger bus 1.
frame#: Specifies the mainframe (0 = default) or an extender (1 - 7).

TBUFF [*control*]

Enables or disables hardware trigger buffering on the HP 34520 Multimeter in the current **USE** slot.

control: **OFF (0)**, ON (1).

TBUFF?

Returns "OFF" if the HP 34520 Multimeter's trigger buffering function is disabled (**TBUFF OFF**) or "ON" if the trigger buffering function is enabled (**TBUFF ON**).

TERM [*source*]

Selects the input source for non-scanning measurements using the HP 34520 Multimeter in the current **USE** slot.

source: OPEN (0), **FRONT (1)**, AB0 (90), AB1 (91), AB2 (92), AB3 (93).

TERM?

Returns a string representing the selected multimeter input terminals (see **TERM**).

TEST [*slot_list*]

Performs an unfixtured self-test on a group of plug-in modules. Abbreviation: **TST**.

slot_list: List of slot numbers ("es00"). Default = all slots.

TIME

Returns the current HP 3235 clock reading in number seconds since midnight.

TIMER *time*

Defines the timer interval for the TIMER *event* in the **NRDGS** command on the HP 34520 Multimeter. The time interval is inserted between successive measurements.

time: 690E-6 to 2100 seconds (in 1 μS intervals). Default = 1 (second).

TIMER?

Returns the present timer interval, in seconds, for the **NRDGS** timer event on the HP 34520 Multimeter in the current **USE** slot.

TRG

Pulses the backplane trigger bus (high-to-low) specified in the **DRIVETB***n* **TRG** command.

TRIG [*event*]

Specifies the sample event which initiates a measurement using the HP 34520 Multimeter in the current **USE** slot.

event: AUTO (1), EXT (2), **SGL (3)**, HOLD (4), TB0 (7), TB1 (8), EXTBAR (9).

TRIG?

Returns a string representing the trigger event for the HP 34520 Multimeter in the current **USE** slot (see **TRIG**).

TRIGBUF *buffer#*, *mode*

Controls the bidirectional trigger bus buffers on the HP 34504 Coaxial Mux, the HP 34506 Coaxial Matrix, and the HP 34523 Breadboard.

buffer#: Trigger bus buffer number ("es00" or "es01").
mode: IN, OUT, OFF.

TST [*slot_list*]

See the **TEST** Command.

USE *device#*

Selects the plug-in module to receive subsequent commands.

device#: Device number ("esnn").

USE?

Returns the address ("esnn") of the present use device set at power-on or by the **USE** command (returns "-1" if no multimeter is installed at power-on).

VERIFY [*function*,] [**AB***n*,] [**FAST**,] *low_array*, *high_array*, *ch_list*

Scans a channel list using the HP 34520 Multimeter and performs a pass/fail limit comparison on each reading.

function: **DCV**, ACV, ACDCV, DCI, ACI, ACDCI, OHM, OHMF, FREQ, PER.
AB*n:* Analog bus 0, 1, 2, or 3. Default = AB0. Can also specify Multimeter front terminals (**FRONT**).
FAST: Closes all backplane relays required to make connection to the specified analog bus before the scan starts (useful only for HP 34502 and HP 34507).
low_array: Lower limit array name.
high_array: Upper limit array name.
ch_list: List of channel numbers ("esnn").

VMCMPLT [*mode*]

Controls destination of the ***voltmeter complete*** signal on the HP 34520 Multimeter in the current **USE** slot.

mode: **OFF (0)**, TB0 (1), TB1 (2), FRONT (3).

VMCMPLT?

Returns a string representing the ***voltmeter complete*** destination on the HP 34520 Multimeter in the current **USE** slot (see **VMCMPLT**).

VREAD *variable*
expression
array_name

Returns the value of the specified variables, expressions, or arrays.

variable: Mainframe variable name.
expression: Number or numeric expression.
array_name: Mainframe array name.

WAIT *seconds*

Waits the specified number of seconds before continuing.

seconds: 0 - 21,474,836.

WAITFOR *source* [*,timeout_value*]

Waits until a trigger is received from the specified source or until a timeout value (in seconds) is reached.

source: EXTIN, TB0, TB1.
timeout_value: 0 - 32767.00 seconds (Default = 0, no timeout limit).

WBIT *bit#, value*

Writes a logic "0" or "1" to a single bit on the HP 34522 Digital I/O Module in the current **USE** slot.

bit#: Numbered 0-7 for 8-bit ports, 0-15 for 16-bit ports, and 0-31 for 32-bit ports.
value: 0, 1.

WCTL *value*

Writes "0" or "1" to the CTL (control output) handshake line on the HP 34522 Digital I/O port specified in the **USE** command. This command is useful only with **HSTYPE NONE.**

value: 0, 1.

WHILE *expression*
program segment
END WHILE

Defines a loop which is repeated as long as the numeric expression is true within an HP 3235 subroutine.

expression: Number or numeric expression.

WRITE [*data2,*] *data1*

Writes a single word to the HP 34522 Digital I/O port selected by the **USE** command.

data2: Upper 16-bit word for 32-bit transfers.
data1: Lower 8- or 16-bit word.

WRITEBLK *array_name* [*,length*]

Writes a series (a block) of words from a mainframe integer array to the HP 34522 Digital I/O port selected by the **USE** command.

array_name: Mainframe array name.
length: Number of words to write to the port. Default = entire array.

XFERMODE *mode*

Configures the output ports of the HP 34522 Digital I/O Module for "live" or "buffered" transfers.

mode: LIVE, BUFFERED.

XFERWIDTH *width*

Defines the port size (in bits) for input and output transfers on the HP 34522 Digital I/O Module in the current **USE** slot.

width: 8, 16, 32.

HP-IB Command Summary

ABORTIO 7 (IFC)

Clears the HP 3235's interface circuitry.

CLEAR (DCL or SDC)

Clears the HP 3235 preparing it to receive a command (same as the **CLR** command).

LOCAL (GTL)

Removes the HP 3235 from the remote state and enables the control panel keyboard (provided that the keyboard is not disabled with the **LOCK** command).

REMOTE

Sets the HP-IB REN line true.

SPOLL (Serial Poll)

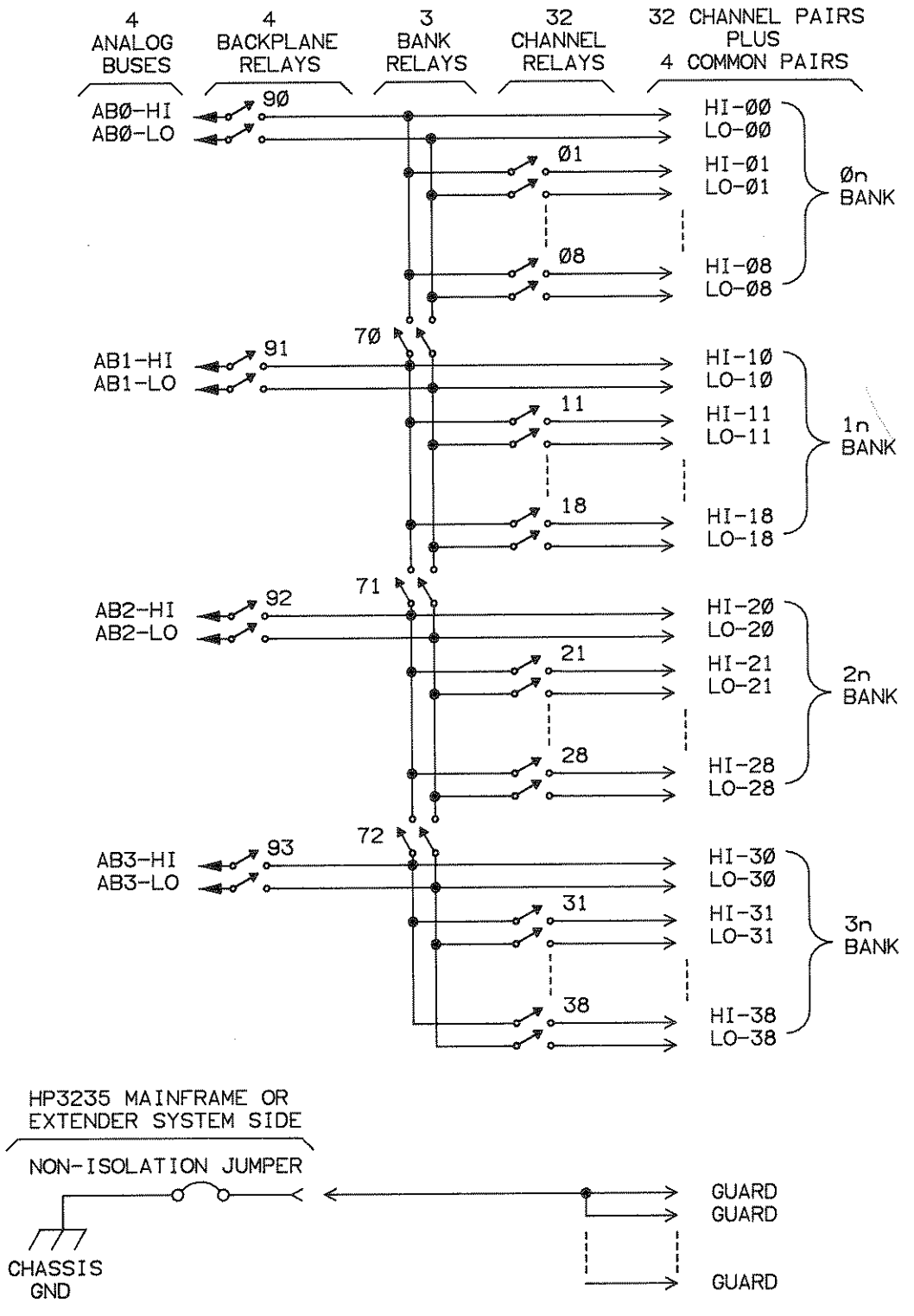
Returns a number representing the bits in the status register (status byte). The number returned is the weighted sum of all set bits.

Bit Number	Decimal Value	Description
0	1	Data Available.
1	2	Not Used.
2	4	User Service Request.
3	8	Local.
4	16	Ready.
5	32	Error.
6	64	SRQ Sent.
7	—	Not Used.

TRIGGER (GET)

If the **DRIVETBn** command is set for TRG, then the HP-IB TRIGGER command pulses the specified backplane trigger bus.

Module Diagrams

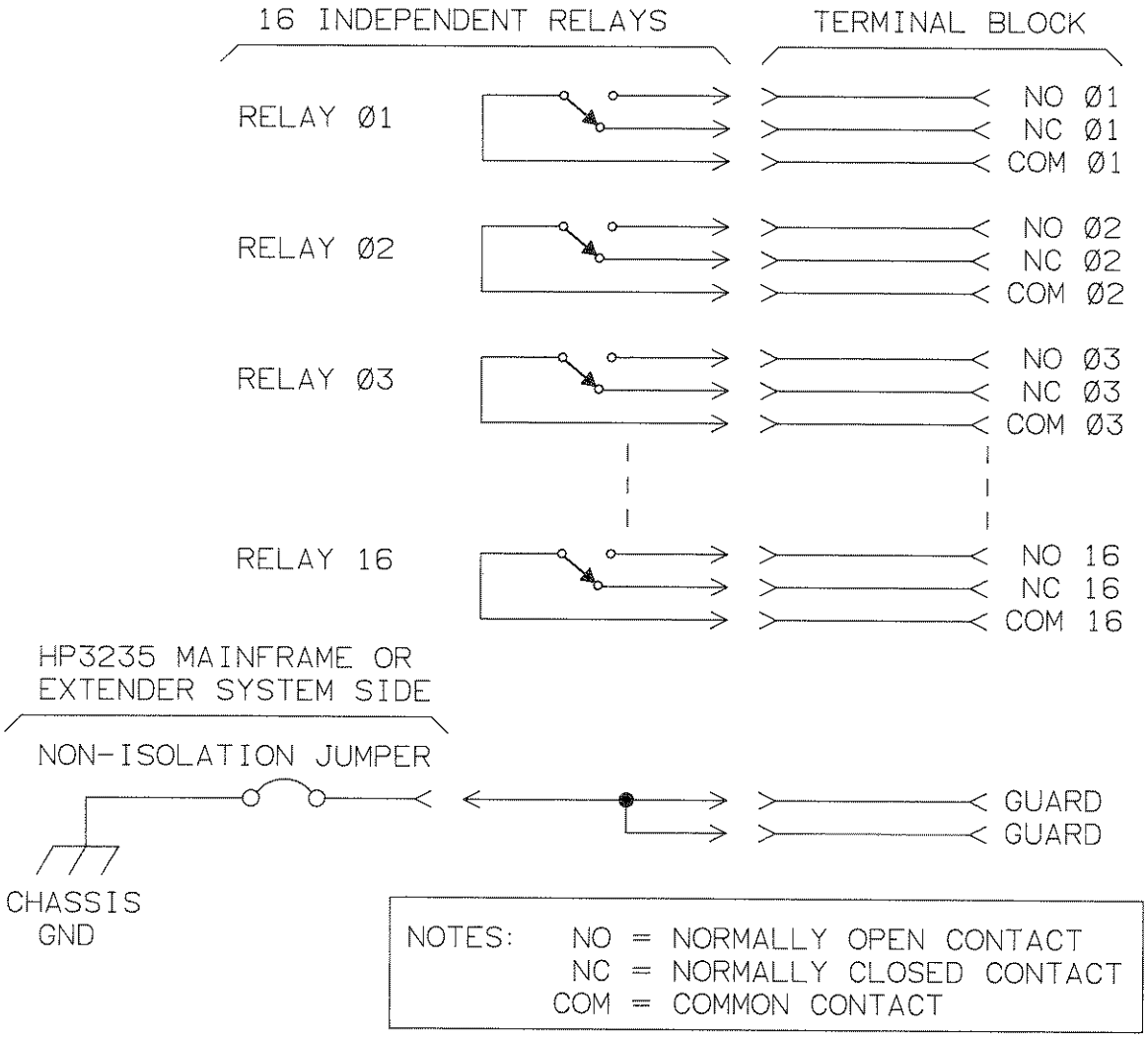


F.2.1

HP 34501/2/7

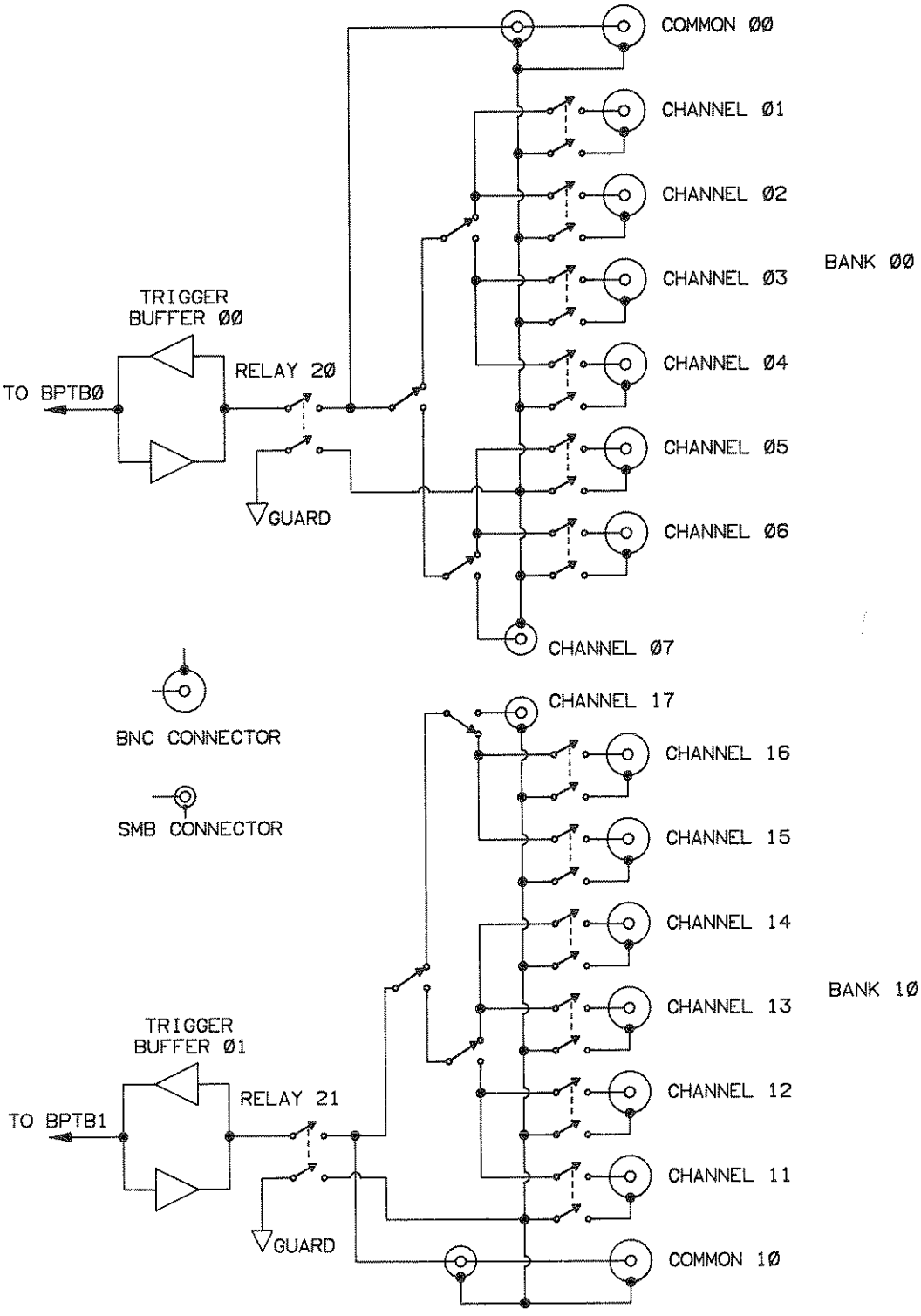
32-Channel Relay Mux Modules

Module Diagrams (cont)



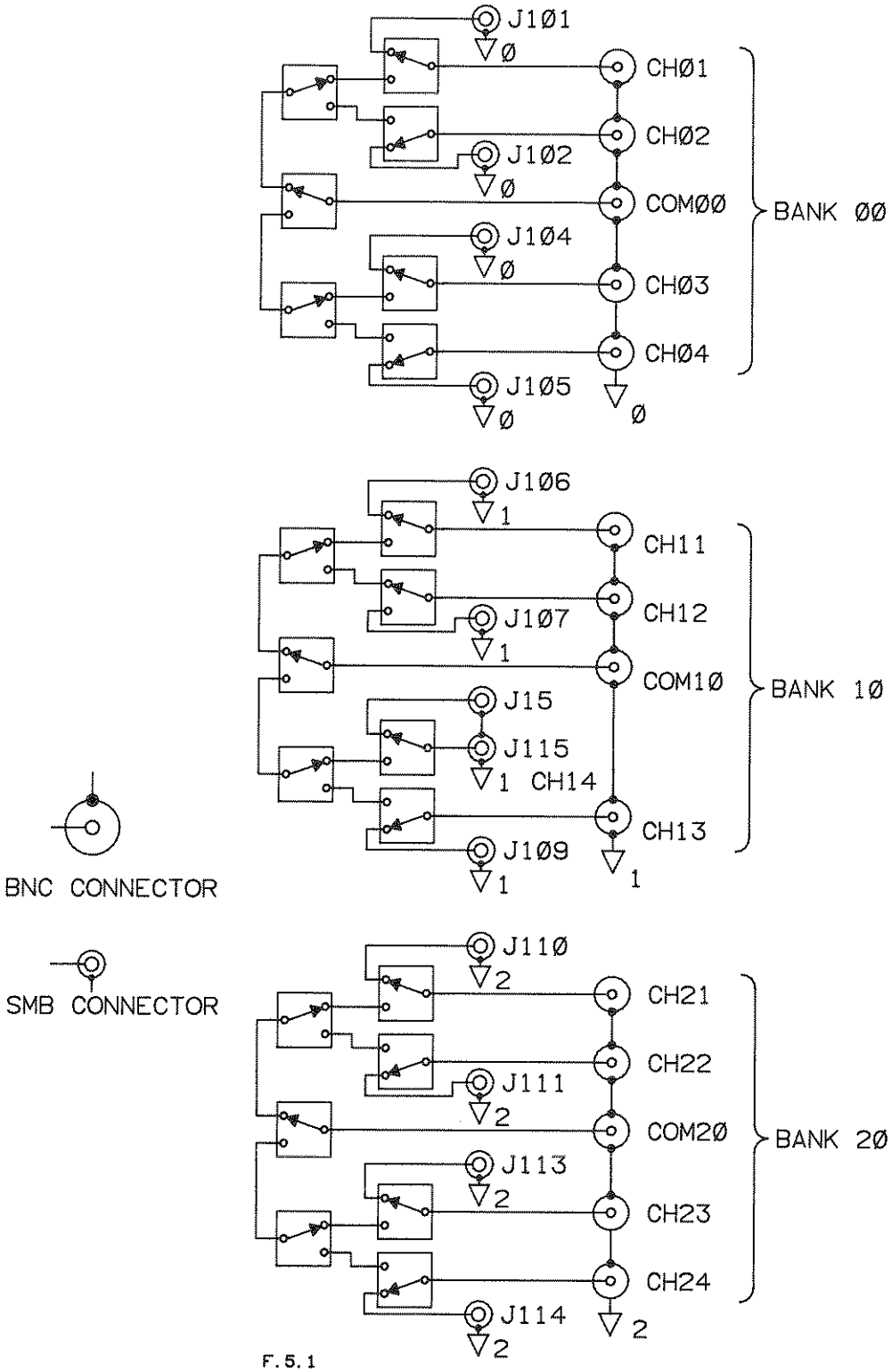
F.3.1

HP 34503
GP Relay Module



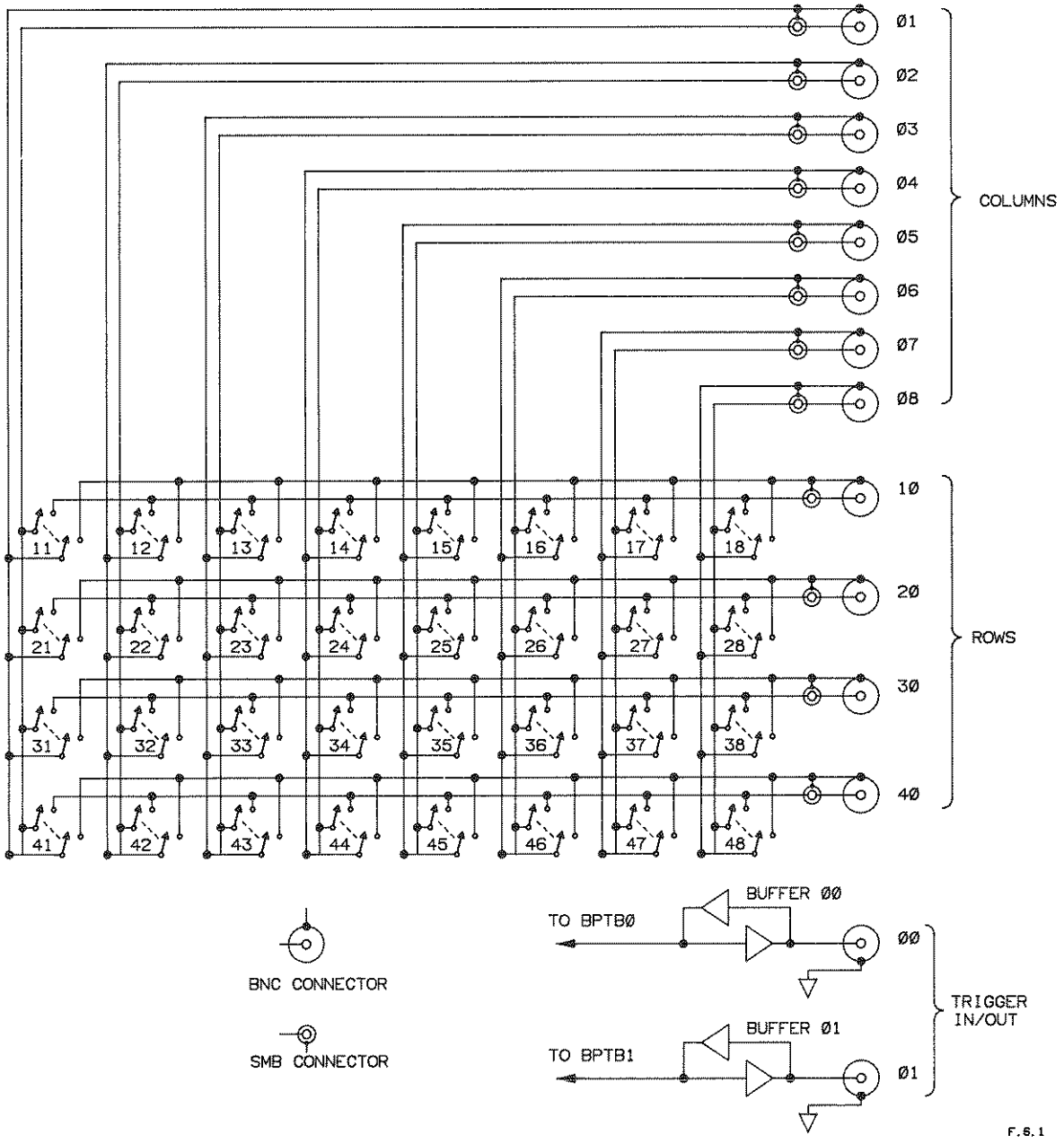
HP 34504
Coaxial Mux Module

Module Diagrams (cont)



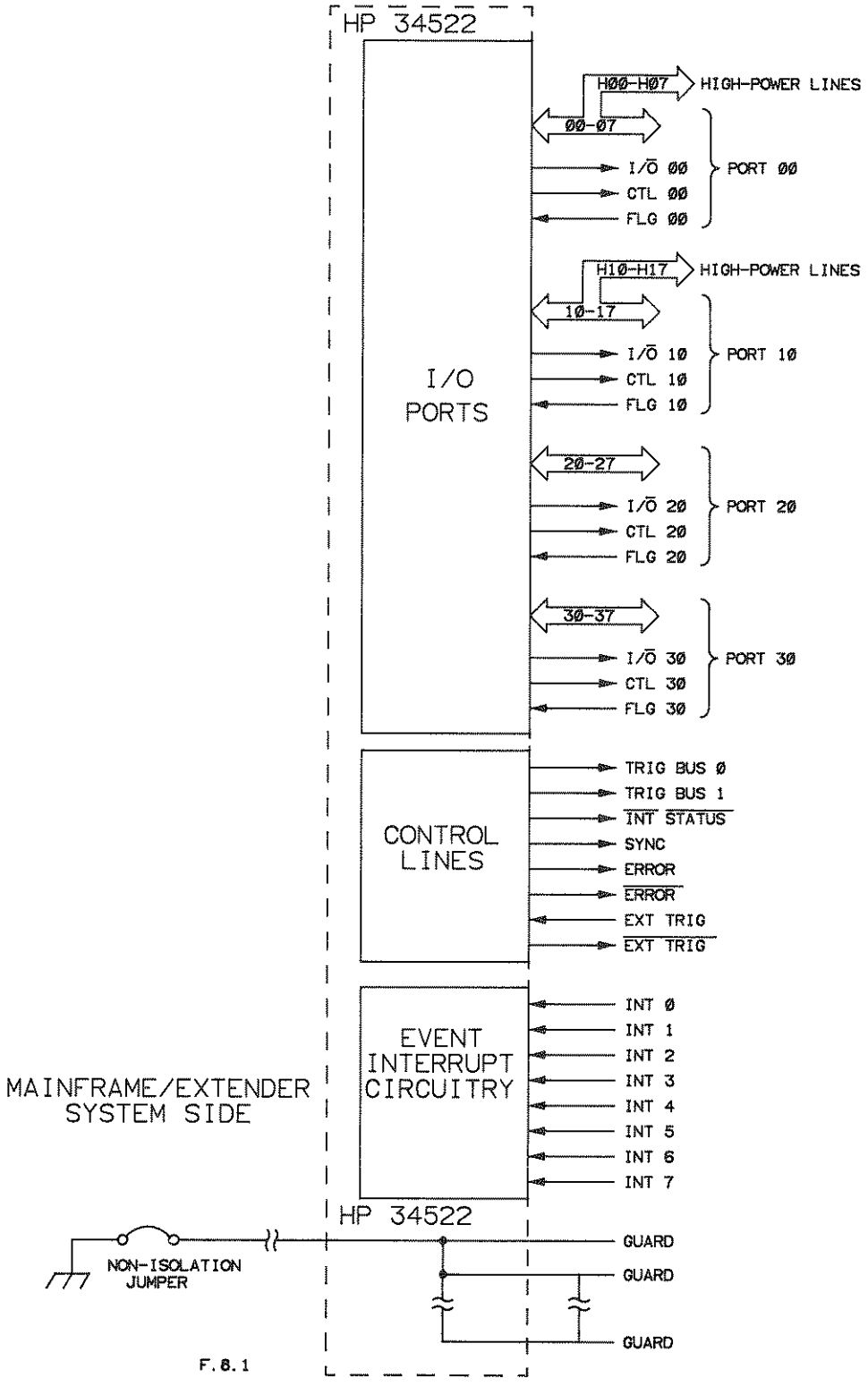
F.5.1

HP 34505
RF Mux Module



HP 34506
Coaxial Matrix Module

Module Diagrams (cont)



HP 34522
Digital I/O Module

Error Messages

Syntax

ERROR 01 "INCOMPLETE COMMAND"
ERROR 02 "SYNTAX"
ERROR 03 "CANNOT RE-TYPE A VARIABLE"
ERROR 04 "ERROR IN #A BLOCK"
ERROR 05 "ARRAY SIZE OR TYPE MISMATCH"
ERROR 06 "COMMAND TOO LONG"

Subroutines

ERROR 21 "NOT ALLOWED IN SUB"
ERROR 22 "ALLOWED ONLY IN SUB"
ERROR 23 "NEXT WITHOUT FOR"
ERROR 24 "NEXT VARIABLE NOT SAME AS FOR VARIABLE "
ERROR 25 "EXPECTED NEXT"
ERROR 26 "ELSE OR END IF WITHOUT IF"
ERROR 27 "EXPECTED END IF"
ERROR 28 "END WHILE WITHOUT WHILE"
ERROR 29 "EXPECTED END WHILE"

Memory

ERROR 41 "OUT OF MEMORY"
ERROR 42 "TOO MANY NESTED CALLS"
ERROR 43 "TOO MANY NESTED STRUCTURES"

Subroutine Execution/Stored States

ERROR 51 "SUB WAS DELETED"
ERROR 52 "NO ACTIVE SUB"
ERROR 53 "SUB NOT PAUSED"
ERROR 54 "SUB IS RUNNING"
ERROR 55 "CANNOT DELSUB AN ACTIVE SUB"
ERROR 56 "STATE WAS PURGED"
ERROR 57 "STATE DOES NOT MATCH"
ERROR 58 "SUB WAS COMPRESSED"

Parameters

ERROR 61 "OUT OF RANGE"
ERROR 62 "EMPTY SLOT"
ERROR 63 "NO SUCH EXTENDER"
ERROR 64 "WRONG CARD TYPE"
ERROR 65 "COMMAND INCOMPATIBLE WITH SETUP"
ERROR 66 "SUBSCRIPT OUT OF BOUNDS"
ERROR 67 "ARRAY TOO SMALL"
ERROR 68 "ON BLOCK NOT FOUND"
ERROR 69 "MUST BE IN LOCAL"
ERROR 70 "SETTINGS CONFLICT"

General

ERROR 81 "COMMAND TIMEOUT"
ERROR 82 "BUSY TOO LONG"
ERROR 83 "BP ERROR FROM SLOT"
ERROR 84 "UNEXPECTED INTR"
ERROR 85 "SYSTEM TRIG TOO FAST"
ERROR 86 "PROHIBITED SWITCH"

System

ERROR 91 "SYSTEMERROR"
ERROR 92 "BUS ERROR"
ERROR 93 "SYSTEM TRAP"
ERROR 94 "MATH ERROR"
ERROR 95 "CPU EXCEPTION"

Multimeter

Triggering

ERROR 101 "ILLEGAL TRIGGERING SETUP"
ERROR 102 "MM TRIG TOO FAST"

Cal Setup

ERROR 111 "PERIOD CAL ILLEGAL"
ERROR 112 "EXT OHMS CAL ILLEGAL"
ERROR 113 "AC OFFSET CAL ILLEGAL"
ERROR 114 "CAL SWITCH NOT ENABLED"
ERROR 115 "CAL SWITCH ENABLED"
ERROR 116 "CAL INPUT OUT OF RANGE"

Cal Hardware Failure

ERROR 121 "AC OFFSET ACAL FAIL"
ERROR 122 "AC FLATNESS ACAL FAIL"
ERROR 123 "OHMS PRECHARGE ACAL FAIL"
ERROR 124 "EXT OHMS ACAL FAIL"

Multimeter Hardware Failure

ERROR 131 "CAL MEMORY LOST"
ERROR 132 "AUTO CAL MEMORY LOST — ACALINIT required"
ERROR 133 "BAD CHECKSUM ON"
ERROR 134 "MM Hardware Error"
ERROR 135 "MM timeout"

Digital I/O

ERROR 151 "INTERRUPT OVERRUN"

Error Messages (cont)

Self-Test

ERROR 201 "PON TEST"
ERROR 202 "DTACK FAIL"
ERROR 203 "CARD ID FAIL"
ERROR 204 "CARD BUSY (D7) STUCK HIGH"
ERROR 205 "CARD BUSY (D7) STUCK LOW"
ERROR 206 "BUSY TOO SHORT"
ERROR 207 "BUSY TOO LONG"
ERROR 208 "RE-TRIG BUSY TIME FAIL"
ERROR 209 "BP /BUSY STUCK LOW"
ERROR 210 "RELAY READBACK FAIL"
ERROR 211 "TRIGGER BUS FAIL"

ERROR 221 "MM SELF TEST "
ERROR 222 "DIG SELF TEST "
ERROR 223 "RELAY OPEN"
ERROR 224 "RELAY SHORTED"
ERROR 225 "TRIGBUF FAIL"