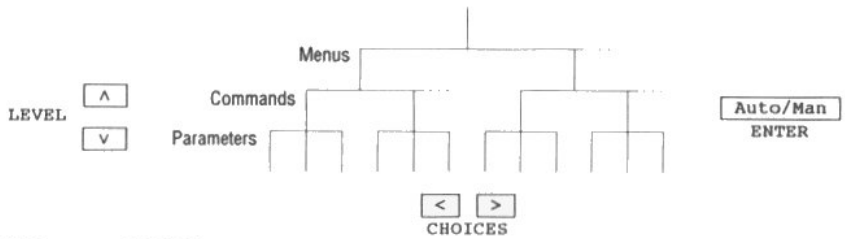
HEWLETT PACKARD

HP 34401A Multimeter Quick Reference



A: MEASurement MENU

1: AC FILTER ➡ **2:** CONTINUITY ➡ **3:** INPUT R ➡ **4:** RATIO FUNC ➡ **5:** RESOLUTION

1: AC FILTER	Selects the slow, medium, or fast ac filter.
2: CONTINUITY	Sets the continuity beeper threshold (1 Ω to 1000 Ω).
3: INPUT R	Sets the input resistance for dc voltage measurements.
4: RATIO FUNC	Enables the dcv:dcv ratio function.
5: RESOLUTION	Selects the measurement resolution.

B: MATH MENU

1: MIN–MAX ➡ **2:** NULL VALUE ➡ **3:** dB REL ➡ **4:** dBm REF R ➡ **5:** LIMIT TEST ➡ **6:** HIGH LIMIT ➡ **7:** LOW LIMIT

1: MIN-MAX	Recalls the stored minimum, maximum, average, and reading count.
2: NULL VALUE	Recalls or sets the null value stored in the null register.
3: dB REL	Recalls or sets the dBm value stored in the dB relative register.
4: dBm REF R	Selects the dBm reference resistance value.
5: LIMIT TEST	Enables or disables limit testing.
6: HIGH LIMIT	Sets the upper limit for limit testing.
7: LOW LIMIT	Sets the lower limit for limit testing.

C: TRIGger MENU

1: READ HOLD ➡ **2:** TRIG DELAY ➡ **3:** N SAMPLES

1: READ HOLD	Sets the reading hold sensitivity band.
2: TRIG DELAY	Specifies a time interval which is inserted before a measurement.
3: N SAMPLES	Sets the number of samples per trigger.

D: SYStem MENU

1: RDGS STORE ➡ **2:** SAVED RDGS ➡ **3:** ERROR ➡ **4:** TEST ➡ **5:** DISPLAY ➡ **6:** BEEP ➡ **7:** COMMA ➡ **8:** REVISION

1: RDGS STORE	Enables or disables reading memory.
2: SAVED RDGS	Recalls readings stored in memory (up to 512 readings).
3: ERROR	Retrieves errors from the error queue (up to 20 errors).
4: TEST	Performs a complete self-test.
5: DISPLAY	Enables or disables the front-panel display.
6: BEEP	Enables or disables the beeper function.
7: COMMA	Enables or disables a comma separator between digits on the display.
8: REVISION	Displays the multimeter's firmware revision codes.

E: Input / Output MENU

1: HP–IB ADDR ➡ **2:** INTERFACE ➡ **3:** BAUD RATE ➡ **4:** PARITY ➡ **5:** LANGUAGE

1: HP-IB ADDR	Sets the HP-IB bus address (0 to 31; 31 = Talk Only).
2: INTERFACE	Selects the HP-IB or RS-232 interface.
3: BAUD RATE	Selects the baud rate for RS-232 operation.
4: PARITY	Selects even, odd, or no parity for RS-232 operation.
5: LANGUAGE	Selects the interface language: SCPI, HP 3478, or Fluke 8840/42.

F: CALibration MENU

1: SECURED ➡ [**1:** UNSECURED] ➡ [**2:** CALIBRATE] ➡ **3:** CAL COUNT ➡ **4:** MESSAGE

1: SECURED	The multimeter is secured against calibration; enter code to unsecure.
1: UNSECURED	The multimeter is unsecured for calibration; enter code to secure.
2: CALIBRATE	Performs complete calibration of present function; must be UNSECURED.
3: CAL COUNT	Reads the total number of times the multimeter has been calibrated.
4: MESSAGE	Reads the calibration string (up to 12 characters) entered from remote.

NOTE: The two commands enclosed in square brackets ([ ]) are "hidden" unless the multimeter is UNSECURED for calibration.

Query Commands: *A query form of most commands is available by appending " ? " to the command. For simplicity, the query form of some commands is omitted from this Guide. See the User's Guide for a complete listing of query commands.*

Measurement Configuration Commands

(See page 115 in User's Guide)

Function	Measurement Ranges
DC V, AC V	100 mV, 1 V, 10 V, 100 V, 1000 V (750 Vac)
Ω 2W, Ω 4W	100 Ω, 1 kΩ, 10 kΩ, 100 kΩ, 1 MΩ, 10 MΩ, 100 MΩ
DC I, AC I	10 mA (dc only), 100 mA (dc only), 1 A, 3A
Freq (Period)	3 Hz to 300 kHz (0.33 sec to 3.3 μsec)

```
MEASure
   :VOLTage:DC? {<range>|MIN|MAX|DEF},{<res>|MIN|MAX|DEF}
   :VOLTage:DC:RATio? {<range>|MIN|MAX|DEF},{<res>|MIN|MAX|DEF}
   :VOLTage:AC? {<range>|MIN|MAX|DEF},{<res>|MIN|MAX|DEF}
   :CURRent:DC? {<range>|MIN|MAX|DEF},{<res>|MIN|MAX|DEF}
   :CURRent:AC? {<range>|MIN|MAX|DEF},{<res>|MIN|MAX|DEF}
   :RESistance? {<range>|MIN|MAX|DEF},{<res>|MIN|MAX|DEF}
   :FRESistance? {<range>|MIN|MAX|DEF},{<res>|MIN|MAX|DEF}
   :FREQuency? {<range>|MIN|MAX|DEF},{<res>|MIN|MAX|DEF}
   :PERiod? {<range>|MIN|MAX|DEF},{<res>|MIN|MAX|DEF}
   :CONTinuity?
   :DIODe?

CONFigure
   :VOLTage:DC {<range>|MIN|MAX|DEF},{<res>|MIN|MAX|DEF}
   :VOLTage:DC:RATio {<range>|MIN|MAX|DEF},{<res>|MIN|MAX|DEF}
   :VOLTage:AC {<range>|MIN|MAX|DEF},{<res>|MIN|MAX|DEF}
   :CURRent:DC {<range>|MIN|MAX|DEF},{<res>|MIN|MAX|DEF}
   :CURRent:AC {<range>|MIN|MAX|DEF},{<res>|MIN|MAX|DEF}
   :RESistance {<range>|MIN|MAX|DEF},{<res>|MIN|MAX|DEF}
   :FRESistance {<range>|MIN|MAX|DEF},{<res>|MIN|MAX|DEF}
   :FREQuency {<range>|MIN|MAX|DEF},{<res>|MIN|MAX|DEF}
   :PERiod {<range>|MIN|MAX|DEF},{<res>|MIN|MAX|DEF}
   :CONTinuity
   :DIODe

[SENSe:]
   FUNCtion "VOLTage:DC"
   FUNCtion "VOLTage:DC:RATio"
   FUNCtion "VOLTage:AC"
   FUNCtion "CURRent:DC"
   FUNCtion "CURRent:AC"
   FUNCtion "RESistance"    (2-wire ohms)
   FUNCtion "FRESistance"   (4-wire ohms)
   FUNCtion "FREQuency"
   FUNCtion "PERiod"
   FUNCtion "CONTinuity"
   FUNCtion "DIODe"

[SENSe:]
   VOLTage:DC:RANGe {<range>|MIN|MAX}
   VOLTage:AC:RANGe {<range>|MIN|MAX}
   CURRent:DC:RANGe {<range>|MIN|MAX}
   CURRent:AC:RANGe {<range>|MIN|MAX}
   RESistance:RANGe {<range>|MIN|MAX}
   FRESistance:RANGe {<range>|MIN|MAX}
   FREQuency:VOLTage:RANGe {<range>|MIN|MAX}
   PERiod:VOLTage:RANGe {<range>|MIN|MAX}
```

Measurement Configuration Commands

(continued)

```
[SENSe:]
  VOLTage:DC:RANGe:AUTO {OFF|ON}
  VOLTage:AC:RANGe:AUTO {OFF|ON}
  CURRent:DC:RANGe:AUTO {OFF|ON}
  CURRent:AC:RANGe:AUTO {OFF|ON}
  RESistance:RANGe:AUTO {OFF|ON}
  FRESistance:RANGe:AUTO {OFF|ON}
  FREQuency:VOLTage:RANGe:AUTO {OFF|ON}
  PERiod:VOLTage:RANGe:AUTO {OFF|ON}

[SENSe:]
  VOLTage:DC:RESolution {<res>|MIN|MAX}
  VOLTage:AC:RESolution {<res>|MIN|MAX}
  CURRent:DC:RESolution {<res>|MIN|MAX}
  CURRent:AC:RESolution {<res>|MIN|MAX}
  RESistance:RESolution {<res>|MIN|MAX}
  FRESistance:RESolution {<res>|MIN|MAX}

[SENSe:]
  VOLTage:DC:NPLCycles {0.02|0.2|1|10|100|MIN|MAX}
  CURRent:DC:NPLCycles {0.02|0.2|1|10|100|MIN|MAX}
  RESistance:NPLCycles {0.02|0.2|1|10|100|MIN|MAX}
  FRESistance:NPLCycles {0.02|0.2|1|10|100|MIN|MAX}

[SENSe:]
  FREQuency:APERture {0.01|0.1|1|MIN|MAX}
  PERiod:APERture {0.01|0.1|1|MIN|MAX}

[SENSe:]DETector:BANDwidth {3|20|200|MIN|MAX}

[SENSe:]ZERO:AUTO {OFF|ONCE|ON}

INPut:IMPedance:AUTO {OFF|ON}

ROUTe:TERMinals?
```

Math Operation Commands

(See page 122 in User's Guide)

```
CALCulate
  :FUNCtion {NULL|DB|DBM|AVERage|LIMit}
  :STATe {OFF|ON}

CALCulate
  :AVERage:MINimum?
  :AVERage:MAXimum?
  :AVERage:AVERage?
  :AVERage:COUNt?

CALCulate:NULL:OFFSet {<value>|MIN|MAX}

CALCulate:DB:REFerence {<value>|MIN|MAX}

CALCulate:DBM:REFerence {<value>|MIN|MAX}

CALCulate
  :LIMit:LOWer {<value>|MIN|MAX}
  :LIMit:UPPer {<value>|MIN|MAX}

DATA:FEED RDG_STORE, {"CALCulate"|" "}
```

Triggering Commands

(See page 125 in User's Guide)

```
INITiate

READ?

TRIGger
   :COUNt {<value>|MIN|MAX|INFinite}
   :DELay {<seconds>|MIN|MAX}
   :DELay:AUTO {OFF|ON}
   :SOURce {BUS|IMMediate|EXTernal}

SAMPle:COUNt {<value>|MIN|MAX}
```

System-Related Commands

(See page 130 in User's Guide)

```
FETCh?

READ?

DATA:FEED RDG_STORE, {"CALCulate"|" "}

DATA:POINts?

DISPlay {OFF|ON}

DISPlay
   :TEXT <quoted string>
   :TEXT:CLEar

SYSTem
   :BEEPer
   :BEEPer:STATe {OFF|ON}

SYSTem:ERRor?

SYSTem:VERSion?

*RST

*TST?

*IDN?
```

RS-232 Interface Commands

(See page 145 in User's Guide)

```
SYSTem
   :LOCal
   :REMote
   :RWLock
```

IEEE-488.2 Common Commands

(See page 163 in User's Guide)

```
*CLS

*ESE <enable value>
*ESE?

*ESR?

*IDN?

*OPC

*OPC?

*PSC {0|1}
*PSC?

*RST

*SRE <enable value>
*SRE?

*STB?

*TRG

*TST?
```

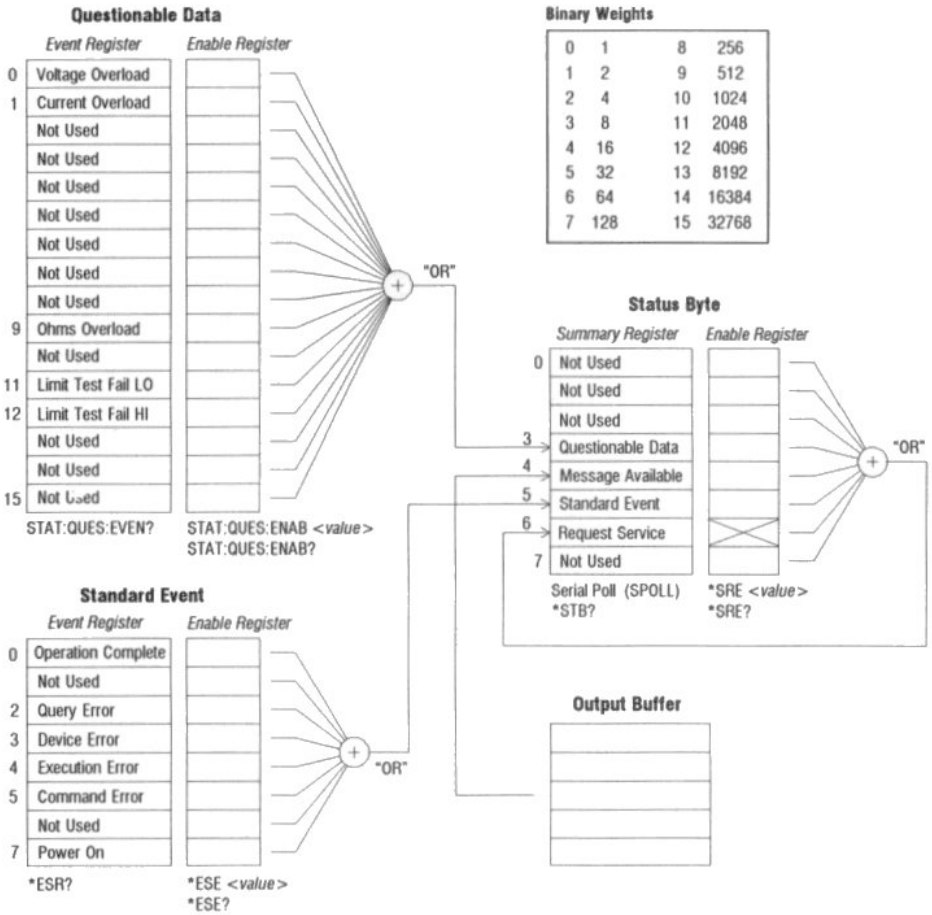
Status Reporting Commands

(See page 132 in User's Guide)

```
SYSTem:ERRor?

STATus
   :QUEStionable:ENABle <value>
   :QUEStionable:ENABle?
   :QUEStionable:EVENt?

STATus
   :PRESet

*CLS

*ESE <enable value>
*ESE?

*ESR?

*OPC

*OPC?

*PSC {0|1}
*PSC?

*SRE <enable value>
*SRE?
```

SCPI Status System

(See page 132 in User's Guide)



Power-On and Reset State

Measurement Configuration	Power-On/Reset State
AC filter	20 Hz (medium filter)
Autozero	On
* Continuity threshold	* 10 Ω
Function	DC volts
Input resistance	10 MΩ (fixed for all DC V ranges)
Integration time	10 PLCs
Range	Autorange
Resolution	5½ digits, slow mode

Math Operations	Power-On/Reset State
Math state, function	Off, Null
Math registers	All registers are cleared
* dBm reference resistance	* 600 Ω

Triggering Operations	Power-On/Reset State
Reading hold threshold	0.10% of reading
Samples per trigger	1 sample
Trigger delay	Automatic delay
Trigger source	Auto trigger

System-Related Operations	Power-On/Reset State
* Beeper mode	* On
* Comma separators	* On
Display mode	On
Reading memory	Off (cleared)

Input/Output Configuration	Power-On/Reset State
* Baud rate	* 9600 baud
* HP-IB address	* 22
* Interface	* HP-IB
* Language	* SCPI
* Parity	* Even (7 data bits)

Calibration	Power-On/Reset State
* Calibration state	* Secured

Those items marked with " * " above are stored in **non-volatile** memory.
The factory settings are shown.

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Data Formats

(See page 153 in User's Guide)

Type of Output Data	Output Data Format
Non-reading queries	<80 ASCII character string
Single reading (IEEE-488)	SD.DDDDDDDESDD<nl>
Multiple readings (IEEE-488)	SD.DDDDDDDESDD,...,...,<nl>
Single reading (RS-232)	SD.DDDDDDDESDD<cr><nl>
Multiple readings (RS-232)	SD.DDDDDDDESDD,...,...,<cr><nl>

S Negative sign or positive sign
D Numeric digits
E Exponent
<**nl**> newline character
<**cr**> carriage return character

SCPI Programming Reminders

(See page 110 in User's Guide)

Using MEASure? Presets best settings for requested configuration and immediately performs measurement. You cannot change any settings (other than function, range, and resolution) before measurement is taken. Results are sent to output buffer. Equivalent to CONFigure followed immediately by READ?.

Using CONFigure Presets best settings for requested configuration. The measurement is not automatically started and you can change measurement parameters before making measurements. Use INITiate or READ? to initiate measurement.

Using READ? Changes state of trigger system from "idle" state to "wait-for-trigger" state. Readings are sent immediately to output buffer (not stored in internal memory). Measurements stop when output queue is full. Similar to INITiate followed immediately by FETCh?, except readings are not buffered internally.

Using INITiate Changes state of trigger system from "idle" state to "wait-for-trigger" state. Readings are stored in internal memory (up to 512 readings). Use FETCh? to transfer readings to output buffer.

Using FETCh? Transfers readings from internal memory to output buffer where you can read them into your bus controller.

SCPI Programming Examples

```
MEAS:VOLT:DC? 10, 0.003
bus enter statement
```

```
CONF:VOLT:DC 10, 0.003
TRIG:SOUR EXT
READ?
bus enter statement
```

```
CONF:VOLT:DC 10, 0.003
TRIG:SOUR EXT
INIT
FETC?
bus enter statement
```

Error Messages

This is a partial listing of error messages. See chapter 5 in the User's Guide for more information.

-102, "Syntax error" Check for blank space before or after a colon in command header, or before a comma.

-103, "Invalid separator" Check for a comma used instead of a colon, semicolon, or blank space – or a blank instead of a comma.

-105, "GET not allowed" IEEE-488 Group Execute Trigger (GET) not allowed in a command string.

-108, "Parameter not allowed" Check for extra parameters in the command string.

-109, "Missing parameter" Check for omitted parameters in the command string.

-113, "Undefined header" Check the spelling of the command or you may have used an invalid command.

-151, "Invalid string data" Check for missing or extra quotes around a character string.

-211, "Trigger ignored" Make sure the DMM is in "wait-for-trigger" state before triggering, and make sure correct trigger source is selected.

-213, "Init ignored" An INITiate was received but measurement was already in progress. Send device clear to halt measurement.

-221, "Settings conflict" (1) You sent CONFigure or MEASure with autorange enabled with fixed resolution. Or, (2) you turned math on and then changed to an invalid math operation.

-222, "Data out of range" Check for numeric parameter value that is outside the valid range for the command.

-224, "Illegal parameter value" Check for an invalid discrete parameter choice for the command.

-230, "Data stale" A FETCh? was received but internal reading memory was empty. The reading retrieved may be invalid.

-350, "Too many errors" More than 20 errors have occurred.

-410, "Query INTERRUPTED" The output buffer contains data from a previous command (the previous data is not overwritten).

531, "Insufficient memory" Not enough memory for the requested number of readings. The product of sample count and trigger count must not exceed 512 readings.

550, "Command not allowed in local" A READ? was received while in local mode for RS-232. Execute SYSTem:REMote before sending other commands over interface.