Agilent Technologies
3458A Multimeter

Quick
Reference
Guide

Agilent Technologies

Printing History

The printing history shown below lists the printing dates of all editions created for this quick reference guide. The edition number changes as the quick reference guide undergoes subsequent revisions. Editions are numbered sequentially starting with Edition 1. Each new edition includes a revised copy of this printing history page.

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Contents

Notes:

The multimeter uses a language developed around a core set of commands which can in themselves satisfy a large number of applications. The core commands consist of 8 commands plus the measurement function commands (FUNC, ACV, DCL etc.). All recent Agilent multimeters support these 8 commands plus the function commands that correspond to the capabilities of the multimeter. The 8 commands are:

RESET   Sets the multimeter to the power-on state
PRESET Sets the multimeter to a convenient starting point for remote operation
ID?   Returns the multimeter's model number
TEST   Runs self-test
ERR?   Reads the error register
STB?   Reads the status register
TRIG   Selects the trigger event
NPLC   Selects the integration time

The complete command set extends the multimeter's capabilities far beyond that of the above core commands. If compatibility with other Agilent multimeters is critical for your applications, you should strive to use only the core commands and the GPIB commands.

Syntax Rules

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

- Parameters may be entered in upper case, lower case, or as a numeric value. Numeric values can be either integer, floating-point, or exponential in format. Parameters in floating-point format are rounded to the nearest integer if the command requires an integer. For example, "SUB 2.49" is rounded *down* to "SUB 2" and "SUB 2.5" is rounded *up* to "SUB 3".

- Command headers and parameters must be separated by either a space or a comma.

- You can default a parameter by omitting it or replacing it with -1 (minus 1). From remote only, you can use two commas to indicate a default value.

- The carriage return (*cr*), line feed (*lf*), semicolon (;), or EOI sent concurrent with the last character indicate the end of message (command terminator) to the multimeter. When you send a command from the system controller in the standard format (e.g. OUTPUT 722:"TEST"), the controller typically adds a *cr lf* to the end of the command. With its input buffer off (off is the power-on input buffer mode), the multimeter processes the *cr* immediately, but does not process the *lf* until the command completes execution. This means that, because of the *lf,* the bus is held and you cannot regain use of the controller until the multimeter is done executing the command (or the GPIB CLEAR command is executed which aborts execution of the command).

  You can prevent the bus from being held by suppressing the *cr lf* when sending commands or by

enabling the input buffer (INBUF ON command). The following program line shows how to use the # and K image specifiers to suppress *cr If* when sending a multimeter command.

OUTPUT 722 USING "#,K";"TEST;"

The # and K image specifiers apply to HP series 200/300 computers. Refer to your computer's operating manual for information on how your computer suppresses cr lf. The semicolon following the TEST command indicates the end of the command to the multimeter and must be present when you suppress cr lf.

• Multiple commands, separated by semicolons. may be sent in one command string. For example, the following command string contains 3 multimeter commands.

OUTPUT 722;"TRIG HOLD;DCV 3;NPLC 1"

Commands by Functional Group

Measurement Functions
ACDCI
ACDCV
ACI
ACV
DCI
DCV
DSAC
DSDC
FREQ
FUNC
OHM
OHMF
PER
SSAC
SSDC

Measurement Related
ACBAND
ARANGE
AZERO
DELAY
FIXEDZ
FSOURCE
LFILTER
OCOMP
PRESET DIG
PRESET FAST
PRESET NORM
RANGE or R
RATIO
SETACV
SSPARM?
TERM

Digitizing
DSAC
DSDC
LEVEL
LFILTER
SLOPE
NRDGS
PRESET DIG
PRESET FAST
SSAC
SSDC
SSPARM?
SSRC
SWEEP
TIMER

Triggering
EXTOUT
LEVEL
LFILTER
NRDGS
SLOPE
SSRC
SWEEP
TARM
TBUFF
TIMER
TRIG or T

Reading Memory
MCOUNT?
MEM
MFORMAT
MSIZE
RMEM

Program Memory
CALL
COMPRESS
CONT
DELSUB
PAUSE
SCRATCH
SUB
SUBEND

State Memory
PURGE
RSTATE
SCRATCH
SSTATE

A/D Converter
APER
LFREQ
LINE?
NPLC
RES

Status
CSB
RQS
SRQ
STB?

Input/Output
END
INBUF
ISCALE?
OFORMAT
QFORMAT

Errors
AUXERR?
EMASK
ERR?
ERRSTR?

Math
MATH
MMATH
RMATH
SMATH

Keyboard
DEFKEY
LOCK
MENU

Bus
ADDRESS
ID?
SRQ

System
BEEP
DEFEAT
EXTOUT
OPT?
PRESET DIG
PRESET FAST
PRESET NORM
GFORMAT
RESET
TONE

Display
DISP
NDIG

Commands by Functional Group

Calibration/Test
ACAL
CAL
CAL?
CALNUM?
CALSTR
REV?
SCAL
SECURE
TEMP?
TEST

GPIB Commands
ABORTIO
CLEAR
LOCAL
LOCAL LOCKOUT
REMOTE
SPOLL
TRIGGER

The following list shows the commands executed when power is applied or when the RESET command is executed.

ACBAND 20,2E6 -- AC bandwidth 20Hz-2MHz

AZERO ON -- Autozero enabled

DCV AUTO -- DC voltage, autorange

DEFEAT OFF -- Defeat disabled

DELAY -1 -- Default delay

DISP ON -- Display enabled

EMASK 32767 -- Enable all error conditions

END OFF -- Disable GPIB EOI

EXTOUT ICOMP,NEG -- Input complete

EXTOUT signal, negative pulse

FIXEDZ OFF -- Disable fixed input resistance

FSOURCE ACV -- FREQ & PER source is AC voltage

INBUF OFF -- Disable input buffer

LEVEL 0,AC -- Level trigger at 0%, AC-coupled

LFILTER OFF -- Level filter disabled

LFREQ 50 or **60** -- Measured line frequency rounded to 50 0r 60Hz

LOCK OFF -- Keyboard enabled

MATH OFF -- Disable real-time math

MEM OFF -- Disable reading memory (last memory operation= FIFO)

MFORMAT SREAL -- Single real reading memory format

MMATH OFF -- Disable post-process math

NDIG 7 -- Display 7.5 digits

NPLC 10 -- 10 power line cycles of integration time

NRDGS 1,AUTO -- 1 reading per trigger, auto sample event

OCOMP OFF -- Disable offset compensated resistance

OFORMAT ASCII -- ASCII output format

QFORMAT NORM -- Normal query format

Power-On/Reset State

RATIO OFF -- Disable ratio measurements
RQS 0 -- Disable Status Register conditions
SETACV ANA -- Analog AC voltage mode
SLOPE POS, -- Positive slope for level triggering
SSRC LEVEL, AUTO -- Level sync source event,
auto synchronous AC voltage
SWEEP 100E-9, 1024 -- Sample interval 100 nano-
seconds, 1024 samples
TARM AUTO -- Auto trigger arm event
TBUFF OFF -- Disable external trigger buffering
TIMER 1 -- 1 second timer interval
TRIG AUTO -- Auto trigger event

All math registers are set to 0 (zero) except:

DEGREE = 20
SCALE = 1
PERC = 1
REF = 1
RES = 50

*NOTE: Pressing the shifted front panel **Reset** key
performs the power-on sequence which has the
same effect as cycling the multimeter's power. This
stores the present state as state 0, destroys any
stored readings and compressed subprograms, sets
the power-on SRQ bit in the status register, resets
the AtoD converter reference frequency, returns the
AC mode to analog, and performs the power-on
self-test, Executing the RESET command from
remote or from the alphabetic command menu
(MENU keys) return the multimeter to the power-on
state but does not perform the power-on sequence.*

Command Summary

In the following command summary, command keywords are shown in upper case print and parameter names are shown in italics. Optional parameters are enclosed in square brackets ([ ]). Where applicable, the numeric query equivalents for parameters are shown in parentheses following each parameter.

ACAL [*type*][,*security_code*]

Autocal. Instructs the multimeter to perform one or all of its self calibrations.

type = *ALL (0),* DCV (1), AC (2), OHMS (4)

Power-on *type* = none.
Default *type* = *ALL*.

ACBAND [*low_freq*][,*high_freq*]

AC Bandwidth. Specifies the frequency content (bandwidth) of the input signal for all *AC* or AC+DC measurements.

low_freq Specifies the lowest expected frequency component of the input signal.

Power-on *low_freq* = 20 Hz
Default *low_freq* = 20 Hz

high_freq: Specifies the highest expected frequency component of the input signal.

Power-on *high_freq* = 2 MHz
Default *high_freq* = 2 MHz

Command Summary

ACDCI, ACDCV, ACI, ACV
Refer to the FUNC command.

ADDRESS *value*
Sets the multimeter's GPIB address (from the front panel only). The address is stored in continuous memory and is not lost when power is removed.

value: The *value* parameter is an integer from 0 to 31.
Power-on *value* = previously stored address (factory setting = 22).
Default *value* = none: parameter required.

APER [*aperture*]
Aperture. Specifies the A/D converter integration time in seconds.

aperture: Specifies the A/D converter's integration time and overrides any previously specified integration time or resolution. The valid range for aperture is 0 - 1s in increments of 100ns. (Specifying a value <500ns selects minimum aperture which is 500ns.)

Power-on *aperture* = is determined by the power-on value for NPLC which specifies an integration time of 166.667ms for a 60Hz power line frequency, or 200ms for a power line frequency of 50Hz or 40OHz.
Default *aperture* = 5OOns.

ARANGE [*control*]
Autorange. Enables or disables the autorange function.

control = OFF (0), ON (1), ONCE (2)

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Power-on *control* = ON.

Default *control* = ON.

AUXERR?

Auxiliary Error. Returns a number representing the decimal-weighted sum of all set bits in the auxiliary error register and then clears the register.

The auxiliary error conditions and their weighted values are:

Weighted Value	Bit Number	Failure
1	0	Slave processor
2	1	DTACK failure
4	2	Slave self-test
8	3	Isolator test
16	4	A/D convergence
32	5	Calibration value
64	6	GPIB chip
128	7	UART
256	8	Timer
512	9	internal overload
1024	10	ROM checksum, Low-order byte
2048	11	ROM checksum, high-order byte
4096	12	Nonvolatile RAM
8192	13	Option RAM
16384	14	Cal RAM

AZERO [*control*]

Autozero. Enables or disables the autozero function. The autozero function applies only to DC voltage, DC current, and resistance measurements.

control = **OFF** (0), ON (1), ONCE (2)

Power-on *control* = ON.
Default *control* = ON.

BEEP [*control*]
Controls the multimeter's beeper. When enabled, the beeper emits a 1 kHz beep if an error occurs.

control = OFF (0), ON (1), ONCE (2)

Power-on *control* = last programmed Value.
Default *control* = ONCE.

CAL
This is a calibration command. Refer to the Agilent 3458A Calibration Manual for details.

CALL [*name*]
Call Subprogram. Executes a previously stored subprogram.

name: A subprogram name may contain up to 10 characters. The name can be alpha, alphanumeric, or an integer in the range of 0 to 127.

Power-on *name* = none.
Default *name* = 0.

CALNUM?
Calibration Number Query. Returns an integer indicating the number of times the multimeter has been calibrated.

CALSTR *string*[,*security_code*]

Calibration String (remote only). Stores a string in the multimeter's nonvolatile calibration RAM.

string: This is the alpha/numeric message that will be appended to the calibration RAM. The *string* parameter must be enclosed in single or double quotes. Maximum string length = 75 characters (the quotes enclosing the string are not counted as characters).

security_code: When the calibration RAM is secured (SECURE command) you must include the *security_code* in order to write a message to the calibration RAM.

COMPRESS *name*

Compress Subprogram. Removes the ASCII text of a specified subprogram previously stored in memory. This saves memory space but removes the subprogram from continuous memory (the subprogram will be destroyed when power is removed).

name: A subprogram name may contain up to 10 characters. The name can be alpha, alphanumeric, or an integer in the range of 0 to 127.

Power-on *name* = none.
Default *name* = none: parameter required.

CONT

Continue. Resumes execution of a subprogram that has been suspended by a PAUSE command.

Command Summary

CSB
Clear Status Byte. Clears (sets to 0) all bits in the status register.

DCI, DCV
Refer to the FUNC command.

DEFEAT [*mode*]
Enables or disables the multimeter's input protection algorithm (see CAUTION in Chapter 4 of the User's Guide) and some syntax and error checking algorithms. With these algorithms disabled. the multimeter can change to a new measurement configuration faster than it can with them enabled.

mode = OFF (0), ON (1)

Power-on *mode* = OFF.
Default *mode* = OFF.

DEFKEY *number,string*
or
DEFKEY DEFAULT
Define Key. Assigns one or more commands to a user-defined function key (labeled f0 - f9). The DEFKEY DEFAULT command erases the strings assigned to all user-defined keys.

number = an integer in the range 0 - 9 (or FO - F9).

Power-on *number* = none.
Default *number* = *0*.

string: The command or list of commands to be assigned to the function key. (Must be enclosed in single or double quotes). Maximum string length = 40 characters (not counting the quotes).

Power-on *string* = none.

Default *string* = none (clears any previous string).

DEFAULT: Erases the strings assigned to all user-defined keys.

DELAY [*time*]

Specifies a time interval that is inserted between the trigger event and the first sample event (or when sub-sampling, between the sync source event and the first reading of each burst).

time: Specifies the delay time in seconds. Delay time can range from 1 E-7 (100 ns) to 6000 seconds in 100 ns increments. Specifying 0 for the delay sets the delay to its minimum possible value.

Power-on *time* = automatic (determined by function, range, resolution, and ACBAND setting).

Default *time* = automatic (determined by function, range, resolution, and ACBAND setting).

DELSUB *name*

Delete Subprogram. Removes a single subprogram from memory.

name: A subprogram name may contain up to 10 characters. The name can be alpha, alphanumeric, or an integer in the range of 0 to 127.

Power-on *name* = none.
Default *name* = none: parameter required.

DIAGNOST
Refer to the Agilent 3458A Assembly Level Repair Manual.

DISP [*control*] [,*message*]
Display. Enables or disables the multimeter's display, and may also be used to send a message to the display or to clear the display.

control = OFF (0), ON (1), MSG (2), CLR (3)

Power-on *control* = ON.
Default *control* = ON.

message = the message to be displayed.

DSAC [*max._input*] [,*%_resolution*]
or
DSDC [*max._input*] [,*%_resolution*]
Direct-Sampling. Configures the multimeter for direct-sampled measurements (digitizing). The DSAC function measures only the AC component of the input waveform. The DSDC function measures the combined AC and DC components. Otherwise. the two functions are identical. The DSAC and DSDC functions use the track/hold circuit (2 nanosecond aperture) and a wide bandwidth input path (12 MHz bandwidth).

max._input: Selects the measurement range. (See The RANGE command for details.)

Power-on *max._input* = not applicable.
Default *max._input* = 10V.

%_resolution: Is ignored when Used with the DSAC or DSDC command.

EMASK [*value*]

Error Mask. Enables certain error condition(s) to set the error bit (bit 5) in the status register.

value: To enable an error condition, specify its decimal weight as the *value* parameter. To enable more than one error condition, specify the sum of the weights. The error conditions and their weights are:

Weighted Value	Bit Number	Error Conditions
1	0	Hardware, see AUXERR?
2	1	Calibration
4	2	Trigger too fast
8	3	Syntax error
16	4	Not allowed from remote
32	5	Undefined parameter
64	6	Parameter out of range
128	7	Memory Error
256	8	Destructive overload
512	9	Out of calibration
1024	10	Calibration required
2048	11	Settings conflict
4096	12	Math error
8192	13	Subprogram error
16384	14	System error

Power-on *value* = 32767 (all enabled).
Default *value* = 32767 (all enabled).

Command Summary

END [*control*]

The END command enables or disables the GPIB End Or Identify (EOI) function.

control = OFF (0), ON (1), ALWAYS (2)

Power-on *control* = OFF.
Default *control* = ALWAYS.

ERR?

Error Query. When an error occurs. it sets a bit in the error register and illuminates the display's ERR annunciator. The ERR? command returns a number representing all set bits, clears the register, and shuts off the annunciator. The returned number is the weighted sum of all set bits.

Weighted Value	Bit Number	Error Conditions
1	0	Hardware, see AUXERR?
2	1	Calibration
4	2	Trigger too fast
8	3	Syntax error
16	4	Not allowed from remote
32	5	Undefined parameter
64	6	Parameter out of range
128	7	Memory Error
256	8	Destructive overload
512	9	Out of calibration
1024	10	Calibration required
2048	11	Settings conflict
4096	12	Math error
8192	13	Subprogram error
16384	14	System error

ERRSTR?

Error String Query. The ERRSTR? command reads the least significant set bit in either the error register or the auxiliary error register and then clears the bit. The ERRSTR? command returns two responses separated by a comma. The first response is an error number (100 series = error register: 200 series = auxiliary error register) and the second response is a message (string) explaining the error.

EXTOUT [*event*][,*polarity*]

External Output. Specifies the event that will generate a signal on the rear panel Ext Out connector (EXTOUT signal). This command also specifies the polarity of the EXTOUT signal.

event = OFF (0), ICOMP (1), ONCE (2), APER (3), BCOMP (4), SRQ (5), RCOMP (6)

Power-on *event* = ICOMP.
Default *event* = ICOMP.

polarity = NEG (0), POS (1)

Power-on *polarity* = NEG.
Default *polarity* = NEG.

FIXEDZ [*control*]

Enables or disables the fixed input resistance function for DC voltage measurements.

control = OFF (0), ON (1)

Power-on *control* = OFF.
Default *control* = ON.

Command Summary

FREQ [*max._input*][*%_resolution*]

Frequency. Instructs the multimeter to measure the frequency of the input signal. You must specify whether the input signal is AC voltage, AC+DC voltage, AC current, or AC+DC current using the FSOURCE command.

Max._input: Selects a fixed range or the autorange mode. (See the RANGE command for details.)

Power-on *max._input* = not applicable.
Default *max._input* = AUTO.

%_resolution: Specifies the digits of resolution and the gate time as shown below:

%_resolution Parameter	Selects Gate Time	Digits of Resolution
.00001	1s	7
.0001	100ms	7
.001	10ms	6
.01	1ms	5
.1	100µs	4

Power-on *%_resolution* = not applicable.
Default *%_resolution* = .00001

FSOURCE [*source*]

Frequency Source. Specifies the type of signal to be used as the input signal for frequency or period measurements.

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

Power-on *source* = ACV.
Default *source* = ACV.

FUNC [*function*][,*max._input*][,*%_resolution*]
or
[FUNC] *function*[,*max._input*][,*%_resolution*]

Function. Selects the type of measurement (AC voltage, DC current, etc.) and specifies the measurement range and resolution.

function = DCV (1), ACV (2), ACDCV (3), OHM (4), OHMF (5), DCI (6), ACI (7), ACDCI (8), FREQ (9), PER (10), DSAC (I11), DSDC (12), SSAC (13), SSDC (14)

Power-on *function* = DCV.
Default *function* = DCV.

max._input: Selects a fixed range or the autorange mode. (See the RANGE command for details.)

Power-on *max._input* = AUTO.
Default *max._input* = AUTO.

%_resolution: Specifies resolution as a a percentage of the *max._input* parameter. (Refer to the FREQ and PER commands for tables showing how *%_resolution* affects frequency and period measurements: *%_resolution* is ignored when the function parameter is DSAC, DSDC, SSAC, or SSDC.)

Power-on *%_resolution* = none.
Default *%_resolution*:
FREQ or PER =.00001 (gate time=1s, 7 digits resolution).
SETACV SYNC = 0.01%
SETACV RNDM = 0.4%

For all other measurement functions, the default resolution is determined by the present integration time.

Command Summary

ID?

Identity Query. Causes the multimeter to send the string "HP 3458A".

INBUF [*control*]

Input Buffer. Enables or disables the multimeter's input buffer. When enabled, the input buffer temporarily stores the commands it receives over the GPIB bus. This releases the bus immediately after a command is received, allowing the controller to perform other tasks while the multimeter executes the stored command.

control = OFF (0), ON (1)

Power-on *control* = OFF.
Default *control* = ON.

ISCALE?

Integer Scale Query. Returns the scale factor for readings output in the SINT or DINT formats.

LEVEL [*percentage*][,*coupling*]

The LEVEL command specifies the level triggering voltage (as a percentage of the present range) and the coupling (AC or DC) for level triggering. A level trigger event occurs when the input signal reaches the specified voltage on its positive-going or negative-going slope as specified by the SLOPE command.

percentage: Specifies the percentage of the present range for level triggering. The valid range for this parameter is -500% to +500% in 5% steps for direct or sub-sampling or -120% to 120% in 1% steps for DC voltage.

Power-on *percentage* = 0% (0V).
Default *percentage* = 0% (0V).

coupling = DC (1), AC (2)

Power-on *coupling* = AC.
Default *coupling* = AC.

LFILTER [*control*]
Level Filter. Enables or disables the level filter function. When enabled. the level filter function connects a single pole low-pass filter circuit to the input of the level-detection circuitry. The low-pass filter has a 3-dB point of 75 kHz and prevents high frequency components from causing false triggers.

control = OFF (0), ON (1)

Power-on *control* = OFF.
Default *control* = ON.

LFREQ [*frequency*]
or
LFREQ LINE
Specifies the A/D converter's reference frequency or measures the line frequency and sets the reference frequency to the measured value.

frequency: Specifies the reference frequency. The valid range is 45 - 65 Hz, or 360 - 440 Hz. When the frequency is in the range of 360 - 440Hz, the multimeter divides that value by 8 (e.g. 400/8 = 50Hz).

Power-on reference *frequency* = rounded value of 50 or 60Hz

Command Summary

Default reference *frequency* = the exact measured line frequency (or measured value/8 for 40OHz line frequency).

LINE: Measures the exact value of the line frequency and sets the reference frequency to that value (or measured value/8 if the measured value is between 360 and 440Hz).

LINE?

Line Frequency Query. Measures and returns the frequency of the AC power line.

LOCK [*control*]

Lockout. Enables or disables the multimeter's keyboard.

control = OFF (0), ON (1)

Power-on *control* = OFF.
Default *control* = ON.

MATH [*operation_a*][*operation_b*]

The MATH command enables or disables real-time math operations.

operation: = OFF (0), CONT (1), CTHRM (3), DB (4), DBM (5), FILTER (6), FTHRM (8), NULL (9), PERC (10), PFAIL (11), RMS (12), SCALE (13), STAT (14), CTHRM2K (16), CTHRM10K (17), FTHRM2K (18), FTHRM10K (19), CRTD85 (20), CRTD92 (21), FRTD85 (22), FRTD92 (23)

Power-on *operation_a*, *operation_b* = OFF, OFF.
Default *operation_a*, *operation_b* = OFF, OFF.

Power-on register values = all registers are set to 0 with the following exceptions:

DEGREE = 20   REF = 1
SCALE = 1   RES = 50
PERC = 1

MCOUNT?
Memory Count Query. Returns the total number of stored readings.

MEM [*mode*]
Memory. Enables or disables reading memory and designates the storage mode.

mode = OFF (0), LIFO (1), FIFO (2), CONT (3)

Power-on *mode* = OFF.
Default *mode* = FIFO.

MENU [*mode*]
The MENU command selects the SHORT or FULL list of commands in the front panel's alphabetic command menu.

mode = SHORT (0), FULL (1)

Power-on *mode* = mode selected when power was removed.
Default *mode* = FULL

MFORMAT [*format*]
Memory Format. Clears reading memory and designates the storage format for new readings.

format = ASCII (1), SINT (2), DINT (3), SREAL (4), DREAL (5)

Power-on *format* = SREAL.
Default *format* = SREAL.

MMATH [*operation_a*][,*operation_b*]

Memory Math. Enables or disables post-process math operations.

operation: = OFF (0), CONT (1), CTHRM (3), DB (4), DBM (5), FILTER (6), FTHRM (8), NULL (9), PERC (10), PFAIL (11), RMS (12), SCALE (13), STAT (14), CTHRM2K (16), CTHRM10K (17), FTHRM2K (18), FTHRM10K (19), CRTD85 (20), CRTD92 (21), FRTD85 (22), FRTD92 (23)

Power-on *operation_a*, *operation_b* = OFF, OFF.
Default *operation_a*, *operation_b* = OFF, OFF.

Power-on **register values** = all registers are set to 0 with the following exceptions:

DEGREE = 20	REF = 1
SCALE = 1	RES = 50
PERC = 1	

MSIZE[reading_mem][,subprogram_mem]

Memory size. On a previous Agilent multimeter, the MSIZE command was used to clear all memory and allocate memory space for readings, subprograms, and state storage. The 3458A accepts the MSIZE command to maintain language compatibility, but performs no action since the 3458A's memory allocations are predefined and cannot be changed. The MSIZE? query command, however, is used to determine the total reading memory and

the largest unused block of subprogram/state memory.

NDIG [*value*]

Number of Digits. Designates the number of display digits.

value: An integer from 3 to 8 (there is an implied 1/2 digit: that is, when you specify NDIG 3. the multimeter displays 3 1/2 digits.)

Power-on *value* = 7 (7 1/2 digits).
Default *value* = 7 (7 11/2 digits).

NPLC [*power_line_cycles*]

Number of Power Line Cycles. Specifies the A/D converter's integration time in terms of power line cycles.
power_line_cycles: Any value >1 for the *power_line_cycles* parameter provides at least 60 dB of NMR at the power line frequency. Any value <1 provides no NMR: it only sets the integration time for the A/D converter. The ranges and the incremental step sizes for the *power_line_cycles* parameter are:

0 - 1 PLC in .000006 PLC steps for 60Hz reference frequency (LFREQ command)
or
0 - 1 PLC in .000005 PLC steps for 50Hz reference frequency
1 - 10 PLC in 1 PLC steps
10 - 1000 PLC in 10 PLC steps.

Power-on *power_line_cycles* = 10.
Default *power_line_cycles* = 0 (selects minimum integration time of 500ns)

Command Summary

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

Number of Readings. Designates the number of readings taken per trigger and the event (sample event) that initiates each reading.

count: Designates the number of readings per trigger event. The valid range for this parameter is 1 to 16777215 (The count parameter also corresponds to the record parameter in the RMEM command.)

Power-on *count* = 1.
Default *count* = 1.

event = AUTO (1), EXT (2), SYN (5), TIMER (6), LEVEL (7), LINE (8)

Power-on *event* = AUTO.
Default *event* = AUTO.

OCOMP [*control*]

The OCOMP command enables or disables the offset compensated ohms function.

control = OFF (0), ON (1)

Power-on *control* = OFF.
Default *control* = ON.

OFORMAT [*format*]

Output Format. Designates the GPIB output format for readings sent directly to the controller or transferred from reading memory to the controller.

format = ASCII (1), SINT (2), DINT (3), SREAL (4), DREAL (5)

Power-on *format* = ASCII.
Default *format* = ASCII.

OHM, OHMF
Refer to the FUNC command.

OPT?
Option Query. Returns a response indicating the multimeter's installed options. The possible responses are:

0 = No installed options
1 = Extended Reading Memory Option

PAUSE
Suspends subprogram execution. The subprogram can be resumed using the CONT command or by executing the GPIB Group Execute Trigger command.

PER [*max._input*][,*%_resolution*]
Period. Instructs the multimeter to measure the period of the input signal. You can specify whether the input signal is AC voltage (default), AC+DC voltage, AC current, or AC+DC current using the FSOURCE command.

max._input: The *max._input* parameter selects a fixed range or the autorange mode. (See the RANGE command for details.)

Power-on *max._input* = not applicable.
Default *max._input* = AUTO.

%_resolution: Specifies the digits of resolution and the gate time as shown below:

%_resolution Parameter	Selects Gate Time	Digits of Resolution
.00001	1s	7
.0001	100ms	7
.001	10ms	6
.01	1ms	5
. 1	100µs	4

Power-on %_resolution = not applicable.
Default %_resolution = .00001

PRESET [*type*]

Configures the multimeter to one of three pre-defined states.

type: Specifies the NORM, FAST, or DIG preset state (the numeric query equivalents of these parameters are 1, 0, and 2, respectively).

Power-on *type* = not applicable.
Default *type* = NORM.

PRESET NORM is similar to RESET but optimizes the multimeter for remote operation. Executing PRESET NORM executes the following commands:

ACBAND 20,2E+6	MEM OFF (last memory operation = FIFO)
AZERO ON	MFORMAT SREAL
BEEP ON	MMATH OFF
DCV AUTO	NDIG 6
DELAY -1	NPLC 1
DISP ON	NRDGS 1,AUTO
FIXEDZ OFF	OCOMP OFF
FSOURCE ACV	OFORMAT ASCII
INBUF OFF	TARM AUTO
LOCK OFF	TIMER 1
MATH OFF	TRIG SYN

all math registers are set to 0 except:

```
DEGREE = 20    REF = 1
SCALE = 1      RES = 50
PERC = 1
```

PRESET FAST configures the multimeter for fast readings, fast transfer to memory, and fast transfer from memory to GPIB. Executing PRESET FAST executes the commands shown under preset norm with the following exceptions:
DCV 10
AZERO OFF
DISP OFF
MFORMAT DINT
OFORMAT DINT
TARM SYN
TRIG AUTO

PRESET DIG configures the multimeter for DCV digitizing. Executing PRESET DIG executes the commands shown under PRESET NORM with the following exceptions:
DCV 10
AZERO OFF
DISP OFF
TARM HOLD
TRIG LEVEL
LEVEL 0,AC
NRDGS 256,TIMER
TIMER 20E-6
APER 3E-6
MFORMAT SINT
OFORMAT SINT

PURGE *name*

Purge State. Removes a single stored state from memory.

name: A state name may contain up to 10 characters. The name can be alpha, alphanumeric, or an integer in the range of 0 to 127.

Power-on *name* = none.
Default *name* = none: parameter required.

QFORMAT [*type*]

Query Format. Designates whether query responses contain numeric or alpha characters (whenever possible), and whether command headers are returned.

type = NUM (0), NORM (1), ALPHA

Power-on *type* = NORM.
Default *type* = NORM.

R [*max._input*][*,%_resolution*]

R is an abbreviation for the RANGE command. Refer to the RANGE command for more information.

RANGE [*max._input*][*,%_resolution*]

Selects a measurement range or the autorange mode.

max._input: Selects a fixed range or the autorange mode. To select a fixed range, specify the absolute value (no negative numbers) of the maximum expected amplitude of the

input signal. The multimeter then selects the correct range. To select autorange, specify AUTO or default the parameter.

The following tables show the $max.\_input$ parameters and the ranges they select for each measurement function.

For DCV:

max._input Parameter	Selects Range	Full Scale
-1 or AUTO	Autorange	
0 to .12	100mV	120mV
>.12 to 1.2	1V	1.2V
>1.2 to 12	10V	12V
>12 to 120	100V	120V
>120 to 1E3	1000V	1050V

For ACV or ACDCV:

max._input Parameter	Selects Range	Full Scale
-1 or AUTO	Autorange	
0 to .012	10mV	12mV
>.012 to .12	100mV	120mV
>.12 to 1.2	1V	1.2V
>1.2 to 12	10V	12V
>12 to 120	100V	120V
>120 to 1E3	1000V	1050V

Command Summary

For OHM or OHMF:

max._input Parameter	Selects Range	Full Scale
–1 or AUTO	Autorange	
0 to 12	10Ω	12Ω
>12 to 120	100Ω	120kΩ
>120 to 1.2E3	1kΩ	1.2kΩ
>1.2E3 to 1.2E4	10kΩ	12kΩ
>1.2E4 1.2E5	100kΩ	120kΩ
>1.2E5 to 1.2E6	1MΩ	1.20MΩ
>1.2E6 to 1.2E7	10MΩ	12MΩ
>1.2E7 1.2E8	100MΩ	120MΩ
>1.2E8 1.2E9	1GΩ	1.2GΩ

For DCI:

max._input Parameter	Selects Range	Full Scale
–1 or AUTO	Autorange	
0 to .12E-6	.1µA	.12µA
>.12E-6 to 1.2E-6	1µA	1.2µA
>1.2E-6 to 12E-6	10µA	12µA
>12E-6 to 120E-6	100µA	120µA
>120E-6 to 1.2E-3	1mA	1.2mA
>1.2E-3 to 12E-3	10mA	12mA
>12E-3 to 120E-3	100mA	120mA
>120E-3 to 1.2	1A	1.05A

For ACI or ACDCI:

max._input Parameter	Selects Range	Full Scale
–1 or AUTO	Autorange	
0 to .120E-6	100µA	120µA
>120E-6 to 1.2E-3	1mA	1.2mA
>1.2E-3 to 12E-3	10mA	12mA
>12E-3 to 120E-3	100mA	120mA
>120E-3 to 1.2	1A	1.05A

For DSAC or DSDC:

max._input Parameter	Selects Range	Full Scale SINT format	DINT format
0 to .012	10mV	12mV	50mV
>.012 to .120	100mV	120mV	500mV
>.120 to 1.2	1V	1.2V	5.0V
>1.2 to 12	10V	12V	50V
>12 to 120	100V	120V	500V
>120 to 1E3	1000V	1050V	1050V

For SSAC or SSDC:

max._input Parameter	Selects Range	Full Scale
0 to .012	10mV	12mV
>.012 to .120	100mV	120mV
>.120 to 1.2	1V	1.2V
>1.2 to 12	10V	12V
>12 to 120	100V	120V
>120 to 1E3	1000V	1050V

Power-on *max._input* = AUTO.
Default *max._input* = AUTO.

Command Summary

%_resolution: Specifies resolution as percentage of the *max._input* parameter. (Refer to the FREQ and PER commands for tables showing how *%_resolution* affects frequency and period measurements.

%_resolution is ignored when the function parameter is DSAC, DSDC, SSAC, or SSDC.

RATIO [*control*]

The RATIO command instructs the multimeter to measure a DC reference voltage applied to the Ω Sense terminals and a signal voltage applied to the Input terminals. The multimeter then computes the ratio as:

$$\text{Ratio} = \frac{\text{Signal Voltage}}{\text{DC Reference Voltage}}$$

control = OFF (0), ON (1)

Power-on *control* = OFF.
Default *control* = ON.

RES [*%_resolution*]

Resolution. Specifies reading resolution as a percentage of the measurement range.

%-resolution: For frequency and period measurements the *%_resolution* parameter specifies the digits of resolution and the gate time (see FREQ or PER for details).

For all other functions (except DSAC, DSDC, SSAC, and SSDC: *%_resolution* is ignored for these functions), the multimeter multiplies *%_resolution* times the present measurement range (1V, 10V, 100V, etc.) to determine the resolution.

Power-on *%_resolution* = none.
Default *%_resolution*:
FREQ (and PER) = .00001 (gate time = 1s, 7 digits resolution)
SETACV SYNC = 0.01%
SETACV RNDM = 0.4%
For all other measurement functions, the default resolution is determined by the present integration time.

RESET

Sets the multimeter to the power-on state without cycling power.

REV?

Revision Query. Returns two numbers separated by a comma. The first number is the multimeter's master processor firmware revision. The second number is the slave processor firmware revision.

RMATH [*register*]

Recall Math. Reads and returns the contents of a math register.

register = DEGREE (1), LOWER (2), MAX (3), MEAN (4), MIN (5), NSAMP (6), OFFSET (7), PERC (8), REF (9), RES (10), SCALE (11), SDEV (12), UPPER (13), HIRES (14), PFAILNUM (15)

Power-on *register* = none.
Default *register* = DEGREE.

RMEM [*first*][,*count*][,*record*]

Recall Memory. Reads and returns the value of a reading or group of readings stored in reading memory. RMEM leaves stored readings intact (not cleared from memory).

first: Designates the beginning reading.

Power-on *first* = none.
Default *first* = 1

count: Designates the number of readings to be recalled, starting with first.

Power-on *count* = none.
Default *count* = 1

record: Designates the record from which to recall readings. Records correspond to the number of readings specified by the NRDGS command. For example, if NRDGS specifies three readings per trigger, each record will contain three readings.

Power-on *record* = none.
Default *record* = I

RQS [*value*]

Request Service. Enables one or more status register conditions. When a condition is enabled and that condition occurs, it sets the GPIB SRQ line true.

value: You enable a condition by specifying its decimal weight as the *value* parameter. For more than one condition, specify the sum of the weights. Refer to the STB? command for a table showing the conditions and their weights.

Power-on *value*: If Power-On SRQ was enabled when power was removed, value = 8: otherwise, value = 0
Default *value* = 0 (no conditions enabled).

RSTATE [*name*]

Recall State. Recalls a stored state from memory and configures the multimeter to that state. States are stored using the SSTATE command.

name: A state name may contain up to 10 characters. The name can be alpha, alphanumeric, or an integer in the range of 0 to 127.

Power-on *name* = none.
Default *name* = 0.

SCAL

This is a calibration command. Refer to the Agilent 3458A Calibration Manual for details.

SCRATCH

Clears all subprograms and stored states from memory.

SECURE *old_code*, *new_code*[,*acal_secure*]

Security Code. Allows the person responsible for calibration to enter a security code to prevent accidental or unauthorized calibration or autocalibration (autocal).

old_code: This is the multimeter's previous security code. The multimeter is shipped from the factory with its security code set to 3458.

new_code: This is the new security code. The code is an integer from -2.1E-9 to 2.1E9. If the number specified is not an integer, the multimeter rounds it to an integer value.

acal_secure = OFF (0), ON (1)

Command Summary

Power-on **acal_secure** = Previously specified value (OFF is the factory setting).
Default **acal_secure** = OFF.

SETACV [*type*]

Set ACV. Selects the RMS conversion technique to be used for AC or AC+DC voltage measurements.

type = ANA (1), RNDM (2), SYNC (3)

Power-on **type** = ANA.
Default **type** = ANA.

SLOPE [*slope*]

SLOPE is used in conjunction with the LEVEL command and specifies which slope of the signal will be used by the level-detection circuitry.

slope = NEG (0), POS (1)

Power-on **slope** = POS.
Default **slope** = POS.

SMATH [*register*][,*number*]

Store Math. Places a number in a math register.

register = DEGREE (1), LOWER (2), MAX (3), MEAN (4), MIN (5), NSAMP (6), OFFSET (7), PERC (8), REF (9), RES (10), SCALE (11), UPPER (13), HIRES (14), PFAILNUM (15)

Default **register** = DEGREE.

number: The *number* parameter is the value to be placed in the register.

Default *number* = last reading.

SRQ

Service Request. Sets bit 2 in the multimeter's status register. If bit 2 is enabled to assert SRQ (RQS 4 command), executing the SRQ command will set the GPIB SRQ line.

SSAC [*max._input*] [*,%_resolution*]
or
SSDC [*max._input*] [*,%_resolution*]

Sub-Sampling. Configures the multimeter for sub-sampled voltage measurements (digitizing). The SSAC function measures only the AC component of the input waveform. The SSDC function measures the combined AC and DC components of the waveform. Otherwise, the two functions are identical. The input signal must be periodic (repetitive) for sub-sampled measurements. Sub-sampled measurements use the track/hold circuit (2 nanoseconds aperture) and a wide bandwidth input path (12 MHz bandwidth).

max._input: Selects the measurement range. (See the RANGE command for details).

Power-on *max._input* = not applicable.
Default *max._input* = 10V.

%_resolution: Is ignored when used with the SSAC or SSDC command.

SSPARM?

Sub-Sampling Parameters Query. Returns the parameters necessary to reconstruct a sub-sampled waveform (SSAC or SSDC command) when the samples are sent directly to the GPIB output

buffer. (Reconstruction is automatic when the samples are sent directly to reading memory).

The first parameter returned by SSPARM? is the number of bursts that contained N samples. The second parameter is the number of bursts that contained N-1 samples. The third parameter returned is the value of N.

SSRC [*source*][,*mode*]

Sync Source. For sub-sampling (SSAC or SSDC command), the SSRC command synchronizes bursts to an external signal or to a voltage level on the input signal.

For synchronous ACV or ACDCV (SETACV SYNC command), the SSRC command synchronizes sampling to an external signal. You can also use the HOLD parameter to prevent the measurement method from changing to random should level triggering not occur within certain time limits. The time limits are determined by the AC band-width (ACBAND command) setting.

source = EXT (2), LEVEL (7)

Power-on *source* = LEVEL.
Default *source* = LEVEL.

mode = AUTO (1), HOLD (4)

Power-on *mode* = AUTO
Default *mode* = AUTO

SSTATE *name*

Store State. Stores the multimeter's present state and assigns it a name. States are recalled using the RSTATE command.

name: A state name may contain up to 10 characters. The name can be alpha, alphanumeric, or an integer in the range of 0 to 127.

Power-on *name* = none.
Default *name* = none: parameter required.

STB?

Status Byte Query. The status register contains seven bits that monitor various multimeter conditions. When a condition occurs, the corresponding bit is set in the status register. The STB? (status byte?) command returns a number representing the set bits. The returned number is the weighted sum of all set bits.

The status register conditions and their weights are:

Decimal Weight	Bit Number	Enables Condition
1	0	Program Memory Execution Complete
2	1	Hi or Lo Limit Exceeded
4	2	SRQ Command Executed
8	3	Power-On SRQ
16	4	Ready for Instructions
32	5	Error (See ERRSTR?)
64	6	Service Requested
128	7	Data Available

Command Summary

SUB *name*

Subprogram. Stores a series of commands as a subprogram and assigns the subprogram name.

name: A subprogram name may contain up to 10 characters. The name can be alpha, alphanumeric, or an integer in the range of 0 to 127.

Power-on *name* = none.
Default *name* = none: parameter required.

SUBEND

Subprogram End. Signals the end of a subprogram.

SWEEP [*effective_interval*][,*#_samples*]

The SWEEP command specifies the effective interval between samples (readings) and the total number of samples taken per trigger event (most measurement functions) or per trigger arm event (sub-sampling only).

effective_interval: For sub-sampling (SSAC or SSDC), this parameter specifies the spacing or samples in the reconstructed waveform. For all other measurement functions, this parameter specifies the actual time interval from one sample to the next. For sub-sampling, the valid range of this parameter is 10E-9 to 6000 seconds: for all other measurement functions the range is (1/maximum reading rate) to 6000 seconds.

Power-on *effective_interval* = 100E-9
Default *effective_interval* = 20µs

#_samples: Specifies the number of samples to be taken. The valid range for this parameter is 1 to 1.67E+7.

Power-on *#_samples* = 1024
Default *#_samples* = 1024

T [*event*]

T is an abbreviation for the TRIG command. Refer to the TRIG command for more information.

TARM [*event*][*,numher_arms*]

Trigger arm. Defines the event that enables (arms) the trigger event (TRIG command). You can also use this command to perform multiple measurement cycles.

event = AUTO (1). EXT (2). SGL (3). HOLD (4). SYN (5)

Power-on *event* = AUTO.
Default *event* = AUTO.

number-arms: Specifies multiple trigger arming (the TARM event must be SGL). The valid range is 0-2.1E+9.

Power-on *number_arms* = 1 (multiple arming disabled)
Default *number_arms* = 1 (multiple arming disabled)

TBUFF [*control*]

Trigger Buffer. Enables or disables the multimeter's external trigger buffer.
control = OFF (0), ON (1)

Power-on *control* = OFF.
Default *control* = OFF.

Command Summary

TEMP?
Temperature Query. returns the multimeter's internal temperature in degrees Centigrade.

TERM [*source*]
On previous Agilent multimeters, the TERM command internally connected or disconnected the multimeter's input terminals. The 3458A accepts the TERM command to maintain language compatibility with these multimeters, but does not respond since the 3458A's input terminals are controlled with a manually operated switch.

Power-on *source* = none.
Default *source* = FRONT.

TEST
Causes the multimeter to perform a series of internal self-tests.

TIMER [*time*]
The TIMER command defines the time interval for the TIMER sample event in the NRDGS command. When using the TIMER event. the time interval is inserted between successive measurements.

time: The valid range of the time parameter is (1/maximum sampling rate) to 6000 seconds in 100ns increments.

Power-on *time* = 1 second.
Default *time* = 1 second.

TONE
Causes the multimeter to beep once, the multimeter then returns to the previous BEEP mode (either OFF or ON).

TRIG [*event*]

Specifies the trigger event.

event = AUTO (1), EXT (2), SGL (3), HOLD (4),
SYN (5), LEVEL (7), LINE (8)

Power-on *event* = AUTO.
Default *event* = SGL.

HP-IB Command Summary

ABORT 7 (IFC)
   Clears the multimeter's interface circuitry.

CLEAR (DCL or SDC)
   Clears the multimeter, preparing it to receive a
   command. The CLEAR command does the follow-
   ing:

   Clears the output buffer.
   Clears the input buffer.
   Aborts subprogram execution.
   Clears the status register (bits 4, 5, and 6 are not
   cleared if the condition(s) that set the bit(s) still
   exist).
   Clears the display.
   Disables triggering (the previous triggering mode
   can be resumed by sending any multimeter com-
   mand).

LOCAL(GTL)
   Removes the multimeter from the remote state
   and enables its keyboard (provided the keyboard
   has not been disabled with the multimeter's
   LOCK command).

LOCAL LOCKOUT (LLO)
   Disables the multimeter's LOCAL key.

REMOTE
   Sets the GPIB REN line true.

SPOLL (Serial Poll)
   The SPOLL command, like the STB? command
   (multimeter command set), returns a number rep-
   resenting the set bits in the status register (status
   byte). The returned number is the weighted sum
   of all set bits.

The status register conditions and their weights are:

Decimal Weight	Bit Number	Enables Condition
1	0	Program Memory Execution Complete
2	1	Hi or Lo Limit Exceeded
4	2	SRQ Command Executed
8	3	Power-On SRQ
16	4	Ready for instructions
32	5	Error (See ERRSTR?)
64	6	Service Requested
128	7	Data AvaiLable

TRIGGER (GET)

If triggering is armed (see TARM command), the TRIGGER command (Group Execute Trigger) triggers the multimeter once, and then holds triggering.

Notes: