

Keysight 3458A Multimeter

Quick Reference
Guide

Contacting Keysight

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Printing History

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Safety Notices

CAUTION

A CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

WARNING

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

For further safety information details, refer to the
Keysight 3458A Multimeter User's Guide.

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The Multimeter Language

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 Keysight 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 Keysight 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 lf* 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

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

Calibration/Test

ACAL

CAL

CAL?

CALNUM?

CALSTR

REV?

SCAL

SECURE

TEMP?

TEST

GPIB

Commands

ABORTIO

CLEAR

LOCAL

LOCAL LOCKOUT

REMOTE

SPOLL

TRIGGER

Power-On/Reset State

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

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

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 and 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 or 60 Hz

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
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 nanoseconds, 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 A-to-D 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 Band width. 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

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 100 ns. (Specifying a value <500 ns selects minimum aperture which is 500 ns.)

Power-on aperture = is determined by the power-on value for NPLC which specifies an integration time of 166.667 ms for a 60 Hz power line frequency, or 200 ms for a power line frequency of 50 Hz or 400 Hz.

Default aperture = 500 ns.

ARANGE [*control*]

Autorange. Enables or disables the autorange function.

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

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

Weighted Value	Bit Number	Failure
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 *Keysight 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.

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 *Keysight 3458A 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 F0 - 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 *Keysight 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).

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

Weighted Value	Bit Number	Error Conditions
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.

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:

<i>%_resolution</i> Parameter	Selects Gate Time	Digits of Resolution
.00001	1 s	7
.0001	100 ms	7
.001	10 ms	6
.01	1 ms	5
.1	100 μ s	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 (11), 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 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.

ID?

Identity Query. Causes the multimeter to send the string "Keysight 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 – 440 Hz, the multimeter divides that value by 8 (e.g. $400/8 = 50$ Hz).

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

Default reference frequency = the exact measured line frequency (or measured value/8 for 400 Hz 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)

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	1 s	7
.0001	100 ms	7
.001	10 ms	6
.01	1 ms	5
.1	100 μ s	4

Power-on %_resolution = not applicable.

Default %_resolution = .00001

PRESET [type]

Configures the multimeter to one of three predefined 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	100 mV	120 mV
>.12 to 1.2	1 V	1.2 V
>1.2 to 12	10 V	12 V
>12 to 120	100 V	120 V
>120 to 1E3	1000 V	1050 V

For ACV or ACDCV:

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

For OHM or OHMF:

max_input Parameter	Selects Range	Full Scale
-1 or AUTO	Autorange	

<i>max_input</i> Parameter	Selects Range	Full Scale
0 to 12	10 Ω	12 Ω
>12 to 120	100 Ω	120 k Ω
>120 to 1.2E3	1 k Ω	1.2 k Ω
>1.2E3 to 1.2E4	10 k Ω	12 k Ω
>1.2E4 1.2E5	100 k Ω	120 k Ω
>1.2E5 to 1.2E6	1 M Ω	1.20 M Ω
>1.2E6 to 1.2E7	10 M Ω	12 M Ω
>1.2E7 1.2E8	100 M Ω	120 M Ω
>1.2E8 1.2E9	1 G Ω	1.2 G Ω

For DCI:

<i>max_input</i> Parameter	Selects Range	Full Scale
-1 or AUTO	Autorange	
0 to .12E-6	.1 μ A	.12 μ A
>.12E-6 to 1.2E-6	1 μ A	1.2 μ A
>1.2E-6 to 12E-6	10 μ A	12 μ A
>12E-6 to 120E-6	100 μ A	120 μ A
>120E-6 to 1.2E-3	1 mA	1.2 mA
>1.2E-3 to 12E-3	10 mA	12 mA
>12E-3 to 120E-3	100 mA	120 mA
>120E-3 to 1.2	1 A	1.05 A

For ACI or ACDCI:

<i>max. input</i> Parameter	Selects Range	Full Scale
-1 or AUTO	Autorange	
0 to .120E-6	100 μ A	120 μ A
>120E-6 to 1.2E-3	1 mA	1.2 mA
>1.2E-3 to 12E-3	10 mA	12 mA
>12E-3 to 120E-3	100 mA	120 mA
>120E-3 to 1.2	1 A	1.05 A

For DSAC or DSDC:

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

For SSAC or SSDC:

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

Power-on *max._input* = AUTO.

Default *max._input* = AUTO.

%_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 (1 V, 10 V, 100 V, etc.) to determine the resolution.

Power-on %_resolution = none.

Default %_resolution:

FREQ (and PER) = .00001 (gate time = 1 s, 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 = 1

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 *Keysight 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 $-2.1\text{E}-9$ to $2.1\text{E}9$. If the number specified is not an integer, the multimeter rounds it to an integer value.

acal_secure = OFF (0), ON (1)

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 bandwidth (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

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 = 20 μ s

#_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*][,*number_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.

TEMP?

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

TERM [*source*]

On previous Keysight 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.

GPB 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 following:

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 command).

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 representing 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.

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This information is subject to change without notice. Always refer to the Keysight website for the latest revision.

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