Programming Manual

5490C Series
5½ and 6½ Digit Multimeters

B&K PRECISION

Contents

About Commands & Queries

This section lists and describes the remote control commands and queries recognized by the instrument. All commands and queries can be executed in either local or remote state.

The description, command syntax, query syntax, example and respond can be found in a section. The commands are given in both long and short form. All examples are shown in short form. Queries perform actions such as obtaining information are recognized by the question mark (?) following the header.

1.1 How They are Listed

The commands are listed by subsystem and alphabetical order according to their short form.

1.2 How They are Described

In the descriptions themselves, a brief explanation of the function performed is given. This is followed by a presentation of the formal syntax, with the header given in Upper-and-Lower-Case characters and the short form derived from it in ALL UPPER-CASE characters. Where applicable, the syntax of the query is given with the format of its response.

1.3 When can they be used?

The commands and queries listed here can be used for teh 549XC Series Digital Multimeter.

1.4 Command Notation

The following notation is used in the commands:

< > Angular brackets enclose words that are used as placeholders, of which there are two types: the header path
and the data parameter of a command.

:= A colon followed by an equals sign separates a placeholder from the description of the type and range of values that
may be used in a command instead of the placeholder.

{ } Braces enclose a list of choices, one of which one must be made.

[ ] Square brackets enclose optional items.

… An ellipsis indicates that the items both to its left and right may be repeated a number of times.

Common Command Introduction

IEEE standard defines the common commands used for querying the basic inSyntaxion of the instrument or executing basic operations. These commands usually start with "*" and and have a 3 character length.

Short	Long	Subsystem	Description
*IDN	*IDN	SYSTEM	Returns a string that uniquely identifies the instrument.
*OPC	*OPC	SYSTEM	Generates the OPC message in the standard event status register when all pending overlapped operations are complete.
*OPC?	*OPC?	SYSTEM	Returns an ASCII "+1" when all pending overlapped operations are complete.
*RST	*RST	SYSTEM	Initiates a device reset.

Table 2.1

2.1 *IDN?

Description The *IDN? query causes the instrument to identify itself. The response comprises manufacturer, model, serial number, software version and firmware version.

Query *IDN?

Response *IDN, ⟨device id⟩,⟨model⟩,⟨serial number⟩, ⟨software version⟩, ⟨hardware version⟩.

⟨device id⟩:="BK" is used to identify instrument.

⟨model⟩:= A model identifier less than 14 characters will contain the model number.

⟨serial number⟩:= Number that uniquley identifies the instrument.

⟨firmware version⟩:= Firmware revision number.

⟨hardware version⟩:= Hardware revision number.

Example *IDN?

Returns: BK Precision,549XC,XXXXXXXXXXXXXX,5.0.1.3.9R3

2.2 *OPC

Description	Sets the **Operation Complete** bit (bit 0) in the Standard Event Register after all of the previous commands have been completed. Other commands may be executed before the bit is set.
	This command is used to stops the controller until all pending commands are completed. ***OPC?** returns **"1"** to the output buffer after the previous commands have been completed.
	Other commands cannot be executed until this command completes.
Syntax	*OPC
Query	*OPC?
Example	INITiate;*OPC
Response	**"1"**

2.3 *RST

Description	Reset the instrument to its factory default state. *RST does not affect stored instrument states, or the I/O settings, which are stored in non-volatile memory.
Syntax	*RST
Example	*RST

CONFigure Subsystem

The CONFigure command is the easiest way to configure measurements. Like the MEASure? query, these commands use the default measurement configuration values. However, these commands do not automatically start measuring, so you can modify the measurement properties before starting the measurement.

3.1 Default measurement configuration for the CONFigure command

Measurement	Default Setting
AC input filter (bandwidth)	20 Hz (medium speed filter)
Auto Zero	If the resolution setting causes NPLC to be less than 1, it will be turn OFF; if the resolution setting causes NPLC to be greater than or equal to 1, it will be turn ON.
Range	AUTO (including voltage range for frequency and period measurement)
Samples per trigger	1 sample
Trigger number	1 trigger
Trigger delay	Auto delay
Trigger source	Immediately
Trigger slope	NEGative
Mathematical function	Forbidden. Other parameters have not changed.

3.2 CONFigure?

Description	Returns a string indicating the current function, range, and resolution.
Query	CONFigure?
Example	conf? DCI, 1.00000000E-04, 1.00000000E-09

3.3 CONFigure:VOLTage:DC

Description   Configure the instrument for DC voltage measurement, setting all measurement parameters and trigger parameters to their default values.

Syntax   CONFigure[:VOLTage]:DC ‹range›

Parameters   ‹range›: 100m, 1, 10, 100, 1000, AUTO, MIN, MAX
Default:AUTO

Example   CONF:VOLT:DC 100

3.4 CONFigure:VOLTage:AC

Description   Configure the instrument for AC voltage measurement, setting all measurement parameters and trigger parameters to default values

Syntax   CONFigure[:VOLTage]:AC ‹range›

Parameters   ‹range›: 100m, 1, 10, 100, 750, AUTO Default:AUTO

Example   CONF:VOLT:AC 100

3.5 CONFigure:CURRent:DC

Description   Configure the instrument for DC current measurement, setting all measurement parameters and trigger parameters to default values

Syntax   CONFigure:CURRent:DC ‹range›

Parameters   ‹range›: 100 uA, 1 mA, 10 mA, 100 mA, 1 A, 3 A, 10 A. Default:AUTO

Example   CONF:CURR:DC 100m

3.6 CONFigure:CURRent:AC

Description   Configure the instrument for AC current measurement, setting all measurement parameters and trigger parameters to default values

Syntax   CONFigure:CURRent:AC ‹range›

Parameters   ‹range›: 100 uA, 1 mA, 10 mA, 100 mA, 1 A, 3 A, 10 A. Default:AUTO

Example   CONF:CURR:AC 100m

3.7 CONFigure:CONTinuity

Description   Configure the instrument for continuity measurement, setting all measurement parameters and trigger parameters to default values

Syntax   CONFigure:CONTiniuty

Example   CONF:CONT

3.8 CONFigure:DIODe

Description   Configure the instrument for diode measurement, setting all measurement parameters and trigger parameters to default values

Syntax   CONFigure:DIODe

Example   CONF:DIOD

3.9 CONFigure:RESistance

Description   Configure the instrument for two-wire resistance measurement, setting all measurement parameters and trigger parameters to default values

Syntax   CONFigure:RESistance ‹range›

Parameters   ‹range›: 10, 100, 1k, 10k, 100k, 1M, 10M, 100M Default:AUTO

Example   CONF:RES 10M

3.10 CONFigure:FRESistance

Description   Configure the instrument for four-wire resistance measurement, setting all measurement parameters and trigger parameters to default values

Syntax   CONFigure:FRESistance ‹range›

Parameters   ‹range›: 10, 100, 1k, 10k, 100k, 1M, 10M, 100M Default:AUTO

Example   CONF:FRES 10M

3.11 CONFigure:FREQuency

Description   Configure the instrument for frequency measurement, set all measurement parameters and trigger parameters to default values

Syntax   CONFigure:FREQuency [<range>-MIN-MAX-DEF]

Parameters   <range>: 100m, 1, 10, 100, 750 Default:AUTO

Example   CONF:FREQ 10

3.12 CONFigure:PERiod

Description   Configure the instrument for periodic measurements, setting all measurement parameters and trigger parameters to default values

Syntax   CONFigure:PERiod [<range>-MIN-MAX-DEF]

Parameters   <range>: 100m, 1, 10, 100, 750 Default:AUTO

Example   CONF:PER 10MA

3.13 CONFigure:TEMPerature

Description   Configure the instrument for temperature measurement and set all measurement parameters and trigger parameters to default values

Syntax   CONFigure:TEMPerature [FRTD-RTD-FTHermistor-THERmistor]

Parameters   <probe_type>:FRTD, RTD, FTHermistor, THERmistor

Example   CONF:TEMP RTD

3.14 CONFigure:CAPacitance

Description   Configure the instrument for capacitance measurement, setting all measurement parameters and trigger parameters to default values

Syntax   CONFigure:CAPacitance <range>

Parameters   <range>:1n, 10n, 100n, 1u, 10u, 100u, 1m, 10m Default:AUTO

Example   CONF:CAP 10u

MEASure subsystem

With MEASure? queries, you can use a single command to select functions and ranges. All other parameters are set to default values (see Table 7.3.1).

The example below configures the DC voltage measurement, internally triggering the instrument to take measurements, and reading the measurement results. The default range (automatic adjustment range) and resolution (10 PLC) are used for measurement.

Query Syntax	MEAS:VOLT:DC?
Response	+4.23450000E-03

The example below configures the instrument for 2-wire resistance measurements, triggers the instrument to take measurements and reads the measurements. Select the 1 kΩ range.
MEAS:RES? 1000

Response	+3.27150000E+02

4.1 MEASure:VOLTage:AC-DC?

Description	Configure the instrument for AC or DC voltage measurement and immediately trigger the measurement to send the measurement to the user. All other measurement parameters and trigger parameters are set to default values.
Syntax	MEASure:VOLTage:AC? or MEASure:VOLTage:DC? ‹range›
Parameters	AC: ‹range›:100m, 1, 10, 100, 750. Default:AUTO
	DC: ‹range›:100m, 1, 10, 100, 1000. Default:AUTO
Example	MEAS:VOLT:DC? 100
Response	+8.53210000E+1

4.2 MEASure:CURRent:AC-DC?

Description	Configure the instrument for AC or DC current measurement and immediately trigger the measurement to send the measurement to the user. All other measurement parameters and trigger parameters are set to default values.
Syntax	MEASure:CURRent:AC? or MEASure:CURRent:DC? ‹range›

Parameters ⟨range⟩: 100u, 1m, 10m, 100m, 1, 3, 10. Default:AUTO

Example MEAS:CURR:DC? 10

Response +8.53210000E+01

4.3 MEASure:CONTinuity?

Description Configure the instrument to perform a continuity measurement and immediately trigger the measurement to send the measurement to the user. All other measurement parameters and trigger parameters are set to default values.

Syntax MEASure:CONTinuity?

Example MEAS:CONT?

Response +8.53210000E+00

4.4 MEASure:DIODe?

Description Configure the instrument to perform a diode measurement and immediately trigger the measurement and send the measurement to the user. All other measurement parameters and trigger parameters are set to default values.

Syntax MEASure:DIODe?

Example MEAS:DIODe?

Response +8.53210000E+00

4.5 MEASure:RESistance-FRESistance?

Description Configure the instrument to perform a 2-wire resistance (RESistance) or 4-wire resistance (FRESistance) measurement and immediately trigger the measurement to send the measurement results to the user. All other measurement parameters and trigger parameters are set to default values.

Syntax MEASure:RESistance? or MEASure:FRESistance? ⟨range⟩

Parameters ⟨range⟩:10, 100, 1k, 10k, 100k, 1M, 10M, 100M . Default:AUTO

Example MEAS:FRES? 100

Response   +8.53210000E+01

4.6 MEASure:FREQuency-PERiod?

Description   Configure the instrument to perform frequency or period measurements and immediately trigger the measurement to send the measurement to the user. All other measurement parameters and trigger parameters are set to default values.

Syntax   MEASure:FREQuency or MEASure:PERiod? ‹range›

Parameters   ‹range›:100m, 1, 10, 100, 750. Default:AUTO

Example   MEAS:FREQ? 10

Response   +1.4527800E-04

4.7 MEASure:TEMPerature?

Description   Configure the instrument to perform temperature measurement and immediately trigger the measurement to send the measurement to the user. All other measurement parameters and trigger parameters are set to default values.

Syntax   MEASure:TEMPerature? ‹probe›

Parameters   ‹probe›: FRTD, RTD, FTHermistor, THERmistor.

Example   MEAS:TEMP? RTD

Response   +8.53210000E+1

4.8 MEASure:CAPacitance?

Description   Configure the instrument to make a capacitance measurement and immediately trigger the measurement and send the measurement to the user. All other measurement parameters and trigger parameters are set to default values

Syntax   MEASure:CAPacitance? ‹range›

Parameters   ‹range›:1n, 10n, 100n, 1u, 10u, 100u, 1m, 10m. Default:AUTO

Example   MEAS:CAP? 10u

Response   +8.53210000E-06

TRIGger subsystem

5.1 ABORt

Description Terminates the measurement in progress and returns the instrument to the trigger idle state.

Syntax ABORt

Example Terminate the measurement in progress: ABORt

5.2 INITiate

Description Changes the state of the trigger system from idle to wait for trigger and then clears the previous set of measurement result from the reading memory. When the specified trigger condition is met after receiving the INIT command, measurement will begin.

You can store up to 10,000 measurements in the reading memory. If the reading memory overflows, the new measured value will overwrite the oldest measured value and the latest measured value will always be retained.
To retrieve measurements from the reading memory, use FETCh?.

Syntax INITiate

Example Return five DC voltage measurements and start the measurement using a software trigger:
CONF:VOLT:DC 10
TRIG:SOUR BUS
SAMP:COUN 5
INIT
*TRG
FETC?

5.3 FETCh?

Description   Wait for the measurement to complete and send all measurements to the user.

The FETCh? query does not erase the measurement results from the reading memory. You can send the query multiple times to retrieve the same data.

When measuring configuration changes, or when executing any of the following commands, the instrument will clear all measurements from the reading memory:INITiate, MEASure:<function>?, READ?, *RST, SYSTem:PRESet.

Syntax   FETCh?

Example   Combine CONFigure and INITiate with FETCh?. The INITiate command places the instrument in the waiting for trigger state, triggers the measurement when the rear panel Ext Trig input is a pulse signal (low by default), and sends the measurement to the user. The FETCh? query copies the measurement from the reading memory to the instrument's output buffer.

CONF:VOLT:DC 10, 0.003
TRIG:SOUR EXT
SAMP:COUN 4
INIT
FETC?

Response   -4.98748741E-01, -4.335163427E-01, -4.33118686E-01, -3.48109378E-01

Note   Before Sending FETCh?, it is best to ensure that the trigger operation completes triggering all the measurements, which is defined by the SAMPle:COUNt command. WTG? command can be used to check the trigger status.

5.4 R?

Description   Read and erase all measurements from the internal buffer memory. The command can be used if the triggered operation requires capturing more than 10000 pts of data. In this case, this command can be used to periodically read and clear the internal buffer memory before it fills to capacity of 10000 pts.

Syntax   R?

Example   R?

Response   -4.98748741E-01, -4.335163427E-01, -4.33118686E-01, -3.48109378E-01

5.5 READ?

Description Start a new set of measurements, wait for all measurements to complete and transfer all available measurements. Sending READ? is similar to sending INITiate;:FETCh?.

Syntax READ?

Example Take the measurement from the reading memory:

READ?

Response -4.98748741E-01, -4.335163427E-01, -4.33118686E-01, -3.48109378E-01

Note The READ? command may cause an error if the remote connection timeout is not longer than required for the instrument to finish triggering and taking the measurements into the memory. Thus, this command is recommended only for capturing smaller multiple points of data. The timing is also dependent on other factors such as integration (aperture time), the function selected for the measurement, the range, the bandwidth (when applicable), the gate time (when applicable), total number of sample counts (specified by SAMPle:COUNt command) and total number of trigger counts (specified by TRIGger:COUNt command).

5.6 TRIGger:COUNt

Description Set the number of triggers the instrument accepts. When the number of triggers reaches the set value, the instrument will return to the idle state and no longer trigger.

Syntax TRIGger:COUNt <count>-MIN-MAX-DEF

Query TRIGger:COUNt? [MIN-MAX-DEF]

Parameters <count>: 1 - 999999. Default: 1

Example Return ten sets of five DC voltage measurements and start each measurement group with an external trigger:

CONF:VOLT:DC
SAMP:COUN 5
TRIG:COUN 10
TRIG:SOUR EXT
READ?

Response +1.00520000E+01, ... (50 measurements)

5.7 TRIGger:SOURce

Description   Select the trigger source for the measurement

IMMediate:The trigger signal is always present. A trigger signal is issued as soon as the instrument is placed in the "waiting for trigger" state.

BUS:When the DMM is in the "Wait Bus Trigger", the instrument is triggered by sending "*TRG" via the remote interface.

EXTernal:When the DMM is in the Wait External Trigger, the instrument is triggered by sending a TTL pulse to the Ext Trig interface on the rear panel.

Syntax   TRIGger:SOURce IMMediate-EXTernal-BUS

Query   TRIGger:SOURce?

Parameters   trigger source type

Example   Return ten sets of five DC voltage measurements and start each measurement group with an external trigger:

CONF:VOLT:DC
SAMP:COUN 5
TRIG:COUN 10
TRIG:SOUR EXT
READ?

Response   +1.00520000E+01, ... (50 measurements)

5.8 TRIGger:DELay

Description   Sets the waiting time for the instrument to receive the trigger signal to the middle of the start measurement.

If you have configured more than one measurement for each trigger of the instrument (SAMPle:COUNt >1), after the trigger, a delay is inserted between two adjacent measurements. Setting a specific trigger delay will disable the automatic trigger delay (TRIGger:DELay:AUTO OFF).

Syntax   TRIGger:DELay <seconds>-MIN-MAX-DEF

Query   TRIGger:DELay? [MIN-MAX-DEF]

Parameters   required delay time

Example   Returns the result of five DC voltage measurements. There is a 2 second delay before each measurement.

CONF:VOLT:DC 10
SAMP:COUN 5
TRIG:DEL 2
READ?

Response   +4.27230000E+00, +4.27150000E+00, +4.27190000E+00, +4.27170000E+00, +4.27200000E+00

5.9 TRIGger:DELay:AUTO

Description Disable or enable automatic trigger delay. If enabled, the instrument sets the delay based on function, range, and integration time or bandwidth.

By default, TRIGger:DELay:AUTO is ON.

Syntax TRIGger:DELay:AUTO ON, 1, OFF, 0

Query TRIGger:DELay:AUTO?

Parameters ON, 1, OFF, 0

Example Returns the result of five DC voltage measurements. There is an automatic delay between each measurement

CONF:VOLT:DC 10
SAMP:COUN 5
READ?

Response +4.27230000E+00, +4.27150000E+00, +4.27190000E+00, +4.27170000E+00, +4.27200000E+00

5.10 SAMPle:COUNt

Description Specifies the number of measurements (number of samples) taken each time the instrument is triggered.

You can use the specified sample count with a trigger count (TRIGger:COUNt). The total number of measurements returned before returning to the idle trigger state is the product of the sample count and the trigger count.

Syntax SAMPle:COUNt <count>-MIN-MAX-DEF

Query SAMPle:COUNt? [MIN-MAX-DEF]

Parameters <count>: 1 - 999999. Default: 1

Example Return ten sets of four-time resistance measurements and start each measurement group with an external trigger:
CONF:RES 1E6
SAMP:COUN 4
TRIG:COUN 10
TRIG:SOUR EXT

READ?

Response   +1.00520000E+06, ... (40 measurements)

5.11 WTG?

Description   Queries the trigger status.

This command can be used during long periods of triggered measurement operation (i.e. high sample count). This command is used in conjunction with INITiate and FETCh? command so that rather than specifying a fixed timeout in the remote settings, this command can be used to query periodically the trigger status. FETCh? command can be sent after the trigger is back to idle state.

Syntax   WTG?

Query   WTG?

Response   0 - Trigger is busy or not ready.

1 - Trigger is ready.

[SENSe:]VOLTage subsystem

This subsystem configures AC voltage measurement, DC voltage measurement.

6.1 [SENSe:]VOLTage:AC:BANDwidth

Description   Sets the AC filter cutoff frequency for AC voltage measurements.

The instrument uses three different AC filters that allow you to optimize low frequency accuracy or reduce AC settling time after changing the input signal amplitude. Based on the cutoff frequency specified by this command, the instrument selects a slow (3 Hz), medium (20 Hz) or fast (200 Hz) filter. Specify the lowest frequency you want to encounter. Lower frequencies result in longer settling times.

Syntax   [SENSe:]VOLTage:AC:BANDwidth ‹filter›-MIN-MAX

Query   [SENSe:]VOLTage:AC:BANDwidth? [MIN-MAX-DEF]

Parameters   ‹filter›:3, 20, 200. Default: 20

Example   VOLT:AC:BAND 200

6.2 [SENSe:]VOLTage:AC:SPEEd

Description   Sets the measurement speed for AC voltage measurements.

The measurement speed is limited by the filter cutoff frequency. The 3Hz filter only supports slow (SLOW), the 20Hz filter supports slow (SLOW) and medium speed (MEDium), and the 200Hz filter supports slow (SLOW), medium speed (MEDium) and fast (FAST).

Syntax   [SENSe:]VOLTage:AC:SPEEd ‹speed›-MIN-MAX

Query   [SENSe:]VOLTage:AC:SPEEd? [MIN-MAX-DEF]

Parameters   ‹speed›:SLOW-MEDium-FAST. Default:MEDium

Example   VOLT:AC:SPEE SLOW

6.3 [SENSe:]VOLTage:AC:SECondary

Description   Select the auxiliary measurement function for the AC voltage measurement. Please use DATA2? to read auxiliary measurement results.

Syntax   [SENSe:]VOLTage:AC:SECondary OFF-BEForemath-FREQuency

Query   [SENSe:]VOLTage:AC:SECondary?

Parameters   OFF-BEForemath-FREQuency

Example   VOLT:AC:SEC FREQ

6.4 [SENSe:]VOLTage:AC-DC:RANGe

Description   Select a fixed range for AC and DC voltage measurements

Syntax   [SENSe:]VOLTage:AC:RANGe <range>-MIN-MAX or [SENSe:]VOLTage:DC:RANGe <range>-MIN-MAX

Query   [SENSe:]VOLTage:AC:RANGe? [MIN-MAX-DEF] or [SENSe:]VOLTage:DC:RANGe? [MIN-MAX-DEF]

Parameters   AC:<range>:100m, 1, 10, 100, 750. Default: 10

DC   <range>:100m, 1, 10, 100, 1000. Default: 1000

Example   VOLT:AC:RANG 10

6.5 [SENSe:]VOLTage:AC-DC:RANGe:AUTO

Description   Enable or disable autoranging for AC and DC voltage measurements

The autoranging range can be adjusted down to less than 10% of the range and can be adjusted upwards to more than 120% of the range.

Syntax   [SENSe:]VOLTage:AC:RANGe:AUTO ON-OFF or [SENSe:]VOLTage:DC:RANGe:AUTO ON-OFF

Query   [SENSe:]VOLTage:AC:RANGe:AUTO? or [SENSe:]VOLTage:DC:RANGe:AUTO?

Parameters   ON, 1, OFF, 0

Example   VOLT:AC:RANG:AUTO ON

6.6 [SENSe:]VOLTage[:DC]:NPLC

Description   Sets the integration time in terms of the number of power line cycles (PLC) for DC voltage measurement.

The integration time is the period during which the instrument's analog-to-digital (A/D) converter measures the input signal samples. A longer integration time gives a higher measurement resolution, but the measurement speed is slower.

Syntax   [SENSe:]VOLTage[:DC]:NPLC ‹plc›-MIN-MAX

Query   [SENSe:]VOLTage[:DC]:NPLC? [MIN-MAX-DEF]

Parameters   ‹plc›:0.02, 0.2, 1, 10, 100

Example   VOLT:NPLC 10

6.7 [SENSe:]VOLTage[:DC]:IMPedance:AUTO

Description   Enable or disable the automatic input impedance mode for DC voltage measurement

Syntax   [SENSe:]VOLTage[:DC]:IMPedance:AUTO ON-OFF

Query   [SENSe:]VOLTage[:DC]:IMPedance:AUTO?

Parameters   ON, 1, OFF, 0

Example   VOLT:IMP:AUTO ON

6.8 [SENSe:]VOLTage[:DC]:ZERO:AUTO

Description   Enable or disable the auto zero mode for the DC voltage.

ON:The DMM internally measures the offset after each measurement. This measurement is then subtracted from the previous reading. This prevents the offset voltage on the DMM input circuit from affecting the measurement accuracy.
OFF:The instrument uses the last measured zero return measurement and subtracts it from each measurement. It reads a new zero reading whenever you change the function, range or integration time.

Syntax   [SENSe:]VOLTage[:DC]:ZERO:AUTO ON-OFF

Query   [SENSe:]VOLTage[:DC]:ZERO:AUTO?

Parameters   ON, 1, OFF, 0

Example   VOLT:ZERO:AUTO ON

6.9 [SENSe:]VOLTage[:DC]:SECondary

Description   Select the auxiliary measurement function for the DC voltage measurement.

Use DATA2? to read secondary/auxiliary measurement results.

Syntax   [SENSe:]VOLTage:AC:SECondary OFF-BEForemath

Query   [SENSe:]VOLTage:AC:SECondary?

Parameters   OFF-BEForemath

Example   VOLT:DC:SEC BEF

[SENSe:]CURRent Subsystem

7.1 [SENSe:]CURRent:AC:BANDwidth

Description   Sets the AC filter cutoff frequency for AC current measurement.

The instrument uses three different AC filters that allow you to optimize low frequency accuracy or reduce AC settling time after changing the input signal amplitude. Based on the cutoff frequency specified by this command, the instrument selects a slow (3 Hz), medium (20 Hz) or fast (200 Hz) filter. Specify the lowest frequency you want to encounter. Lower frequencies result in longer settling times

Command Syntax   [SENSe:]CURRent:AC:BANDwidth <filter>-MIN-MAX

Query Syntax   [SENSe:]CURRent:AC:BANDwidth? [MIN-MAX-DEF]

Parameters   <filter>:3, 20, 200. Default: 20

Example   CURR:AC:BAND 200

7.2 [SENSe:]CURRent:AC:SPEEd

Description   Sets the measurement speed for AC current measurement.

The measurement speed is limited by the filter cutoff frequency. The 3Hz filter only supports slow (SLOW), the 20Hz filter supports slow (SLOW) and medium speed (MEDium), and the 200Hz filter supports slow (SLOW), medium speed (MEDium) and fast (FAST).

Command Syntax   [SENSe:]CURRent:AC:SPEEd <speed>-MIN-MAX

Query Syntax   [SENSe:]CURRent:AC:SPEEd? [MIN-MAX-DEF]

Parameters   <speed>:SLOW, MEDium, FAST. Default:MEDium

Example   CURR:AC:SPEE SLOW

7.3 [SENSe:]CURRent:AC:SECondary

Description   Select the auxiliary measurement function for AC current measurement.

Please use DATA2? to read auxiliary measurement results.

Command Syntax [SENSe:]CURRent:AC:SECondary OFF-BEForemath-FREQuency

Query Syntax [SENSe:]CURRent:AC:SECondary?

Parameters OFF, BEForemath, FREQuency

Example CURR:AC:SEC BEF

7.4 [SENSe:]CURRent:AC-DC:RANGe

Description Select a fixed range for AC and DC current measurements. Select a fixed measurement range for AC or DC current measurement on the 3 A terminal. For digital multimeter with a 10A range, you cannot use this command to select a 10A range. Please use the directive 7.3.5.5

Command Syntax [SENSe:]CURRent:AC:RANGe <range>-MIN-MAX or [SENSe:]CURRent:DC:RANGe <range>-MIN-MAX

Query Syntax [SENSe:]CURRent:AC:RANGe? [MIN-MAX-DEF] or [SENSe:]CURRent:DC:RANGe? [MIN-MAX-DEF]

Parameters <range>: 100u, 1m, 10m, 100m, 1, 3. Default:AUTO

Example CURRent:AC:RANG 100m

7.5 [SENSe:]CURRent:AC-DC:RANGe:AUTO

Description Autoranging for AC and DC current measurements

The autoranging range can be adjusted down to less than 10% of the range and can be adjusted upwards to more than 120% of the range.

Command Syntax [SENSe:]CURRent:AC:RANGe:AUTO ON-OFF or [SENSe:]CURRent:DC:RANGe:AUTO ON-OFF

Query Syntax [SENSe:]CURRent:AC:RANGe:AUTO? or [SENSe:]CURRent:DC:RANGe:AUTO?

Parameters ON, 1, OFF, 0

Example CURR:AC:RANG:AUTO ON

7.6 [SENSe:]CURRent:AC-DC:TERMinals

Description Enable or disable autoranging for AC and DC current measurements

The autoranging range can be adjusted down to less than 10% of the range and can be adjusted upwards to more than 120% of the range.

Command Syntax [SENSe:]CURRent:AC:TERMinals 3-10 or [SENSe:]CURRent:DC:TERMinals 3-10

Query Syntax [SENSe:]CURRent:AC:TERMinals? or [SENSe:]CURRent:DC:TERMinals?

Parameters 3, 10

Example CURR:AC:TERM 10

7.7 [SENSe:]CURRent[:DC]:NPLC

Description Sets the integration time in terms of the number of power line cycles (PLC) for DC current measurement. The integration time is the period during which the instrument's analog-to-digital (A/D) converter measures the input signal samples. A longer integration time gives a higher measurement resolution, but the measurement speed is slower.

Command Syntax [SENSe:]CURRent[:DC]:NPLC <plc>-MIN-MAX

Query Syntax [SENSe:]CURRent[:DC:]NPLC? [MIN-MAX-DEF]

Parameters <plc>:0.02, 0.2, 1, 10, 100

Example CURR:NPLC 1

7.8 [SENSe:]CURRent:DC:SECondary

Description Select the auxiliary measurement function for the DC current measurement.

Please use DATA2? to read auxiliary measurement results.

Command Syntax [SENSe:]CURRent:DC:SECondary OFF-BEForemath

Query Syntax [SENSe:]CURRent:DC:SECondary?

Parameters OFF, BEForemath

Example CURR:DC:SEC BEF

7.9 [SENSe:]CURRent[:DC]:ZERO:AUTO

Description Enable or disable the auto zero mode for DC current.

ON: The DMM internally measures the offset after each measurement. This measurement is then subtracted from the previous reading. This prevents the offset voltage on the DMM input circuit from affecting the measurement accuracy.

OFF: The instrument uses the last measured zero return measurement and subtracts it from each measurement. It reads a new zero reading whenever you change the function, range or integration time.

Command Syntax   [SENSe:]CURRent [:DC]:ZERO:AUTO ON-OFF

Query Syntax   [SENSe:]CURRent [:DC]:ZERO:AUTO?

Parameters   ON, 1, OFF, 0

Example   CURR:ZERO:AUTO ON

8.1 [SENSe:]RESistance-FRESistance:RANGe

Description   Set a fixed range for 2-wire or 4-wire resistors

Command Syntax   [SENSe:]RESistance-FRESistance:RANGe ‹range›-MIN-MAX

Query Syntax   [SENSe:]RESistance-FRESistance:RANGe? [MIN-MAX-DEF]

Parameters   ‹range›:10, 100, 1k, 10k, 100k, 1MA, 10MA, 100MA

Example   RES:RANG 10MA

8.2 [SENSe:]RESistance-FRESistance:RANGe:AUTO

Description   Enable or disable the autoranging for 2-wire or 4-wire resistance measurements

The autoranging range can be adjusted down to less than 10% of the range and can be adjusted upwards to more than 120% of the range.

Command Syntax   [SENSe:]RESistance:RANGe:AUTO ON-OFF or [SENSe:]FRESistance:RANGe:AUTO ONOFF

Query Syntax   [SENSe:]RESistance:RANGe:AUTO? or [SENSe:]FRESistance:RANGe:AUTO?

Parameters   ON, 1, OFF, 0

Example   RES:RANG:AUTO ON

8.3 [SENSe:]RESistance-FRESistance:NPLC

Description   Sets the integration time in terms of the number of power line cycles (PLC) for 2-wire or 4-wire resistance measurements. The integration time is the period during which the instrument's analog-to-digital (A/D) converter measures the input signal samples. A longer integration time gives a higher measurement resolution, but the measurement speed is slower.

Command Syntax   [SENSe:]RESistance:NPLC ‹plc›-MIN-MAX or [SENSe:]FRESistance:NPLC ‹plc›-MIN-MAX

Query Syntax   [SENSe:]RESistance:NPLC? [MIN-MAX-DEF] or [SENSe:]FRESistance:NPLC? [MIN-MAX-DEF]

Parameters   <plc>:0.02, 0.2, 1, 10, 100

Example   RES:NPLC 1

8.4 [SENSe:]RESistance-FRESistance:SECondary

Description   Select the auxiliary measurement function for the resistance measurement. This parameter is shared between two-wire and four-wire resistors.

Please use DATA2? to read auxiliary measurement results.

Command Syntax   [SENSe:]RESistance:SECondary OFF-BEForemath or [SENSe:]FRESistance:SECondary OFF-BEForemath

Query Syntax   [SENSe:]RESistance:SECondary? or [SENSe:]FRESistance:SECondary?

Parameters   OFF-BEForemath

Example   RES:SEC BEF

8.5 [SENSe:]RESistance:ZERO:AUTO

Description   Enable or disable the auto zero mode for 2-wire resistors.

ON:The DMM internally measures the offset after each measurement. This measurement is then subtracted from the previous reading. This prevents the offset voltage on the DMM input circuit from affecting the measurement accuracy.
OFF:The instrument uses the last measured zero return measurement and subtracts it from each measurement. It reads a new zero reading whenever you change the function, range or integration time.

Command Syntax   [SENSe:]RESistance:ZERO:AUTO ON-OFF

Query Syntax   [SENSe:]RESistance ZERO:AUTO?

Parameters   ON, 1, OFF, 0

Example   RES:ZERO:AUTO ON

9.1 [SENSe:]FREQuency-PERiod:VOLTage:RANGe

Description   Select a fixed range for frequency and period measurements.

This parameter is shared between frequency and period.

Command Syntax   [SENSe:]FREQuency:VOLTage:RANGe ‹range›-MIN-MAX or [SENSe:]PERiod:VOLTage:RANGe ‹range›-MIN-MAX

Query Syntax   [SENSe:]FREQuency:VOLTage:RANGe? [MIN-MAX-DEF] or [SENSe:]PERiod:VOLTage:RANGe? [MIN-MAX-DEF]

Parameters   ‹range›:100m, 1, 10, 100, 750

Example   FREQ:RANG 10

9.2 [SENSe:]FREQuency-PERiod:VOLTage:RANGe:AUTO

Description   Enable or disable autoranging for frequency and period measurements.

This parameter is shared between frequency and period.
The autoranging range can be adjusted down to less than 10% of the range and can be adjusted upwards
to more than 120% of the range.

Command Syntax   [SENSe:]FREQuency:VOLTage:RANGe:AUTO ON-OFF or [SENSe:]PERiod:VOLTage:RANGe:AUTO ON-OFF

Query Syntax   [SENSe:]FREQuency:VOLTage:RANGe:AUTO? or [SENSe:]PERiod:VOLTage:RANGe:AUTO?

Parameters   ON, 1, OFF, 0

Example   FREQ:RANG:AUTO ON

9.3 [SENSe:]FREQuency-PERiod:RANGe:LOWer

Description   Sets the AC bandwidth used to detect signals during frequency and period measurements.

This parameter is shared between frequency and period.

The instrument uses three different AC filters that allow you to optimize low frequency accuracy or reduce AC settling time after changing the input signal amplitude. Based on the cutoff frequency specified by this command, the instrument selects a slow (3 Hz), medium (20 Hz) or fast (200 Hz) filter. Specify the lowest frequency you want to encounter. Lower frequencies result in longer settling times.

Command Syntax	[SENSe:]FREQuency:RANGe:LOWer ‹filter›-MIN-MAX or [SENSe:]PERiod:RANGe:LOWer ‹filter›-MIN-MAX
Query Syntax	[SENSe:]FREQuency:RANGe:LOWer? [MIN-MAX-DEF] or [SENSe:]PERiod:RANGe:LOWer? [MIN-MAX-DEF]
Parameters	‹filter›:3, 20, 200. Default: 20
Example	FREQ:RANG:LOW 200

9.4 [SENSe:]FREQuency-PERiod:APERture

Description   Set the aperture time (gated time) for frequency and period measurement.

This parameter is shared between frequency and period.
The larger the aperture time, the higher the measurement accuracy and the lower the measurement speed.

Command Syntax	[SENSe:]FREQuency:APERture ‹seconds›-MIN-MAX or [SENSe:]PERiod:APERture ‹seconds› -MIN-MAX
Query Syntax	[SENSe:]FREQuency:APERture? [MIN-MAX-DEF] or [SENSe:]PERiod:APERture? [MIN-MAX-DEF]
Parameters	‹seconds›:10m, 100m, 1
Example	FREQ:APER 100m

9.5 [SENSe:]FREQuency:SECondary

Description   Select the auxiliary measurement function for the frequency measurement.

Please use DATA2? to read auxiliary measurement results.

Command Syntax	[SENSe:]FREQuency:SECondary OFF-BEForemath-ACV-PERiod
Query Syntax	[SENSe:]FREQuency:SECondary?
Parameters	OFF, BEForemath, ACV, PERiod

Example   FREQ BEF

9.6 [SENSe:]PERiod:SECondary

Description   Select the auxiliary measurement function for the period measurement.

Please use DATA2? to read auxiliary measurement results.

Command Syntax   [SENSe:]PERiod:SECondary OFF-BEForemath-ACV-FREQuency

Query Syntax   [SENSe:]PERiod:SECondary?

Parameters   OFF-BEForemath-ACV- FREQuency

Example   PER BEF

[SENSe:]TEMPerture Subsystem

10.1 [SENSe:]TEMPerture:NPLC

Description   Sets the integration time in terms of the number of power line cycles (PLC) for temperature measurement.

The integration time is the period during which the instrument's analog-to-digital (A/D) converter measures the input signal samples. A longer integration time gives a higher measurement resolution, but the measurement speed is slower.

Command Syntax   [SENSe:]TEMPerture:NPLC ‹plc›-MIN-MAX

Query Syntax   [SENSe:]TEMPerture:NPLC? [MIN-MAX-DEF]

Parameters   ‹plc›:0.02, 0.2, 1, 10, 100

Example   TEMP:NPLC 10

10.2 [SENSe:]TEMPerture:TRANsducer:FRTD-RTD:RESistance

Description   Select the nominal resistance (R0) for 2-wire and 4-wire RTD measurements. R0 is an RTD nominal resistance at 0 °C.

Command Syntax   [SENSe:]TEMPerature:TRANsducer:FRTD-RTD:RESistance ‹reference›-MIN-MAX

Query Syntax   [SENSe:]TEMPerature:TRANsducer:FRTD-RTD:RESistance? [MIN-MAX-DEF]

Parameters   ‹reference›: set resistance value

Example   TEMP:TRAN:RTD:RES 10

10.3 [SENSe:]TEMPerture:TRANsducer:TYPE

Description   Select a probe type sensor for temperature measurement. Supported probes are 2-wire and 4-wire RTD, 2-wire and 4-wire thermistors

Command Syntax   [SENSe:]TEMPerature:TRANsducer:TYPE FRTD-RTD-FTHermistor-THERmistor

Query Syntax   [SENSe:]TEMPerature:TRANsducer:TYPE?

Parameters FRTD, RTD, FTHermistor, THERmistor

Example TEMP:TRAN:TYPE RTD

10.4 [SENSe:]TEMPerture:SECondary

Description Select an auxiliary measurement function for the temperature measurement.

Please use DATA2? to read auxiliary measurement results.

Command Syntax [SENSe:]TEMPerture:SECondary OFF-BEForemath-RESistor

Query Syntax [SENSe:]TEMPerture:SECondary?

Parameters OFF, BEForemath, RESistor

Example TEMP BEF

10.5 [SENSe:]TEMPerture:ZERO:AUTO

Description Enable or disable the auto zero mode for temperature measurement.

ON:The DMM internally measures the offset after each measurement. This measurement is then subtracted from the previous reading. This prevents the offset voltage on the DMM input circuit from affecting the measurement accuracy.
OFF:The instrument uses the last measured zero return measurement and subtracts it from each measurement. It reads a new zero reading whenever you change the function, range or integration time.

Command Syntax [SENSe:]TEMPerture:ZERO:AUTO ON-OFF

Query Syntax [SENSe:]TEMPerture:ZERO:AUTO?

Parameters ON, 1, OFF, 0

Example TEMP:ZERO:AUTO ON

10.6 UNIT:TEMPerture

Description Sets the unit used for temperature measurement (C, F or Kelvin)

Command Syntax UNIT:TEMPerature C-F-K

UNIT:TEMPerature?

Parameters C, F, K

Example UNIT:TEMP F

[SENSe:]CAPacitance subsystem

11.1 [SENSe:]CAPacitance:RANGe

Description   Select a fixed range for capacitance measurement.

Command Syntax   [SENSe:]CAPacitance:RANGe <range>-MIN-MAX

Query Syntax   [SENSe:]CAPacitance:RANGe? [MIN-MAX-DEF]

Parameters   <range>:1n, 10n, 100n, 1u, 10u, 100u, 1m, 10m

Example   CAP:RANG 100n

11.2 [SENSe:]CAPacitance:RANGe:AUTO

Description   Enable or disable autoranging for capacitance measurements

The autoranging range can be adjusted down to less than 10% of the range and can be adjusted upwards to more than 120% of the range.

Command Syntax   [SENSe:]CAPacitance:RANGe:AUTO ON-OFF

Query Syntax   [SENSe:]CAPacitance:RANGe:AUTO?

Parameters   ON, 1, OFF, 0

Example   CAP:RANG:AUTO ON

11.3 [SENSe:]CAPacitance:SECondary

Description   Select an auxiliary measurement function for the capacitance measurement.

Please use DATA2? to read auxiliary measurement results.

Command Syntax   [SENSe:]CAPacitance:SECondary OFF-BEForemath

Query Syntax   [SENSe:]CAPacitance:SECondary?

Parameters   OFF, BEForemath

Example   CAP BEF

SYSTem Subsystem

12.1 SYSTem:REMote

Description   Sets the instrument in remote mode.

Syntax   SYSTem:REMote

Example   SYST:REM

12.2 SYSTem:COMMunicate:RS232:BAUDrate

Description   Set the serial port baud rate

Syntax   SYSTem:COMMunicate:RS232:BAUDrate 4800, 9600, 19200, 38400, 57600, 115200

Query   SYSTem:COMMunicate:RS232:BAUDrate?:

Parameters   Supported baud rate: 4800, 9600, 19200, 38400, 57600, 115200

Example   SYST:COMM:RS232:BAUD 9600

12.3 SYSTem:COMMunicate:RS232:DATAbits

Description   Set serial data bits.

Syntax   SYSTem:COMMunicate:RS232:DATAbits 7-8

Query   SYSTem:COMMunicate:RS232:DATAbits?:

Parameters   Supported data bits: 7-8

Example   SYST:COMM:RS232:DATA 8

12.4 SYSTem:COMMunicate:RS232:PARity

Description   Set the serial port parity bit.

Syntax   SYSTem:COMMunicate:RS232:PARity EVEN-ODD-MARK-SPACE-NULL

Query   SYSTem:COMMunicate:RS232:PARity?:

Parameters Check method:EVEN, ODD, MARK, SPACE, NULL

Example SYST:COMM:RS232:PAR NULL

12.5 SYSTem:COMMunicate:RS232:STOPbits

Description Set the serial port stop bit.

Syntax SYSTem:COMMunicate:RS232:STOPbits 1-2

Query SYSTem:COMMunicate:RS232:STOPbits?

Parameters Serial port stop bit: 1-2

Example SYST:COMM:RS232:STOP 1

12.6 SYSTem:COMMunicate:LAN:DNS1-2

Description Set the DNS server address.

Syntax SYSTem:COMMunicate:LAN:DNS1-2 ‹address›

Query SYSTem:COMMunicate:LAN:DNS1-2?

Parameters Address

Example SYST:COMM:LAN:DNS1 192.168.1.4

12.7 SYSTem:COMMunicate:LAN:GATeway

Description Set the default route for the instrument.

Syntax SYSTem:COMMunicate:LAN:GATeway ‹address›

Query SYSTem:COMMunicate:LAN:GATeway?

Parameters Address

Example SYST:COMM:LAN:GAT 192.168.1.5

12.8 SYSTem:COMMunicate:LAN:HOSTname

Description Set the host name of the instrument.

Syntax	SYSTem:COMMunicate:LAN:HOSTname <name>
Query	SYSTem:COMMunicate:LAN:HOSTname?
Parameters	Defined hostname
Example	SYST:COMM:LAN:HOST "LAB1-DMM"

12.9 SYSTem:COMMunicate:LAN:IPADdress

Description	Set the IP address.
Syntax	SYSTem:COMMunicate:LAN:IPADdress <address>
Query	SYSTem:COMMunicate:LAN:IPADdress?
Parameters	IP address
Example	SYST:COMM:LAN:IPAD 192.168.1.242

12.10 SYSTem:COMMunicate:LAN:PORT

Description	Set the port number of the network port TCP communication.
Syntax	SYSTem:COMMunicate:LAN:PORT <port>
Query	SYSTem:COMMunicate:LAN:PORT?
Parameters	port number
Example	SYST:COMM:LAN:PORT 45454

12.11 SYSTem:COMMunicate:LAN:SMASk

Description	Set the subnet mask.
Syntax	SYSTem:COMMunicate:LAN:SMASk <smask>
Query	SYSTem:COMMunicate:LAN:SMASk?
Parameters	Subnet mask
Example	SYST:COMM:LAN:SMAS 255.255.255.0

General Command

13.1 SYSTem:BEEPer[:IMMediate]

Description   Issue a single beep

Syntax   SYSTem:BEEPer[:IMMediate]

Example   SYST:BEEP

13.2 SYSTem:BEEPer:STATe

Description   Disable or enable the buzzer sounding during continuity, diode or probe hold measurements, or when an error occurs on the current panel or remote interface.

Syntax   SYSTem:BEEPer:STATe ON, 1, OFF, 0

Query   SYSTem:BEEPer:STATe?

Parameters   ON, 1, OFF, 0

Example   SYST:BEEP:STAT OFF

13.3 SYSTem:CLICk:STATe

Description   When the front panel button or softkey is pressed, the button beep can be disabled or enabled.

Syntax   SYSTem:CLICk:STAT ON, 1, OFF, 0

Query   SYSTem:CLICk:STAT?

Parameters   ON, 1, OFF, 0

Example   SYST:CLIC:STAT OFF

13.4 SYSTem:DATE

Description   Sets the date of the instrument's real-time clock. Set the time with SYSTem:TIME.

The unix 32-bit timestamp is used, and the maximum time cannot exceed 2038.

Syntax   SYSTem:DATE ‹year›,‹month›,‹day›

Query   SYSTem:DATE?

Parameters   ‹year›:1970-2038

‹month›: 1-12
‹day›:1 - the maximum number of days in the current month

Example   SYST:DATE 2018, 5, 29

13.5 SYSTem:TIME

Description   Sets the time of the instrument's real-time clock. Set the date with SYSTem:DATE.

Syntax   SYSTem:TIME ‹hour›, ‹minute›, ‹second›

Query   SYSTem:TIME?

Parameters   ‹hour›: 0-23

‹minute›: 0-59
‹second›: 0-59

Example   SYST:TIME 13, 59, 10

13.6 SYSTem:VERSion?

Description   Query the current software version.

Syntax   SYSTem:VERSion?

Example   SYST:VER?

Typical return: 1.10

DATA2 subsystem

This subsystem is used to read auxiliary measurement results.

Description   Retrieve auxiliary measurement results

Syntax   DATA2?

Example   CONF:VOLT:DC 10
VOLT:DC:SEC BEF
READ?
Typical return: 1.70897747E-03
DATA2?
Typical return: 1.70897747E-03

NULL subsystem

This subsystem is used to set and control the null operation of the instrument.

VOLTage[:DC]	DC voltage
VOLTage:AC	AC Voltage
CURRent:DC	DC Current
CURRent:AC	AC Current
RESistance	2-wire resistance
FRESistance	4-wire resistance
FREQuency	Frequency
Period	Period
TEMPerature	Temperature
CAPacitance	Capacitance

The value of ‹function›

15.1 ‹function›:NULL:STATe

Description   Enable or disable the null function for the function specified by ‹function›. The possible values of ‹function› can be found in 7.3.12.

Syntax   ‹function›:NULL:STATe ON, 1, OFF, 0

Query   ‹function›:NULL:STATe?

Parameters   ON, 1, OFF, 0

Example   VOLT:DC:NULL:STAT ON

15.2 ‹function›:NULL:VALue

Description   Set a null value for the function specified by ‹function›. See ‹7.3.12› for the possible value of ‹function›.

To use a null value, you must turn on the null state (‹function›:NULL:STATe ON).
Specifying a null value disables automatic null selection (‹function›:NULL:VALue:AUTO OFF).

Syntax   ‹function›:NULL:VALue ON, 1, OFF, 0

Query   <function>:NULL:VALue?

Parameters   ON, 1, OFF, 0

Example   VOLT:DC:NULL:VAL 0.214

15.3 <function>:NULL:VALue:AUTO

Description   Enable or disable null values for the function specified by <function>. See <7.3.12> for possible values of <function>.

When the automatic reference selection is turned on, the first measurement made is used as the null value for all subsequent measurements.
<function>:NULL:VALue has been set to this value. Automatic null selection will be disabled.

Syntax   <function>:NULL:VALue:AUTO ON, 1, OFF, 0

Query   <function>:NULL:VALue:AUTO?

Parameters   ON, 1, OFF, 0

Example   VOLT:DC:NULL:VALue:AUTO ON

CALCulate:SCALe subsystem

This subsystem is mainly used to set and control the mathematical operations of the instrument.

16.1 CALCulate:SCALe:DB:REFerence

Description   Stores the relative value in the multimeter's dB relative register, which is used for the dB function in CALCulate:SCALe:FUNCtion. When the dB function is enabled, this value is subtracted from each voltage measurement after the measurement result is converted to dBm.

Syntax   CALCulate:SCALe:DB:REFerence ‹reference›

Query   CALCulate:SCALe:DB:REFerence?

Parameters

Example   CALC:SCAL:DB:REF -10.0

16.2 CALCulate:SCALe:DBM:REFerence

Description   Select the reference resistor to convert the voltage measurement to dBm. This reference affects the dBm and dB calibration function.

Syntax   CALCulate:SCALe:DBM:REFerence ‹reference›

Query   CALCulate:SCALe:DBM:REFerence?

Parameters

Example   CALC:SCAL:DBM:REF 300

16.3 CALCulate:SCALe:FUNCtion

Description   Select the operation to be performed by the calibration function.

The DB performs a relative dB calculation. The result is the difference between the input signal and the stored DB relative reference value (CALCulate:SCALe:DB:REFerence), both values are converted to dBm (dB = measurement in dBm − relative value in dBm) . dB calibration is only available for ACV and DCV measurements.

The DBM performs a dBM calculation. The result is a logarithmic expression based on the power passed to the reference resistor (CALCulate:SCALe:DBM:REFerence) and relative to 1 mW.
(dBm = 10 × log (measurement result / reference resistance / 1 mW)). The dBm calibration is only available for ACV and DCV measurements.

The PCT performs a percentage change operation. The result is a percentage change in the measurement results in the reference value:

Result = ((measurement result - reference value) / reference value) * 100

SCALe performs Mx+B operations. The result is the measurement result multiplied by the gain value M (CALCulate:SCALe:GAIN) + offset value B (CALCulate:SCALe:OFFSet). The Mx+B calibration applies to all measurement functions except ratio, continuity and diode.

Syntax	CALCulate:SCALe:FUNCtion DB-DBM-PCT-SCALe
Query	CALCulate:SCALe:FUNCtion?
Parameters	Selected operation:DB, DBM, PCT, SCALe
Example	Enable the DB calibration function for the next measurement reference:

CALC:SCAL:FUNC DB
CALC:SCAL:STAT ON

16.4 CALCulate:SCALe:GAIN

Description	Sets the gain value M of the calibration function in CALCulate:SCALe:FUNCtion.
Syntax	CALCulate:SCALe:GAIN ⟨gain⟩
Query	CALCulate:SCALe:GAIN?
Parameters	gain
Example	CALC:SCAL:GAIN 100

16.5 CALCulate:SCALe:OFFSet

Description	Sets the offset value B of the calibration function in CALCulate:SCALe:FUNCtion.
Syntax	CALCulate:SCALe:OFFSet ⟨offset⟩
Query	CALCulate:SCALe:OFFSet?
Parameters	offset

Example   CALC:SCAL:OFFSet 5

16.6 CALCulate:SCALe:REFerence

Description   Sets the reference value for the PCT function in CALCulate:SCALe:FUNCtion.

Syntax   CALCulate:SCALe:REFerence ‹reference›

Query   CALCulate:SCALe:REFerence?

Parameters   reference

Example   CALC:SCAL:REF 100

16.7 CALCulate:SCALe:REFerence:AUTO

Description   Enable or disable the automatic reference selection for the dB calibration function.

Syntax   CALCulate:SCALe:REFerence:AUTO ON, 1, OFF, 0

Query   CALCulate:SCALe:REFerence:AUTO?

Parameters   ON, 1, OFF, 0

Example   CALC:SCAL:REF:AUTO ON

16.8 CALCulate:SCALe[:STATe]

Description   Enable or disable the calibration function

Syntax   CALCulate:SCALe[:STATe] ON, 1, OFF, 0

Query   CALCulate:SCALe[:STATe]?

Parameters   ON, 1, OFF, 0

Example   CALC:SCAL:STAT ON

CALCulate:LIMit subsystem

This subsystem takes limit tests for the measurement results.

17.1 CALCulate:LIMit:LOWer[:DATA]

Description	Set the lower limit of the limit test
Syntax	CALCulate:LIMit:LOWer[:DATA] ‹value›
Query	CALCulate:LIMit:LOWer[:DATA]?
Parameters	‹value› set lower limit
Example	CALC:LIM:LOW -50

17.2 CALCulate:LIMit:UPPer[:DATA]

Description	Set the upper limit of the limit test
Syntax	CALCulate:LIMit:UPPer[:DATA] ‹value›
Query	CALCulate:LIMit:UPPer[:DATA]?
Parameters	‹value› set upper limit
Example	CALC:LIM:UPP 50

17.3 CALCulate:LIMit[:STATe]

Description	Enable or disable the limit test
Syntax	CALCulate:LIMit [:STATe] ON, 1, OFF, 0
Query	CALCulate:LIMit[:STATe]?
Parameters	ON, 1, OFF, 0
Example	CALC:LIM ON

17.4 CALCulate:LIMit:CLEar[:IMMediate]

Description   Clear limit test results

Syntax   CALCulate:LIMit:CLEar[:IMMediate]

Example   CALC:LIM:CLE

CALCulate:AVERage Subsystem

This subsystem calculates measurement statistics. Measurement statistics require triggering measurements with more than one sample (use SAMPle:COUNt command to configure) to be useful, as the calculation is based on the sets of data captured per each trigger.

18.1 CALCulate:AVERage:ALL?

Description	Queries the measurement statistics data of the average (mean), standard deviation, minimum, and maximum values (in order).
Query	CALCulate:AVERage:ALL?
Typical response	+1.234235, +1.000000, +1.000000, +1.2348289 (format: ⟨mean⟩, ⟨standard deviation⟩, ⟨minimum⟩, ⟨maximum⟩)

18.2 CALCulate:AVERage:AVERage?

Description	Queries the measurement statistics average or mean.
Query	CALCulate:AVERage:AVERage?
Typical response	+1.21892357

18.3 CALCulate:AVERage:COUNt?

Description	Queries the total number of samples used to calculate measurement statisitcs.
Query	CALCulate:AVERage:COUNt?
Typical response	10 (for 10 samples)

18.4 CALCulate:AVERage:MAXimum?

Description	Queries the measurement statistics maximum value.
Query	CALCulate:AVERage:MAXimum?
Typical response	+1.01238548

18.5 CALCulate:AVERage:MINimum?

Description   Queries the measurement statistics minimum value.

Query   CALCulate:AVERage:MINimum?

Typical response   +1.01238548

18.6 CALCulate:AVERage:PTPeak?

Description   Queries the measurement statistics peak-to-peak value.

Query   CALCulate:AVERage:PTPeak?

Typical response   +1.01238548

18.7 CALCulate:AVERage:SDEViation?

Description   Queries the measurement statistics standard deviation.

Query   CALCulate:AVERage:SDEViation?

Typical response   +1.01238548

18.8 CALCulate:AVERage[:STATe]

Description   Enable or disable statistical calculations

Syntax   CALCulate:AVERage[:STATe] ON, 1, OFF, 0

Query   CALCulate:AVERage[:STATe]?

Parameters   ON, 1, OFF, 0

Example   CALC:AVER ON

18.9 CALCulate:AVERage:CLEar[:IMMediate]

Description   Clear all calculated statistics data: minimum, maximum, average, peak-to-peak, count, and standard deviation.

Syntax   CALCulate:AVERage:CLEar[:IMMediate]

Example   CALC:AVER:CLE

Non SCPI Commands

19.1 5493C Switch Terminals

Description Switch between rear and front panel terminals. Only available for 5493C

Syntax front
rear

Example front

19.2 Front and Rear Measurement Example

Description To fetch measurements between the front and rear terminals using the bus trigger source follow the sequence below

Example rear
INIT
*TRG
FETCh?
front
INIT
*TRG
FETCh?

19.3 LOCAL

Description Sets instrumen in local mode.

Syntax LOCAL

Example LOC

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