

1 00,000-count Graphical Multimeters

MTX 3281

MTX 3282

MTX 3283

Remote Programming Manual



metrix

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Introduction

The programming instructions comply with standard IEEE488.2.

They provide the user with the possibility of checking the instrument remotely.

Communication between a controller and a generator enables users :

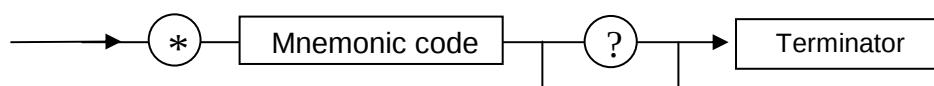
- to configure the instrument
- to measure frequencies
- to transfer measurement campaigns

Command syntax

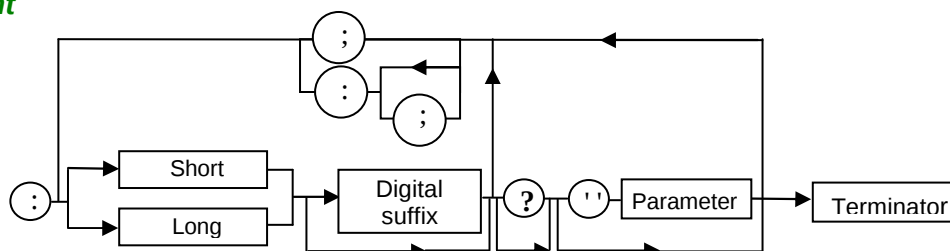
Orders are based on a tree structure.

There are two types of commands:

Common commands



Commands specific to the instrument



Key words

The brackets ([]) frame a keyword which is optional when programming; i.e. the instrument will execute the command whether the keyword is optional or not. Uppercase and lowercase are used to differentiate the short form of the keyword (uppercase letters) and the long form (whole word).

The instrument accepts the uppercase or lowercase letters without distinction.

 Example : CALC:MATH:MFUNC VOLT
is equivalent to CALCULATE:MATH:MFUNCTION VOLT

Introduction (cont'd)

Parameters The parameters, if any, are separated from the keyword by a space (' '). A command can accept parameters of a defined type, a literal expression or a combination of both.

< > The defined-type parameters are marked by the characters.

([]) The brackets mean that the parameters are optional.

{ } The accolades define the list of parameters allowed.

(|) The vertical bar may be read as an "or", it is used to separate the various possible parameters.

Separators

' : ' descends in the next directory or returns under the root, if preceded by a ' ; '.

' ; ' separates 2 commands in the same directory or marks the end of a directory command, enabling a return to the root level by adding the separator ' : '.

' ' (space) separates the keyword from the following parameter.

' , ' separates one parameter from the other.

Terminator

<NL> <NL> is a general term for a terminator.

NL is the character CR (code ASCII 13 or 0x0D).

A line of command should not exceed 80 characters ; it ends with a terminator.

Programming convention

Tree structure The command tree diagram includes all the commands specific to the instrument.

Common commands (standard IEEE 488.2) are listed separately, since they do not affect the position of the syntax analyzer in the tree.

When the terminator <NL> is sent to the instrument, the analyzer is positioned at root level.

When the analyzer is in a directory, both separators ' ; : ' are necessary to return to the root.

Detailed description of commands

CALCulate commands

MATH:MAFactor (Command/Query)

The **CALC:MATH:MAF <NRf>** command sets the "a" value of the "y = ax + b" math function.

Note: the values vary from -1^{E+38} to 1^{E+38} with resolution of $\pm 1^{E-37}$.

To the **CALC:MATH:MAF?** question, the multimeter returns the "a" value of the "y = ax + b" math function.

MATH:MBFactor (Command/Query)

The **CALC:MATH:MBF <NRf>** command sets the "a" value of the "y = ax + b" math function.

Note: the values vary from -1^{E+38} to 1^{E+38} with resolution of $\pm 1^{E-37}$.

To the **CALC:MATH:MBF?** question, the multimeter returns the "a" value of the "y = ax + b" math function.

MATH:MUNits (Command/Query)

The **CALC:MATH:MUNits <"unit">** command determinates the math function unit.

Note: **unit** is composed of max. three characters and is selected among the capital letters of the alphabet (A through Z, plus the unit Ω can be obtained with the "OHM" chain of characters).

To the **CALC:MATH:MUNits?** question, the multimeter returns the math function unit.

DISPlay Command

CONTrast (Command/Query)

The **DISP:CONT <NR1>** command sets the contrast intensity of the multimeter.

Note: The values vary from 0 to 100.

To the question **DISP:CONT?**, the multimeter returns the contrast intensity.

HELP? command

(Query)

To the **HELP?** question, the multimeter returns the list of the available SCPI command groups.

To the **HELP? {* | CALCulate | DISPlay | HELP | INPut | MEASure | SENSE | SYSTem | TRACe | UNIT}** question, the multimeter returns the list of the selected command group.

INPut commands

COUPling (Command/Query)

The **INP:COUP {AC | DC | ACDC}** command selects the type of coupling of the current volt or amp measurement.

To the **INP:COUP?** question, the multimeter returns the active type of coupling.

IMPedance (Command/Query)

The command **INP:IMP <NR3>** selects the input impedance.

Note: The values are $1^{E+7} \Omega$ (10 M Ω) or $1^{E+9} \Omega$ (1G Ω).

To the **INP:IMP?** question, the multimeter returns the input impedance.

SENSe commands

FILTer[:LPASS] (Command/Query)
[:STATE]

The **FILT {1 | 0 | ON | OFF}** command authorises or inhibits the multimeter filter.

To the question **FILT?**, the multimeter returns the activation state of the filter.

FREQuency:THRes (Command/Query)
hold:VOLTage
:RANGE

The **FREQ:THR:VOLT:RANG <NR3>** command sets the voltage range for the frequency measurement.

Note: The values vary from 0 V to 1000 V.

To the question **FREQ:THR:VOLT:RANG?**, the multimeter returns the voltage range for the frequency measurement.

FUNCTION (Command/Query)

The **FUNC {"VOLTage" | "CURRent" | "RESistance" | "CONTinuity" | "DIODE" | "FREQuency" | "CAPAcitor" | "TEMPerature"}** command selects the type of main measurement.

To the **FUNC?** question, the multimeter returns the type of the active main measurement.

MENU:DBM (Command/Query)**:IMPedance****MTX3283 only**

The **MENU:DBM:IMP <NR1>** command sets the impedance used to calculate dBm.

Note: The values vary from 1 Ω to 10000 Ω .

To the **MENU:DBM:IMP?** question, the multimeter returns the impedance used to calculate dBm.

MENU:WATT (Command/Query)**:IMPedance****MTX3283 only**

The **MENU:WATT:IMP <NR1>** command sets the impedance used to calculate the resistive power.

Note: The values vary from 1 Ω to 10000 Ω .

To the question **MENU:WATT:IMP?**, the multimeter returns the impedance used to calculate the resistive power.

RANGE:AUTO (Command/Query)

The **RANG:AUTO {1 | 0 | ON | OFF}** command authorises or inhibits the automatic ranging of the active main measurement.

To the **RANG:AUTO?** question, the multimeter returns the automatic ranging of the active main measurement.

RANGE:AUTO:PEAK (Command/Query)**MTX3282 and MTX3283 only**

The **RANG:AUTO:PEAK {1 | 0 | ON | OFF}** command authorises or inhibits the peak automatic ranging of the active main measurement.

To the **RANG:AUTO:PEAK?** question, the multimeter returns the activation state of the peak automatic ranging.

RANGe[:UPPER] (Command/Query)

The **RANG <NR3>** command sets the range of the active main measurement.

Note: Possible values acc. the active main measurement are :

0 (0 V) to	1000 (1000 V)	for the voltage measurement
0 (0 A) to	10 (10 A)	for the current measurement
0 (0 Ω) to	50^{E+6} (50 M Ω)	for the resistance measurement
0 (0 nF) to	10^{E-3} (10 mF)	for the capacitance measurement

Reminder: The continuity, frequency, test diode and temperature measurements are monorange.

To the **RANG?** question, the multimeter returns the range of the active main measurement.

SECondary (Command/Query)

The **SEC <NR1>** command selects the type of secondary measurements.

Note: The values vary from 0 to 10:

<u>Display 2</u>	<u>Display 3</u>	<u>Display 4</u>
0 none	none	none
1 frequency	periode	math function
2 frequency	dB	math function
3 dBm	dBm reference	math function
4 positive peak	negative peak	crest factor
5 resistive power	reference resistance of the	math function
	resistive power	
6 apparent power (VA)	voltage	math function
7 period	positive duty cycle	math function
8 period	negative duty cycle	math function
9 positive pulse width	positive event counter	math function
10 negative pulse width	negative event counter	math function

To the **SEC?** question, the multimeter returns the type of active second measurements.

**TEMPerature
:TRANsducer** (Command/Query)

The **TEMP:TRAN {PT100 | PT1000 | TCJ | TCK}** command selects the type of sensor used for temperature measurement.

To the question **TEMP:TRAN?**, the multimeter returns the type of sensor used in temperature measurement.

Commandes SYSTem**BEEP:STATe** (Command/Query)

The command **SYST:BEEP:STAT {1 | 0 | ON | OFF}**, authorises or inhibits the multimeter beeper.

To the **SYST:BEEP:STAT?** question, the multimeter returns the activation state of the beeper.

COMMunicate (Command/Query)

:SERial[:RECEive]
:BAUD

The **SYST:COMM:SER:BAUD {9600 | 19200 | 38400}** command sets the speed of the multimeter RS232 link transmission.

To the **SYST:COMM:SER:BAUD?** question, the multimeter returns the speed of the multimeter RS232 link transmission.

DATE (Command/Query)

The **SYST:DATE <NR1>,<NR1>,<NR1>** command sets the multimeter date.

Possible data are :

0	to	37	for the field year	(first field)
1	to	12	for the field month	(second field)
1	to	31	for the field day	(third field)

To the **SYST:DATE?** question, the multimeter returns the date.

Response format : < AAAA,MM,JJ ><NL>

A = year, M = month, J = day.

ERRor[:NEXT]? (Query)

To the **SYST:ERR?** question, the instrument returns the number of error positioned at the top of the queue. The queue has a stack of 10 numbers and is managed as follows : first in, first out.

As the **SYST:ERR?** question arrives, the instrument returns the number of errors in order of arrival, until the queue is empty. If the queue is empty, the instrument returns the message "0,No error". If more than 10 errors are generated, the 10th error is "-350,Queue overflow".

The queue is empty:

- when the instrument is getting started
- at the receipt of a *CLS command
- at the reading of the last error.

Response format: <NR1>,<error><NL>

with error = chain of characters

Error list:

* Command errors: (-100 to -199)

They indicate that a syntax error has been detected by the syntax analyzer and causes event register bit 5, called CME, CoMmand Error to be set to 1.

-101	:	Invalid character
-103	:	Invalid seperator
-104	:	Data type error
-108	:	Parameter not allowed
-109	:	Missing parameter
-111	:	Header separator error
-112	:	Program mnemonic too long
-113	:	Undefined header
-114	:	Header suffix out of range
-121	:	Invalid character in number
-128	:	Numeric data not allowed
-141	:	Invalid character data
-148	:	Character data not allowed
-151	:	Invalid string data
-154	:	String data too long

* Execution error: (-200 to -299)

They indicate that an error has been detected at the moment of command execution and causes event register bit 4, called EXE, Execution Error, to be set to 1.

-200	:	Execution error
-221	:	Settings conflict
-222	:	Data out of range

* instrument specific errors: (-300 to -399)

They indicate that an abnormal error has been detected during execution of a task, and causes event register bit 3, called DDE, Device Dependent Error to be set to 1.

-350	:	Queue overflow
-360	:	Communication error

* Query errors: (-400 to -499)

They indicate that an abnormal error has been detected during execution of a task, and cause event register bit 2, called QYE, QuerY Error, to be set to 1.

-400	:	Query error
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LANGuage (Command/Query)

The **SYST:LANG {ENGLISH | FRENch}** command selects the language of the instrument.

To the **SYST:LANG?** question, the instrument returns the selected language.

LOCal (Command)

The **SYST:LOC** command switches the multimeter in local mode, the front face is now available.

Reminder: The multimeter switches in REMOTE mode when it gets an SCPI command other than SYST:LOC.

TIME (Command/Query)

The **SYST:TIME <NR1>,<NR1>,<NR1>** command sets the time of the multimeter.

Possible values are:

0	to	23	for the hour field (1. field)
0	to	59	for the minute field (2. field)
0	to	59	for the second field (3. field)

To the **SYST:TIME?** question, the multimeter returns the time.

Response format: < HH,MM,SS ><NL>

H for hour, M for minute, S for second.

VERSion? (Query)

To the **SYST:VERS?** question, the multimeter returns the SCPI version it bears. The response shows the year and software version.

Response format: <AAAA.V><NL>

A for year and V for version.

TRACe | DATA commands

CATalog? (Query)

To the **TRAC:CAT?** question, the multimeter returns the list of files present in the instrument.

Format response:

< MEMN° JJ.MM.AA HH:MnMn:SS (PPPP)><NL>

N° for number of measurement campaign, J for day, M for month, A for year, H for hour, Mn for minute, S for second, P for number points.

Example: MEM2 25.02.02 15:00:42 (0211)<NL>

Note: If the memory is empty the multimeter returns following message: MEM EMPTY.

DELeTe:ALL (Command)

The **TRAC:DEL:ALL** command deletes all measurement campaigns which have been memorized in the instrument.

DELeTe[:NAME] (Command)

The **TRAC:DEL MEM{0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9}** command deletes the selected measurement campaign.

POINts (Command/Query)

The **TRAC:POIN <NR1>** command sets the multimeter acquisition depth.

Note: The values vary from 1 to 6500 for MTX3282 and MTX3283.
The values vary from 1 to 158 for MTX3281.

To the **TRAC:POIN?** question, the multimeter returns the acquisition depth.

RATE (Command/Query)

The **TRAC:RATE <NR1>** command sets the STORE mode rate.

Note: The values vary from 1000 ms to 86399000 ms (23h 59min 59sec).

To the **TRAC:RATE?** question, the multimeter returns the STORE mode rate.

STOre:STATe (Command/Query)

The **TRAC:STO:STAT {1 | 0 | ON | OFF}** command authorises or inhibits the recording of the current measurements.

To the **TRAC:STO:STAT?** question, the multimeter returns the state of activation of the STORE mode.

Note: Once the STORE mode has been activated, the recording starts with the first available campaign.

[DATA]:VALue? (Query)

To the **TRAC:VAL? MEM{0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9}** question, the multimeter returns the values of the selected measurement campaign.

Response format:

Heading of the response <DDDD JJ.MM.AA HH:Mn:SS>

D for measurement number, J = day, M = month, A = year, H = hour, Mn = minute, S = seconde.

The measurement follows the heading with a value or four acc. to display number.

Example:1 display only:

02311 24.03.04 15:45:00 +276.91mVAC<NL>

4 displays:

01977 24.03.04 15:27:00 +230.49 VAC +0050.0 Hz +023.04 GL<NL>

UNIT command**TEMPerature** (Command/Query)

The **UNIT:TEMP {Celsius | Fahrenheit | Kelvin}** command selects the unit of temperature measurement.

To the **UNIT:TEMP?** question, the multimeter returns the unit of the selected temperature unit.

READ? command

(Query)

To the **READ?** question, the multimeter returns the result of the current measurement.

Response format:

1 display only

+276.91mVAC<NL>

4 displays:

+230.49 VAC +0050.0 Hz +023.04 GL<NL>

MEASure? command

(Query)

To the **MEAS ?** question, the multimeter returns the result of the current measurement.

Response format: Id. READ ? function

IEEE 488.2 common commands

The common commands are defined by the IEEE 488.2 standard. They are operational on all instruments which are specified IEEE 488.2. They command basic functions such as:

- identification,
- reset,
- configuration reading,
- reading of event and status register,
- reset of event and status register.

If a command containing one or several directories has been received, and if a common command has been stacked up, then the instrument stays in this directory and execute normally the commands.

IEEE 488.2 commands

*CLS (Command)
(Clear Status)

The *CLS common command resets the status and event register.

*ESE
(Event Status
Enable)

(Command/Query)

The *ESE <mask> common command positions the status of the event mask.

<mask> is a value in format <NR1>, from 0 to 255.

A “1” authorises the corresponding bit of the event register to generate an event, while a 0 masks it.

To the question *ESE?, the instrument returns the current content of the event mask register.

Response format: <value><NL>

value in format <NR1> from 0 to 255.

Description of Event Mask Register

Bit	Value	Authorised event
7	128	PON (Power ON) : not used (0)
6	64	URQ (User Request) : not used (0)
5	32	CME (command error)
4	16	EXE (execution error)
3	8	DDE (instrument error)
2	4	QYE - Query Error
1	2	RQC - not used (0)
0	1	OPC - complete operation

***ESR?** (*Query*)
 (Event Status Register) To the ***ESR?** question, the instrument returns the content of the event register.
 Once the register has been read, the content value is reset to zero.
Response format: <value><NL>
 value in format **<NR1>** from 0 to 255.

Description of Event Register (Query)

Bit	Value	Name	Condition
7	128	PON	not used (0)
6	64	URQ	not used (0)
5	32	CME	0 : no command error 1 : an error has been detected
4	16	EXE	0 : no execution error 1 : an execution error has been detected
3	8	DDE	0 : no error specific to the instrument 1 : a specific error has been detected
2	4	QYE	0 : no query error 1 : a query error has been detected
1	2	RQC	not used (0)
0	1	OPC	0 : running command is not over 1 : running command is over

***IDN?** (Query)
(Identification Number) To the ***IDN?** question, the instrument returns the type of instrument and the software version.

Response format:

```
<manufacturer>,<firmware version><NL>
<instrument>      Instrument reference
<firmware version> Software version
<manufacturer>    METRIX
```

***OPC** (Command/Query)
(Operation Complete) The ***OPC** command authorises the setting to 1 of the OPC bit in the event register as soon as the running operation is completed.

To the ***OPC?** question, the instrument returns the character ASCII "1" as soon as the running operation is terminated.

***RST** (Command)

(Reset)

The ***RST** command reconfigures the instrument with the factory settings.

***SRE** (Command/Query)

(Service Request Enable)

The ***SRE <mask>** command positions the service request mask register.

<mask> is a value in format **<NR1>**, from 0 to 255.

A value of bit at 1 enables the same-rank bit of the status register to request a service (bit of the status register contains 1). A bit value at 0 neutralizes it.

To the question ***SRE?**, the instrument returns the value of the service demand mask register.

Response format: <value><NL>

value in format **<NR1>** from 0 to 255.

Service demand mask register

Bit	Value	Authorised
7	128	not used
6	64	not used
5	32	ESB - Event Status Bit
4	16	MAV - Message Available
3	8	not used
2	4	not used
1	2	not used
0	1	not used

***STB?** (Query)

(Status Byte)

To the ***STB?** question the instrument returns the content of its status register (Status Byte Register).

The bit 6 returned indicates the MSS value (Master Summary Status) (at 1 if the instrument has a reason for requesting a service).

Contrary to RQS, it is not reset to zero after reading the status register (RQS is accessible only by a serie recognition, and falls to 0 at its end).

State register

Bit	Value	Name	Condition
7	128	-	not used (0)
6	64	RQS/MSS	0 = no demand 1 = service demand
5	32	ESB	0 = no event received 1 = an authorised event occurred
4	16	MAV	0 = no message available 1 = output message available
3	8	-	not used (0)
2	4	-	not used (0)
1	2	-	not used (0)
0	1	-	not used (0)

***TRG** (Command)

The ***TRG** command launches an acquisition in the « singleshot » or « repetitive » current mode.

***TST?** (Query)
(Test)

To the ***TST?** question, the instrument returns the state of the autotest procedure.

Response format: <0|1><NL>

- answers 0 when the autotest went fine
- answers 1 when a autotest problem was detected.

***WAI** (Command)
(Wait)

The ***WAI** command prevents the instrument from performing further commands as long as the current command has not been terminated. This enables to synchronize the instrument with the application program in progress on the controller.

Tree structure

IEEE 488.2 common command summary

Commands	Functions
*CLS	Resets the status and event registers
*ESE	Writes event mask
*ESE?	Reads event mask
*ESR?	Reads event register
*IDN?	Reads identifier
*OPC	Validates bit OPC
*OPC?	Waits till end of execution
*RST	Resets
*SRE	Writes service request mask
*SRE?	Reads service request mask
*STB?	Reads status register
*TRG	Starts an acquisition in the current mode
*TST?	Returns the status of the autoset procedure
*WAI	Commands synchronization

Summary of the multimeter specific commands

Directory	Command	Function
CALCulate	:MATH:MAFactor :MATH:MAFactor?	Configures the "a" value of the math function "y = ax + b".
	:MATH:MBFactor :MATH:MBFactor?	Configures the "b" value of the math function "y = ax + b".
	:MATH:MUNits :MATH:MUNits?	Configures the unit of the math function
DISPlay	:CONTRast :CONTRast?	Configures the contrast intensity of the multimeter.
HELP?		Displays all the available SCPI commands.
INPut	:COUPling :COUPling?	Configures the type of coupling of the current volt or amp measurement.
	:IMPedance :IMPedance?	Configures the input impedance.
SENSe	:FILTer[:LPASs][:STATe] :FILTer[:LPASs][:STATe]?	Authorises or inhibits the multimeter filter.
	:FREQuency:THReshold:VOLTage:RANGe :FREQuency:THReshold:VOLTage:RANGe?	Configures the voltage range for the frequency measurement.
	:FUNCTion :FUNCTion?	Configures the type of main measurement.
	:MENU:DBM:IMPedance :MENU:DBM:IMPedance?	Configures the impedance used to calculate dBm (MTX3283 only).
	:MENU:WATT:IMPedance :MENU:WATT:IMPedance?	Configures the impedance used to calculate the resistive power (MTX3283 only).
	:RANGe:AUTO :RANGe:AUTO?	Authorises or inhibits the automatic ranging of the active main measurement.
	:RANGe:AUTO:PEAK :RANGe:AUTO:PEAK?	Authorises or inhibits the peak automatic ranging of the active main measurement (MTX3282, MTX3283 only).
	:RANGe[:UPPER] :RANGe[:UPPER]?	Configures the ranging of the active main measurement.

SENSe	:SEConDary :SEConDary?	Configures the type of secondary measurements.
	:TEMPerature:TRANsducer :TEMPerature:TRANsducer?	Configures the type of sensor used in temperature measurements.
SYSTem	:BEEPer:STATe :BEEPer:STATe?	Authorises or inhibits the multimeter beeper.
	:COMMunicate:SERial[:RECeive]:BAUD :COMMunicate:SERial[:RECeive]:BAUD?	Configures the transmission speed of the multimeter RS232 link.
	:DATE :DATE?	Configures the multimeter date.
	:ERRor[:NEXT]?	Reads the error number.
	:LANGuage :LANGuage?	Sets the language of the multimeter.
	:LOCal	Switches the multimeter in local mode, the front face is again available.
	:TIME :TIME?	Configures the multimeter time.
	:VERSion?	Reads the SCPI version.
TRACe DATA	:CATalog?	Reads the list of the measurement campaigns present in the multimeter.
	:DELeTe:ALL	Deletes the measurement campaigns stored in the multimeter.
	:DELeTe[:NAME]	Deletes the selected measurement campaigns.
	:POINts :POINts?	Configures the multimeter acquisition depth.
	:RATE :RATE?	Configures the STORE mode rate.
	:STOre:STATe :STOre:STATe?	Authorises or inhibits the recording of the running measurements.
	[:DATA]:VALue?	Reads a measurement campaign.
UNIT	:TEMPerature :TEMPerature?	Configures the unit of the temperature measurement.
READ?		Returns the result of the running measurement.
MEASure?		Returns the result of the running measurement.