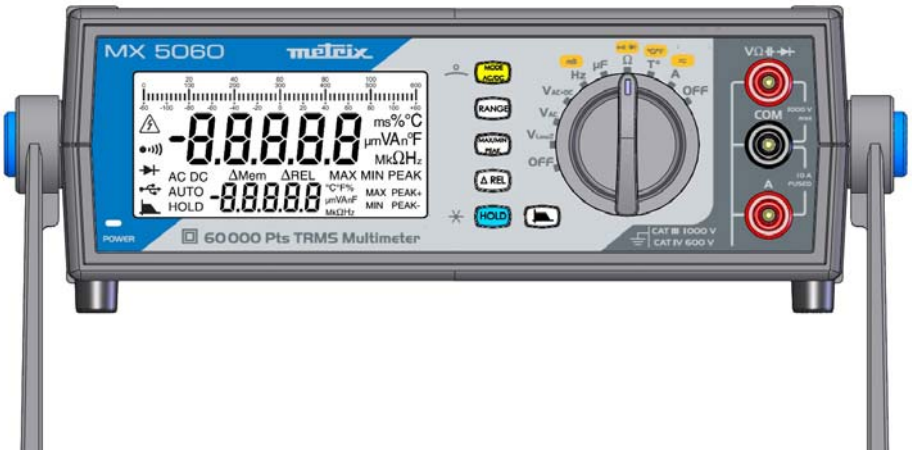
Benchtop Multimeter MX 5060 60,000 pts

Remote programming



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X03972B02 - Ed. 01 - 03/14

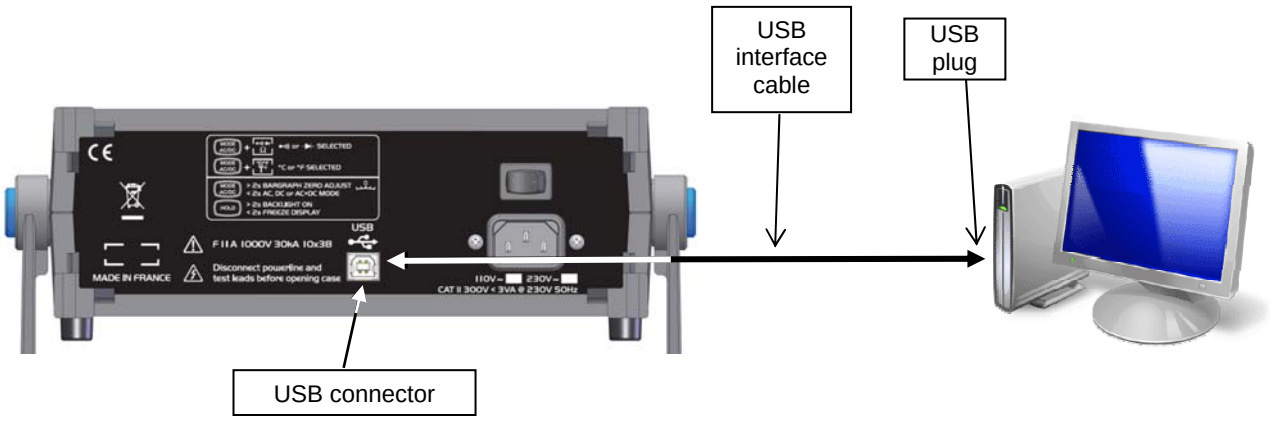
Remote Programming

Connection of USB cable

The generator can be remotely programmed using a computer or PC with the programming kit.

1.Connect the optical cable at the rear of the unit at the USB input.
A mechanical fail-safe device indicates the connection direction.

2.Connect connector DB9F on one of the USB inputs of the PC.



Configuration

- Communication : 4800 bauds
- 8 data bits,
- 1 stop bit,
- no parity,
- no flow control

Remote control

The programming instructions comply with standard IEEE488.2, protocol SCPI.

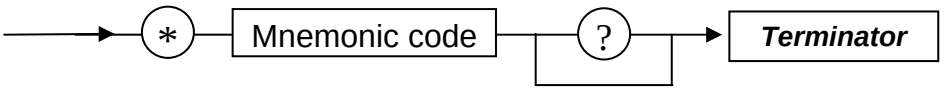
They provide the user with the possibility of checking the instrument remotely from simple standard controls.

Communication between a controller and a generator enables users to:

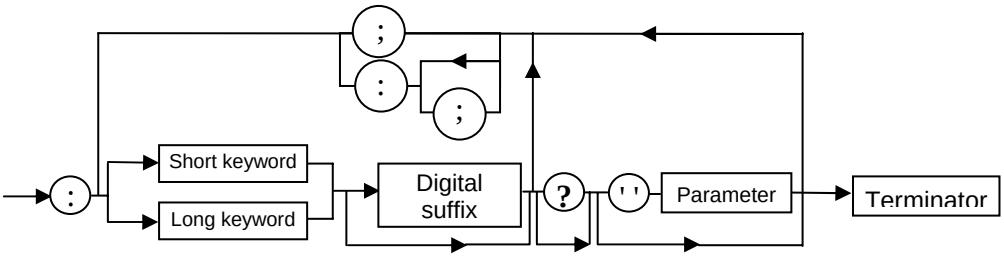
- Configure the instrument
- Perform measurements campaign
- Receive information (configuration)

Command syntax

Common commands



Specific commands



Keywords

The brackets ([ ]) are used to frame a keyword which is optional during 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.

FUNC:SIN is equivalent to **SOURCE:FUNCTION:SHAPE SINUSOID**

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

Separators

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

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

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

Terminators

<NL> used as a general term designating a terminator.

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

A command line must not exceed 80 characters; it is ended by 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.

IEEE 488.2 common commands

Commands	Functions
***CLS**	*Reset the event and status registries*
***IDN?**	*Read identifier*
***RST**	*Reset*

Specific commands of the benchtop multimeter

Directory	Command	Function
INPut	:COUPling :COUPling?	Configures the type of coupling of the volt or ampere measurement in progress.
SENSe	:FUNCtion :FUNCtion?	Configures the main measurement type.
	:RANGe[:UPPER] :RANGe[:UPPER]?	Configures the range for the active main measurement.
	:RANGe:AUTO :RANGe:AUTO?	Authorizes or inhibits automatic ranging on the active main measurement.
	:SECondary :SECondary?	Configures the secondary measurement type.
	:FILTer[:LPASs][:STATe] :FILTer[:LPASs][:STATe]?	Authorizes or inhibits the multimeter filter.
SYSTem	:ERRor[:NEXT]?	Reading of error number.
	:BEEPer:STATe :BEEPer:STATe?	Authorizes or inhibits the multimeter beeper.
	:LOCal	Configures the multimeter in local mode, so the front panel is accessible again.
	:VERSion?	Reading of the SCPI version
UNIT	:TEMPerature :TEMPerature?	Configures the temperature measurement unit.
READ?		Returns the result of the measurement in progress.
MEASure?	:RANGe:AUTO:PEAK :RANGe:AUTO:PEAK?	Authorizes or inhibits automatic peak ranging on the active main measurement.

Detailed description of commands

IEEE 488.2 common commands

****CLS***
(Clear Status)

(Command)
The ***CLS** common command resets to zero the event and status registries.

Command syntax: *CLS

****IDN?***
(Identification Number)

(Query)
In response to the question ***IDN?**, the generator returns the instrument type and the software version.

Query syntax: *IDN?

Response format:
"*manufacturer*, *instrument*, FV<firmware version ><NL>

<manufacturer>	Name of manufacturer
<instrument>	Reference of the instrument
<firmware version>	Software version

****RST***
(Reset)

(Command)
The ***RST** command reconfigures the instrument with the factory settings.

Detailed description of commands (cont'd.) | ***Commands specific to the instrument***

INPut commands

COUPling *(Command/Query)*
The command **INP:COUP <DC | AC | ACDC >** selects the type of coupling for the volt or ampere measurement in progress.
To the question **INP:COUP?,** the multimeter returns the active type of coupling.

SENSe commands

FUNCtion *(Command/Query)*
The command **FUNC <"VOLTage" | "CURRent" | "RESistance" | "CONTinuity" | "DIODe" | "FREQuency" | "CAPAcitor" | "TEMPerature">** selects the main measurement type.
In response to the question **FUNC?**, the multimeter returns the active main measurement type.

RANGe[:UPPER] *(Command/Query)*
The command **RANG <NRf>** sets the range for the active main measurement.
Depending on the active main measurement, the possible values are:

0 (0 V)	to	600 (1000 V)	for voltage measurement
0 (0 A)	to	10 (20 A)	for current measurement
0 (0 Ω)	to	60^{E+6} (60 MΩ)	for resistance measurement
6^{E-9} (6 nF)	to	60^{E-3} (650 mF)	for capacitance measurement

Reminder: Frequency measurement is only available with AUTO ranging and the continuity, diode test and temperature measurements are mono-range.
In response to the question **RANG?**, the multimeter returns the range of the active main measurement.

RANGe:AUTO *(Command/Query)*
The command **RANG:AUTO <b>** authorizes or inhibits automatic ranging of the active main measurement.
The values are 0 to inhibit and 1 to authorize.
In response to the question **RANG:AUTO?,** the multimeter returns the activation status of the automatic ranging.

SECondary *(Command/Query)*
The command **SEC <NRf>** selects the type of secondary measurements.
The values vary from 0 to 8:

	Display 2
0 →	Hz
1 →	Min/Max/Pk ➔ MAX
2 →	Min/Max/Pk ➔ MIN
3 →	Min/Max/Pk ➔ PK+
4 →	Min/Max/Pk ➔ PK-
5 →	delta MEM/ delta REL

In response to the question **SEC?**, the multimeter returns the active secondary measurement .

FILTer[:LPASs][:STATe] *(Command/Query)*
The command **FILT <b>** authorizes or inhibits the filter of the multimeter.
The values are 0 to inhibit and 1 to authorize.
In response to the question **FILT?,** the multimeter returns the activation status of the filter.

SYSTem commands

ERRor[:NEXT]? *(Query)*

In response to the question **SYST:ERR?,** the multimeter returns the number of the error positioned at the top of the queue. The queue contains 10 numbers and is managed on the principle of first in, first out.

As the **SYST:ERR?** questions progress, the multimeter returns the error numbers in the order of their arrival, until the queue is empty.
Any additional **SYST:ERR?** question will cause a negative response: character "0" (ASCII code 48).
If the queue is full, the box located at the top of the queue takes the value –350 (Queue saturated).

The queue is emptied:

- on powering up
- on receipt of a *CLS
- when the last error is read

Response format: <error><NL>
where error = negative integer or null.

List of errors

* Command errors: (-199 to -100)

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

-101 : Invalid character
-102 : Syntax error
-103 : Invalid separator
-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
-131 : Invalid suffix
-138 : Suffix not allowed
-141 : Invalid character data
-148 : Character data not allowed
-151 : Invalid string data
-171 : Invalid expression
-178 : Expression data not allowed

* Execution errors: (-299 to -200)

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

-203 : Command protected
-213 : Init ignored
-221 : Settings conflict
-222 : Data out of range
-224 : Illegal parameter value
-232 : Invalid format
-233 : Invalid version

* Query errors: (-499 to -400)

They indicate that an anomaly in the information exchange protocol has occurred and cause event register bit 2, called QYE, QuerY Error, to be set to 1.

-400 : Query error

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

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

-350 : Queue overflow
-360 : Communication error

BEEPer:STATe *(Command/Query)*
The command **SYST:BEEP:STAT <b>** authorizes or inhibits the beeper of the multimeter.
The values are 0 to inhibit and 1 to authorize.
In response to the question **SYST:BEEP:STAT?,** the multimeter returns the activation status of the beeper.

COMMunicate: SERial[:RECeive] :BAUD *(Command/Query)*
In response to the question **SYST :COMM :SER :BAUD<9600>**, the multimeter returns the transmission speed of the USB link.

LOCal *(Command)*
The command **SYST:LOC** configures the multimeter in local mode, so the front panel is accessible again

Reminder: The multimeter switches to REMOTE mode when it receives an SCPI command other than **SYST:LOC.**
The multimeter can also be switched to local mode using the MENU key.

VERSion? *(Query)*
In response to the question **SYST:VERS?,** the multimeter returns the SCPI version that it supports. The response includes the year and the revision index.

Response format: <YYYY.V><NL>
where Y = year and V = version.

UNIT command

TEMPerature

(Command/Query)
The command **UNIT:TEMP <Celsius | Fahrenheit | Kelvin>,** selects the unit for temperature measurement.

In response to the question **UNIT:TEMP?,** the multimeter returns the temperature unit chosen.

READ? command

(Query)
In response to the question **READ?**, the multimeter returns the result of the measurement in progress.

Response format: +276.91 mVAC

MEASure? commands

(Query)
In response to the question **MEAS?**, the multimeter returns the result of the measurement in progress.

Response format: 2.7691e-01