Function Generators

GX 305

GX 310 - GX 310P

GX 320 - GX 320E

User's manual

Chauvin Arnoux, Inc d.b.a. AEMC Instruments
15 Faraday Drive, Dover NH 03820 USA
Tel. (603) 749-6434 - Fax (603) 742-2346

99-MAN 100379 - v2 03/17

Contents

General Instructions

Introduction

You have just purchased a **GX 305**, **GX 310** or **GX 320 Function Generator** and we appreciate your confidence.

Content of the box

- the generator
- the safety notice
- the power supply cable
- the USB A/B cable for the programmable versions
- the ETHERNET cable for the **GX 320E**
- the CD-ROM containing:
  the operating guide in 5 languages
  the programming in 2 languages
  the USB 'CP210x USB to UART Bridge Controller' Drivers
  the LabView and LabWindows Drivers
  the USBxPress application (USB port identification)
  the GX320E-Admin (IP address programming)

Precautions

To obtain the best service:
- read this notice carefully,
- respect the safety instructions.

Failure to respect the warnings and/or usage instructions may damage the device and/or installations and may be dangerous for the user.

Safety measures

This instrument complies with the NF EN 61010-1 - Ed. 2 (2001) safety standard relating to the safety of electric measurement devices.

- It is designed for indoor use in an level 2 pollution environment at an altitude of less than 2000 m, a temperature between 0°C and 40°C and a RH (relative humidity) of less than 80% up to 40°C.
- The MAIN OUT, SWEEP OUT, TTL OUT outlets are referenced to earth and protected from accidental voltages that are not in excess of 60 V DC or 40 V AC.
- The FREQ EXT entry can only be used for measurements on Category 1 installations and for voltages not exceeding 300 V in relation to the earth.
- Mains power supply: 120 V

Definition of installation categories

CAT II: Category II corresponds to measurements on circuits that are directly connected to low voltage installations.
Example: power supply for household appliances and portable tools

CAT III: Category III corresponds to measurements on the building installation.
Example: power supply for industrial machinery or devices.

CAT IV: Category IV corresponds to measurements at the source of the low voltage installation.
Example: power supply

General Instructions *(contd.)*

Symbols on the instrument


Warning: potential hazard, refer to the operating guide.


Selective waste sorting for recycling electric and electronic waste. In compliance with the WEEE 2002/96/EC directive:
the device should not be considered as household waste.


Earth terminal

Alternating signal


Indication of a key double function when pressed for more than 1 second


USB symbol

Guarantee

This equipment is guaranteed for all manufacturing and parts defects in compliance with the general terms and conditions which are available on request

During the warranty period (3 years), the instrument may only be repaired by the manufacturer who reserves the right to make the decision to either repair or replace all or part of the appliance. In the event of a return of the equipment to the manufacturer the shipping charge from the customer to the manufacturer is at the customer's expense.

The guarantee does not apply in the following conditions:

- inappropriate use of the equipment or use with incompatible equipment
- one or more changes made to the equipment without prior explicit authorisation from the manufacturer's technical department
- an intervention is made on the instrument by a person not approved by the manufacturer
- the adapting to a specific application that is not part of the definition of the instrument or in the operating guide
- damage caused by a mechanical shock, by dropping the instrument or by flooding.

Maintenance, repairs, metrological checks

The device includes no parts that can be replaced by the operator. All operations must be carried out by competent approved personnel.

For checks and calibrations, contact one of our accredited metrology laboratories (information and contact details available on request), at our Chauvin Arnoux subsidiary or the branch in your country.

Cleaning

No interventions are authorised inside the instrument.

- Turn the instrument off (remove the power supply cable).
- Clean using a damp cloth and soap.
- Never use abrasive products or solvents.
- Dry quickly using a dry cloth or an air blower at max. 80°C.

GX 305 and GX 310 Description

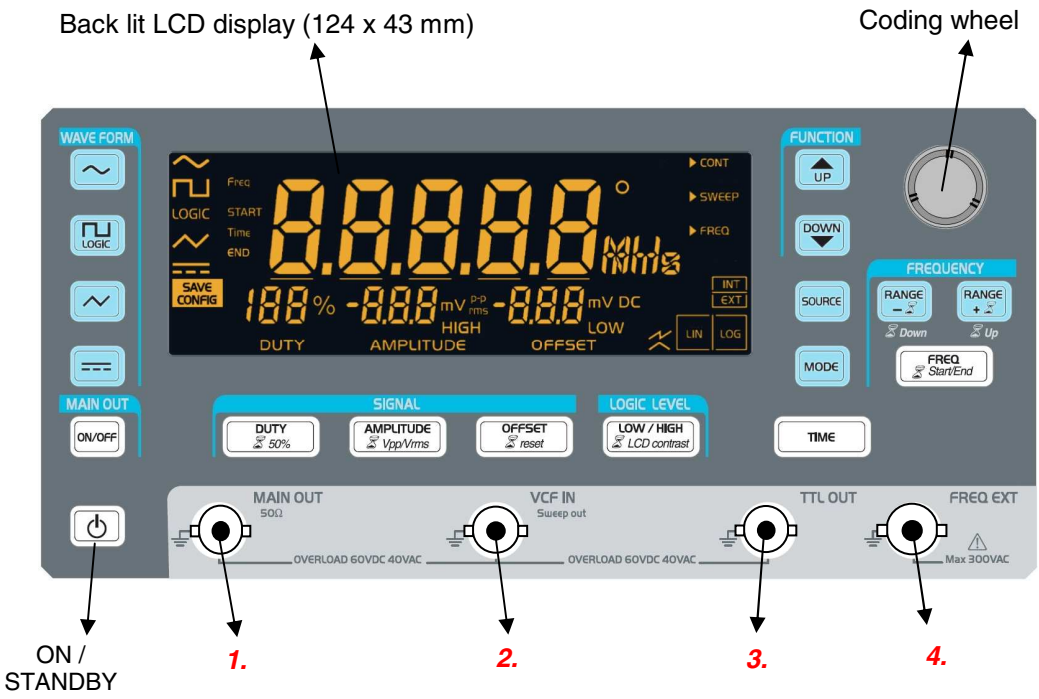
Presentation

The **GX 305** and **GX 310** are alternating standard form wave **generators,** using the DDS (Direct Digital Synthesis) technology. They may simulate the operation and specifications of various electronic systems.
They also include a frequency meter input.
The **GX 310P** is a generator that can be programmed remotely via an USB link.

Specifications

- Wave form: sinusoidal, square, triangle, logical, TTL, continuous
- Wave frequency: **GX 305** → 0.001 Hz to 5 MHz for the sinus and the square
  0.001 Hz to 2 MHz for the triangle
  GX 310 → 0.001 Hz to 10 MHz for the sinus and the square
  0.001 Hz to 2 MHz for the triangle
- INT and EXT sweep: **GX 305** → adjustable from 0.001 Hz to 5 MHz
  GX 310 → adjustable from 0.001 Hz to 10 MHz
- EXT freq. meter : from 5 Hz to 100 MHz

Front face



Terminals

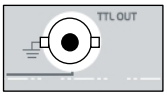
1. 

MAIN OUT
- Main output

2. 

VCF IN
- SWEEP input pilot signal in **EXT**ernal source

SWEEP OUT
- Pilot output signal for **INT**ernal SWEEP

3. 

TTL OUT
- TTL output

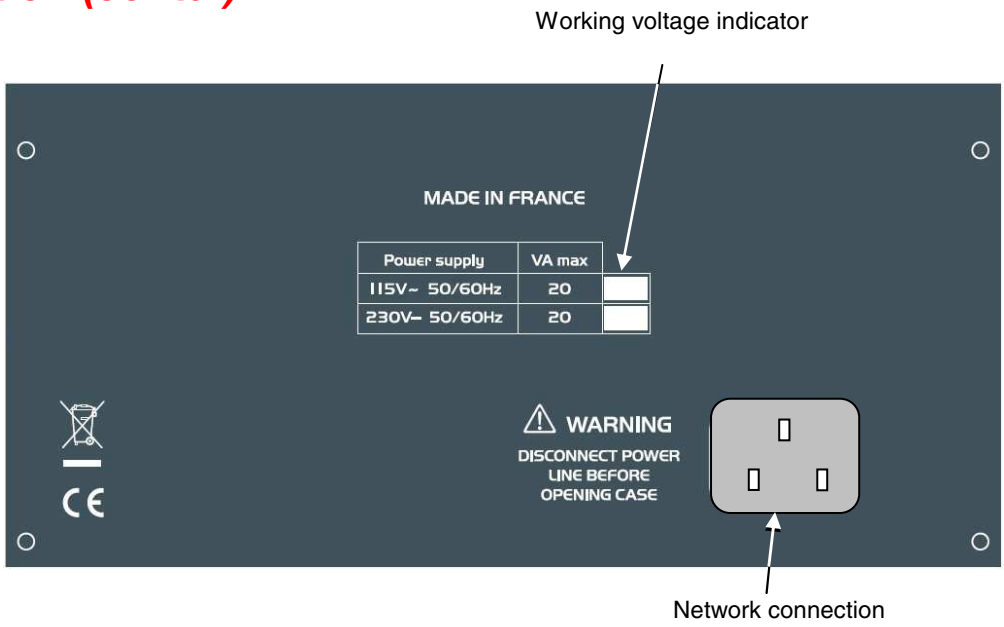
4. 

FREQ EXT
- Frequency meter input

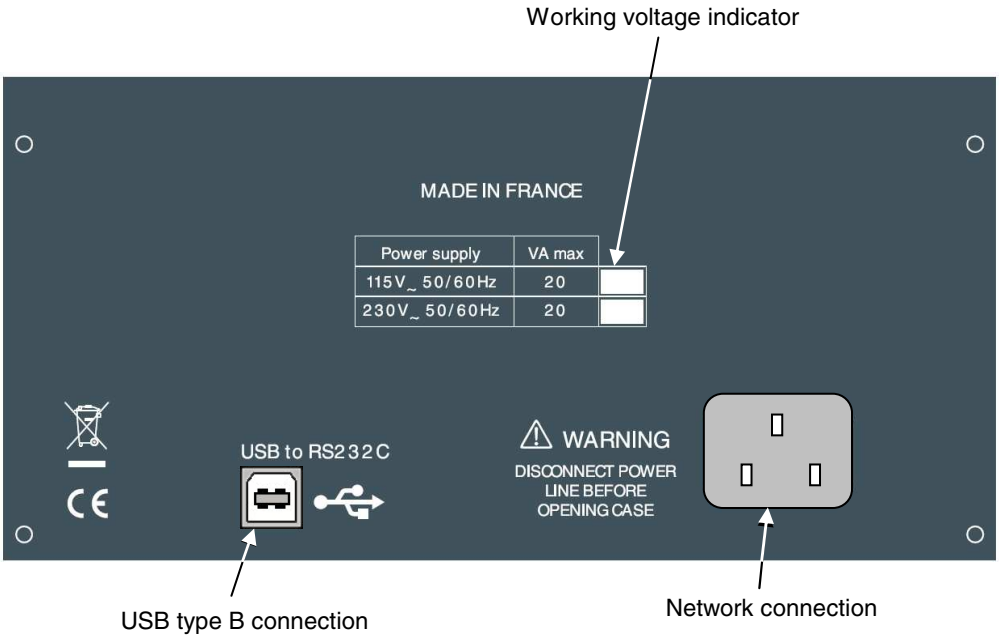
GX 310 Description *(contd.)*

Back face

GX 305



GX 310
GX 310P



Display

GX 305 and GX 310 Description *(contd.)*

Wave selection:
- Sinusoidal
- square
- logic
- triangle
- continuous

Indication of the displayed frequency:
- Freq, $Freq_{START}$ or $Freq_{END}$
- Time (sweep interval)

Frequency display (digit height: 20 mm)

Underscores: Indication of the digit to which the wheel increments apply during adjustment.

Unit of measure display
- degree
- MHz, kHz, Hz
- seconds

Function selection: ▶ current function indicator
- continuous
- sweep
- frequency

Duty cycle value display

Display of the amplitude value

Display of the offset value or the DC level

OFFSET display

DUTY display

AMPLITUDE display

Logical HIGH / LOW display

INTernal / **EXT**ernal source selection

LINear / **LOG**arithmic sweep display

Sawtooth or triangle type sweep

Indication that the MODE key is assigned:
- to trigger the adjustment step when calibrating
- to trigger the selected test in Autotest

During calibration the  is assigned to saving the parameters.

GX 305 and GX 310 Description *(contd.)*

Keys

The keys with the ⌛ symbol have a specific action when pressed for more than 1 second.

- The white keys may have a backlight:

	Appliance under power but not turned on
	Appliance turned on
MAIN OUT 	Key lit → MAIN OUT exit activated

- The other keys can be:

 unlit	→ keys not assigned to the wheel adjustment or having no action
 lit	→ the corresponding adjustment is assigned to the wheel.
 blinking	→ the corresponding adjustment can be assigned to the wheel.

Each time the* WAVEFORM *or* FUNCTION *is changed the keys that can be assigned to the wheel adjustment blink for 4 seconds; if no keys are used at this time the frequency adjustment (Freq** or **$Freq_{START}$) is assigned to the wheel.

Keys pressed for less than 1 second

Sinusoidal waveform selection

Selects square or logical waveform by successive pressing on the key

Triangular waveform selection or saves adjustments during calibration

Continuous waveform selection

MAIN OUT

Validation, or not, of the waveform on the **MAIN OUT** BNC

Adjustment of the duty cycle using the wheel (square, triangle)

Adjustment of the output signal amplitude using the wheel

- Offset adjustment using the wheel
- DC level adjustment if the continuous ⎓ waveform is selected.

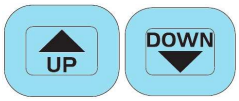
GX 305 and GX 310 Description *(contd.)*

Keys pressed for less than 1 second (contd.)

LOGIC LEVEL

LOGIC waveform selected:
Adjustment of the high or low signal level using the wheel

FUNCTION



FUNCTION keys:
Selection of one of the three available functions

SWEEP selection of the INTernal or **EXT**ernal command signal

- **SWEEP** activated: selection of **LIN** or **LOG** sweep
- calibration: triggering of the selected adjustment step
- Autotest: run the selected test

SWEEP function activated in **INT**: assignment of the desired duration setting for carrying out the sweep using the wheel.
Then, by pressing several times, selection of the digit on which to increment.

Division or multiplication by 10 of the current frequency value (decade change)

- Assignment of frequency adjustment to the wheel.
  Then, by pressing several times, selection of the digit on which to increment.
- **SWEEP** function activated: same functions with **$Freq_{START}$** and **$Freq_{END}$** frequencies.

GX 305 and GX 310 Description *(contd.)*

Keys pressed for more than 1 second

Pressing the key for more than 1 second forces the duty cycle to 50%.

Pressing the key for more than 1 second switches from a peak to peak amplitude display to an RMS (root mean square) display.

Pressing the key for more than 1 second forces the offset value to 0.

Pressing the key for more than 1 second assigns the LCD contrast adjustment to the wheel.

For the **SWEEP** function, pressing the key for more than 1 second switches from $Freq_{START}$ to $Freq_{END}$ and vice versa.

These keys assign the selected frequency to the start or end of the current range.

Ranges	Press > 1 Second 'RANGE-'	Press > 1 second 'RANGE+'
[0.001 Hz ; 0.01 Hz]	0.001 Hz	0.01 Hz
[0.01 Hz ; 0.1 Hz]	0.01 Hz	0.1 Hz
[0.1 Hz ; 1 Hz]	0.1 Hz	1 Hz
[1 Hz ; 10 Hz]	1 Hz	10 Hz
[10 Hz ; 100 Hz]	10 Hz	100 Hz
[100 Hz ; 1 kHz]	100 Hz	1 kHz
[1 kHz ; 10 kHz]	1 kHz	10 kHz
[10 kHz ; 100 kHz]	10 kHz	100 kHz
[100 kHz ; 1 MHz]	100 kHz	1 MHz
GX 305→ [1 MHz ; 5 MHz] **GX 310**→ [1 MHz ; 10 MHz]	1 MHz	**GX 305**→ 5 MHz **GX 310**→10 MHz

GX 320 Description

Presentation

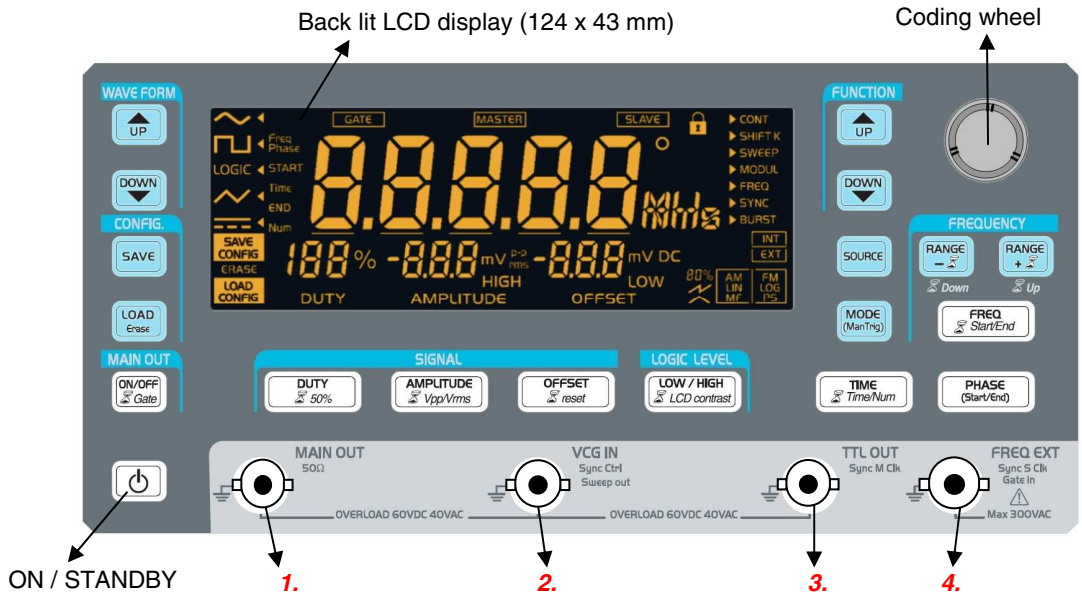
The **GX 320** is a standard alternating signal **generator,** using the DDS (Direct Digital Synthesis) technology. It may simulate the operation and the specifications of various electronic systems. It also includes a **frequency meter** input. The **GX 320E** is remote programmable via an USB or ETHERNET link.

Specifications

- Wave form:	sinusoidal, square, triangle, logical, TTL, continuous
- Wave frequency:	0.001 Hz to 20 MHz for the sinusoidal and square 0.001 Hz to 2 MHz for the triangle
- INT and EXT sweep:	adjustable from 0.001 Hz to 20 MHz
- EXT frequency meter:	from 5 Hz to 100 MHz
- AM modulation:	internal (1 kHz) and external (< 5 kHz)
- FM modulation:	internal (1 kHz) and external (< 15 kHz)
- Frequency Shift Keying FSK:	internal (1 kHz) and external (< 1 MHz)
- Phase Shift Keying PSK :	internal (1 kHz) and external (< 1 MHz)
- BURST function:	internal or external (< 1 MHz)
- GATE function:	external (< 2 MHz)

- Function to synchronise several generators
- 15 configurations can be saved and recalled

Front face



Terminals

1. 

MAIN OUT
- Main output

2. 

VCG IN
- External SWEEP, MODUL, SHIFT K, BURST piloting signal input

SYNC CTRL
- Master synchronisation output signal in SYNC function
- Slave synchronisation input signal in SYNC function

SWEEP OUT in SWEEP or SHIFT K INTernal source
- Sweep piloting output signal for FSK and PSK

3. 

TTL OUT
- TTL output

SYNC M CLK
- in SYNC function, master clock output

4. 

FREQ EXT
- Frequency meter input

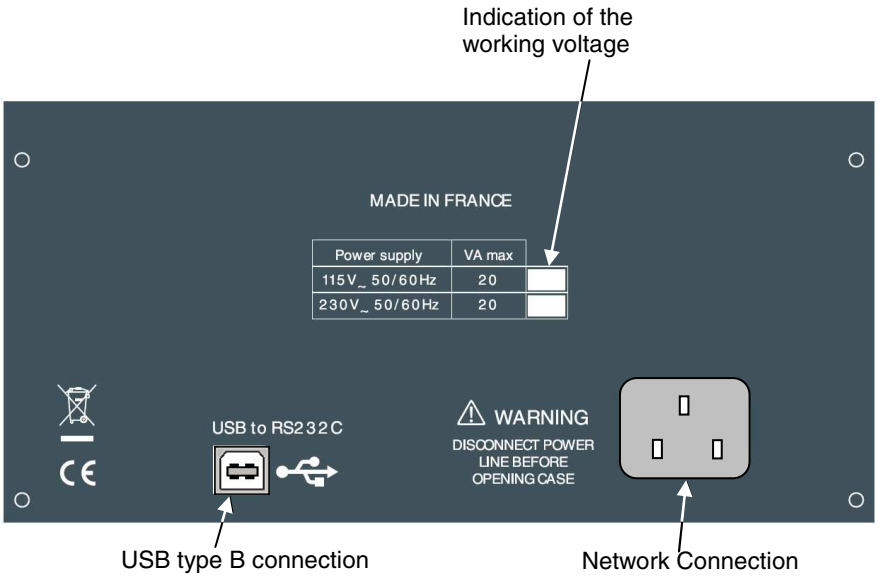
SYNC S CLK
- in SYNC function, slave synchronisation clock input

GATE IN
- GATE piloting input signal

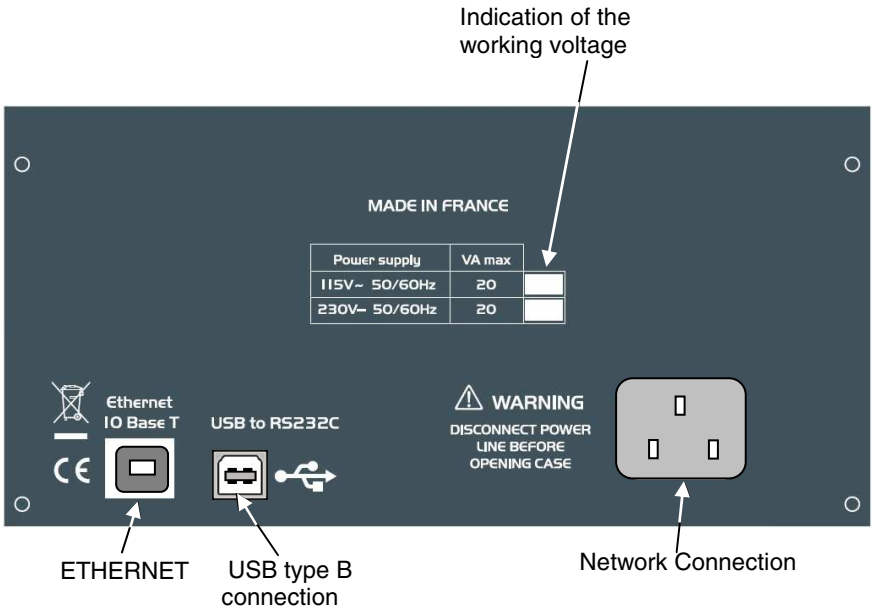
GX 320 Description *(contd.)*

Rear panel

GX 320



GX 320E



Display

GX 320 Description *(contd.)*

Signal selection:

- sinusoidal
- square
- logic
- triangle
- continuous

current waveform indicator

Display of the current frequency phase:

- Freq, $Freq_{START}$ and $Freq_{END}$
- Phase, $Phase_{START}$, $Phase_{END}$
- Time (sweep period, pulse period)
- Num : number of pulses

Frequency display (digit height 20 mm)

Underscores:
Indicate to which digit the wheel increments apply during adjustment.

Unit of measure display:

- degree
- MHz, kHz, Hz
- seconds

Function selection:

- continue
- Shift Key
- sweep
- modulation
- frequency meter
- synchronisation
- Burst

Current function indicator

Duty cycle value display

Amplitude value display

Offset value or DC level value display

OFFSET type display

DUTY type display

AMPLITUDE type display

GX 320 Description *(contd.)*

HIGH / LOW level logical type display

INTernal / **EXT**ernal source selection

Mode display:

- AM / FM Modulation
- **LINear** / **LOG**arithmic sweep
- Master / Slave synchronisation
- Shift key Frequency / Phase

Indication that the MODE key is assigned:

- to triggering the adjustment step when calibrating
- to the manual triggering of a set of pulses in BURST mode
- to triggering the selected test in Autotest mode

Sawtooth or triangle sweep type

Modulation rate display AM 20 % or 80 %

GATE mode activated display

Master synchronisation activated display

Slave synchronisation activated display

For the synchronisation function: indicates that the frequency and phase adjustment on the slave are restricted by the master.

- During calibration the 

key is assigned to saving the settings.
- In normal mode selects save configuration mode

Selects configuration recall mode

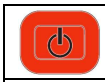
Selects configuration clearing mode

GX 320 Description *(contd.)*

Keys

Keys with the ⌛ symbol have a specific action when pressed for more than 1 second.

- The white keys may have a back light:

	Appliance under power but not turned on (red)
	Appliance turned on (green)
MAIN OUT 	Key lit → MAIN OUT exit activated
MAIN OUT 	Blinking key → MAIN OUT and GATE functions activated

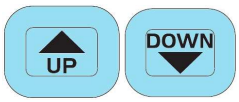
- The other keys can be:

 unlit	→ keys not assigned to the wheel adjustment or having no action
 lit	→ the corresponding adjustment is assigned to the wheel.
 blinking	→ the corresponding adjustment can be assigned to the wheel.

Each time the* WAVEFORM *or* FUNCTION *is changed the keys that can be assigned to the wheel adjustment blink for 4 seconds; if no keys are used at this time the frequency adjustment (Freq* or *$Freq_{START}$) is assigned to the wheel.

Keys pressed for less than 1 second

WAVEFORM



WAVEFORM keys:
Selects the waveform to be generated

Saves the current configuration or saves the settings when calibrating

Recalls or clears a saved configuration

GX 320 Description *(contd.)*

Keys pressed for less than 1s (contd.)

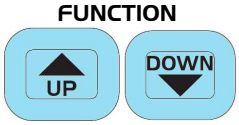
Validation or not of the wave on the **MAIN OUT** BNC**.**

Adjustment of the wave duty cycle (square, triangle) using the wheel.

Adjustment of the output wave amplitude using the wheel.

- Offset adjustment using the wheel.
- Adjustment of the DC level if the ⎓ continuous waveform is selected.

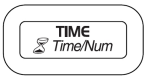
LOGIC waveform selected: adjustment of the high or low wave level using the wheel.



FUNCTION keys:
Selection of one of the 7 available functions.

SHIFT K, or **SWEEP**, or **MODUL** or **BURST** functions activated: selection of the **INT**ernal or **EXT**ernal command signal.

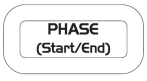
- **SHIFT K** or **SWEEP** or **MODUL** or **SYNC** functions activated: selection of a specific function mode (see Function list and adjustment paragraph).
- **BURST** function and **EXT**ernal source activated: manual triggering of a set of pulses.
- calibration: triggers the selected adjustment step.
- Autotest: triggers the selected test.



- **SWEEP** activated with **INT**ernal source: assignment of the wheel to the desired timing adjustment to carry out a frequency sweep; then, by pressing several times, selection of the digit on which to apply the increment.
- **BURST** function active: assignment of the wheel to the adjustment of the number of pulses or the burst generation period (INT source); then, by pressing several times, selection of the digit on which to apply the increment.

Division or multiplication by 10 of the current frequency value (decade change).

- Assignment of frequency adjustment to the wheel; then, by pressing several times, selection of the digit on which to apply the increment.
- **SWEEP** or **MODUL FM** or **FSK** activated: same functions with the FreqSTART and $Freq_{end}$ frequencies.



- **SYNC** function activated: adjustment of the de-phasing between the two generators using the wheel.
- **PSK** function activated: by pressing several times, adjustment of the PhaseSTART or $Phase_{end}$ using the wheel.

GX 320 Description *(contd.)*

Keys pressed for more than 1 second

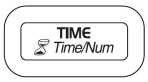
Pressing for more than 1 second sets the **GATE** function**.**

Pressing for more than 1 second forces the duty cycle to 50 %.

Pressing the key for more than 1 second switches from a peak to peak amplitude display to an RMS (root mean square) display.

Pressing the key for more than 1 second forces the offset value to 0.

Pressing the key for more than 1 second assigns the LCD contrast adjustment to the wheel.



BURST function activated, **INT**ernal source. Pressing the key for more than 1 second is used to switch the number of pulses **Num** in the pulse generation period **Time,** and vice versa.

These keys assign the selected frequency to the start or end of the current range.

Ranges	Press > 1 Second ‘RANGE-’	Press > 1 second ‘RANGE+’
[0.001 Hz ; 0.01 Hz]	0.001 Hz	0.01 Hz
[0.01 Hz ; 0.1 Hz]	0.01 Hz	0.1 Hz
[0.1 Hz ; 1 Hz]	0.1 Hz	1 Hz
[1 Hz ; 10 Hz]	1 Hz	10 Hz
[10 Hz ; 100 Hz]	10 Hz	100 Hz
[100 Hz ; 1 kHz]	100 Hz	1 kHz
[1 kHz ; 10 kHz]	1 kHz	10 kHz
[10 kHz ; 100 kHz]	10 kHz	100 kHz
[100 kHz ; 1 MHz]	100 kHz	1 MHz
[1 MHz ; 10 MHz]	1 MHz	10 MHz
[10 MHz ; 20 MHz]	10 MHz	20 MHz

For the **SWEEP** or **MODUL FM** or **FSK** functions pressing the key for more than 1 second is used to switch between $Freq_{START}$ and $Freq_{END}$ and vice versa.

General Commands

Commissioning

Check that your instrument is compatible with the mains network voltage (see the label at the back of the instrument), that the power supply cable is not damaged and that it is earthed.

The power supply cable plug is used as a cut off point, connect the device to a mains outlet that is easily accessible and is earthed in order to ensure safety.

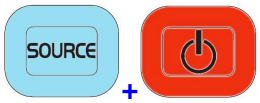
Four start-up modes are possible depending on the key – or combination of keys - used:

1. Normal Mode:

The instrument starts up using the last used configuration. By default the **factory configuration** is restored.

The key becomes: 

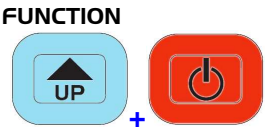
2. Version Mode:



The instrument starts up in **Version** mode and displays the current software version number and date.

The key becomes:  *(See Display of the software version).*

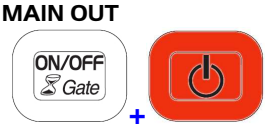
3. Calibration Mode:



The instrument starts up in **Calibration** mode with the selection of the calibration to be run: automatic mode CAL_AU, by default.

The key becomes:  *(See automatic calibration).*

4. Autotest Mode:



The instrument starts up in **Autotest** mode with the selection of the test to be run: automatic mode tSt_AU by default.

The key becomes:  *(See Autotest).*

General Commands *(contd.)*

Stop

Whatever the mode, pressing this key puts the instrument on **STANDBY**.
When pressed while in **Normal** mode the context is saved:

- current settings in use for signal generation when the instrument was stopped,
- settings for other functions that may have been changed.

The key becomes: 

☝ ***Each time Normal mode start-up is used all the settings are reloaded.***

In the event of a power failure (or if the power cable is unplugged …), the instrument restarts using the last backup (backup made the last time the device was turned off using the ON/STANDBY key).

In the event of an error the default configuration is loaded:

- Signal sinusoidal
- Function **CONT**inuous
- Frequency 1 kHz
- Amplitude 1 Vpp
- Offset 0 V
- Output **MAIN OUT ON** not active
- No adjustments assigned to the wheel.

The key becomes:  .

Activating the MAIN OUT terminal

☝ ***At start-up the MAIN OUT terminal is always de-activated.***

MAIN OUT

Pressing the key activates the terminal and the key lights: 

.
On the **GX 320**: the key may blink when the **GATE** function is activated (see **GATE** function).

MAIN OUT

De-activation of the **MAIN OUT** terminal, the key is no longer lit: 

.

General Command *(contd.)*

Setting the screen contrast

LOGIC LEVEL

The display shows: 

.

The key becomes: 

.

Adjustment of the contrast value from 0 to 99 using the coding wheel.

Exiting from this mode is made by pressing another key. The frequency display returns to the screen and the possible associated keys blink.

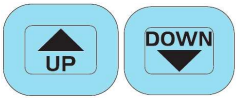
The key becomes: 

.

The contrast value is memorised in the device configuration once it is turned off (see left margin) or when the configuration is saved (**GX 320**).

Selection of the instrument function

FUNCTION

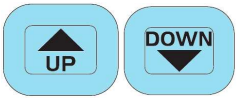


Pressing once displays the list of functions available on the device in the top right hand corner: 

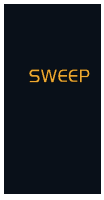
(**GX 310**) 

(**GX 320**).
The cursor ▶ indicates the selected function.

FUNCTION



Pressing again moves the cursor towards the top or bottom to select another function.
If, after 2 seconds, no keys have been pressed or when another key is pressed, the selected function is validated and is the only one remaining displayed:

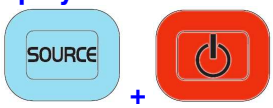


When the function has been validated the keys that can be assigned to the wheel blink until one of them is selected; the key then lights up.

If no keys are used in the 4 seconds following the function validation the wheel is automatically assigned to frequency setting
(Freq or $Freq_{START}$ depending on the function).

General Commands *(contd.)*

Software version display



The following screen is displayed:

Exit Version mode.

The key becomes:  .

Automatic calibration

The device has an automatic function that can be used to calibrate signal generation.

This function can be triggered:

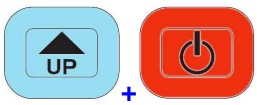
- automatically (all settings are run automatically) or
- manually (individual selection and run of settings).

No specific wiring is needed for this function.

For optimal calibration the device must be at operating temperature (switched on for 30 minutes) before running calibration.
In addition, when in manual mode it is recommended to respect the running order of the calibration steps.

Entering Calibration mode

FUNCTION



Entry into this mode is the CAL.AU. automatic mode. The display is as below:

Switching to manual mode is done by turning the wheel and selecting the calibration step to be run individually.

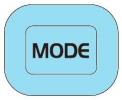
General Commands *(contd.)*

Selecting the calibration step to run:

- **CAL.AU** : automatic calibration (all settings are triggered automatically)
- **CAL.00** : cancels offsets for sine and triangle signals
- **CAL.01** : cancels offsets for square and LOGIC signals
- **CAL.02** : calculates gains for the DC level offset setting
- **CAL.03** : cancels the secondary offset for square and LOGIC signals
- **CAL.04** : calculates gains for amplitude setting for sine, triangle, square and LOGIC
- **CAL.05** : calibrates the duty cycle for square and LOGIC
- **CAL.06** : sets AM and FM external modulation
- **CAL.07** : sets AM modulation for square and LOGIC signals

Running adjustments

(GX 305/310)



(GX 320)

Pressing the key triggers automatic calibration or the selected calibration step. The display shows:

for automatic (then the adjustments are displayed in order) or

in manual mode.

At the end of the run two situations are possible: the adjustment either succeeded or failed.

If the adjustment succeeded the display shows:

in automatic or

in manual.

The SAVE CONFIG display indicates that the adjustment settings may have changed and that the changes can be saved.

General Commands *(contd.)*

In the event of an error the automatic calibration stops at the step in error, it then switches to manual mode.

The display shows:

In the event of repeated errors contact your CHAUVIN-ARNOUX representative (see p. 5).

Saving settings

(**GX 320**)

(**GX 305/310**)

Pressing saves the calibration.

The 

display is cleared once the backup is made. It reappears if the calibration is changed.

Exit from Calibration mode

Exit this mode using this key.

The key becomes:  .

To save settings a data backup should be made (see above) before exiting the mode, otherwise the settings are lost and the previous settings are re-loaded at start-up.

General Commands *(contd.)*

Instrument Autotest

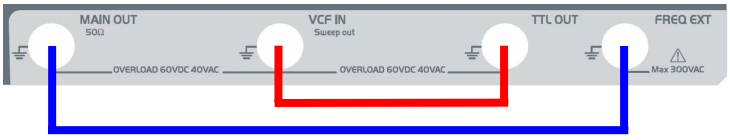
The device has an automatic electronics test function. This feature can be run automatically (all tests run automatically) or manually (individual selection and running of tests).

Wiring needed

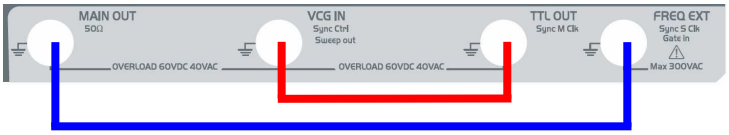
These tests require specific wiring of the device's input/output terminals. Two wirings are needed.

When needed they are indicated by the following messages:

for wiring n°1:

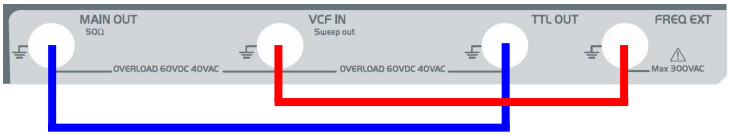


(**GX 305/310**)

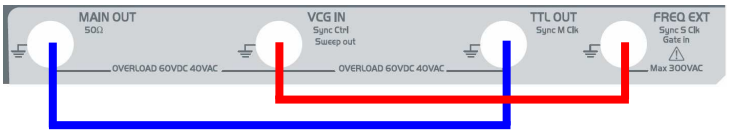


(**GX 320**)

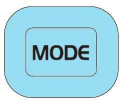
for wiring n°2:

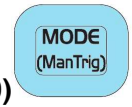


(**GX 305/310**)



(**GX 320**)

(GX 305/310) 

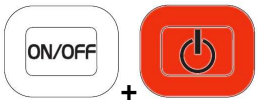
(GX 320) 

Once the wiring has been made pressing the key continues the test.

General Commands (*contd.*)

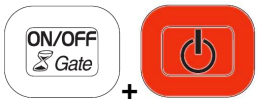
Entering AUTOTEST mode

MAIN OUT



(GX 305/310)

MAIN OUT



(GX 320)

By default this mode is entered using the automatic mode tSt.AU. The display is the following:

Switching to manual mode is done by turning the test step selection wheel and running individually.

Selection of the test step to run:

- **tSt.AU** : automatic test (all tests automatically sequenced)
- **tSt.00** : LCD test (scrolls through all segment, even segment, odd segment displays by pressing the MODE key)
- **tSt.01**: keyboard and key light test

  (you must press all the keys except  , each time a key is pressed an LCD segment is cleared).

N°1 wiring is needed:

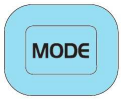
- **tSt.02**: frequency meter test
- **tSt.03**: GATE IN test (**GX 320**)
- **tSt.04**: CTRL IN test using SYNC function (**GX 320**)
- **tSt.05**: FM modulation test (**GX 320**)
- **tSt.06**: external AM test (**GX 320**)
- **tSt.07**: Reset DDS pilot test
- **tSt.08**: DDS FS register pilot test (frequency commutation)
- **tSt.09**: DDS PS register pilot test (phase commutation)
- **tSt.10**: triangle duty cycle test

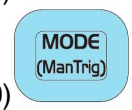
N°2 wiring needed:

- **tSt.11** : CTRL OUT test using SYNC function (**GX 320**)
- **tSt.12** : SWEEP OUT test

General Commands *(contd.)*

Running the tests

(**GX 310**) 

(**GX 320**) 

Pressing the key triggers the automatic test or the selected test step.
The display shows:

in automatic mode (then scrolls through the tests) or

in manual mode.

At the end of the run 2 situations are possible: the test was successful or the test failed.

If the test succeeded the display shows:

in automatic mode or

in manual mode.

If the test failed the automatic test stops at the failed test step or switches to manual mode. The display shows:

If the error persists contact your MANUMESURE representative (see p. 5).

Exiting AUTOTEST

Pressing this key exits Autotest mode.

The current test is stopped and the instrument switches to STANDBY, the key becomes:  .

General Commands *(contd.)*

Saving a configuration (GX 320)

The **GX 320** can save and reload user configurations.

A total of up to 15 files can be saved.

This backup is permanent (the data is saved even if the instrument is powered down).

SAVE

Enters the configuration management mode.

SAVE CONFIG is displayed on the screen with the current file number:

if file 3 is empty;

if file 3 already contains a configuration the data (other than frequency) is displayed on the screen.

Pressing another key than SAVE or LOAD Erase exits the mode without saving.

Selects files from SEt.01 to SEt.15. The screen is updated with the data from the selected file.

SAVE

Pressing the key again saves the current configuration in the selected file.

The display returns to its pre-backup status and the SAVE CONFIG display is cleared.

When saving the content of the selected file is overwritten by the content of the current configuration without any warning messages.

General Commands *(contd.)*

Reloading a configuration (GX 320)

The **GX 320** can reload 16 saved configurations:

- 15 user configurations,
- plus the default configuration (“factory” configuration see §. Stop).

Entering configuration reload mode.

LOAD CONFIG is displayed on the screen with the current file number:

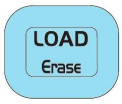
if file 3 is empty.

if file 3 contains a configuration the data (except frequency) is displayed on the screen.

Pressing a key other than 

exits the mode without making any changes.

Selects a file from SEt.00 to SEt.15 (Set.00 is the factory configuration). The screen is updated using the data from the selected file.



Pressing the key again reloads the configuration from the selected file.

If the file is empty or inconsistent the operation is cancelled:

- the settings used before the reload operation are maintained,
- the initial display is shown.

If the selected file is valid the configuration it contains is loaded and the display is updated with its data.

LOAD CONFIG is no longer displayed indicating that the configuration reload mode has been exited.

General Commands *(contd.)*

Clearing a configuration (GX 320)

Clearing a user configuration file (Set.01 to Set.15) consists in saving a null configuration in the file.

This configuration is shown by displaying the file number only during file selection.

Reloading a null configuration has no effect (the existing settings are kept active).

It is not necessary to clear a file before saving a configuration since saving the configuration overwrites the data in the file.

SAVE

Enters configuration mode.

SAVE CONFIG is displayed with the current file number:

if file 3 is empty

if file 3 already contains a configuration the data (except frequency) is displayed on the screen.

Pressing a key other than SAVE or LOAD Erase exits the mode without making any changes.

LOAD Erase

Selects file erase mode.

ERASE is added to the display:

Pressing the key again unselects the file erase mode.

Selects a file from SEt.01 to SEt.15. The screen is updated with the data from the selected file.

SAVE

Pressing the key again saves a null configuration in the selected file and returns to the current configuration display.

SAVE CONFIG and ERASE are cleared from the screen.

Generation of basic “CONTinous” periodic signals

Available output waveforms

The instrument generates the following waveforms:

sine
square
TTL logic
triangular
continuous.

Waveform selection

GX 305/310

Sine waveform

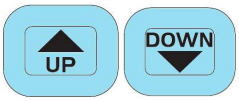
Square waveform
Logic output waveform

Triangular waveform

Continuous waveform

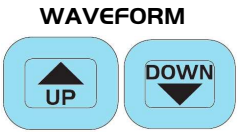
Each time a key is pressed the symbol is displayed on the screen and the keys that can be assigned to the wheel blink.

GX 320



Pressing once displays the list of available waveforms at the top left of the screen:

The cursor  indicates the current waveform.



Pressing again moves the cursor up or down to select a new waveform.

If the keys are not pressed for 2 seconds or if another key is pressed the selected waveform is validated and remains displayed:

When the waveform is validated the keys that can be assigned to the wheel blink until one of them is selected; this key is then lit.
If no key is pressed within 4 s of validation the wheel is automatically assigned to frequency adjustment (Freq or $Freq_{START}$).

Generation of basic “CONT” periodic signals *(contd.)*

Adjusting signal frequency

Frequency is set in two steps:

- Entry of the five significant digits
- Setting the decimal point and the unit multiplier

Entering the 5 significant digits

The coding wheel and the following key can be used to enter the 5 significant digits.

Assign frequency setting to the wheel. The:  key lights.

Value adjustment.

By pressing several times, the digit from which wheel increments are added is selected.

By default the digit to which increments are applied is the unit digit (extreme right). This setting is programmed each time the instrument is started up.

Positioning the decimal point and the unit multiplier

These keys position the decimal point and the unit multiplier.

Entry short cuts

Assigns the minimum value for the current range
(see Pressing keys for more than 1 second in the ***GX*** description paragraph).

Assigns the maximum value for the current range
(see Pressing keys for more than 1 second in the ***GX*** description paragraph).

Generation of basic CONT periodic signals *(contd.)*

Example 1: The wheel is not assigned to a setting (**FREQ** not lit or blinking),

the current frequency value is:  .

We want to enter:  .

1st possibility

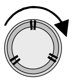
The **FREQ** key lights:  .

The display shows: 

The display shows:  .

The display shows:  .

The display shows:  .

 25

The display shows:  .

The display shows:  .

2nd possibility

The **FREQ** key lights:  .

The display shows:  .

The display shows:  .

Generation of basic “CONT” periodic signals *(contd.)*

FREQ Start/End

The display shows: 

2

The display shows: 

FREQ Start/End

The display shows: 

5

The display shows: 

3rd possibility

FREQ (Start/End)

The **FREQ** key FREQ Start/End lights.

The display shows: 

2500

The display shows: 

RANGE +

The display shows: 

Example 2:

The wheel is not assigned to any settings (FREQ key unlit),

the current frequency value is: 

We want to enter: 

RANGE − 1s

The **FREQ** key lights: FREQ Start/End.

The display shows: 

Generation of basic “CONT” periodic signals *(contd.)*

Setting the duty cycle

The duty cycle can only be adjusted for square, logic or triangle forms using the “**CONT**inuous” function.

The setting can be limited depending on the signal frequency.

Signal	Frequency	Possible adjustments
Square Logical	≤ 200 kHz 200 kHz < F ≤ 1 MHz F > 1 MHz	10 to 90 % 20 to 80 % 50 %
Triangle	F < 0.2Hz 0.2Hz ≤ F ≤ 1 kHz 1 kHz < F ≤ 10 kHz F > 10 kHz	50% 10 to 90 % 30 to 70 % 50 %

Assignment of the duty cycle to the wheel. The key lights: 

.

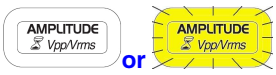
Setting the value.

Forces the duty cycle value to 50 %.

The duty cycle is limited by the frequency, turning the wheel may have no effect.

Setting the signal amplitude

Amplitude indications are given in open circuit.
Under 50Ω, amplitudes are divided by 2.



Assignment of amplitude adjustment to the wheel. The key lights: 

.

Adjustment of the Vpp or Vrms value depending on the selected display.

Vpp/Vrms display

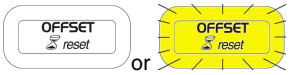
Switches from Vpp to Vrms display and vice versa

The variation is from 0 to 20 Vpp in open circuit.

The sum of continuous voltage + alternating voltage cannot be > ± 10 V.

Generation of basic “CONT” periodic signals *(contd.)*

Setting the offset and DC level



Assignment of offset adjustment to the wheel. The 

key lights.

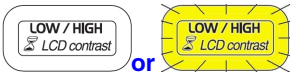
Value adjustment.
The variation field is from -10 V to +10 V maximum in an open circuit.

Forces the offset value to 0.

The sum of continuous voltage + alternating voltage cannot be > ± 10 V.

Setting signal logical levels

This function is only available if the “**LOGIC**” waveform has been selected.



Assignment of the logic signal low level to the wheel.
The 

key lights.
The "Adj.LO" message displays instead of the frequency value:

By pressing several times the high or low level is selected, "Adj.HI" is displayed for high level adjustment:

Adjustment of the selected value.

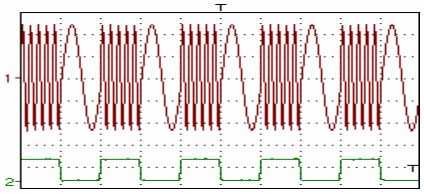
The field of variation for these levels is from -10 V to +10 V by 100 mV intervals.

The high level is always greater than or equal to the low level.

Shift Keying function “SHIFT K” *(GX 320 only)*

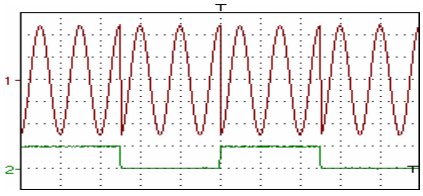
The **SHIFT KEY** function can work with the signal frequency (**FSK)** or phase (**PSK**):

- “**FSK”** is a frequency commutation piloted either **INT**ernally or **EXT**ernally: switching from $Freq_{START}$ to $Freq_{END}$ and vice versa.



INTernal FSK:
Channel1: MAIN OUT
Channel2: VCG IN Sweep out

- “**PSK”** is a phase jump with value $Phase_{START}$ and $Phase_{END}$, piloted by a command signal that can be **INT**ernal or **EXT**ernal.



INTernal PSK:
Channel1: MAIN OUT
Channel2: VCG IN Sweep out

At each change in signal status the programmed phase value ($Phase_{START}$ or $Phase_{END)}$ is added to the current phase.

- With an **INT**ernal source the command signal has a frequency of 1 kHz. It can be viewed on the generator **SWEEP OUT** terminal.
- With an **EXT**ernal source the pilot signal is a TTL signal (0 - 5 V) with a frequency of < 1 MHz from the generator **VCG IN terminal**.

Connections

Main output signal

TTL input command signal from an EXTernal F < 1 MHz
Output command signal from an INTernal source

TTL output signal

FSK mode selection

Pressed successively, “**F**” mode selection (**F**requency).

PSK mode selection

Pressed successively, “**P**” mode selection (**P**hase).

Selection of the source

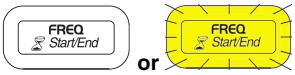
Pressed successively, source selection:

INTernal  or

EXTernal  .

Shift Keying “SHIFT K” function *(contd.)*

Setting frequencies in FSK mode



$Freq_{START}$ display and assignment of adjustment to the wheel.

The key lights: 

.

$Freq_{END}$ display and assignment of adjustment to the wheel.

The key lights: 

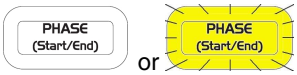
.

Pressed successively selects the digit from which the increment will be applied.

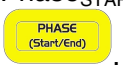
Adjustment of the selected value.

Passage from $Freq_{START}$ adjustment to $Freq_{END}$ adjustment.

Setting phases in PSK mode

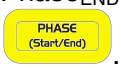


Assignment of $Phase_{START}$ adjustment to the wheel.

The key lights: 

.

Assignment of $Phase_{END}$ adjustment to the wheel.

The key lights: 

.

Adjustment of the selected value.
The field of phase variation is of -180°to +180°b y intervals of 1°.

Pressed successively assigns $Phase_{START}$ or $Phase_{END}$ adjustment to the wheel.

Forces the phase being set to 0.

Other settings

See “**CONT**” function.

SWEEP frequency scan function

SWEEP is a frequency scan from $Freq_{START}$ to $Freq_{END}$ piloted:

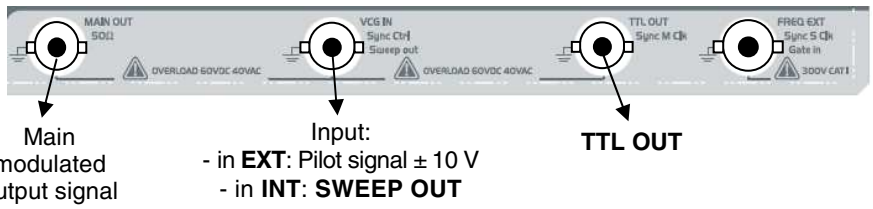
- either **INT**ernally by the generator following a linear or logarithmic formula and a saw tooth or triangle variation.
  The user can choose a scan time from 10 ms to 100 s.
- either **EXT**ernally using a voltage of ± 10 V applied to VCF IN (**GX 305/310**) or VCG IN (**GX 320**) with a frequency < 15 kHz.
- Depending on the values of $Freq_{START}$ and $Freq_{END}$ the frequency scan will be in ascending or descending order.

Remarks

When using **EXT**ernal **SWEEP** the signal level is read at a frequency of 60 kHz. This amplitude (coded on 256 values) is then converted into frequency.

When using **INT**ernal **SWEEP**, the scan is made using a maximum of 256 values.

Connections



Main modulated output signal

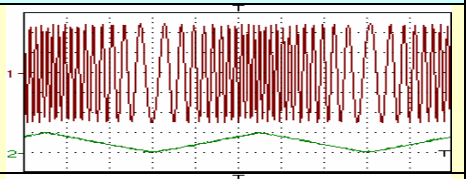
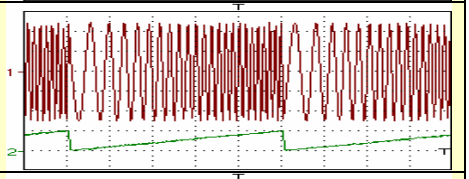
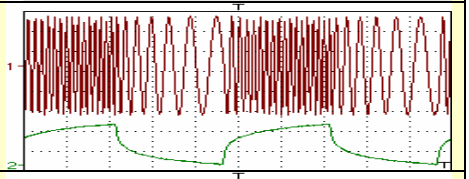
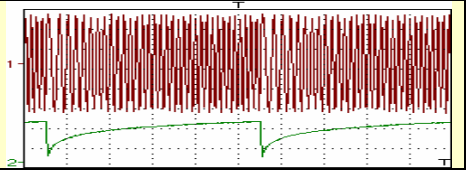
Input:
- in **EXT**: Pilot signal ± 10 V
- in **INT**: **SWEEP OUT**

TTL OUT

Selection of scan mode

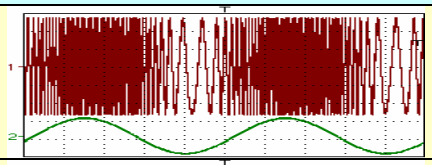
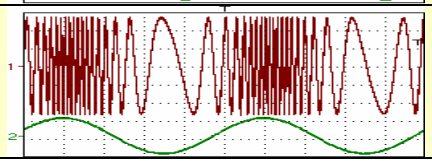
→ Pressed successively this key selects one of the following scan modes:

Assignment sequence using INTernal source

Display	Description	Channel1: MAIN OUT, Channel2: SWEEP OUT
	Linear rule, triangular variation	
	Linear rule, saw tooth variation	
	Logarithmic rule, triangular variation	
	Logarithmic rule, Saw tooth variation	

SWEEP frequency scan function *(contd.)*

Assignment sequence using EXTernal source

Display	Description	Channel 1: MAIN OUT(F_{start} = 1 kHz, F_{end} = 100 kHz Channel 2: Modulation: SINE, 1 kHz, 10Vpp
LIN LOG	Linear rule between the command signal and the generated frequency	
LIN LOG	Logarithmic rule between the command signal and the generated frequency	

INTernal source

→ A **SWEEP OUT** signal is available on the **VCF IN** BNC **(GX 305/310)** or **VCG IN (GX 320)**.
It is a proportional signal with a generated frequency, amplitude from 0 to 2V.

EXTernal source

→ The generated output frequency is proportional (according to a linear or logarithmic rule) to the voltage on **VCF IN (GX 305/310)** or **VCG IN (GX 320).**
The command signal is sampled on 8 bits using a frequency of 60 kHz.

→ For -10 V: the output frequency F ≅ $Freq_{START}$
For 10 V: F ≅ $Freq_{END}$

Selecting the scan source

Pressing the key successively selects the **INT**ernal source 

or the EXTernal source 

.

Setting the START / END frequencies

or 

Displays $Freq_{START}$ and assigns adjustment to the wheel.
The key lights: 

.

1s or 

1s

Displays $Freq_{END}$ and assigns adjustment to the wheel.
The key lights: 

.

Pressing successively selects the digit from which the increment will apply.

Adjusts the selected value.

1s

Switches from setting $Freq_{START}$ to setting $Freq_{END}$.

SWEEP frequency scan function *(contd.)*

Setting the scan time using INTernal source

Displays the Time and assigns adjustment to the wheel.

The key lights: 

.

Pressed successively selects the digit to which the increment will apply.

Adjusts the value using the wheel.

Other settings

See the **CONT** function.

MODUL Modulation function *(GX 320 only)*

The **MODUL** function modulates a carrier frequency (**FM**) or amplitude (**AM**).

The modulating signal can be:

- either internal (**INT**ernal source, sinusoidal 1 kHz signal)
- or on VCG IN, for an **EXT**ernal source.

The carrier specifications are defined in the same way as the **CONT** function.

Using an **EXT**ernal source the signal must have an amplitude of ± 10 Vpp and a frequency of < 15 kHz (FM) and < 5 kHz (AM).

Depending on the voltage the modulation is as follows:

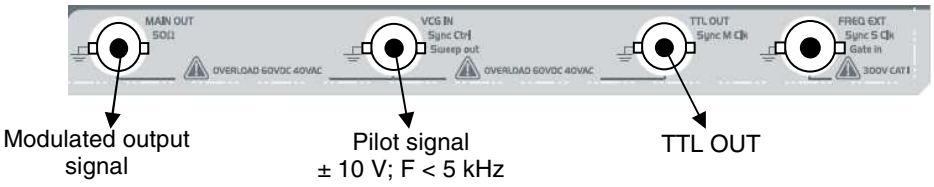
- **AM**: the output signal amplitude is typically
  100 % for -10 V
  50 % for 0 V
  null for 10 V
- **FM**: the output signal frequency is typically
  $Freq_{start}$ for -10 V
  ($Freq_{start}$ + $Freq_{end}$) / 2 for 0 V
  $Freq_{end}$ for +10 V

Remarks

- *For **AM:** with **LOGIC** and square signals modulation is digital: the modulating signal is read at a frequency of 150 kHz. This amplitude (256 values) pilots the output signal amplitude.*

  For the other types of signal modulation is analogue and the modulating signal cannot exceed 5 kHz.
- *For **AM**: with the **SINE** and **TRIANGLE** signals, TTL OUT is not available*
- *For **FM**: modulation is digital: the modulating signal level is read at a frequency of 65 kHz.*
  This amplitude (256 values) is then converted into frequency.

Connections



Selection of modulation source

Pressed successively selects the INTernal source 

or the EXTernal source 

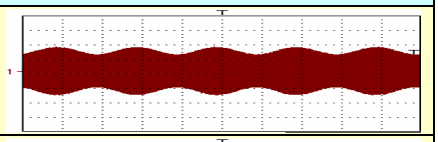
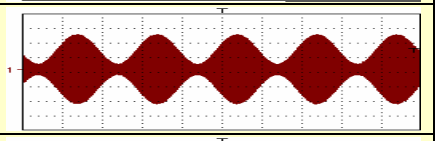
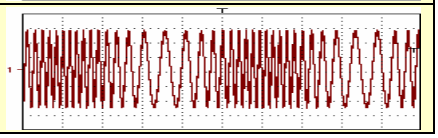
.

MODUL Modulation function *(GX 320 only, contd.)*

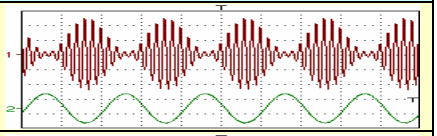
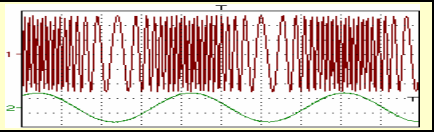
Selection of the AM/FM modulation mode

Pressing successively selects the following modulation modes:

INTernal source

Display	Description	
	20% amplitude modulation	
	80% amplitude modulation	
	Frequency modulation	

EXTernal source

Display	Description	
	Amplitude modulation	
	Frequency modulation	

Setting START / END FM frequencies

Displays $Freq_{START}$ and assigns adjustment to the wheel.

The key lights: 

.

Displays $Freq_{END}$ and assigns the adjustment to the wheel.

The key lights: 

.

Pressed successively selects the digit to which the increment will be applied.

Adjusts the selected value.

Switches from setting $Freq_{START}$ to setting $Freq_{END}$.

Other settings

See **CONT** function.

Frequency meter function “FREQ”

Selecting the **FREQ** function activates measurement of the frequency of the signal input to the **FREQ EXT** terminal.

The frequency meter can measure frequencies from 5 Hz to 100 MHz with the following precision:

< 50 mV sensitivity F ≤ 30 MHz
< 60 mV sensitivity for 30 MHz < F ≤ 80 MHz
< 90 mV sensitivity for 80 MHz < F ≤ 100 MHz

The maximum amplitude (*) of the measured signal is:

300 V sensitivity from 5 Hz to 5 kHz
30 V sensitivity from 5 kHz to 1 MHz
10 V sensitivity above this value

(*) signal with a 50% duty cycle.

Measurement stabilisation time depends on the input frequency:

≤ 1 s from 5 to 20 Hz (≥ 1 measurements per second)
≤ 100 ms from 20 to 400 Hz (2 measurements per second)
≤ 40 ms from 400 Hz to 100 MHz (2 measurements per second)

Indication of the 300 V protection (50 - 60 Hz) CAT I

Connections

SYNC Synchronisation Function *(GX 320 only)*

The **SYNC** function is used to synchronise several **GX 320** set up in a cascade in order to create a variable phase multiple signal generator.

The frequency resolution of this function is: 37 mHz, the clock frequency of the DDS is set at 10 MHz.
To limit the sampling effect the maximum frequency of the output signal is set at 100 kHz.

The Master generator supplies the Slave generators with the clock (**Clk**) used to generate the signals (10 MHz) and a synchronisation signal (**Ctrl**). This allows all the generators to start at the same time and control their phase offset.

Connections

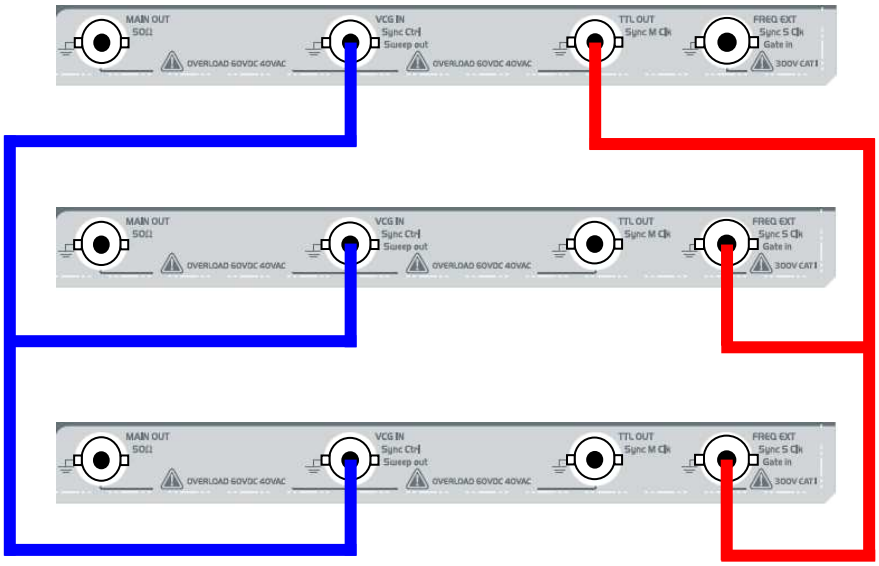
Control signal (**Ctrl**): Connect the Slave **VCG IN** BNCs to the Master.

Clock signal (**Clk**): Connect the slave **FREQ_EXT** BNCs to the Master **TTL OUT**.

Master

Slave1

Slave2



During signal generation disconnecting one of the Ctrl or Clk cables desynchronises the generators.

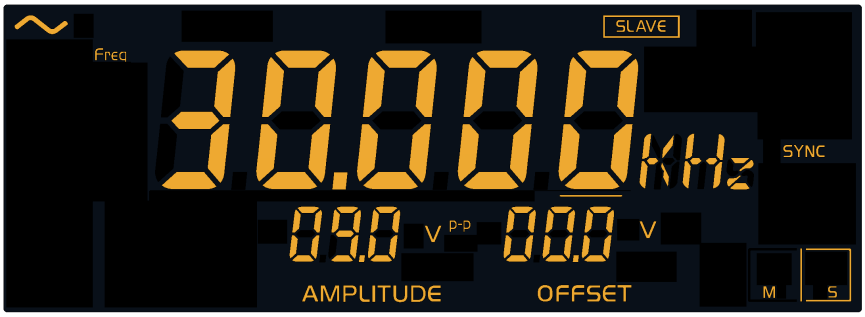
To resynchronise them use the master's 'MAIN OUT ON/OFF' key to deactivate and then reactivate signal generation.

SYNC Synchronisation Function *(GX 320 only, contd.)*

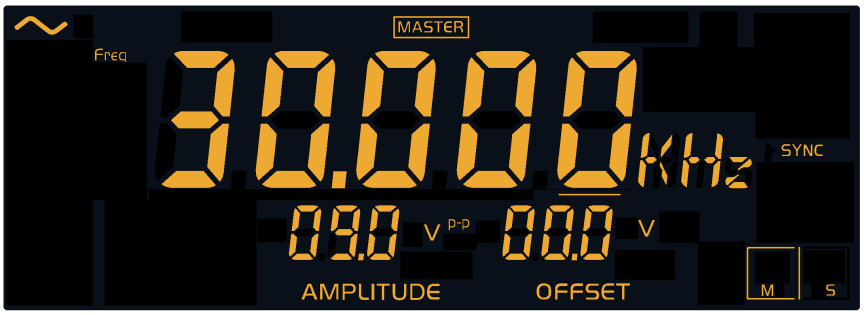
Selection of the Slave / Master mode

MODE (ManTrig)

Pressed successively selects **S** mode (Slave):



or **M** (Master):



Adjusting phase offset

Phase offset can be set on the master and on the slave (if it is not locked). Whatever the mode selected (M/S) the phase offset is that of the slave(s) related to the master.

The phase offset entered on the master is applied to all the slaves whereas the phase offset entered on the slave is limited to that slave:

Phase offset (slave/master) = entered phase offset $_{master}$ + entered phasing$_{slave}$

PHASE (Start/End) or PHASE (Start/End)

Displays phase offset and assigns the adjustment to the coding wheel.

The PHASE (Start/End) key lights.

Value adjustment.
The phase is in degrees and can have values between -180°C and +180°C, varying by 1°.
The master mode phase is reversed in relation to the slave mode.

PHASE (Start/End) 1s

Forces the phase to 0°

SYNC Synchronisation Function *(GX 320 only, contd.)*

Activation of signal generation (Master)

On the master all adjustments are possible in real time because each change in the master commands resynchronisation of all the slaves. As this is not possible on the slaves, changing waveform, frequency or phase are not possible when signal generation is activated. On the other hand as amplitude and offset have no effect on synchronisation they remain adjustable at all times.

The slave is said to be locked: is displayed on the top right hand corner of the slave screen(s).
In order to change the waveform, frequency or phase on the slave you must stop signal generation on the master using its 'MAIN OUT ON/OFF' key.

MAIN OUT

- <u>on the Master</u>:
  - Activates MAIN OUT and signal generation on all devices on which MAIN OUT is activated.

    The master key lights: 

.
  - Locking slaves: selecting waveform and adjusting frequency and phase are no longer possible on the slaves.

    The symbol is dispayed on the slave screen as below:

- <u>on the slaves</u>:
  - Activation of the associated **MAIN OUT** (effective signal output is only possible if signal generation is activated on the master).

    The slave key lights: 

.

MAIN OUT

- <u>on the Master</u>:
  - Deactivation of **MAIN OUT** and halting of signal generation on all devices.

    The master key is turned off: 

.
  - The master frees the slaves: waveform selection and frequency and phase adjustment are now possible.

    The symbol disappears from the slaves.

- <u>on the Slaves</u>: the associated MAIN OUT is deactivated.

  The slave key is turned off: 

.

Other settings

See the CONT function.

SYNC Synchronisation function *(GX 320 only, contd.)*

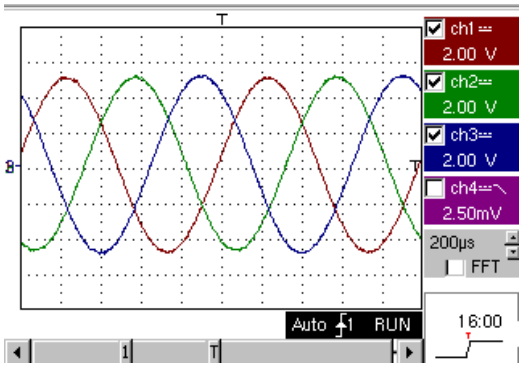
Example 1: **Generating three phase signals**

Connect the three **GX 320 generators** as shown above (see Connections), identify a master and 2 slaves and then programme the 3 devices with:

- the same frequency 1 kHz,
- the same amplitude 10 Vpp
- the same offset 0 V
- the same sine waveform
- phases 0° (master), +120° and -120°.

Activate the 3 MAIN OUTs.

On an oscilloscope view the output signals from the three devices:



Channel 1: master (0°)

Channel 2: slave1 (120°)

Channel 3: slave 2 (-120°)

Example 2: **Fourier synthesis**

A simple illustration of generator synchronisation is the synthesis of a square signal using its first harmonics.

The square signal is broken down as follows:

$f(x) = 4/\pi\ (\sin x + \sin 3x / 3 + \sin 5x / 5 + \sin 7x / 7 + ... \sin nx / n + ...)$

where n is always an odd number.

To synchronise multiple frequencies the values programmed in the DDS must also be multiple.

We are here faced with the problem of calculation rounding and programming resolution: it is highly probable that the direct entry on F on the master and n*F on the slaves will not give synchronous signals.

The DDS is programmed using a 28 bit register and is piloted by a 10 MHz clock (in the **SYNC** function).

The DDS frequency resolution for this function is therefore:
$10\ MHz / 2^{28} = 0.037\ Hz$, which means that for a frequency F entered the resulting frequency is F ± 18.5 MHz.

The formula relating the user entered frequency to the value programmed in the DDS is the following:

$$Val_{DDS} = ENT((Frequency_{(Hz)} \times 2^{28}) / DDS\_Clock + 0.5)$$

with: ENT( ) function returning the whole part of the value

DDS_Clock = 10 MHz,

adding 0.5 rounds the value.

SYNC Synchronisation Function *(GX 320 only, contd.)*

Thus when you programme a frequency of 100 Hz, the programmed value is:

ENT((100*2^{28})/10^7 + 0.5) = 2684 which is the equivalent of a frequency of 99.987 Hz (obtained by reverse calculation).

If you wish to programme a synchronous n*100 Hz multiple frequency you must enter a frequency which results in a DDS programmed value of n*2684, or a true frequency equal to n*99.987 Hz.

In our example we will generate a square 100 Hz signal using its first three harmonics: 3 sinusoids with a frequency of 100 Hz, 300 Hz and 500 Hz and an amplitude of A, A/3 and A/5.

For this example 3 **GX 320** generators are needed:

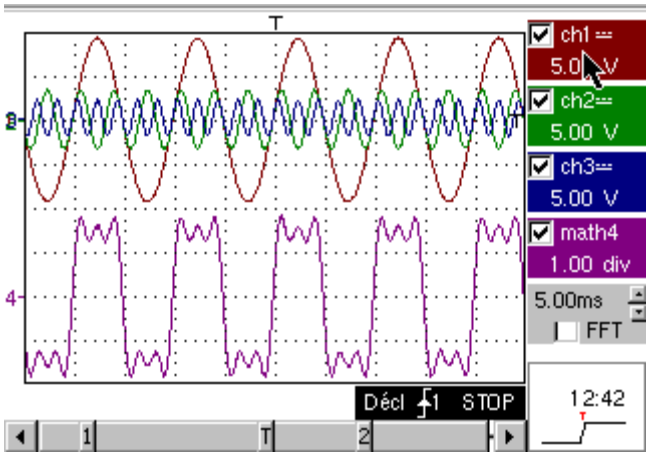
- one Master: on which the SINE waveform is selected, amplitude 20 Vpp, a null offset, a null phase and a frequency of 100 Hz (or 99.987 Hz).
- Slave 1: on which the SINE waveform is selected, amplitude 6.7 V, a null offset, a null phase and a frequency of 3*99.987 = 299.96 Hz.
- Slave 2: on which the SINE waveform is selected, amplitude 4 V, a null offset, a null phase and a frequency of 5*99.987 = 499.93 Hz.

Connect the generators as shown in the Connections paragraph, activate the slave outputs and then the master output (to ensure synchronisation do a master MAIN OUT OFF and then ON).

On the oscilloscope connect the device MAIN OUT (respectively Master, Slave1 and Slave 2) outputs on channels 1, 2, 3.

Select the same sensitivity of 5 V/div. on each channel (choose the weakest frequency signal as trigger: channel 1).

On channel 4 carry out the sum of Channel1 + Channel2 + Channel3, and observe the result:



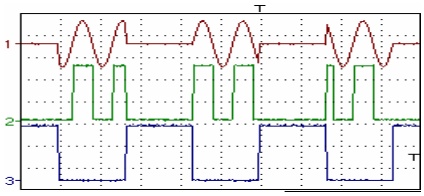
A square signal forms: the higher the number of odd harmonics the better the signal quality obtained.

GATE function *(GX 320 only)*

This function is only available with “**CONT**”, “**SWEEP**” and “**MODUL**”.

It superimposes a stop command for the alternating **MAIN OUT** signal component over the current function, piloted by a TTL input to the BNC **FREQ EXT Gate in** terminal.

When the TTL signal is at the 1 logical level (5 V), the alternating component of the **MAIN OUT** terminal is cut.
At 0 level it is generated freely.



Channel 1: Main Out (sine, 1 kHz, 10 Vpp)

Channel 2: TTL Out

Channel 3: Gate In (LOGIC, 300 Hz, 10 V - 0 V)

The **GATE** has no effect on the direct component of the signal.

The command takes effect in approximately 100 ns.

Connections

GATE activation

MAIN OUT

ON/OFF Gate ⧖ 1s

Function activation, the GATE indication is displayed, the MAIN OUT terminal remains activated

The key blinks: ON/OFF Gate.

MAIN OUT

ON/OFF Gate ⧖ 1s

Pressing the key for more than 1 second does not activate the MAIN OUT terminal but only the GATE function GATE :the key remains unlit.

GATE de-activation

MAIN OUT

ON/OFF Gate ⧖ 1s

Function is de-activated and the GATE is cleared, the MAIN OUT terminal remains active.

The key lights: ON/OFF Gate.

MAIN OUT

ON/OFF Gate ⧖ 1s

Function de-activation and the GATE indication is cleared, the terminal is still not activated: the key remains unlit.

Remark

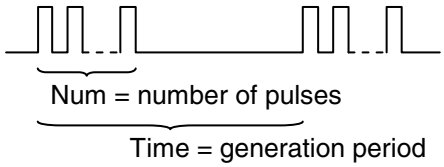
At each function change (**CONT**, **SHIFT K**, **SWEEP**, **MODUL**, **FREQ**, **BURST** or **SYNC**), the **GATE** function is de-activated.

BURST Pulse burst function *(GX 320 only)*

The **BURST** function generates sets of pulses:

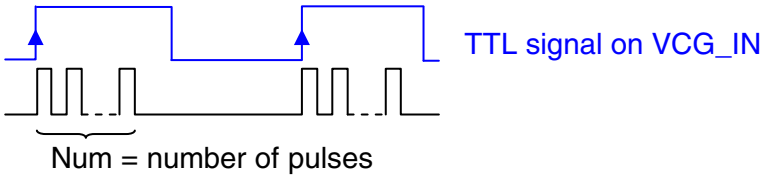
- Using an **INT**ernal source the user must enter a generation period and the number of pulses to generate.

  The number of pulses Num is automatically limited so that the number cannot be greater than the number of pulses a period can contain.



- Using an **EXT**ernal source the pulse bursts are piloted:

  - either by an external TTL with a frequency of less than 10 kHz on VCG IN



  - or manually by pressing the 'MODE' key.

The minimum authorised window time is 2 µs: the number of pulses is defined as follows:

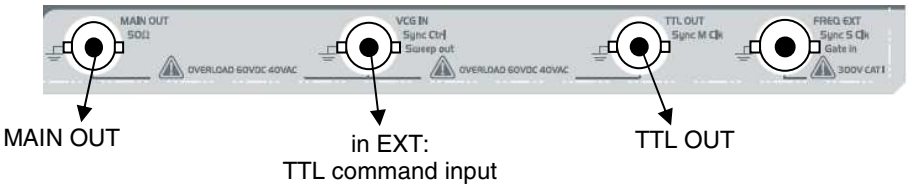
$Num_{min} \geq F*2\mu s$ where Num_{min} (whole number ≥ 1) is the minimum number of authorised pulses and F is the programmed pulse frequency.

Changing the frequency can cause the modification of the programmed Num value in order to obey this rule.

Example if F = 2.6 MHz, then F * 2 µs = 5.2 → the minimum authorised value for NUM_{min} = 6.

if F = 2 MHz, then F * 2 µs = 4 → the minimum authorised value for NUM_{min} = 4.

Connections



Selection of the BURST source

Pressed successively selects the source:

INTernal 

or

EXTernal 

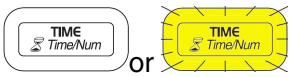
.

BURST Pulse burst function *(contd.)*

Setting the number of pulses Num

The pulse number value (Num) can be limited in **INT**ernal source by the value of the entered period (Time).

In both cases (**INT**ernal or **EXT**ernal), the Num_{min} value is set in order to avoid having a window of less than 2 µs (see above).



Display of the number of pulses Num and assignment of the adjustment to the wheel.

The key lights: 

.

Pressed successively selects the digit to which the wheel increments will be applied.

Value adjustment.

Pressed successively selects the digit to which the wheel increments will be applied.

Using an **INT** source pressing successively for more than 1 second switches from Num to Time and vice versa, otherwise selects Num setting.

Setting the generation period using an INTernal source

Displays the Time and assigns the wheel to adjustment.

The key lights: 

.

Pressed successively switches from Num to Time.

Pressed successively selects the digit to which the wheel increments are applied.

Value adjustment.

Switches from Num to Time and vice versa.

Manual triggering using EXTernal source

Pressing this key triggers the generation of a pulse burst.

Other settings

See the **CONT** function.

Remote programming (*programmable version only) (contd.)*

The programming instructions respect the IEEE 488-2 standard and the SCPI (Standard Commands for Programmable Instruments) protocol.
The user has the possibility of having complete remote control of the device.

For more information please consult the programming guide.

Communication interfaces

Connecting the generator to a PC is done using either :

- an A/B type USB cable via a USB to UART converter,
- via ETHERNET ***Warning ! To use the ETHERNET link, the USB cable must be disconnected.***

USB

If the CP210x driver is correctly installed on the PC the USB peripheral will be recognised and a new COM port will appear in the PC's system settings (see the programming guide to install).

The new COM port is configured as follows:

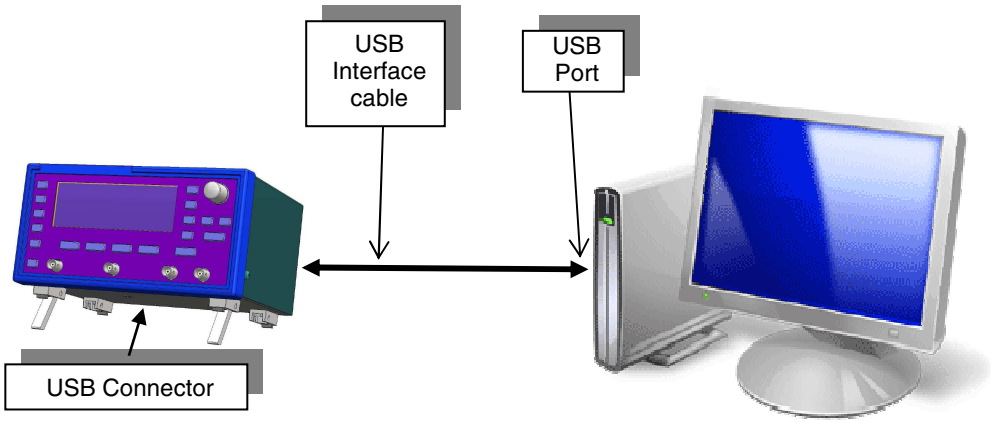
- speed: 19200 bauds
- data bits: 8
- parity: none
- stop bit: 1
- protocol: hardware (RTS / CTS)

ETHERNET

Once the IP address has been programmed through the **GX320E-Admin** application, the **GX320E** can be accessed via this address.

Connection

via USB



Remote programming (*programmable version only) (contd.)*

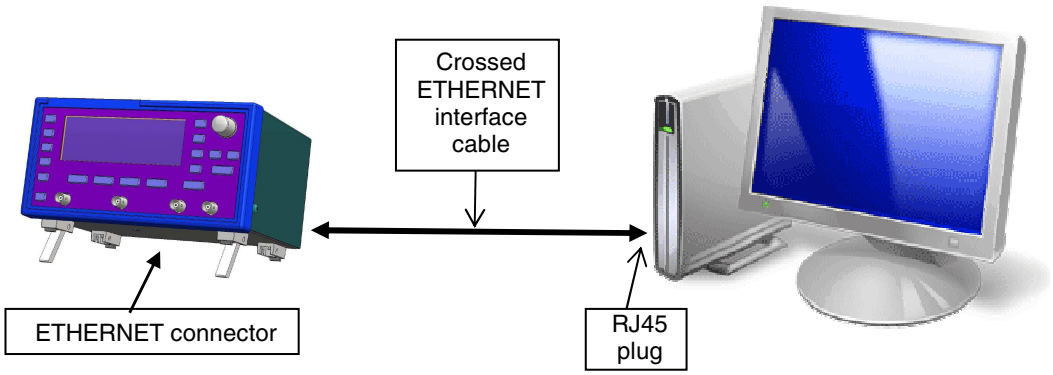
via ETHERNET

Crossed cable

Warning ! The USB cable must be disconnected.

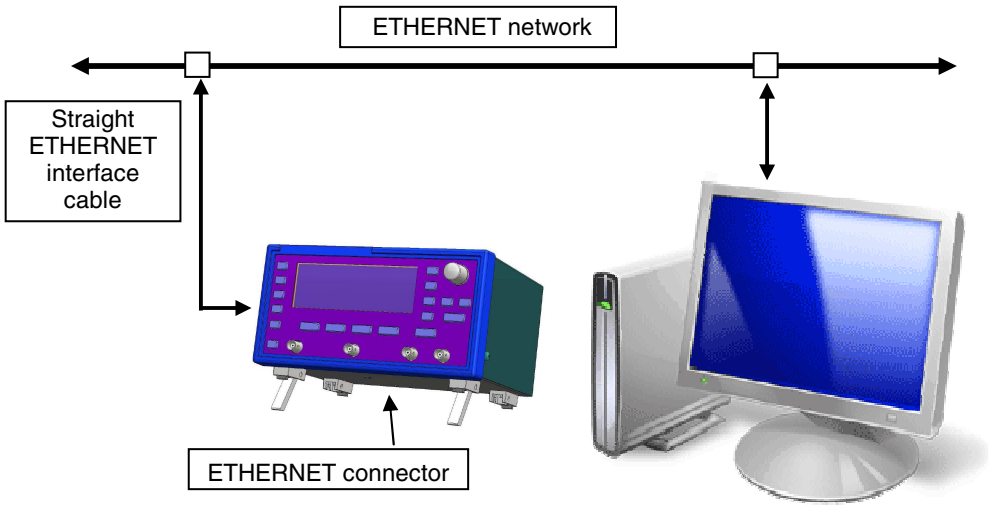
- Connect the crossed ETHERNET interface cable directly to the PC.

- Set the connection with a terminal (Port TELNET : 23) to the IP address which has been defined in the generator.



Straight cable

- Connect the generator to the PC network through a Hub with the straight ETHERNET interface cable.
- Connect a terminal (TELNET Port : 23) to the IP address defined on the generator.



Remote programming (*programmable version only*) (contd.)

Remark

All the devices **GX 310** or **GX 320** – whether programmable or not – respond to the IEEE488.2 ***idn?** command which returns the device identification and version.

Reminder : The **GX 305** is not programmable.

Reply format:

METRIX <instrument><programmable>,<firmware version>,<version date>,<serial number><NL>

with:	<instrument>	device type **GX310** / **GX320**
	<programmable>	'**P**' if the **GX 310** device is programmable '**E**' if the **GX 320** device is programmable
	<firmware version>	software version
	<version date>	software version date
	<serial number>	device serial number
	<NL>	CR character (code ASCII 13 or 0x0D)

LabViews Driver
LabWindows Driver

The **GX 310P** and **GX 320E** device drivers for LabWindows and LabView are available on the CD-ROM which contains this guide.

They can be used to interface SCPI commands for these development environments.

Technical Specifications

CONTinuous function

Waveforms

- sine
  triangle
  square
  logic pulses (programmable high and low levels)
  positive pulses (TTL level)
  continuous (DC: offset)

Signal frequency

- **GX 305** : from 0.001 Hz to 5 MHz in 10 ranges (decades)
  GX 310 : from 0.001 Hz to 10 MHz in 10 ranges (decades)
  GX 320 : from 0.001 Hz to 20 MHz in 11 ranges (decades)
- 3 internal ranges, for DDS resolution:
  F ≤ 1 kHz the DDS resolution is approx. 1 mHz
  1 kHz < F ≤ 10 kHz the DDS resolution is approx. 10 mHz
  10 kHz < F ≤ 20 MHz the DDS resolution is approx. 280 mHz
- Frequency display on the LCD: 5 digits (units: Hz, kHz, MHz)
- Settings: direct using the encoder, automatic range switching
- Precision: ± 30 ppm for F < 10 kHz
  ± 20 ppm for F ≥ 10 kHz
  for sine, square, LOGIC and triangle (duty cycle 50 %)
- Temperature ratio: ± 20 ppm / °C
- Long term derivation: ± 5 ppm / an

MAIN OUT signal

- Adjustable amplitude in open circuit: from 0 to 20 Vpp
  Precision: from 0.1 to 20 Vpp < 5 % from 1 mHz to 10 MHz
  ± 1,5 dB for F > 10 MHz (± 0.5 dB typical)
- Impedance : 50 Ω ± 3 %
- DC offset voltage: adjustable from -10 V to +10 V in open circuit (OFFSET).
  Precision : ± 5 % amplitude (residual offset < ± 5 mV)
- Protection from input voltage surge: 60 VDC, 40 VAC

Sine Signal ∼

- Distortion:
  - for F ≤ 50 kHz: typical distortion rate 0.05 %, < 0.15 % max.
  - for 50 kHz < F ≤ 1MHz, harmonics < -41 dB / H1
  - for F > 1 MHz, harmonics < -36 dB / H1
- Measuring conditions:
  - device operational for at least 1 hour

Triangle Signal ⩘

- Frequency: ≤ 2 MHz
- Linearity error: < 1 % max at 200 kHz from 10 % to 90 % of the signal amplitude
- Duty cycle: resolution 1 %
  10 to 90 % for 0.2 Hz ≤ F ≤ 1 kHz
  30 to 70 % for 1 kHz < F ≤ 10 kHz
  50 % for F < 0.2 Hz and F > 10 kHz
  frequency error for duty cycle ≠ 50 %, < 2 %

Technical Specifications *(contd.)*

Square Signal

- Increase time: 7 ns typically, < 10 ns max.
- Duty cycle: resolution 1 %
  10 to 90 % for F ≤ 200 kHz,
  20 to 80 % for 200 kHz < F ≤ 1 MHz
  50 % for > 1 MHz

Signal LOGIC

- Increase time: 7 ns typically, < 10 ns max.
- VHigh, VLow adjustable at ± 10 V with a precision of ± 0.2 V
- Duty cycle: resolution 1 %
  10 to 90 % for F ≤ 200 kHz
  20 to 80 % for 200 kHz < F ≤ 1 MHz
  50 % for F > 1 MHz

TTL OUT Signal

- Increase time: 5 ns typically, < 10 ns max.
- Max. admissible charge: > 10 charges TTL
- Protection from an input power surge: ± 60 VDC, 40 VAC

SWEEP scan function

- Frequency resolution: 0.28 Hz, 10 mHz or 1 mHz depending on the selected range (depending on entered $Freq_{START}$, $Freq_{END}$ and Time)
- Linear Mode (LIN) or logarithmic mode (LOG)

EXT external scan

- Scan using a signal with a frequency of < 15 kHz and an amplitude between ± 10 V on the BNC
  - 'VCF IN' (**GX 305/310**) (-10 V ⇔ $Freq_{START}$ and +10 V ⇔ $Freq_{END}$)
  - 'VCG IN' (**GX 320**) (-10 V ⇔ $Freq_{START}$ and +10 V ⇔ $Freq_{END}$)
- Entry Impedance: 10 kΩ ± 10 %

INT internal scan

- $Freq_{START}$ to $Freq_{END}$ scan using saw tooth or triangle mode
- Programmable scan period (Time) from 10 ms to 100 s, resolution 10 mS
- BNC 'SWEEP OUT' output of approx. 2 V continuous voltage proportional to the generated frequency
- 'SWEEP OUT' output impedance = 10 kΩ ± 10 %

Technical Specifications *(contd.)*

MODUL modulation function *(GX 320 only)*

FM Modulation

- Frequency resolution: 0.28 Hz, 10 mHz or 1 mHz depending on the selected range (depending on $Freq_{START}$, $Freq_{END}$).
- Digital modulation: the modulating signal is read at a frequency of 65 kHz. This amplitude (256 values) is then converted to a frequency.
- **INT**ernal source: frequency modulation using a sine signal with a frequency of 1 kHz ± 1 %
- **EXT**ernal: modulation using a signal with an amplitude between ± 10 V on the BNC 'VCG IN' (-10 V⇔ $Freq_{START}$ and +10 V⇔ $Freq_{END}$), with a frequency of < 15 kHz

AM Modulation

- In sine and triangle, digital modulation using a frequency modulating signal of < 5 kHz
- In square and LOGIC, digital modulation: the modulating signal is read at a frequency of 150 kHz. This amplitude (256 values) pilots the output signal amplitude.
- **INT**ernal source: modulation using a sine signal with a frequency of 1 kHz ± 1 % and an amplitude allowing to select a modulation at 20 % and 80 % of the total programmed amplitude
- **EXT**ernal source: modulation using an amplitude signal between ± 10 V on the BNC 'VCG IN', with a frequency of < 5 kHz (-10 V ⇔ 100 %, 0 V ⇔ 50 %, +10 V ⇔ 0 % of the programmed amplitude)

SHIFT KEY Function (SHIFT K) *(GX 320 only)*

Internal FSK

- Frequency resolution: 0.28 Hz, 10 mHz or 1 mHz depending on the selected range (depending on $Freq_{START}$, $Freq_{END}$)
- Frequency commutation using a TTL signal (0 - 5 V) 1 kHz ± 1 % (0V ⇔ $Freq_{START}$ and + 5 V ⇔ $Freq_{END}$), viewable on SWEEP OUT

External FSK

- Frequency resolution: 0.28 Hz, 10 mHz or 1 mHz depending on the selected range (depending on $Freq_{START}$, $Freq_{END}$).
- Frequency commutation using a TTL signal (0 - 5 V) with a frequency of < 1 MHz, on the BNC 'VCG IN' (0 V ⇔ $Freq_{START}$ and + 5 V ⇔ $Freq_{END}$)

Internal PSK

- Phase resolution: approx. 0.08°, adjustable from ± 180° by 1° steps
- Phase switch using a TTL signal (0 - 5 V) 1 kHz ± 1 % (0 V ⇔ add $Phase_{START}$ and + 5 V ⇔ add $Phase_{END}$), viewable on SWEEP OUT

External PSK

- Phase resolution: approx 0.08°, adjustable from ± 1 80° by 1° steps
- Phase switch using a TTL signal (0 - 5 V) with a frequency of < 1 MHz, on the BNC 'VCG IN' (0 V ⇔ + $Phase_{START}$ and + 5 V ⇔ + $Phase_{END}$)

Technical Specifications *(contd.)*

SYNC synchronisation function

(GX 320 only)

- Max. generated signal frequency: 100 kHz
- Phase adjustment ± 180 °by steps of 1°
- Synchronisation precision dependent on generated signal frequency, $\Delta\phi = \pm\ F_{signal} \times 3.6 \times 10^{-5}$ (for a cable length of < 1 m)

BURST pulse generation function

(GX 320 only)

- Entry of the number of signal periods (impulses) from 1 to 65535
- The minimum window for the signal is: 2 µs (see details in BURST para.)
- Over 10 MHz the number of periods can vary by 1 and the phase on SQUARE and TTL_OUT can change by 180°
- Trigger Jitter: ≤ 15 ns

Internal BURST

- Entry of the burst period from 10 ms to 100 s with a 10 ms resolution

External BURST

- Triggering of the burst using an external TTL signal with a frequency of less than 1 MHz on the BNC '**INPUT BURST**' or triggered manually (MODE key)
- Trigger delay of approx. 1.5 µs

GATE Function

(GX 320 only)

- Authorisation to output the alternating component of the MAIN OUT signal using a TTL signal with a frequency of ≤ 2 MHz on BNC 'INPUT GATE'
  (+ 5 V ⇔ Main out generated and 0 V ⇔ alternating component cut)
- Delay of approx 100 ns

FREQ external frequency meter function

- Input on the front face BNC terminal (**FREQ EXT**)
- External frequency measurement from 5 Hz to 100 MHz
- Max. amplitude max. (*) of measured signals:
  300 V from 5 Hz to 5 kHz
  30 V from 5 kHz to 1 MHz
  10 V beyond these values

(*) signal with a duty cycle at 50 %

- Precision of the measured frequency: ± 0.05 % + 1 digit
- Frequency display measured on 5 digits

Sensitivity

- < 50 mVrms for F ≤ 30 MHz
- < 60 mVrms for 30 MHz < F ≤ 80 MHz
- < 90 mVrms for 80 MHz < F ≤ 100 MHz

Measurement stabilisation time

- ≤ 1 s from 5 Hz to 20 Hz (≥ 1 measurement per second)
- ≤ 100 ms from 20 Hz to 400 Hz (2 measurements per second)
- ≤ 40 ms from 400 Hz to 100 MHz (2 measurements per second)

Input Impedance

- 1 MΩ // 22 pF approx.

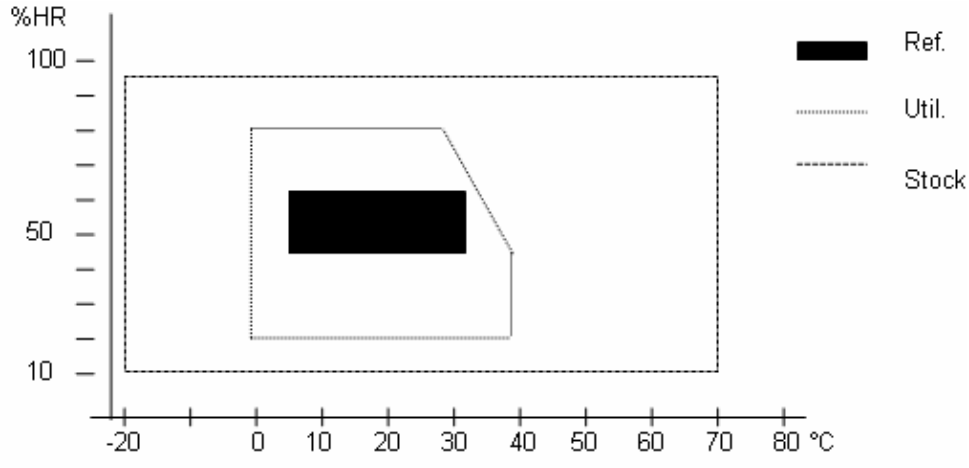
Protection

- Max voltage. : 300 V (50 - 60 Hz) CAT I

General Specifications

Environment

• Reference temperature	23°C ± 5°C	45 to 65 % RH
• Nominal usage range	5°C to 35°C	45 to 65 % RH
• Operating temperature	0°C to 40°C	20 to 80 % RH
• Storage temperature	-20°C to + 70°C	10 to 95 % RH
• Use	indoor	
• Altitude	< 2000 m	
• Relative Humidity	< 80 % up to 31°C	



Power supply

Mains

- Voltage 120 V
- Frequency 50 - 60 Hz
- Consumption 20 VA max.
- Removable power supply cable

CE

Safety

CEM

This device has been designed in compliance with the current CEM standards and its compatibility has been tested in compliance with the following standards:

Emission and Immunity: EN 61326-1 (2006)

Mechanical Specifications

Mechanical specifications

Box Size (support folded):

- length 190 mm
- width 227 mm
- height 130 mm

Weight 2.850 kg

Packaging 330 x 260 x 200 mm

Supply

Delivered with the instrument

- Safety instructions
- Power supply cable
- USB A/B cable for programmable versions
- CD-ROM containing:
  - Operating instructions in 5 languages
  - Programming instructions in 2 languages
  - USB 'CP210x USB to UART Bridge Controller' USB Drivers
  - LabView and LabWindows Drivers
  - USBxPress application (USB port identification)
  - GX320E-Admin application (IP address application)

Accessories

- USB A/B cable .....Cat. #2140.51