

RIGOL DG4162 FUNCTION GENERATOR

STUDENT INNOVATION CENTER
ROOM 2222

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VERSION 1.0

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OVERVIEW

The purpose of this document is to provide standard operating procedures for the use of the Rigol DG4162 Function Generator in room 2222 of the Student Innovation Center

Prior to engaging in hands-on training and operation, these required training modules MUST be completed:

- Shop Safety Fundamentals
- Fire Safety and Fire Extinguisher Training
- Hazard Communication Training (aka Worker Right to Know)
- Portable Power Tool Safety

HEALTH & SAFETY INFO

Chemical Vapors: Heating of solder can generate toxic vapors and vapors with high volatile organic compounds (VOCs).

Hot Surfaces: Circuits and soldering equipment generate heat. Such surfaces must be guarded and labeling must warn users of the hazards.

Mechanical Hazards: Moving parts must be guarded to prevent accidental contact. Guards must never be bypassed.

Electrical: Contact with energized parts can lead to injury or even death. Before each use, inspect for any damaged wiring and safeguards. Do not use if problems are found. Ensure the oscilloscope is properly grounded and plugged directly into an outlet.

HAZARD CONTROL MEASURES AND REQUIRED PPE

REQUIRED PPE:

- Safety glasses
- Closed toed shoes

Hazard Control Measures:

- Always use the grounding strap when operating equipment
- No food/drink
- Electric shock can be dangerous and possibly deadly! If you are unfamiliar with the electricity requirements of your project, ask a shop staff for assistance

FIRST AID PROCEDURES

BURNS: Minor burns are typically small, red, have swelling, and can blister. Cool burns with cold water and continue until the pain lessens. After cooling, cover with a dry, sterile bandage or clean dressing. Consult a physician as needed.

CUTS/SCRAPES: Minor cuts and scrapes usually stop bleeding on their own. If needed, apply gentle pressure with a clean bandage or cloth and elevate the wound until bleeding stops. Clean the wound and apply bandages. Consult a physician as needed.

PINCH/CRUSH: Consult a physician as needed.

INHALATION: Ensure there is proper ventilation prior to use. If needed, stop the procedure and move to a well ventilated area. Consult a physician as needed.

EYES: Immediately irrigate the eyes at an eyewash station for at least 15 minutes. Hold the eyelids away from the eyeball, moving eye in all directions to wash thoroughly behind the eyelids. Consult a physician as needed.

All accidents and injuries occurring at work or in the course of employment must be reported to the employee's supervisor as soon as possible (even if no medical attention is required).

<http://www.ehs.iastate.edu/occupational/accidents-injuries>

WASTE DISPOSAL

If you have left over parts/materials that are still useable, you may donate them to the shop for other users.

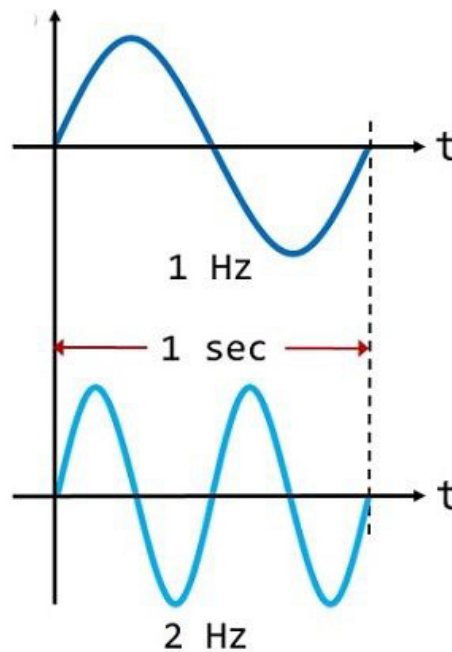
Dispose of any un-useable left over wires, components, solder drips, etc. into the waste bin.

SPILL/CLEAN UP PROCEDURES

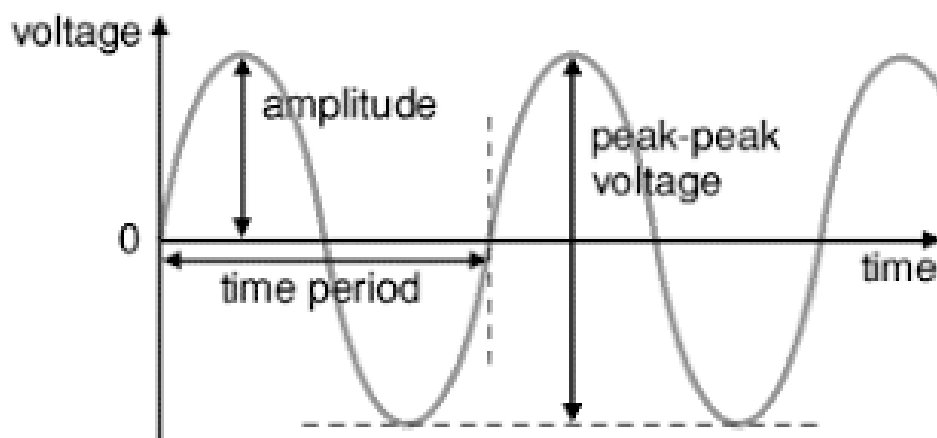
If using solder, do not touch solder drips for 30 seconds to allow solder to cool. After 30 seconds, wipe off surface(s) and dispose of in the waste bins.

KEY TERMS

Frequency: This is the number of times the waveform repeats itself within a one second time period. It is the reciprocal of the period ($f = 1/T$). The unit of measurement for frequency is Hertz (Hz).

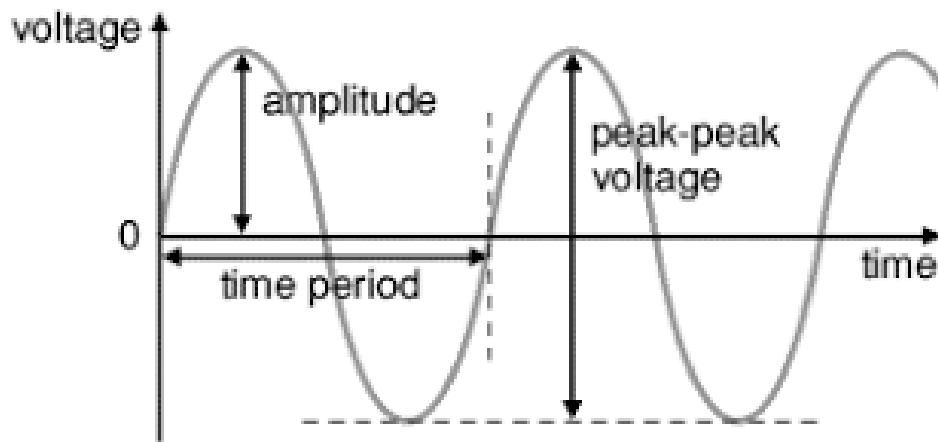


Period: This is the length of time in seconds that the waveform takes to repeat itself from start to finish. It is the reciprocal of frequency ($T = 1/f$)

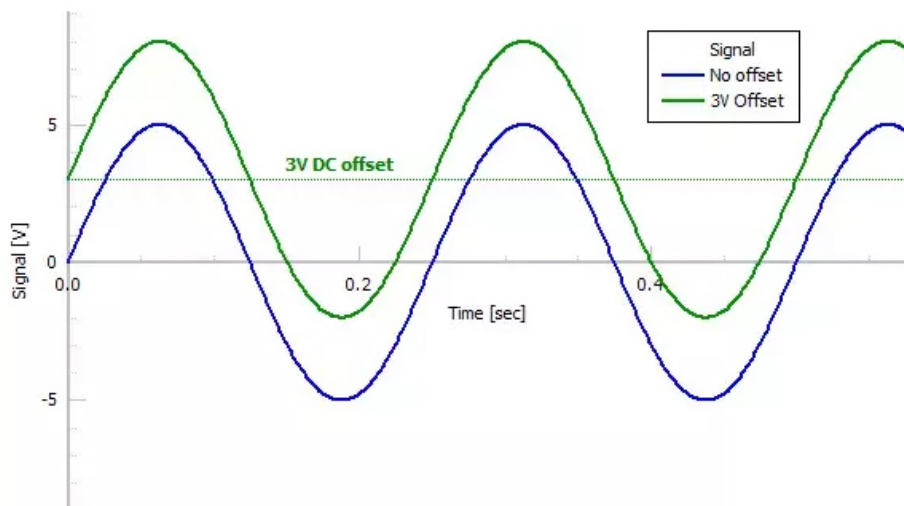


KEY TERMS CONTINUED

Amplitude: This is the magnitude or intensity of the signal waveform measured in volts or amps. This is often measured in peak-to-peak voltage (V_{pp}), meaning, if the amplitude is $10V_{pp}$, it has $+5V$ and $-5V$.

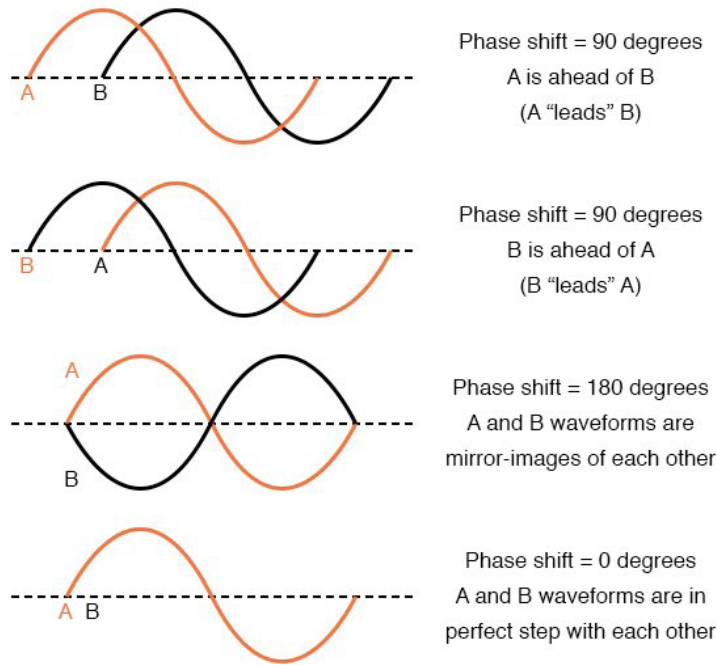


DC Offset Voltage: DC offset is how many volts above or below ground the signal is. Consider the following sine wave; it is a $2V$ pk-to-pk of $2V$ AC ($1V$ pk). An offset of $2V$ has been applied so now the it has a $3V$ maximum peak and a $1V$ minimum peak.

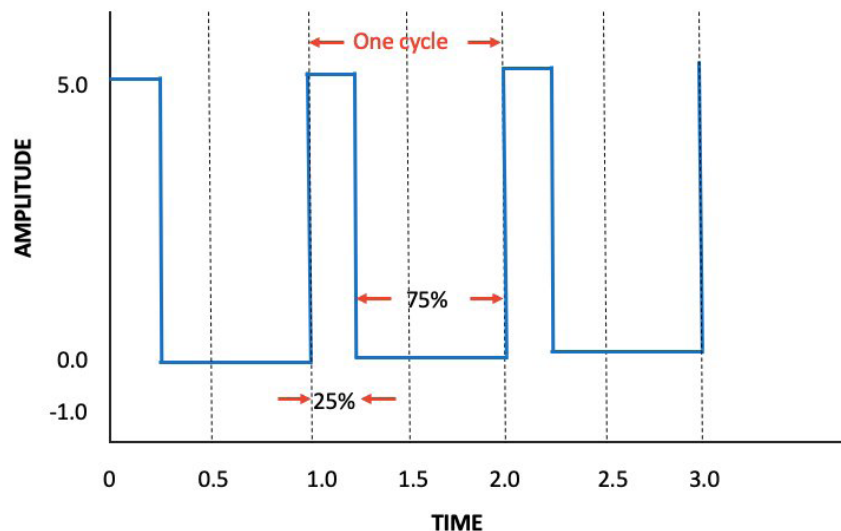


KEY TERMS CONTINUED

Start Phase: a phase shift is the delay present between two waveforms. Start Phase allows you to deliberately offset the starting phase of a waveform

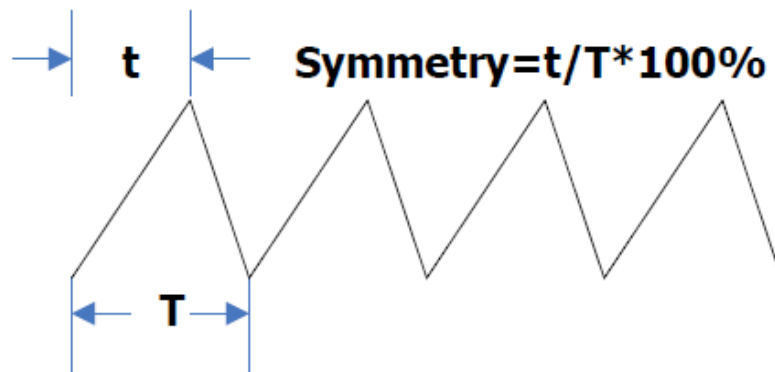


Duty Cycle: Duty Cycle is defined as the percentage that the high level takes up in the whole period as shown in the figure below.

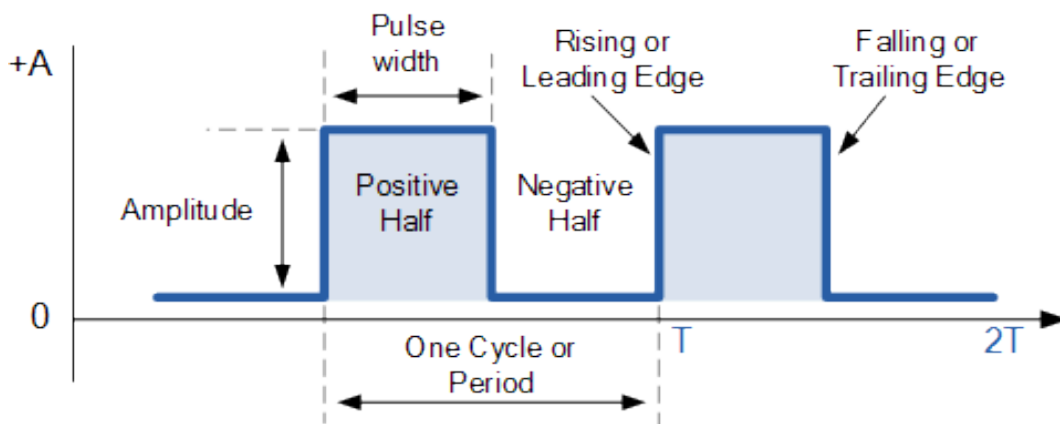


KEY TERMS CONTINUED

Symmetry: Symmetry is defined as the percentage that the rising period takes up in the whole period as shown in the figure below. This parameter is only available when ramp is selected.

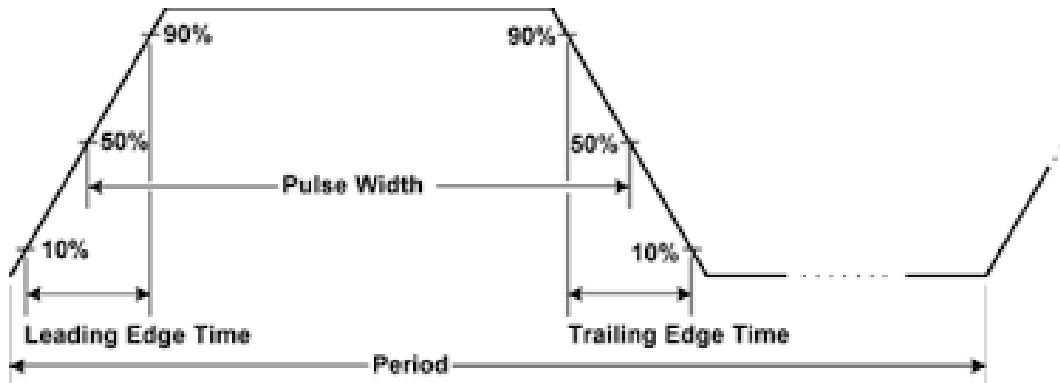


Pulse Width: Pulse width is defined as the time from the 50% threshold of a rising edge amplitude to the 50% threshold of the next falling edge amplitude as shown in the figure above.



KEY TERMS CONTINUED

Leading/Trailing Edge Time: The leading (rising) edge time is defined as the time required for the pulse amplitude to rise from 10% threshold to 90% threshold; while the trailing (falling) edge time is defined as the time required for the pulse amplitude to fall from 90% threshold to 10% threshold as shown in the figure above.



OPERATIONS GUIDE

PLEASE NOTE:

While there are many types of waveforms that can be generated using the Rigol DG4162, this guide will cover only basic Sine wave generation and harmonic waveform generation due to scope and space limitations. Other waveforms such as square waves and ramp waves will have more (or less) parameters that may need adjusting (i.e. duty cycle, leading/trailing, symmetry, etc.). However, the process used to generate other waveforms with the Rigol DG4162 is very similar to the steps outlined in this guide.

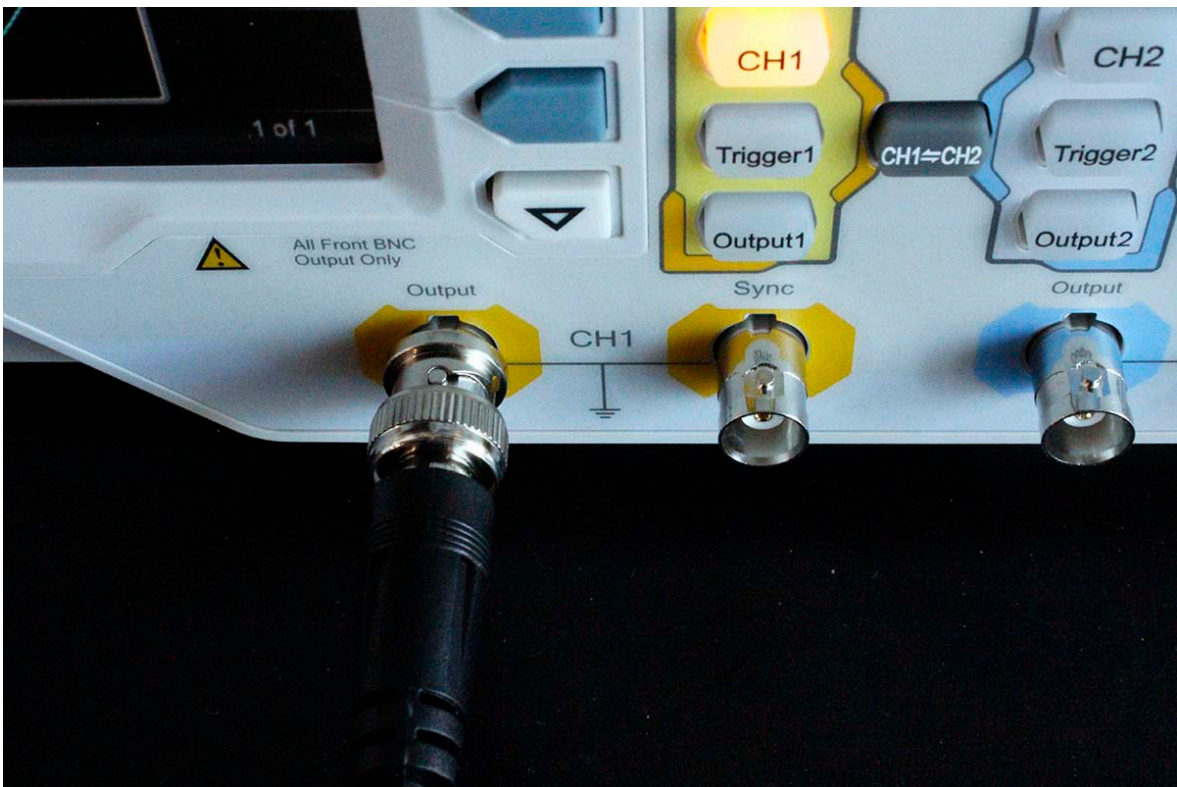
If you need assistance, ask one of the shop staff to help!

GENERATING A SINE WAVE FUNCTION

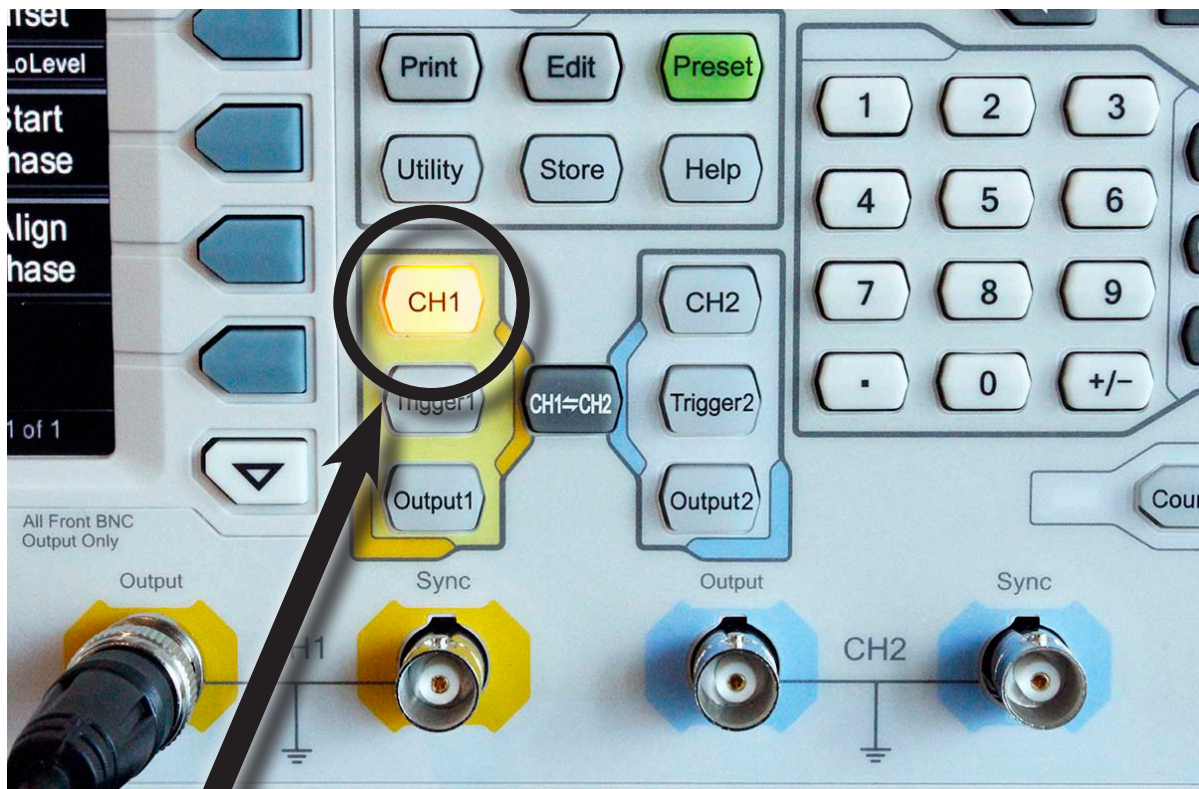
1. Turn on the power



2. Attach your BNC lead to the terminal



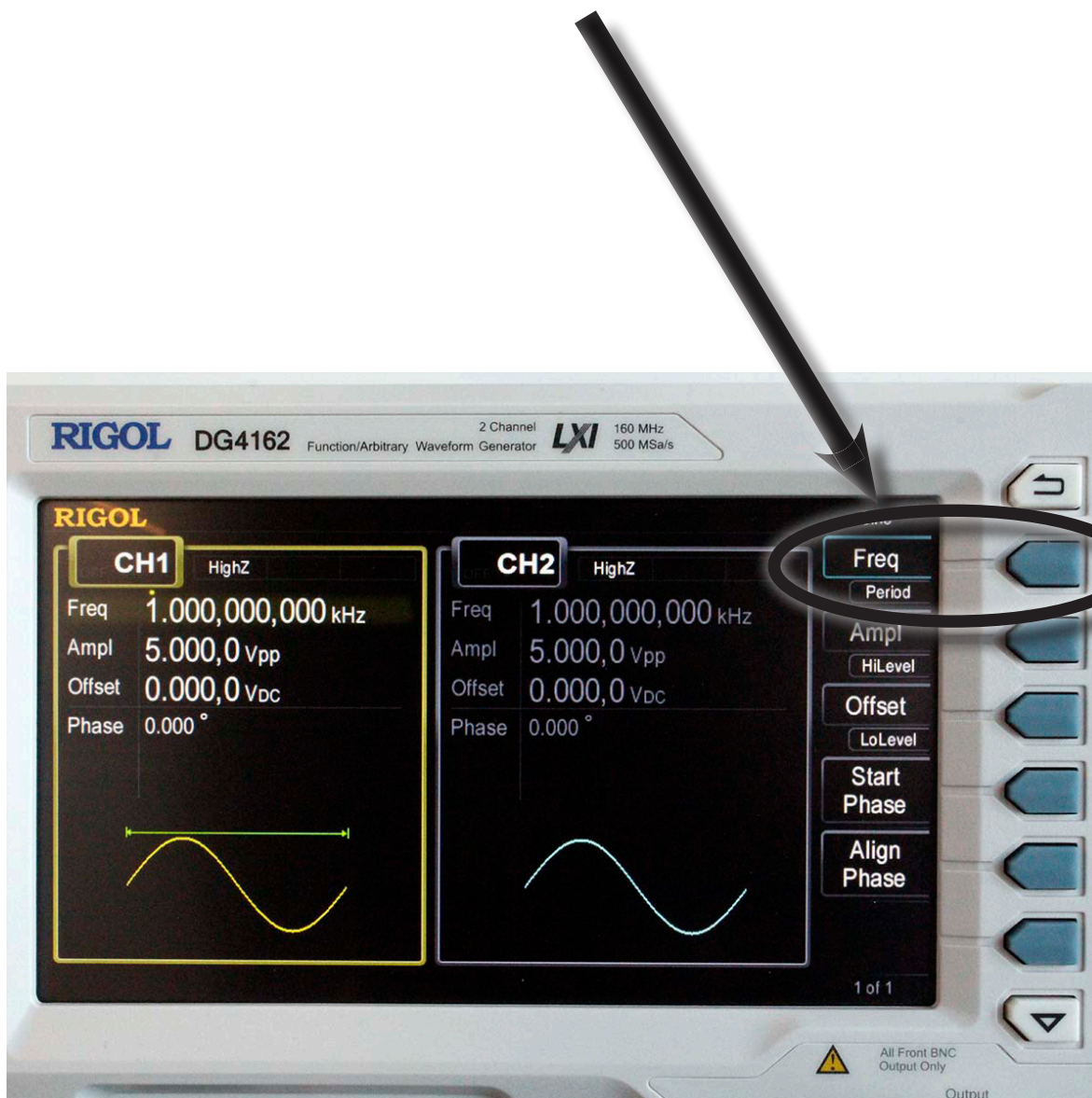
3. Select Channel 1



4. Select the Sine wave function by pressing the “Sine” button



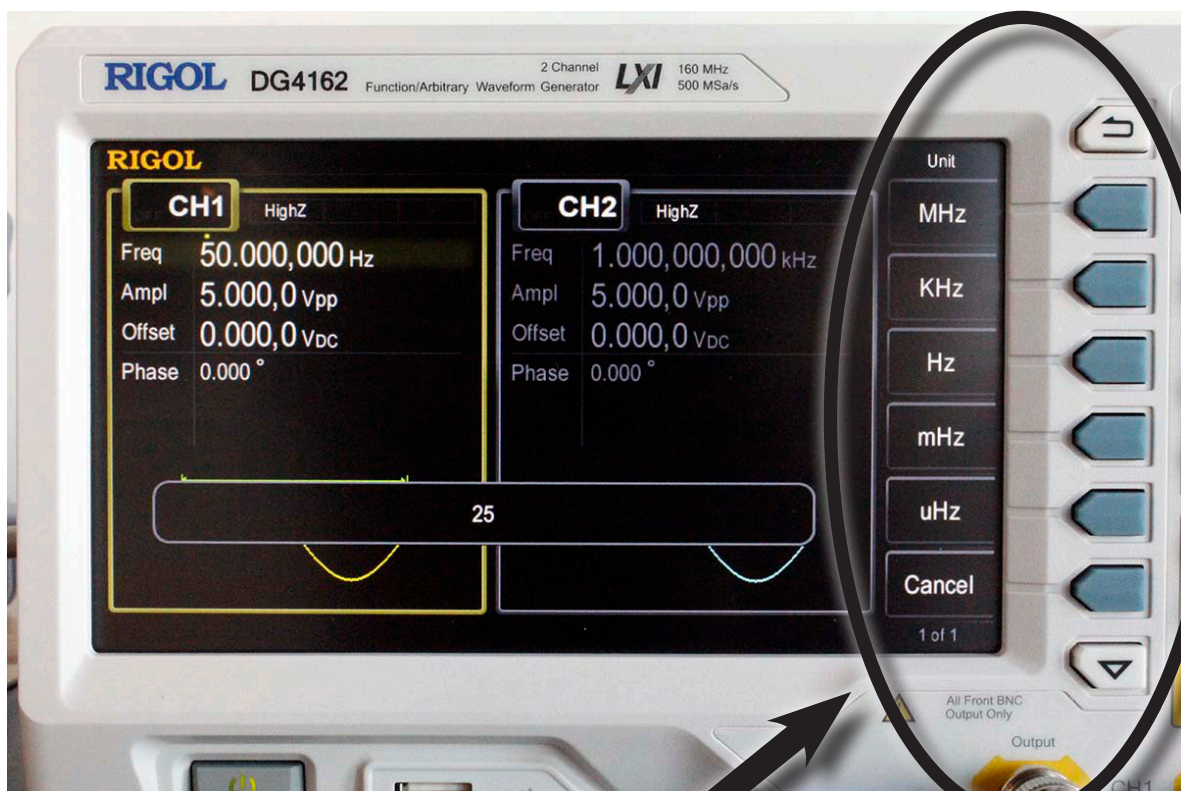
5. Ensure Frequency is selected. (It will be highlighted on the screen. If it is not, press the “Freq/Period” soft key)



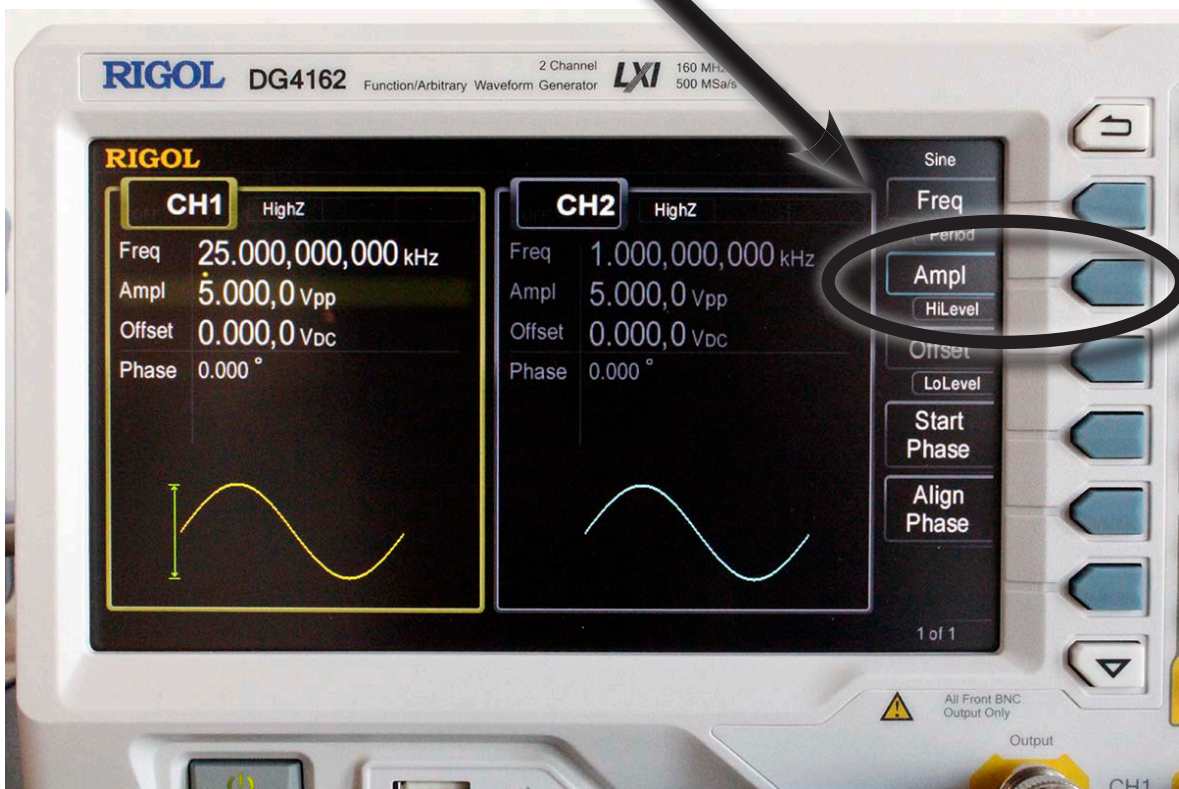
6. Use the numeric keypad to enter the frequency value you wish to use. (Alternatively, you can use the dial to change values as well)



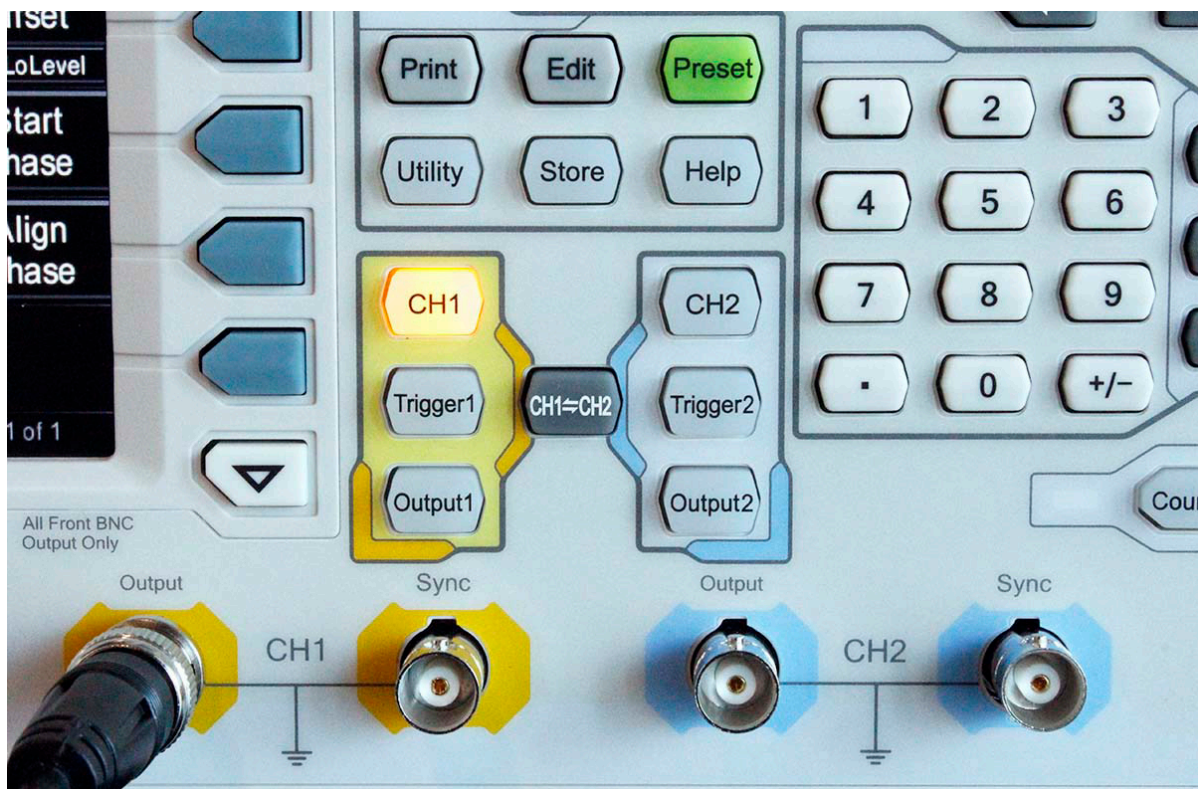
7. Select the frequency units (MHz, kHz, etc.) by pressing the corresponding soft key



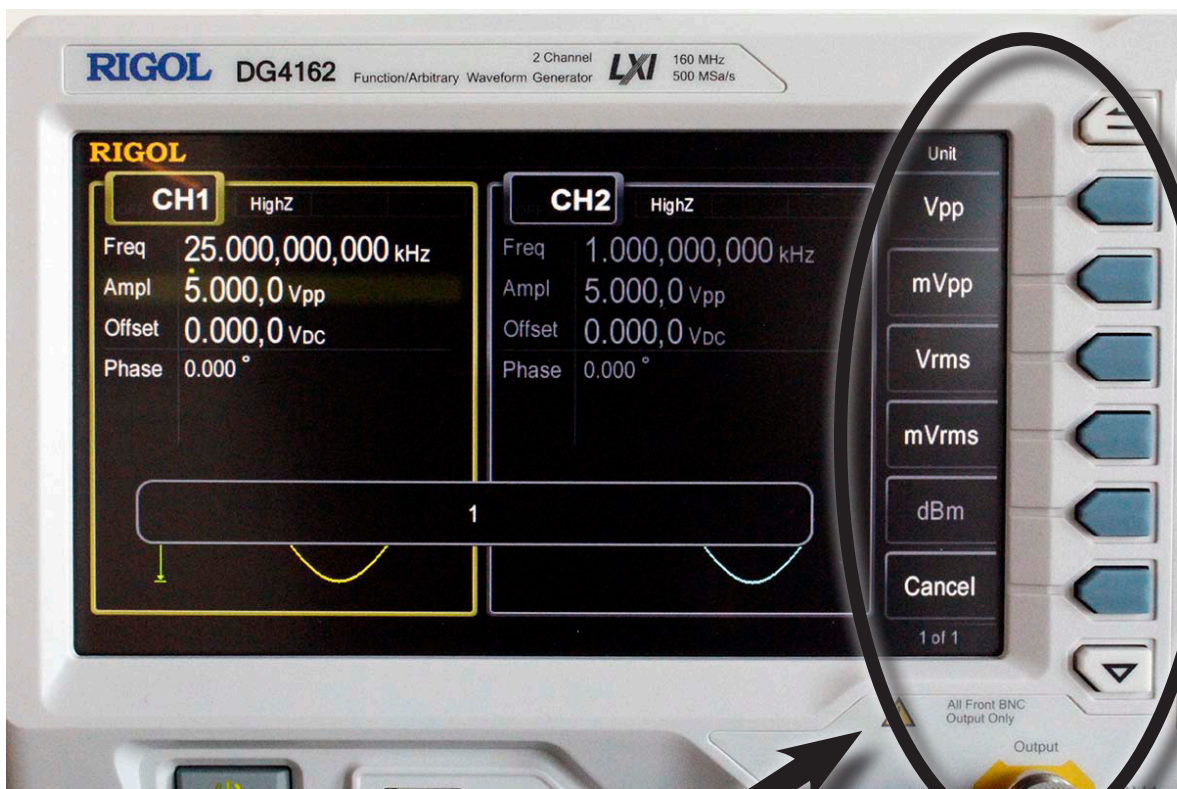
8. Press the "Ampl" softkey to adjust the amplitude of your waveform



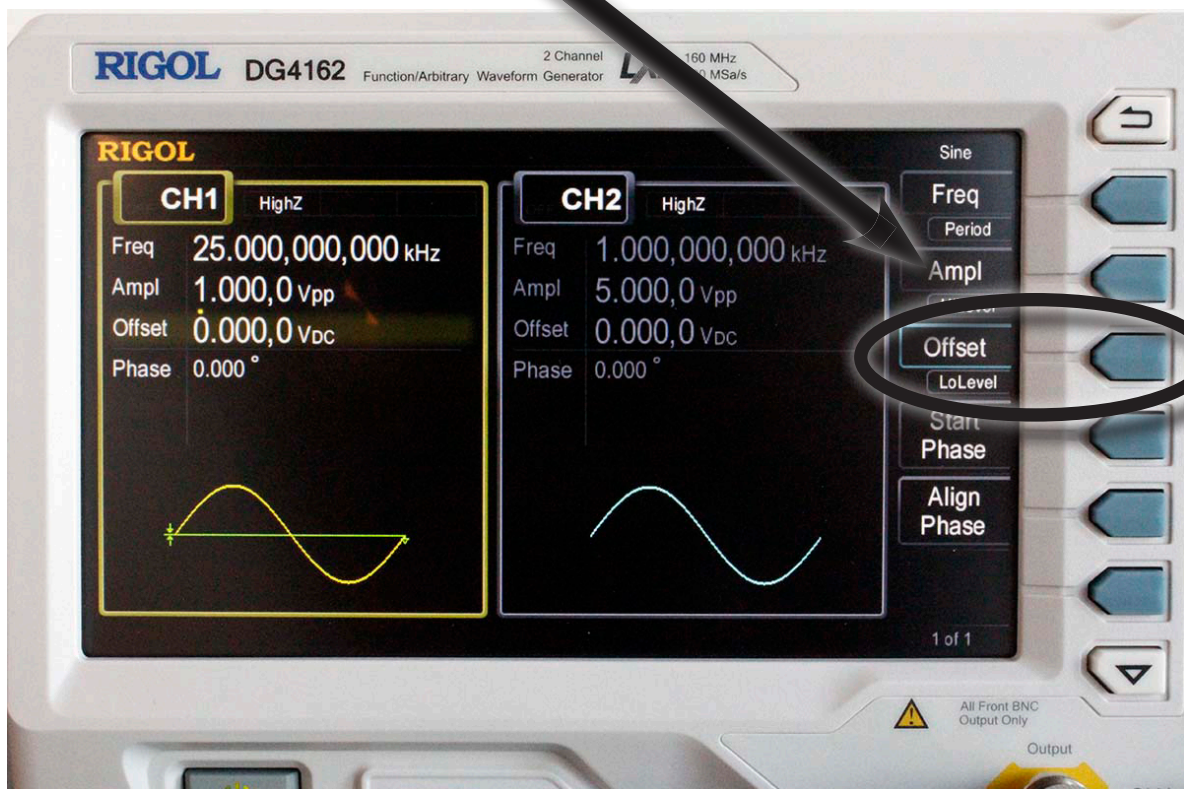
9. Use the numerical keypad to select your amplitude value



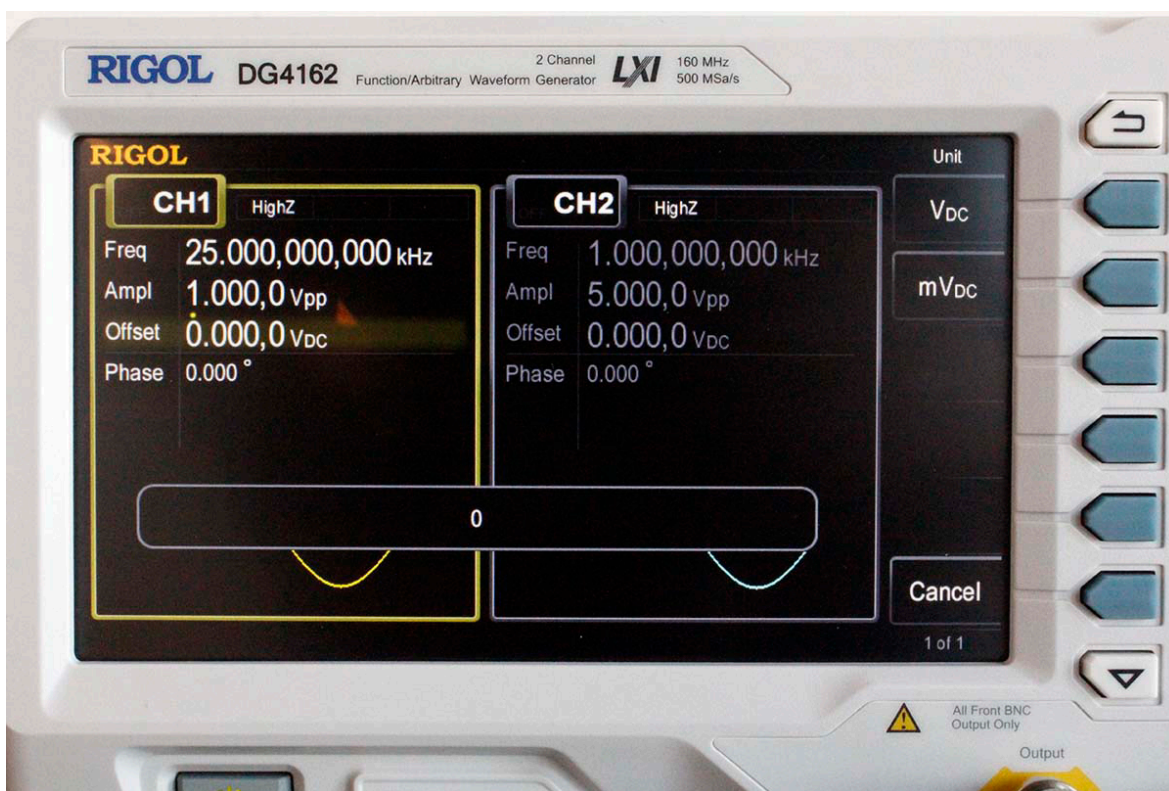
10. Select the type of amplitude by pressing one of the soft keys (i.e. Vpp, mVpp, Vrms, etc.)



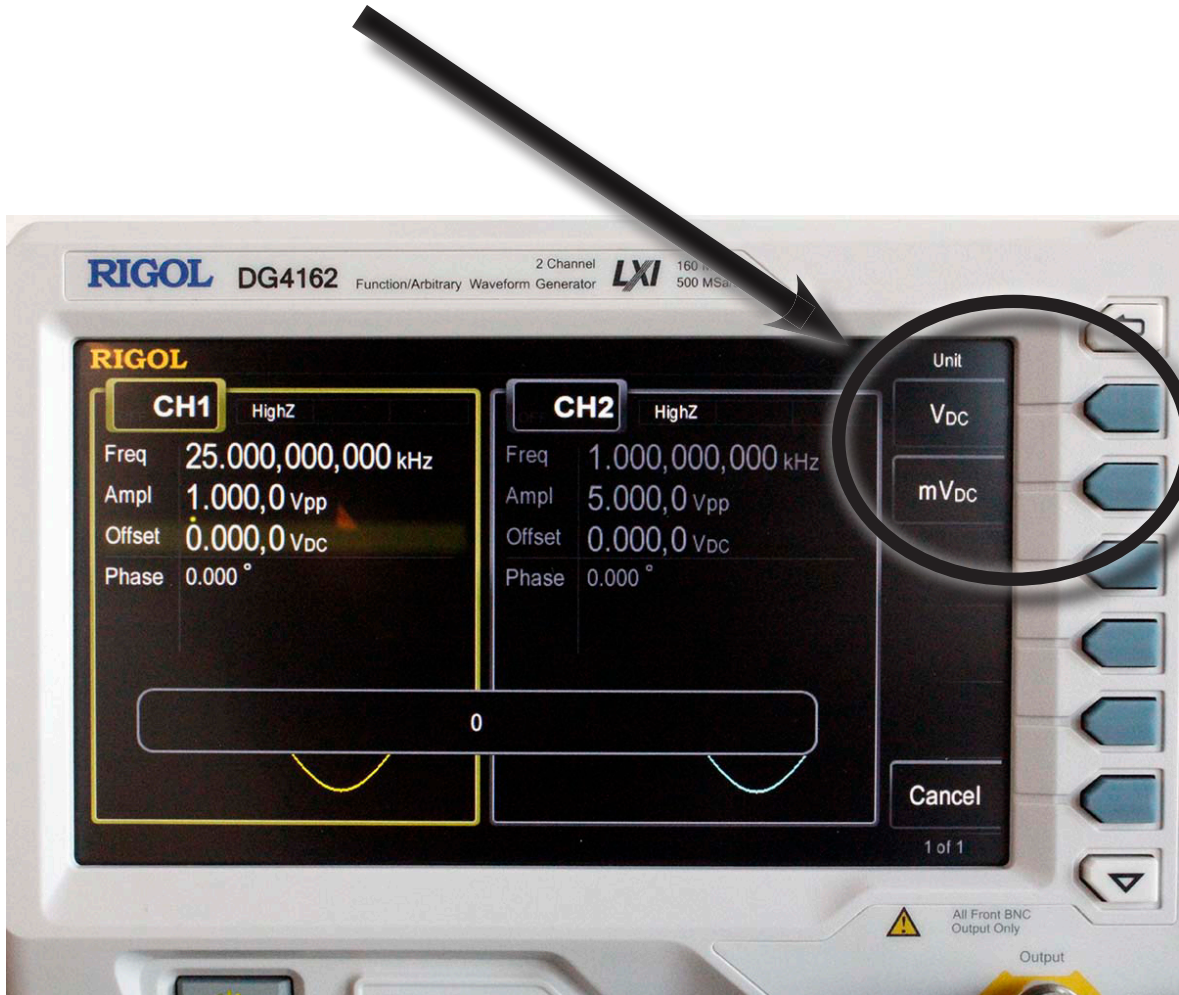
11. Press the "Offset" softkey to set a voltage offset



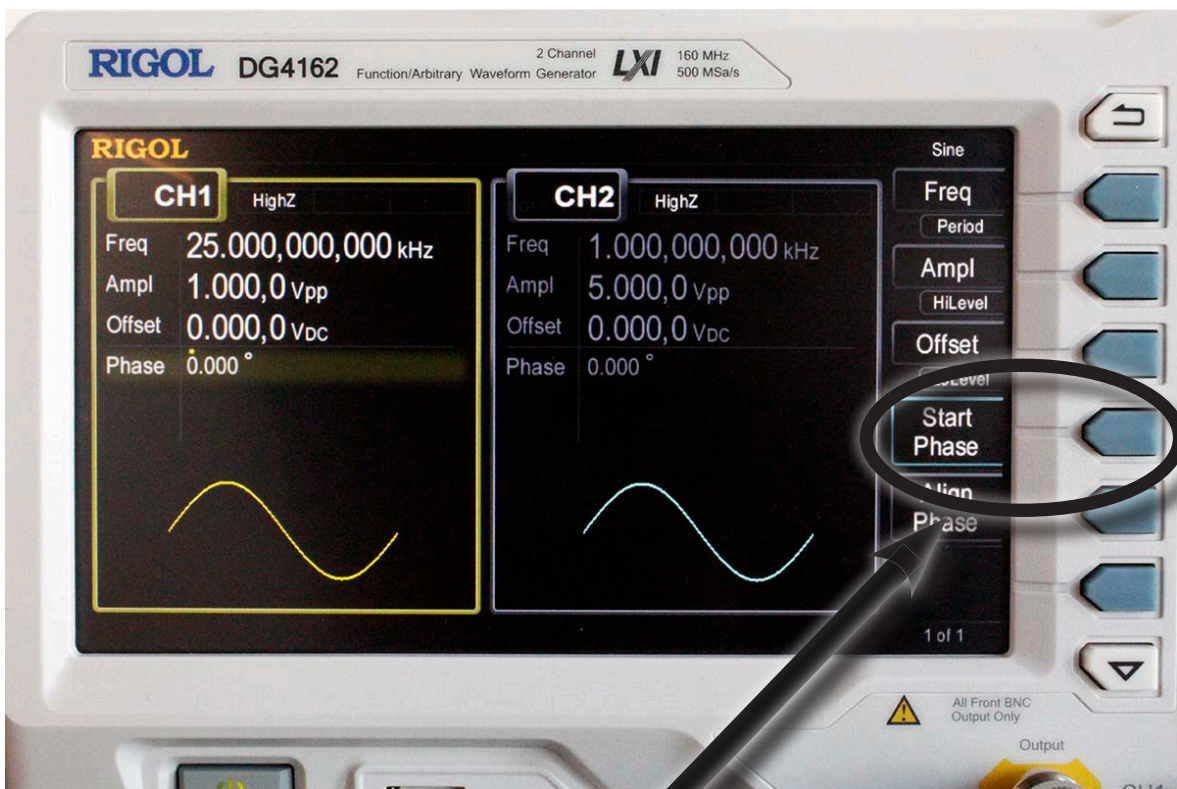
12. If a voltage offset is needed, use the numerical keypad to adjust the voltage offset. (Use 0 if no offset is needed)



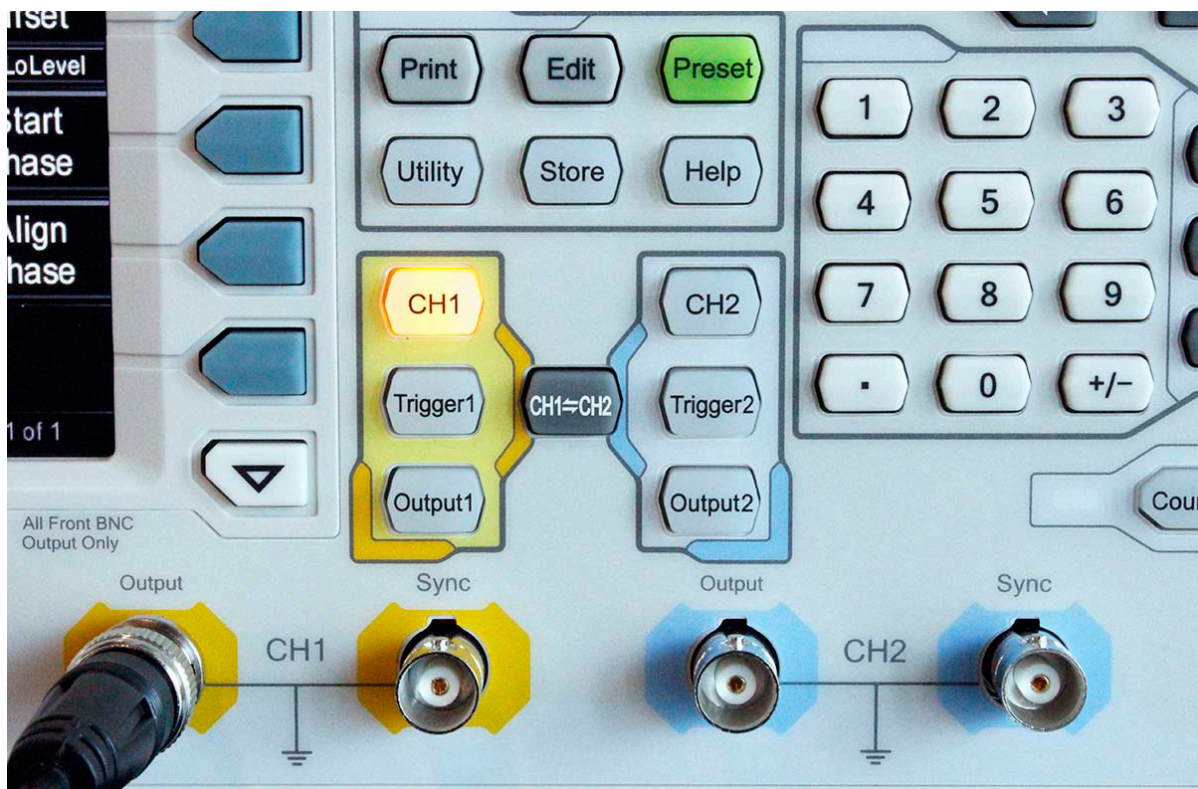
13. Select the type of voltage offset needed (Vdc or mVdc)



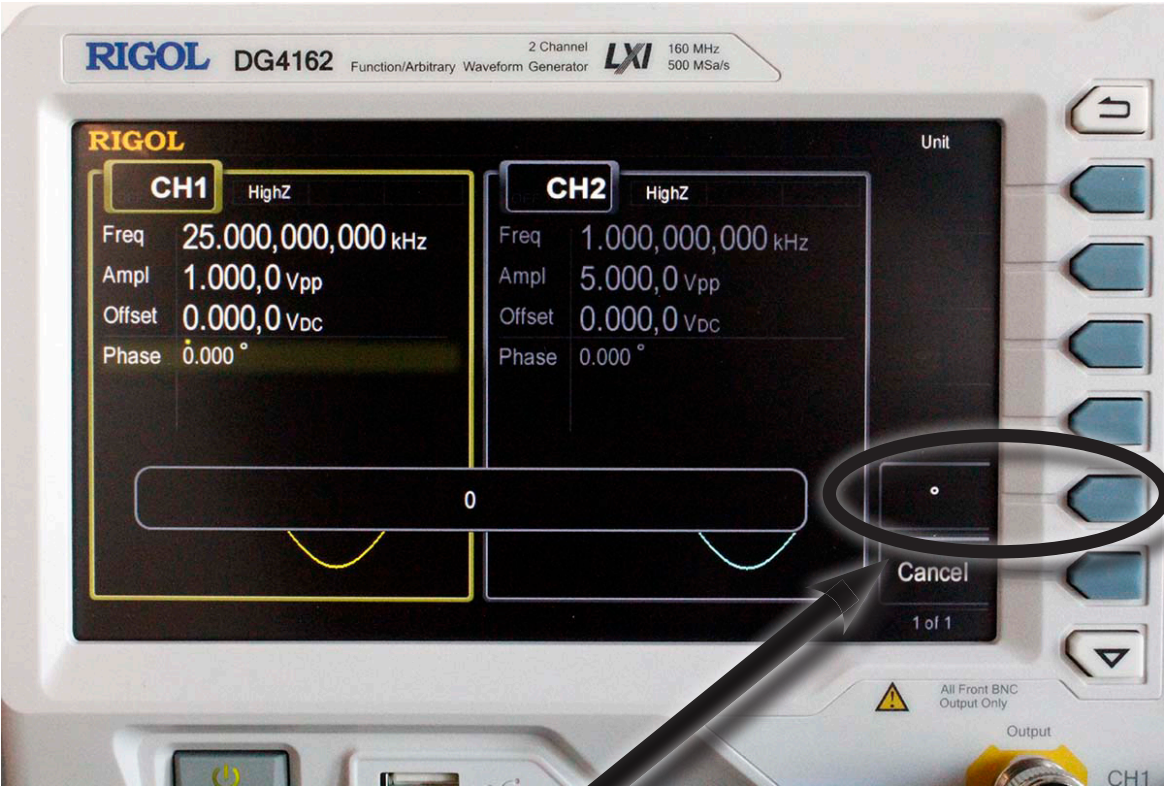
14. Press the “Start Phase” soft key to adjust the phase shift if needed



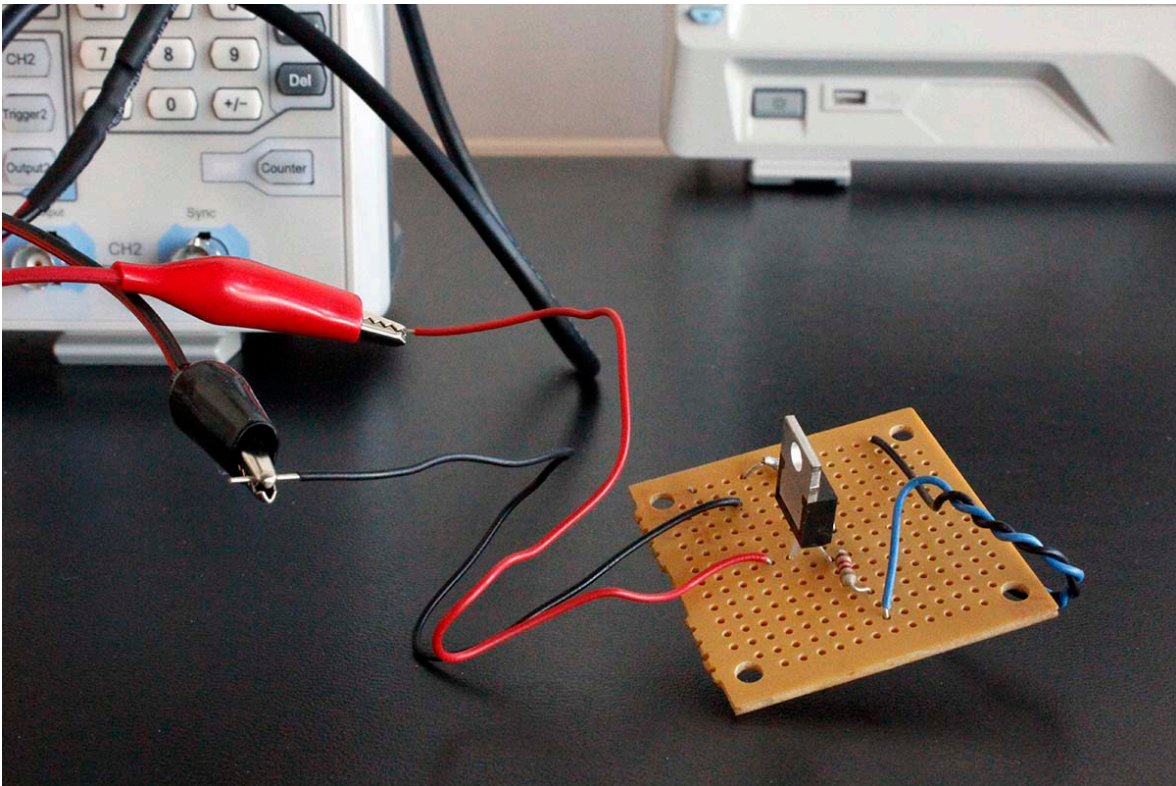
15. Use the numeric keypad to adjust the degrees of phase shift. (Use 0 if not needed).



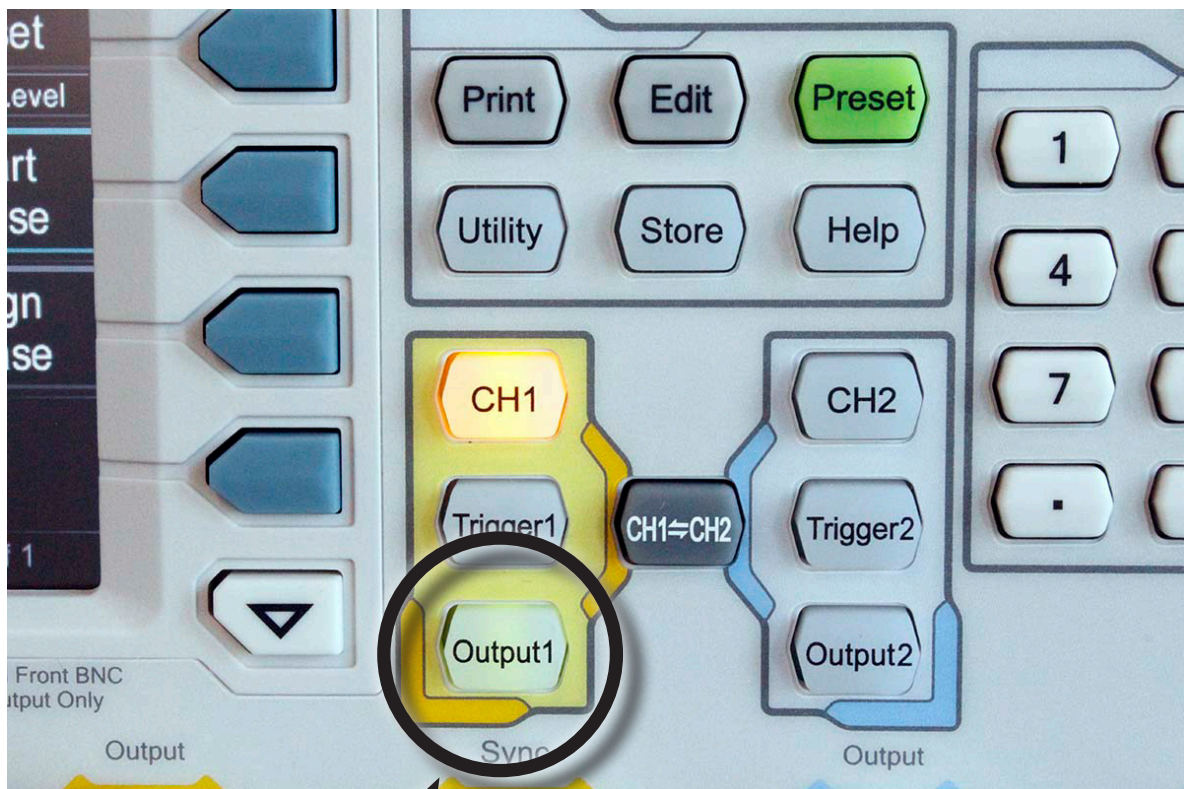
16. Press the “°” softkey



17. Attach your lead to your load/circuit/oscilloscope

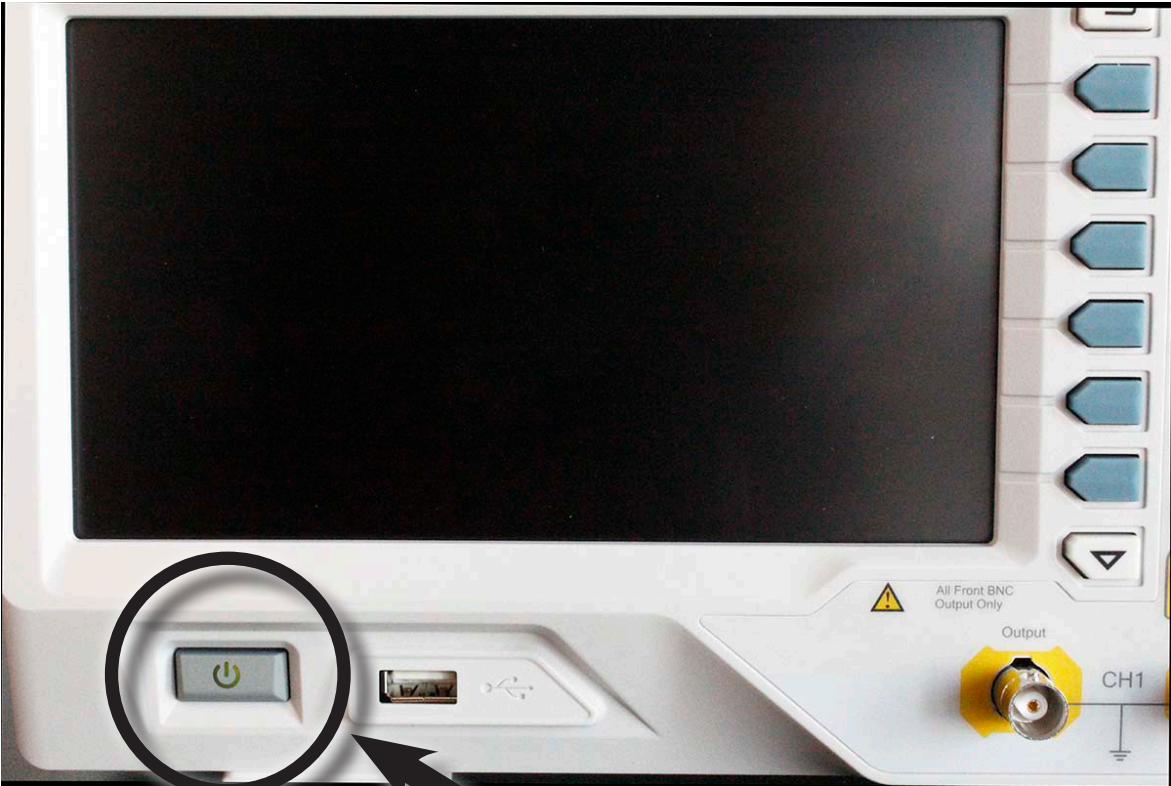


18. When you are finished adjusting your waveform parameters, press the “Output” button

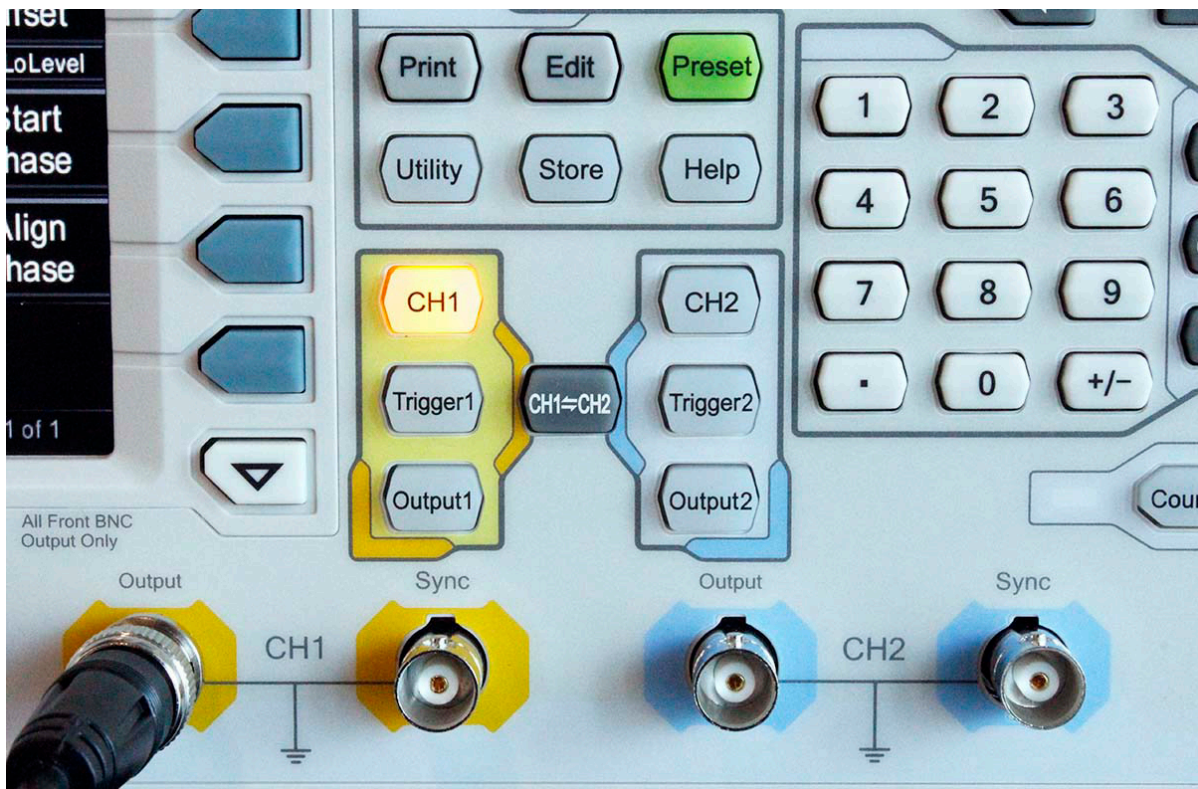


GENERATING HARMONICS

1. Turn on the power



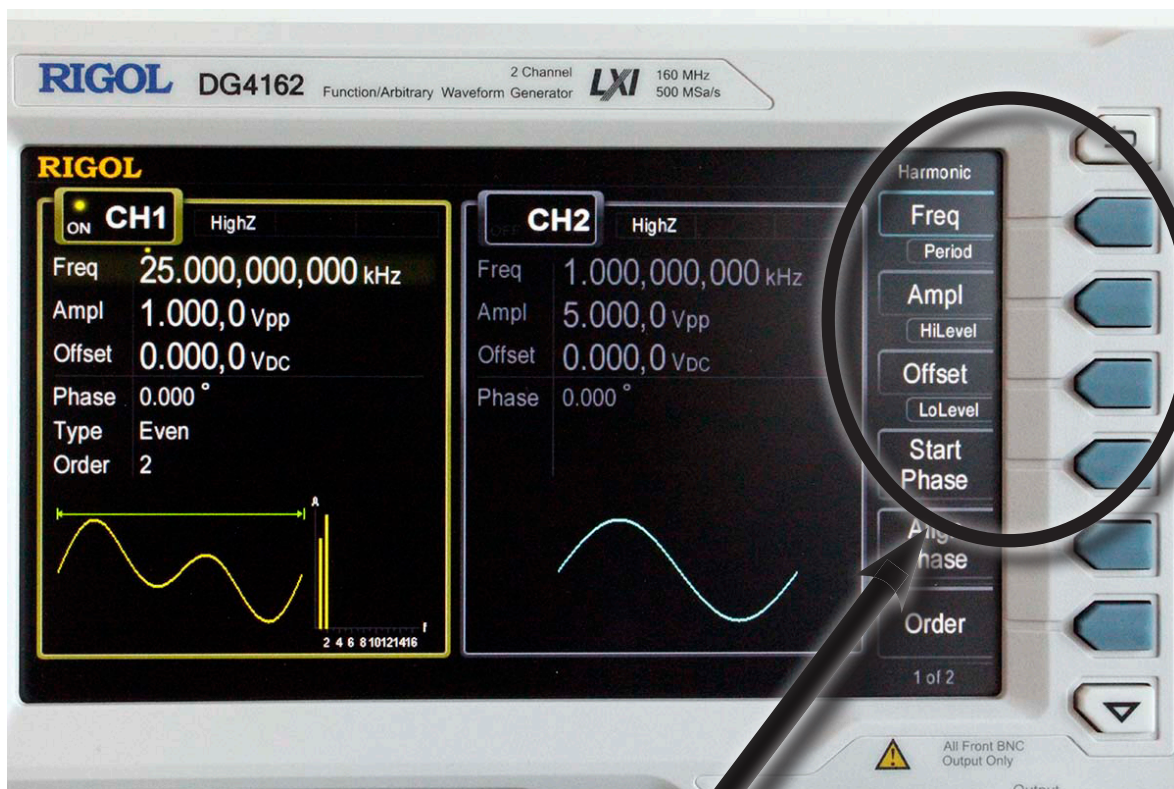
2. Select Channel 1



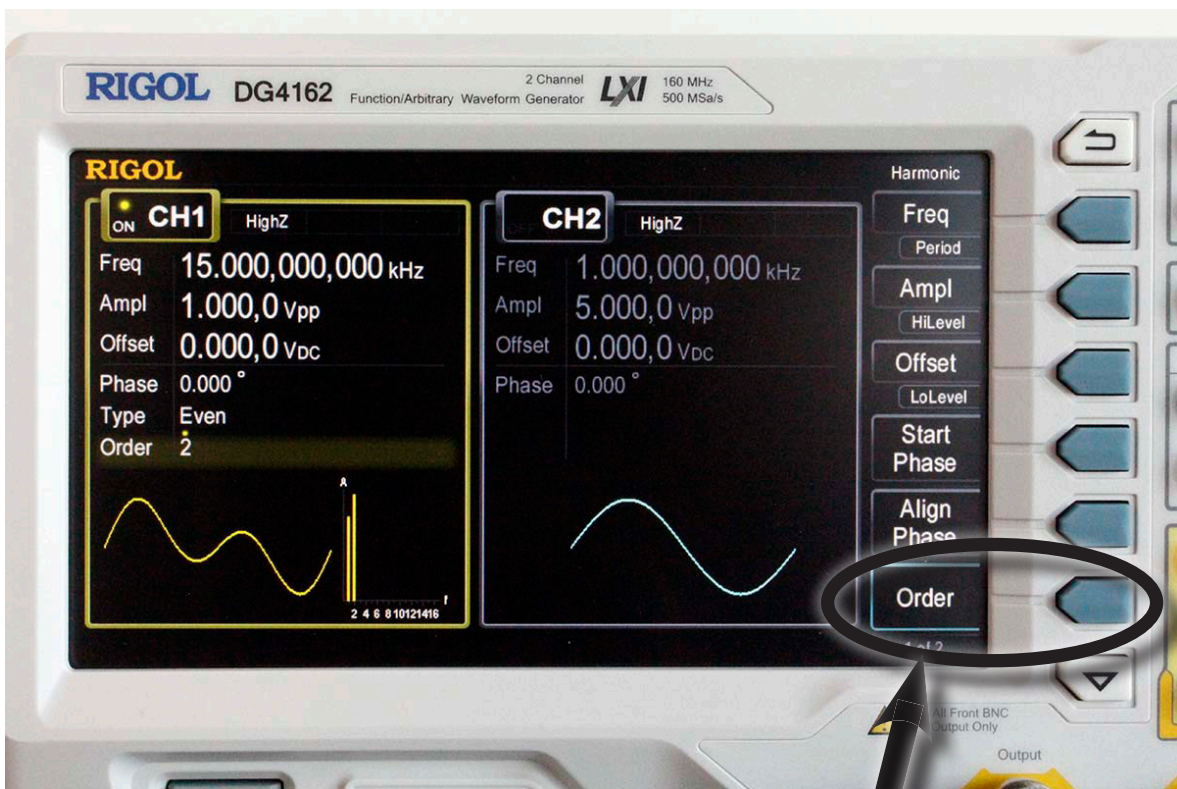
3. Press the "Harmonic" button on the front panel



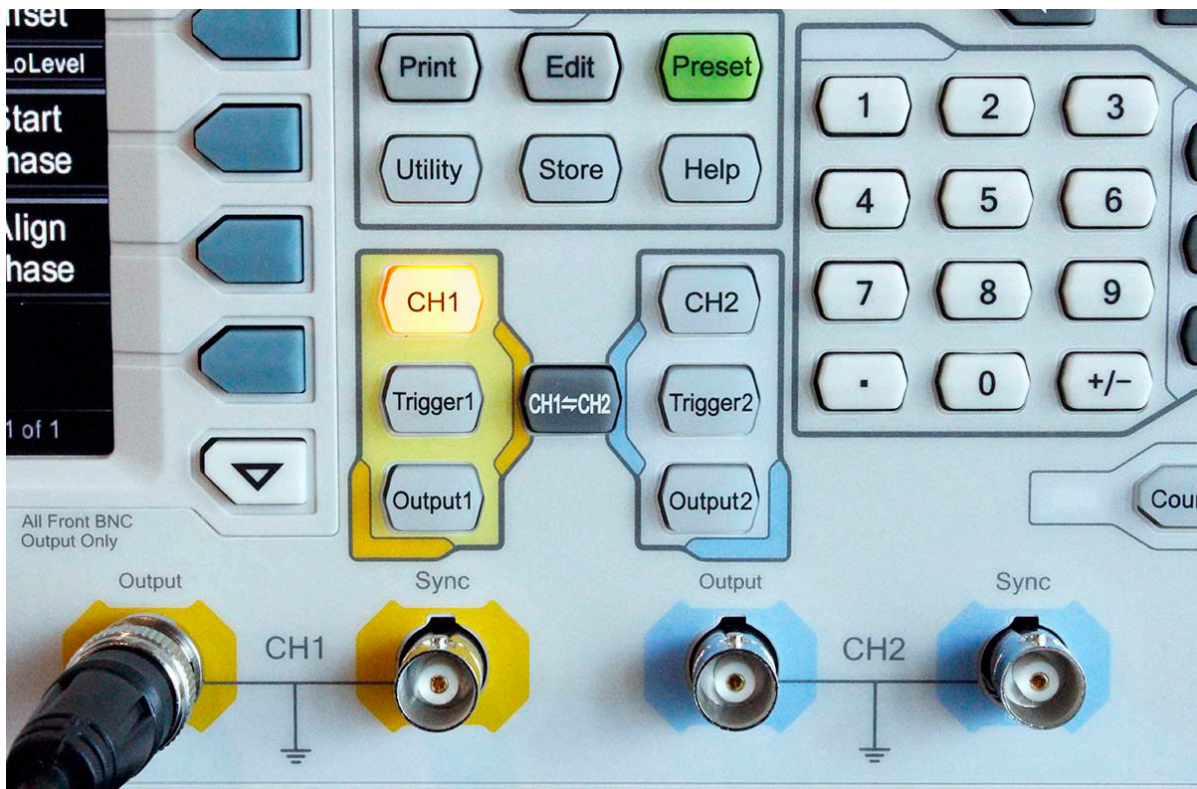
4. Set your Fundamental waveform parameters (frequency, amplitude, DC offset, etc.) NOTE: SEE “GENERATING A SINE WAVE” FOR MORE INFORMATION



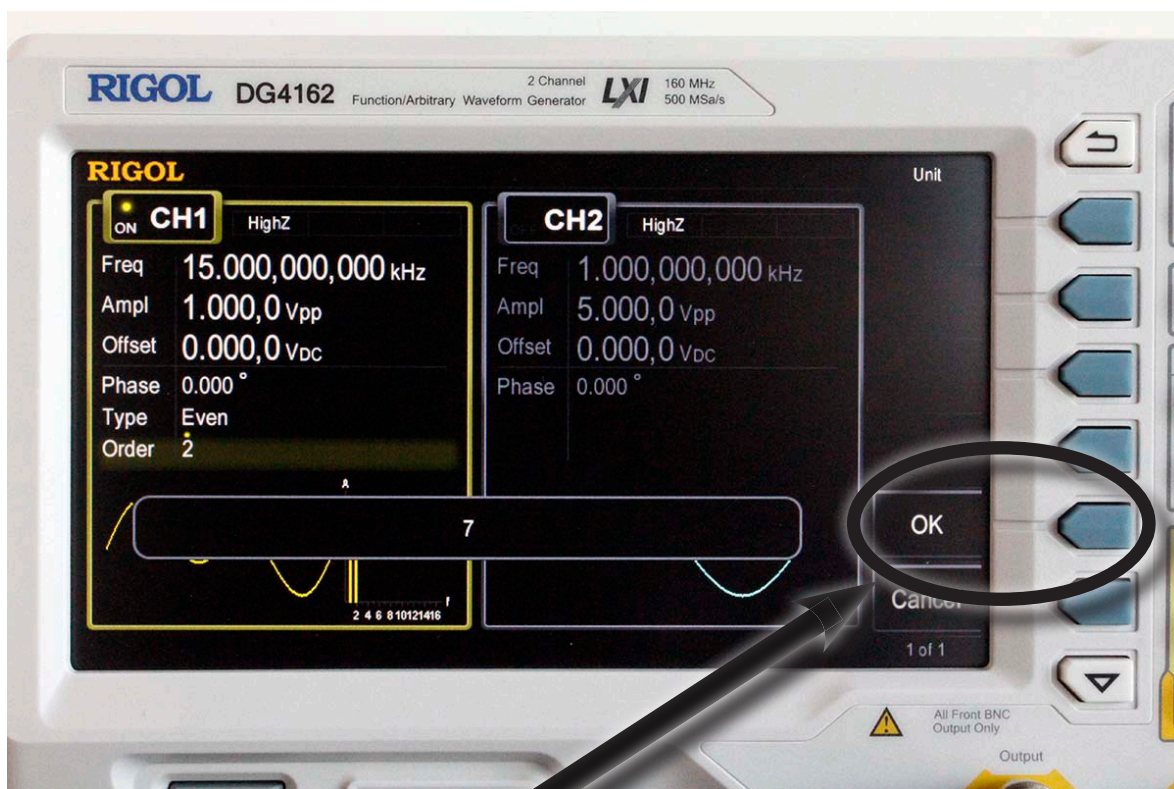
5. Press the "Order" soft key to begin adjusting the order limit (max. 16)



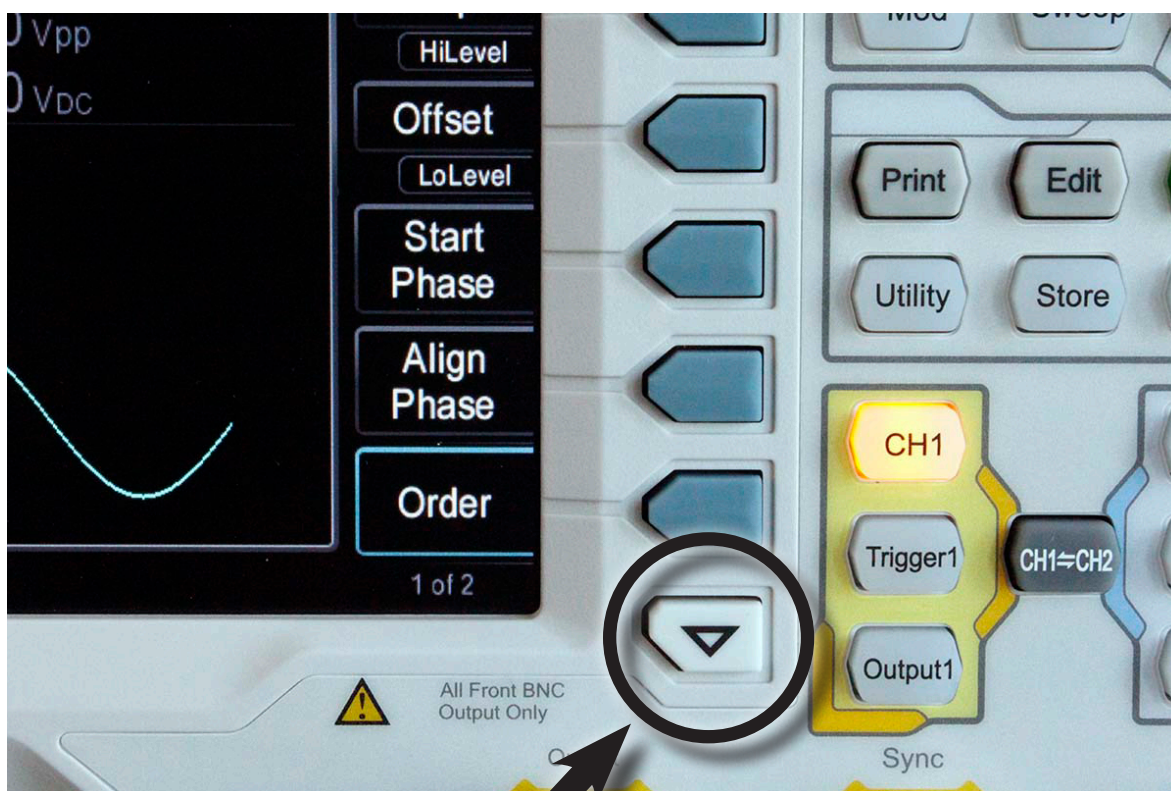
6. Use the numeric keypad to enter the number of harmonic orders



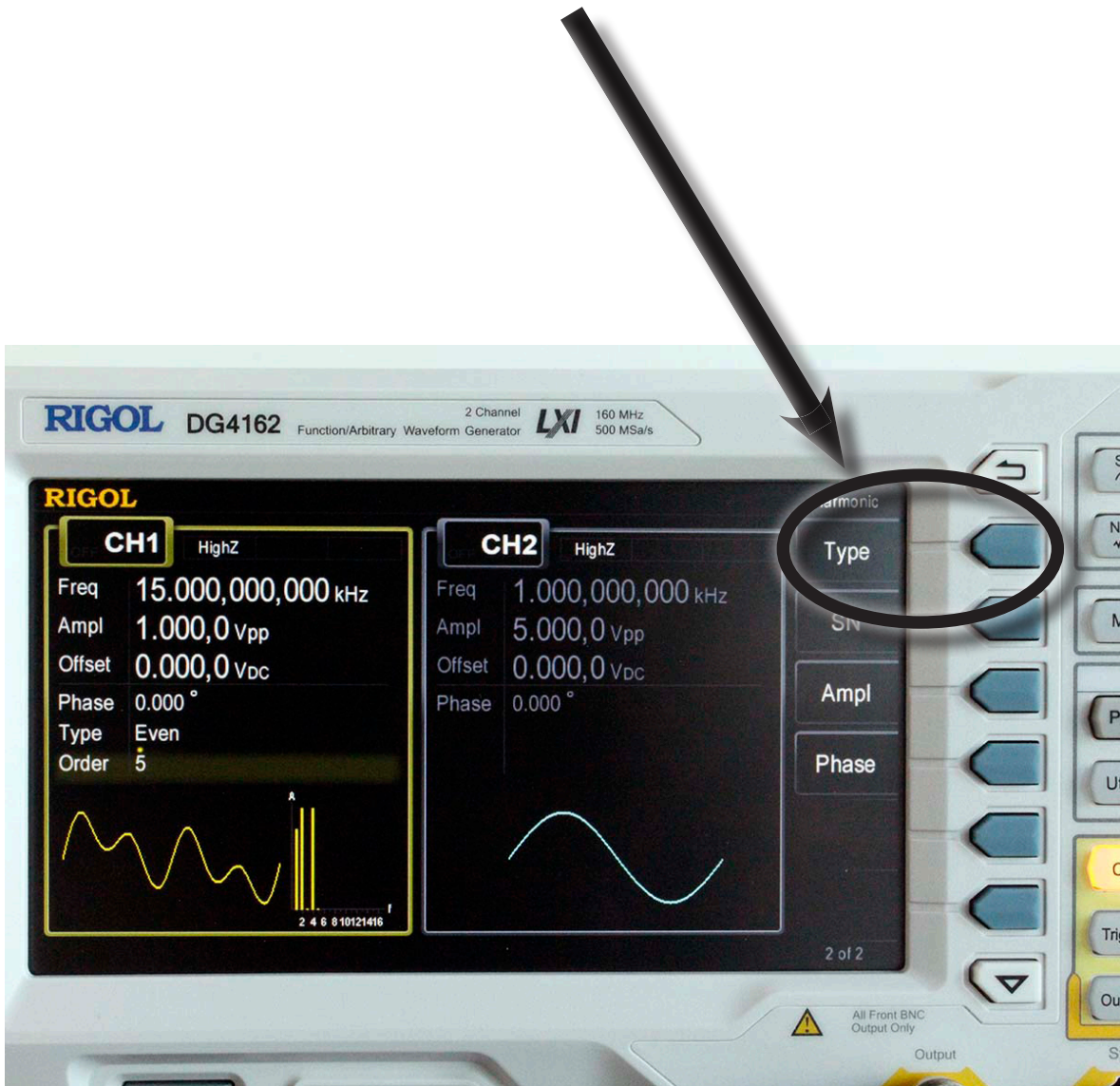
7. Press the "OK" soft key to set this value



8. Press the “↓” button to access the 2nd page of parameters



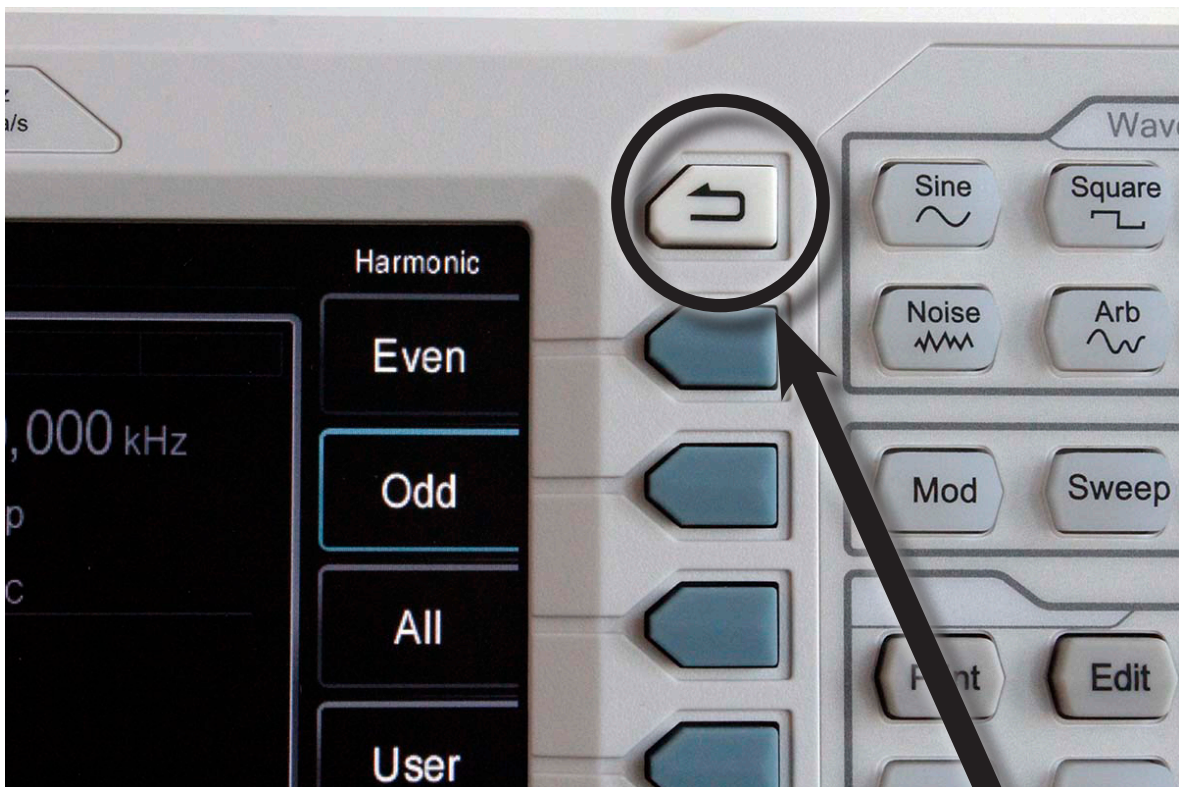
9. Press the "Type" soft key to adjust the Harmonic Type (Even, Odd, All, User defined)



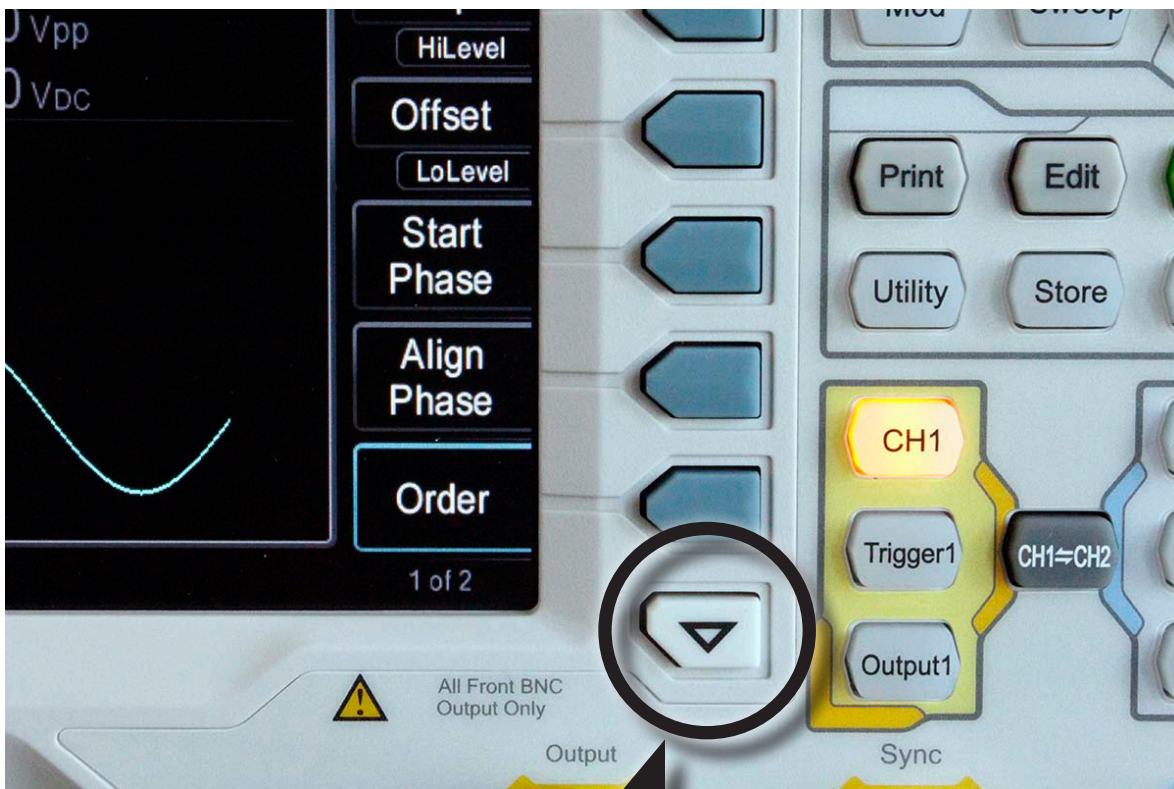
10. Press the appropriate softkey to set the harmonic type (i.e. Odd)



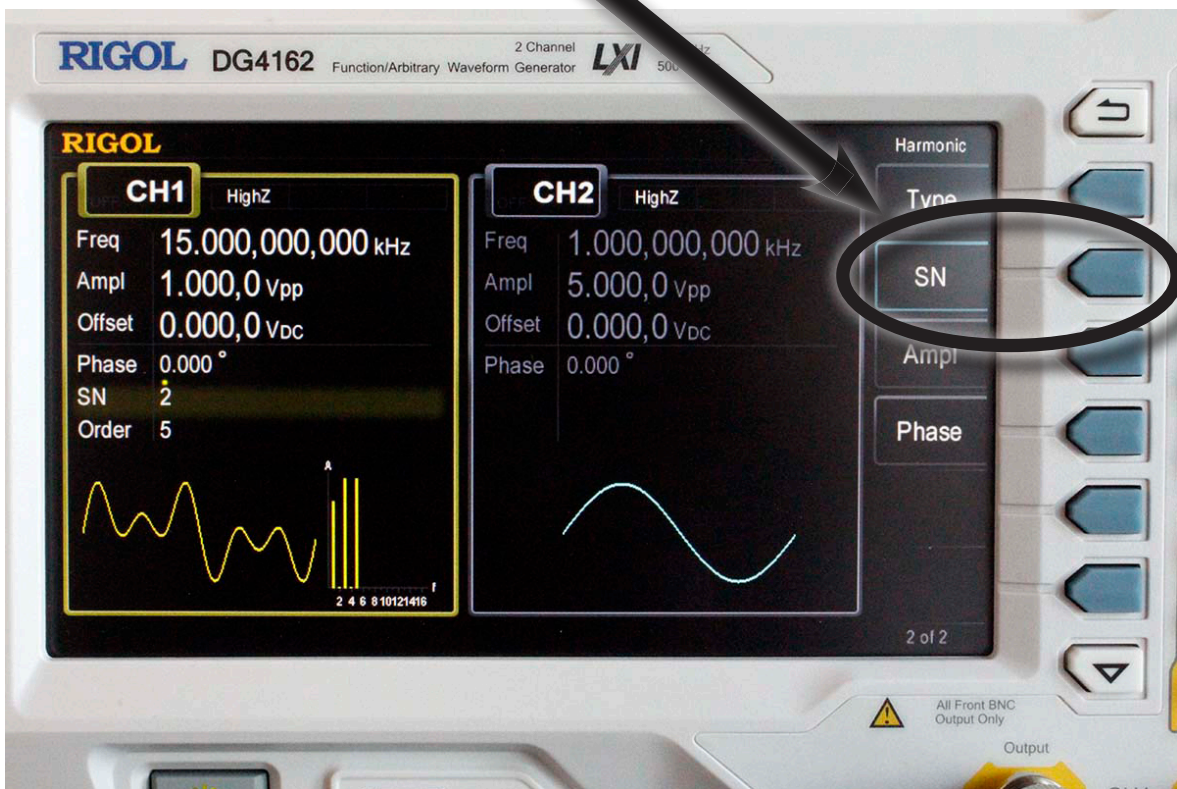
11. Press the “RETURN” button on front panel to return to the parameter menu



12. Press the “↓” button to access the 2nd page of parameters



13. Press the “SN” soft key to select the sequence number of the harmonic to be set



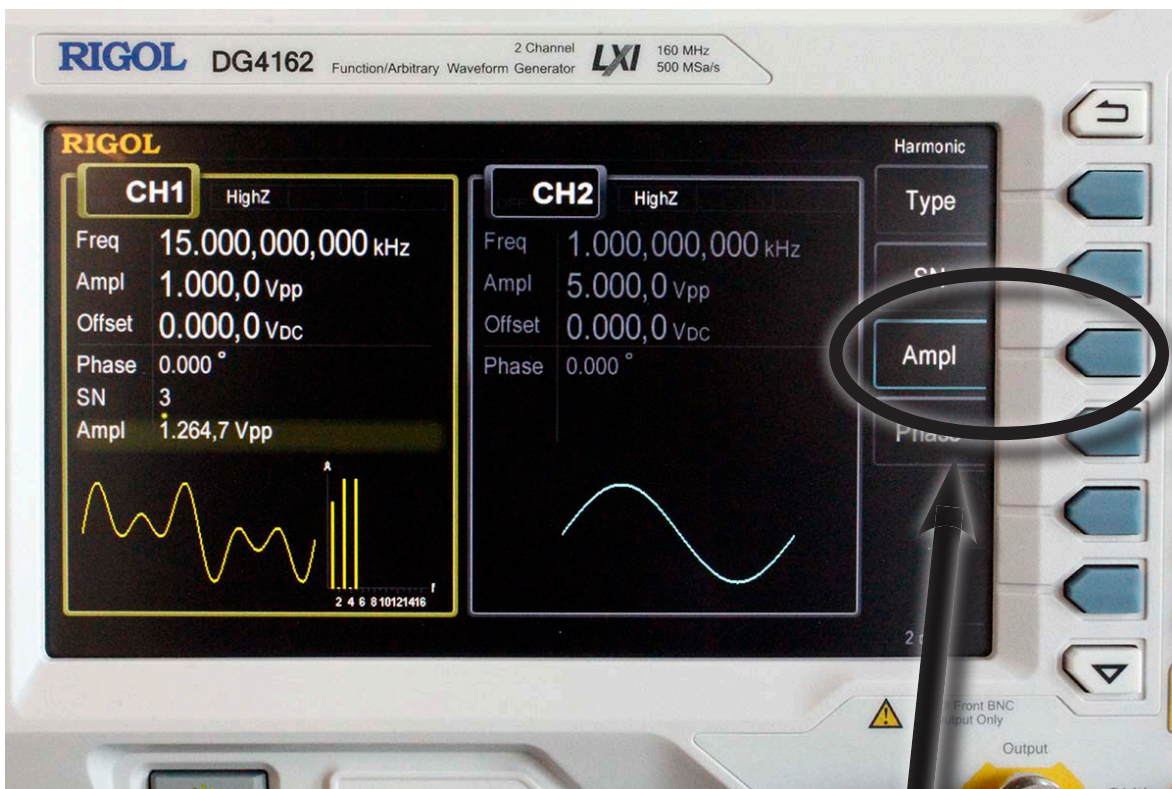
14. Use the numeric keypad to enter your number



15. Press the "OK" soft key to set this value



16. To adjust the amplitude of the specific harmonic you just selected, press the “Ampl” soft key on the 2nd page of the parameters screen



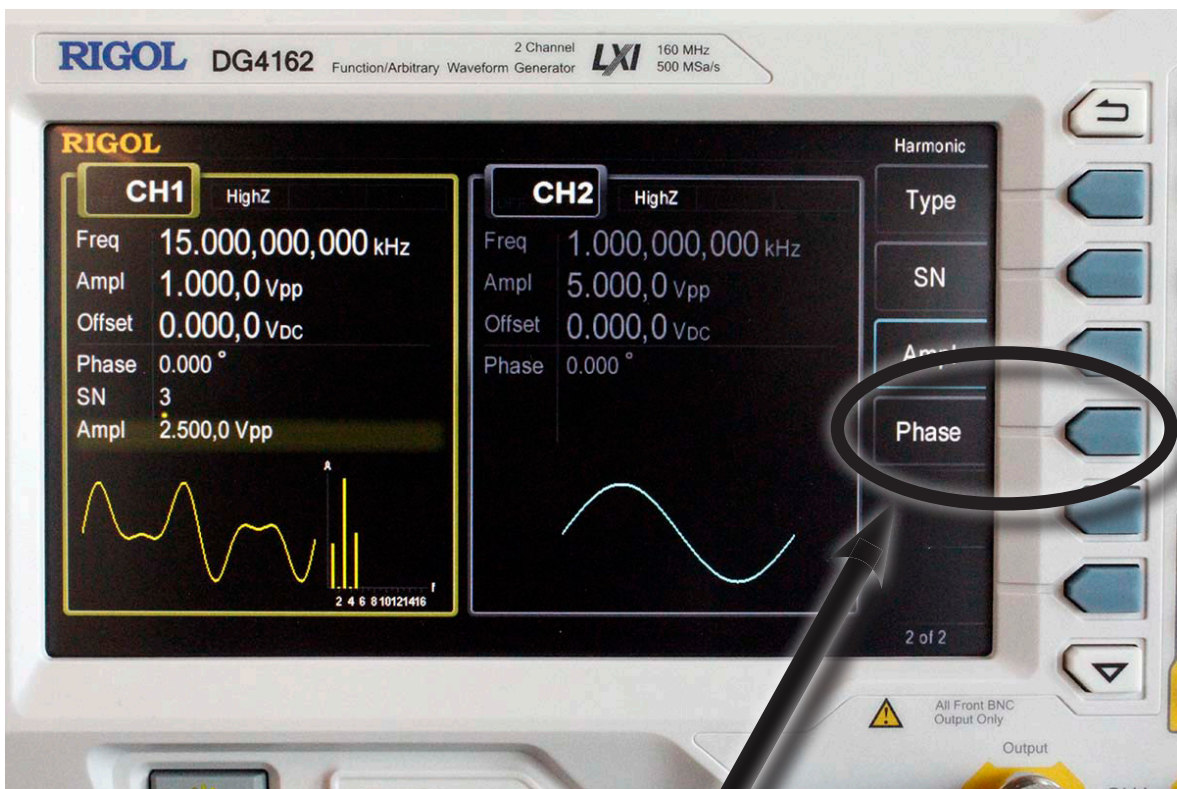
17. Use the numeric keypad to enter the amplitude value of the harmonic



18. Select the type of amplitude by pressing one of the corresponding soft keys (i.e. Vpp, mVpp, Vrms, etc.)



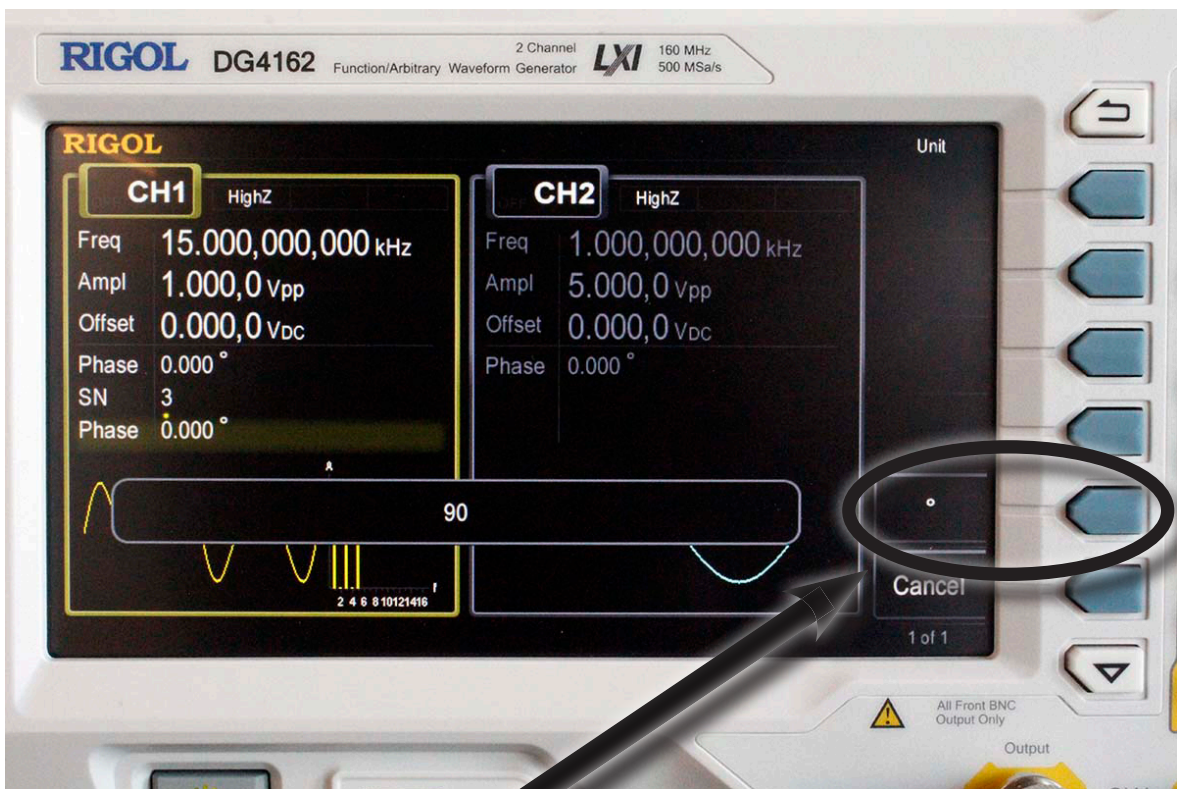
19. To set the phase of each order of harmonic, press the “Phase” soft key on the 2nd page of the parameters screen



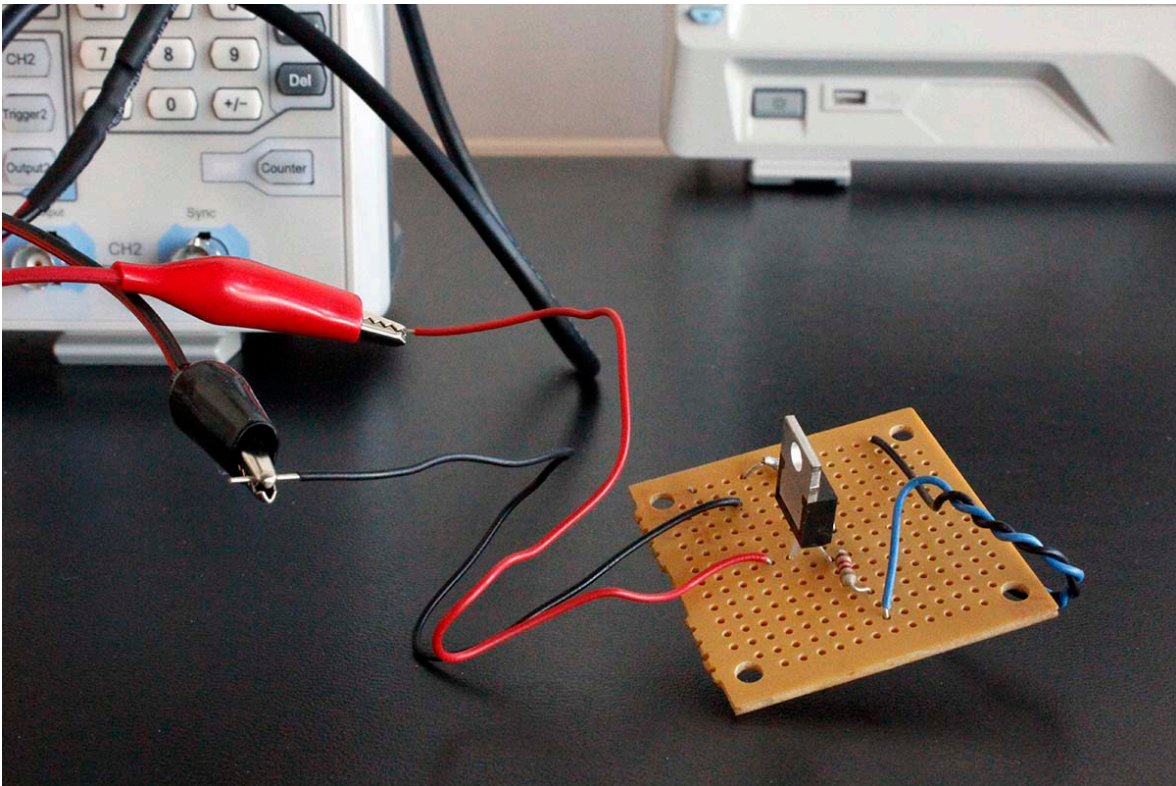
20. Use the numeric keypad to enter a value for the phase shift (i.e. 90°)



21. Press the “°” softkey



22. Attach your lead to your load/circuit/oscilloscope



23. When you are finished adjusting your waveform parameters, press the “Output” button

