

**User Manual**

**Tektronix**

**CFG253  
3 MHz Function Generator  
070-8362-04**



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## WARRANTY

Tektronix warrants that this product will be free from defects in materials and workmanship for a period of one (1) year from the date of shipment. If any such product proves defective during this warranty period, Tektronix, at its option, either will repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product.

In order to obtain service under this warranty, Customer must notify Tektronix of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. Customer shall be responsible for packaging and shipping the defective product to the service center designated by Tektronix, with shipping charges prepaid. Tektronix shall pay for the return of the product to Customer if the shipment is to a location within the country in which the Tektronix service center is located. Customer shall be responsible for paying all shipping charges, duties, taxes, and any other charges for products returned to any other locations.

This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care. Tektronix shall not be obligated to furnish service under this warranty a) to repair damage resulting from attempts by personnel other than Tektronix representatives to install, repair or service the product; b) to repair damage resulting from improper use or connection to incompatible equipment; or c) to service a product that has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty of servicing the product.

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## General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it.

### Injury Precautions

#### **Use Proper Power Cord**

To avoid fire hazard, use only the power cord specified for this product.

#### **Avoid Electric Overload**

To avoid electric shock or fire hazard, do not apply a voltage to a terminal that is outside the range specified for that terminal.

#### **Ground the Product**

This product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals of the product, ensure that the product is properly grounded.

#### **Do Not Operate Without Covers**

To avoid electric shock or fire hazard, do not operate this product with covers or panels removed.

#### **Use Proper Fuse**

To avoid fire hazard, use only the fuse type and rating specified for this product.

## General Safety Summary

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### **Do Not Operate in Wet/Damp Conditions**

To avoid electric shock, do not operate this product in wet or damp conditions.

### **Do Not Operate in Explosive Atmosphere**

To avoid injury or fire hazard, do not operate this product in an explosive atmosphere.

### **Use Proper Voltage Setting**

Before applying power, ensure that the line selector is in the proper position for the power source being used.

### **Provide Proper Ventilation**

To prevent product overheating, provide proper ventilation.

### **Do Not Operate With Suspected Failures**

If you suspect there is damage to this product, have it inspected by qualified service personnel.

## Safety Terms and Symbols

### **Terms in This Manual**

These terms may appear in this manual:



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**WARNING.** *Warning statements identify conditions or practices that could result in injury or loss of life.*

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**CAUTION.** *Caution statements identify conditions or practices that could result in damage to this product or other property.*

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## General Safety Summary

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### Terms on the Product

These terms may appear on the product:

**DANGER** indicates an injury hazard immediately accessible as you read the marking.

**WARNING** indicates an injury hazard not immediately accessible as you read the marking.

**CAUTION** indicates a hazard to property including the product.

### Symbols on the Product

The following symbols may appear on the product:



**DANGER**  
High Voltage



Protective Ground  
(Earth) Terminal



**ATTENTION**  
Refer to  
Manual



Double  
Insulated

## Certifications and Compliances

### CSA Certified Power Cords

CSA Certification includes the products and power cords appropriate for use in the North America power network. All other power cords supplied are approved for the country of use.

General Safety Summary

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## Getting Started

The Tektronix CFG253 Function Generator produces sine, square, and sawtooth waves and TTL signals in a frequency range of 0.03 Hz to 3 MHz. You can use it to test and calibrate audio and ultrasonic equipment and servo systems. You can also directly control amplitude and DC offset.

The function generator has a symmetry function to control the rise and fall times of sine or sawtooth waves and the duty cycles of square waves. It also has a sweep function that makes the output signal traverse a range of frequencies. The sweep rate and sweep width can be controlled internally or the sweep function can be input from an external DC signal.

The function generator has a locking, multiposition handle that folds under the instrument. The instrument is delivered with a power cord, an installed fuse for 115 V operation, and this instruction manual.

## Preparing the CFG253 Function Generator for Use

Check the following items prior to operating the CFG253 Function Generator for the first time (see Figure 1 for locations of items):

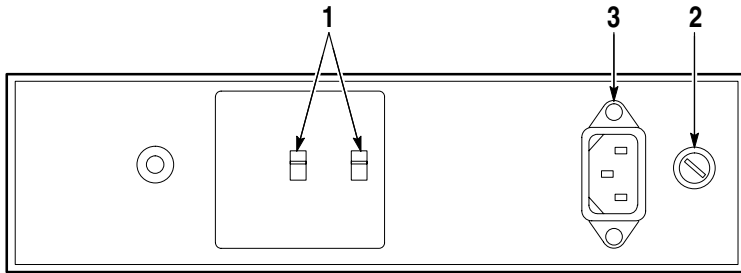


Figure 1: Line Voltage Selectors, Power Input, and Fuse Locations



**CAUTION.** To prevent damage to the instrument, set the line voltage selectors to the proper voltage setting and install the correct line voltage fuse before operating the equipment.

1. Set the line voltage selectors to the input line voltage. These selectors connect internal wiring for various line voltages. This product is intended to operate from a power source that does not supply more than 250 V<sub>RMS</sub> between the supply conductors or between either supply conductor and ground. For line voltage ranges, refer to *Appendix A: Specifications* on page 9.



**WARNING.** To prevent electrical shock, unplug the power cord and disconnect the signal input cable from any signal source before checking or replacing the fuse.

2. Check that the correct line fuse is installed. The line fuse provides protection if the equipment malfunctions or an overload occurs. Refer to *Appendix C: Replaceable Parts* on page 15 for fuse part numbers.



**WARNING.** To prevent electrical shock, connect the power cord to a properly grounded power source. The outside (ground) of this connector is connected through the equipment to the power source ground. Do not remove the ground lug from the power cord for any reason.

3. Connect the input power cord. Use only the power cords specified for this equipment. Refer to *Appendix C: Replaceable Parts* on page 15 for power cord part numbers.

## Front Panel

Figure 2 shows the front panel controls, connectors, and indicators with brief descriptions of the items listed following the figure.

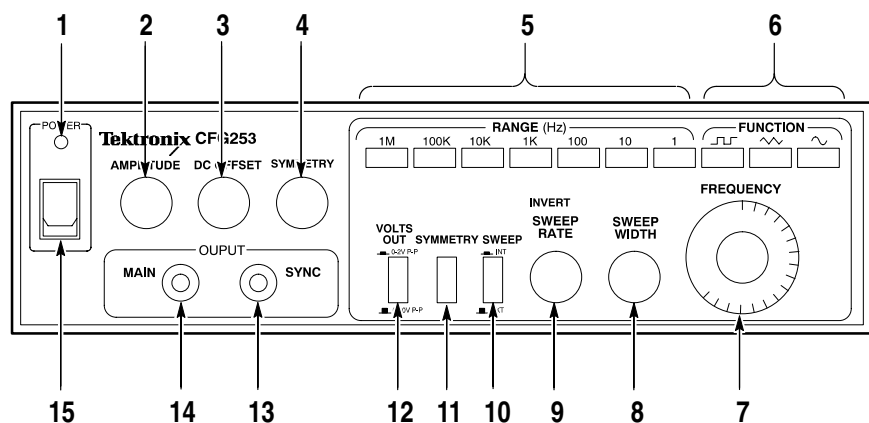


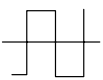
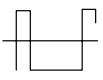
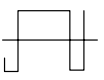



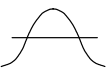


Figure 2: Front Panel Controls, Connectors, and Indicators

1. POWER On Light. When lighted, indicates a power on condition.
2. AMPLITUDE Control. This variable control, depending on the position of the VOLTS OUT button, determines the level of the signal at the MAIN output connector.

3. **DC OFFSET.** Pull out this control to activate. The DC OFFSET control sets the DC level and polarity of the signal at the MAIN output. When the control is pressed in, the signal is centered at zero VDC.
4. **SYMMETRY Knob.** This knob changes the duty cycle of a square wave signal or the rise and fall times of sawtooth and sine wave signals. This feature is called symmetry because it affects the visual symmetry of the waveform along its longitudinal axis. The knob has no effect unless the SYMMETRY button (see item 11) is pushed in.

When the SYMMETRY knob is at the center position, the symmetry of the waveform is unaffected. Rotating the knob clockwise has an increasing effect on the waveform; rotating the knob counterclockwise has the opposite effect, as shown in Table 1.

**Table 1: Effect of Symmetry Controls on Waveforms**

Type	Waveform	SYMMETRY CCW	SYMMETRY CW
Square			
Triangle			
Sine			

5. **RANGE (Hz) Buttons.** These buttons determine the frequency range of the signal at the MAIN output connector.
6. **FUNCTION Buttons.** The sine, square or sawtooth buttons select the type of signal provided at the MAIN output connector.
7. **FREQUENCY Control.** This variable control determines the frequency of the signal at the MAIN output connector within the range set by the RANGE buttons.

8. SWEEP WIDTH. This control adjusts the sweep amplitude.
9. SWEEP RATE. This control adjusts the rate of the internal sweep generator and the repetition rate of the burst gate.
10. SWEEP Button. Push in for internal sweep. This button activates the sweep rate and sweep width controls. When the button is set out, the function generator accepts signals from its external sweep input connector on the rear panel.
11. SYMMETRY Button. Pushing this button in divides the frequency of the output signal by ten and allows the symmetry of the signal to be varied using the SYMMETRY knob (see item 4). Table 1 shows effects of adjusting the symmetry on waveforms.
12. VOLTS OUT Button. Push in for AMPLITUDE control range of 0 to 2 V<sub>p-p</sub>, open circuit, or 0 to 1 V<sub>p-p</sub> into a 50 Ω load. Set to the out position for an AMPLITUDE control range of 0 to 20 V<sub>p-p</sub> in an open circuit, or 0 to 10 V<sub>p-p</sub> to a 50 Ω load.



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**CAUTION.** *To prevent equipment damage, check the grounding system of the receiving equipment before connecting the function generator. The outside (ground) of the MAIN and SYNC OUTPUT connectors are connected through the equipment to the power source ground.*

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13. SYNC (TTL) OUTPUT. BNC output connector for TTL signals.
14. MAIN OUTPUT. BNC output connector for sine wave, square wave and sawtooth wave signals.
15. POWER Button. Push in to turn function generator on. A second push turns the function generator off.

## Rear Panel

Figure 3 shows the location of the VCF INPUT (external sweep) connector on the rear panel with a brief description of the connector following the figure.

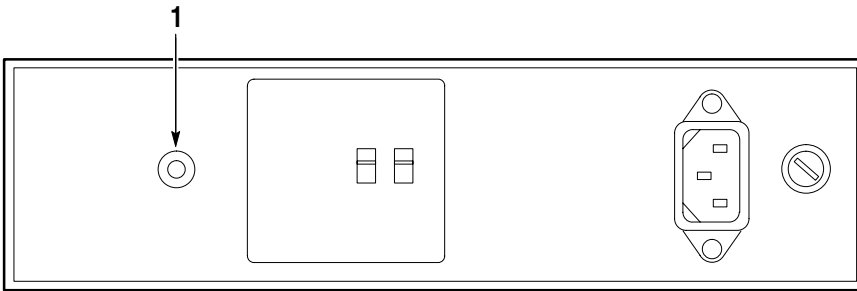


Figure 3: Rear Panel Signal Connection



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**CAUTION.** *The outside (ground) of the EXTERNAL SWEEP input connector is connected through the equipment to the power source ground. Check the grounding system of the input equipment before connecting the function generator.*

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1. VCF INPUT (External Sweep). Input BNC connector for voltage-controlled sweep. Signals applied to this connector will control the output frequency when the SWEEP button is set to the out position. An input of 0 to +10 VDC sweeps the signal at the MAIN output down two decades (100:1). The total sweep range is also dependent on the base frequency and the desired sweep direction.



## Reference

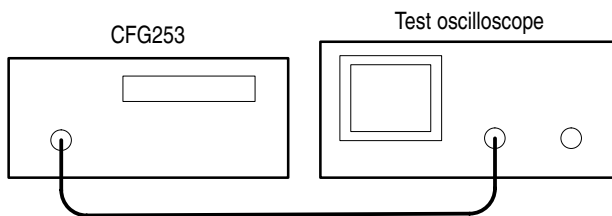
This section describes two advanced functions of the CFG253 Function Generator: TTL signals and external sweep.

### TTL Signals

To generate a TTL signal, follow these steps:

1. Connect the BNC connector from your oscilloscope to the **SYNC (TTL) OUTPUT** as shown below.

Observe the results on the oscilloscope. You may want to change the volts per division setting or other controls on the oscilloscope to acquire a useful signal.



2. Change the frequency **RANGE** and rotate the **FREQUENCY** dial to observe how the frequency of the TTL signal changes.
3. Rotate the **DC OFFSET** knob.

Notice that this knob has no effect on TTL signals. That is because the DC offset of a TTL signal is standardized for compliance with TTL logic. Signals produced from the SYNC (TTL) OUTPUT are not affected by this knob.

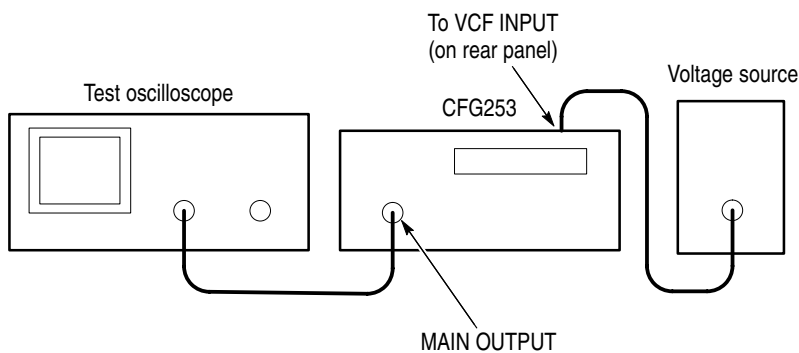
4. Rotate the **AMPLITUDE** knob.

Notice that this knob has no effect on TTL signals. That is because the amplitude of a TTL signal is standardized for compliance with TTL logic. Signals from the SYNC (TTL) OUTPUT are therefore not affected by this knob.

## External Sweep

To use the external sweep function, follow these steps:

1. Connect the BNC connector to the **MAIN OUTPUT** as shown below.



2. Turn the **FREQUENCY** dial to the **.3** position.



**CAUTION.** To avoid damage to the CFG253 Function Generator, ensure that the maximum voltage into the rear panel VCF input is no more than  $\pm 10$  V pk.

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3. Connect the external voltage signal to the **VCF INPUT** on the rear panel of the instrument.
4. Push the **SWEEP** button out to deactivate the internal sweep function.

When using an external sweep signal, the sweep width and sweep rate knobs have no effect on the signal sweep. Instead, these parameters are controlled entirely by the external signal provided through the rear panel.

## Appendix A: Specifications

Table 2 shows characteristics of the CFG253 Function Generator that are guaranteed by warranty.

**Table 2: Warranted Characteristics**

Characteristic	Measurement	
Outputs	Square wave, sine wave, sawtooth wave, TTL pulse, and sweep functions for all outputs	
Line Voltage Range	90 to 110, 108 to 132, 198 to 242, and 216 to 250 VAC at 50–60 Hz	
Frequency ranges, nonskewed waveform (Freq/1)	<b>Range Setting</b>	<b>Variable</b>
	1	0.3 to 3.0 Hz
	10	3.0 to 30 Hz
	100	30 to 300 Hz
	1 K	0.3 K to 3.0 kHz
	10 K	3 K to 30 kHz
	100 K	30 K to 300 kHz
	1 M	0.3 M to 3.0 MHz
Frequency ranges, skewed waveform (Freq/10)	<b>Range Setting</b>	<b>Variable</b>
	1	0.03 to 0.3 Hz
	10	0.3 to 3.0 Hz
	100	3.0 to 30 Hz
	1 K	30 to 300 Hz
	10 K	0.3 K to 3.0 kHz
	100 K	3.0 K to 30 kHz
	1 M	30 K to 300 kHz
Frequency multiplier	Variable 0.3 to 3.0 times the selected frequency range	
Frequency/1 dial accuracy	±5% of full scale of frequency/1	
Frequency/10 dial accuracy	±5% of full scale of frequency/10	
Sine wave distortion	<1% from 10 Hz to 100 kHz	

## Appendix A: Specifications

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**Table 2: Warranted Characteristics (Cont.)**

Characteristic	Measurement
Sawtooth linearity	20 Hz to 200 kHz $\geq 99\%$ 200 kHz to 3 MHz $\geq 97\%$
Square response	$\leq 100$ ns rise/fall time maximum output into 50 $\Omega$ load
Main output amplitude	Two ranges:  0–20 V peak-to-peak 100 mV to 20 V <sub>p-p</sub> (open circuit) 50 mV to 10 V <sub>p-p</sub> (50 $\Omega$ load)  0–2 V peak-to-peak 10 mV to 2 V <sub>p-p</sub> (open circuit) 5 mV to 1 V <sub>p-p</sub> (50 $\Omega$ load)
Impedance	50 $\Omega \pm 10\%$
DC offset	<-10 V to >+10 V (open circuit), and <-5 V to >+5 V (into 50 $\Omega$ load)
Duty cycle	5:1 minimum duty cycle change (50% at Center:Cal position), with symmetry button (Freq ÷ 10) pushed in
Sweep rate	Continuously variable from 0.5 to 50 Hz
Sweep width	Variable from 1:1 to 100:1

**Table 3: Physical Characteristics**

Characteristic	Dimension
Width	240 mm (9.46 in)
Height	64 mm (2.53 in)
Depth	230 mm (9.0 in)
Weight	2.0 kg (4.4 lb)

**Table 4: Certifications and Compliances**

<p>EC Declaration of Conformity – EMC</p>	<p>Meets intent of Directive 89/336/EEC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities:</p> <p>EN 55011                    Class A Radiated and Conducted Emissions</p> <p>EN 50081-1 Emissions:              EN 60555-2    AC Power Line Harmonic Emissions</p> <p>EN 50082-1 Immunity:              IEC 801-2    Electrostatic Discharge Immunity              IEC 801-3    RF Electromagnetic Field Immunity              IEC 801-4    Electrical Fast Transient/Burst Immunity              IEC 801-5    Power Line Surge Immunity</p>
<p>EC Declaration of Conformity – Low Voltage</p>	<p>Compliance was demonstrated to the following specification as listed in the Official Journal of the European Communities:</p> <p>Low Voltage Directive 73/23/EEC, amended by 93/68/EEC:          HD401S1          Safety requirements for electronic measuring apparatus</p>

Appendix A: Specifications

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## Appendix B: Maintenance

This appendix provides information for the basic maintenance of the CFG253 Function Generator.

### Cleaning

To clean the function generator, use a soft cloth dampened in a solution of mild detergent and water. Do not spray cleaner directly onto the instrument, since it may leak into the cabinet and cause damage.

Do not use chemicals containing benzine, benzene, toluene, xylene, acetone, or similar solvents.

Do not use abrasive cleaners on any portion of the function generator.

### Preparing for Shipment

If the original packaging is unfit for use or not available, use the following packaging guidelines:

1. Use a corrugated cardboard shipping carton having inside dimensions at least three inches greater than the instrument dimensions.
2. Put the instrument into a plastic bag or wrap to protect it from dampness and loose packing material.
3. Place the instrument into the box and firmly stabilize it with packing material.
4. Seal the carton with shipping tape.

## Troubleshooting

Electronic maintenance on the CFG253 Function Generator must be performed by a trained technician. However, an operator can perform some basic and routine maintenance. The CFG253 Function Generator will give some indications of problems to aid the operator.



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**WARNING.** *To prevent electrical shock, unplug the power cord and disconnect the signal input cable from any signal source before checking or replacing the fuse.*

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If the power on indicator does not light when the POWER switch is in the on position, check the power line fuse.



## Appendix C: Replaceable Parts

Replaceable parts may be ordered directly from your authorized Tektronix dealer.

### Standard Accessories

The following items are shipped with the CFG253 Function Generator:

**Table 5: Standard Accessories**

Accessory	Tektronix Part Number
Fuse, 3AG, 0.3 A, 250 V, SB (90 – 132 V operation)	159-0029-00
CFG253 User Manual	070-8362-XX
115 V Power Cord	Refer to Table 7

### Optional Accessories

The following items are available as optional accessories:

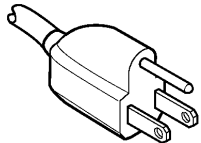
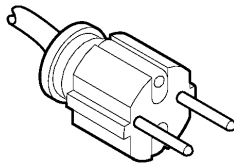
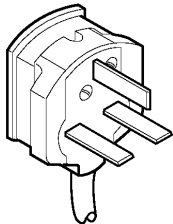
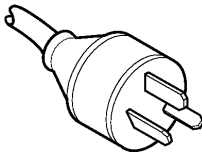
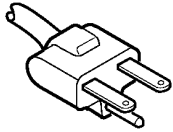
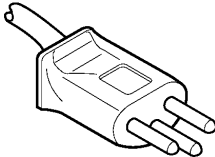
**Table 6: Optional Accessories**

Accessory	Tektronix Part Number
Fuse, 3AG, 0.15 A, 250 V, SB (198 – 250 V operation)	159-0054-00
230 V Power Cords	Refer to Table 7

Appendix C: Replaceable Parts

The following power cords are available.

**Table 7: Accessory Power Cords**

Plug Configuration	Normal Usage	Tektronix Part Number
	North America 115 V	161-0104-00
	Europe 230 V	161-0104-06
	United Kingdom 230 V	161-0104-07
	Australia 230 V	161-0104-05
	North America 230 V	161-0104-08
	Switzerland 230 V	161-0167-00