Contents

Chapter 1 Quick Start

The Rear Panel at a Glance  3
The Front-Panel Menu at a Glance  4
To phase lock to an external clock signal  5
To phase lock multiple function generators  7
To set a zero phase reference  9
To phase lock using the triggered burst mode  10
To generate a phase unlock error  14

Chapter 2 Remote Interface Operation

SCPI Command Summary  17
Phase-Lock Commands  18
Simplified Programming Overview  20
The SCPI Status Registers  23
Status Reporting Commands  26
Phase-Lock Error Messages  26

Chapter 3 Specifications  27

Chapter 4 Replaceable Parts and Schematics

To Order Replaceable Parts  30
Replaceable Parts Lists  31
Manufacturer’s List  33
33120-66503 Component Locator Diagram  34
33120-66503 Schematic Diagram  35

Index  37
Quick Start
Quick Start

This manual contains supplemental information for the Agilent 33120A Phase-Lock assembly. Refer to the 33120A User’s Guide and Service Guide for complete details on using the function generator.

The Phase-Lock assembly (Option 001) adds the following capabilities to the 33120A Function / Arbitrary Waveform Generator:

- External clock input and output connectors on the rear panel. These connectors allow synchronization between multiple 33120As or to an external 10 MHz clock signal.
- Phase offset control from the front panel or over the remote interface.
- Simultaneous hardware triggering of multiple Agilent 33120As. Option 001 allows the 33120A to generate a trigger pulse from the Ext Trig terminal which can be routed to other instruments in a system.
- 2 ppm timebase—10 times the frequency stability of the standard Agilent 33120A.

If you have questions relating to the operation of the function generator, call 1-800-452-4844 in the United States, or contact your nearest Agilent Technologies Sales Office.
The Rear Panel at a Glance

The Phase-Lock assembly adds the *Ref Out* and *Ext Ref In* terminals to allow synchronization between multiple 33120As or to an external 10 MHz clock signal.

1. Internal 10 MHz reference output terminal
2. External 10 MHz reference input terminal
3. Chassis ground
4. Power-line fuse-holder assembly
5. Power-line voltage setting
6. AM modulation input terminal
7. External Trigger / FSK / Burst modulation input terminal
8. GPIB (IEEE-488) interface connector
9. RS-232 interface connector
The Front-Panel Menu at a Glance

The Phase-Lock assembly adds the *Phase Menu* to the front-panel menu.

The menu is organized in a top-down tree structure with three levels.

To turn on menu press:

To move up or down

To move right or left

To enter command press:

---

G: PHASE MENU

1: ADJUST  2: SET ZERO  3: TRIG OUT  4: UNLOCK ERR

1: ADJUST  Sets the phase offset of the output waveform to a value in degrees.
2: SET ZERO  Nulls the phase offset to a zero reference for relative adjustments.
3: TRIG OUT  Enables or disables an external trigger from the Ext Trig terminal.
4: UNLOCK ERR  Enables or disables error generation when phase-lock is lost.
To phase lock to an external clock signal

The rear-panel Ext Ref In terminal allows you to synchronize one or more function generators with an external 10 MHz signal. The following steps show you how to configure a single instrument for synchronization with an external signal.

1 Select the function and set the output frequency to 10 MHz.

You must select either sine or square wave since the other output waveforms cannot be used up to 10 MHz.

To adjust the phase offset, you will use the front-panel menu as described on the following page.
2 Turn on the menu.

A: MOD MENU

3 Move across to the PHASE MENU choice on this level.

G: PHASE MENU

4 Move down a level to the ADJUST command.

1: ADJUST

5 Move down a level and set the phase offset.

You can set the offset to any value between -360 degrees and +360 degrees. The displayed phase is output “real time” unless you have selected the arbitrary waveform function.

∧000.000 DEG

6 Turn off the menu.

The function generator beeps and displays a message. You are then exited from the menu.

At this point, the function generator is phase-locked to the external clock signal with the specified phase relationship. The two signals will remain locked unless you change the function or output frequency.
To phase lock multiple function generators

The rear-panel Ref Out and Ext Ref In terminals allow you to synchronize multiple function generators. The diagram below shows how to make connections for the “real-time” phase-lock mode. In the real-time mode, the phase offset relationship is random at first. You can adjust the phase offset “real time” from the front panel. The following steps show you how to synchronize two function generators at 10 kHz.

1 Set both instruments to the same output frequency.

You can select sine, square, ramp, or triangle waveforms for phase-lock operation. You cannot perform real-time phase adjustments on arbitrary waveforms.

10.000,000 KHz

To adjust the phase offset, you will use the front-panel menu as described on the following page.
2 Turn on the menu.

A: MOD MENU

3 Move across to the PHASE MENU choice on this level.

G: PHASE MENU

4 Move down a level to the ADJUST command.

1: ADJUST

5 Move down a level and set the phase offset.

You can set the offset to any value between -360 degrees and +360 degrees. The displayed phase is output “real time” unless you have selected the arbitrary waveform function.

^000.000 DEG

6 Turn off the menu.

The function generator beeps and displays a message. You are then exited from the menu.

At this point, the two function generators are phase-locked with the specified phase relationship. The two signals will remain locked unless you change the function or output frequency.
To set a zero phase reference

After selecting the desired phase relationship as described on the previous pages, you can set a zero-phase point. The function generator then assumes that its present phase is zero and you can adjust the phase relative to this new “zero”.

1 Turn on the menu.

A: MOD MENU

2 Move across to the PHASE MENU choice on this level.

G: PHASE MENU

3 Move down a level and then across to the SET ZERO command.

2: SET ZERO

4 Move down a level to set the zero phase reference.

The displayed message indicates that the phase reference will be set to zero degrees (you must exit the menu to select the displayed value).

PHASE = 0

5 Save the phase reference and turn off the menu.

The function generator beeps and displays a message to show that the change is now in effect. You are then exited from the menu.
To phase lock using the triggered burst mode

The rear-panel *Ref Out* and *Ext Ref In* terminals allow you to synchronize multiple function generators. The diagram below shows how to make connections for the “triggered burst” phase-lock mode. In the triggered burst mode, you can synchronize phase-lock signals using an external trigger from the rear-panel *Ext Trig* terminal. The following steps show you how to synchronize two function generators at 10 kHz in the triggered burst mode.

1 Set both instruments to the same output frequency.

You can select sine, square, ramp, or triangle waveforms for phase-lock operation. You cannot perform real-time phase adjustments on arbitrary waveforms.

10.000,000 KHz
2 Enable the burst mode on both instruments.
Notice that the Burst annunciator turns on.

3 Use the menu to set the burst count on both instruments.
After you enable the burst mode, the “recall menu” key will automatically take you to the BURST CNT command in the MOD MENU.

4 Move down to the parameter level and set the count to “INFINITE”.
Press the right or left arrow keys until the “CYC” units are flashing. Then, press the down arrow key to display “INFINITE”.

5 Save the change and turn off the menu.
The function generator beeps and displays a message to show that the change is now in effect. You are then exited from the menu.

Next, you will set up the starting phase of the burst as shown on the next page.
6 Go to the BURST PHAS command in the MOD MENU.

7 Move down a level and set the burst phase.

You can set the starting phase of the burst to any value between -360 degrees and +360 degrees. With the BURST PHAS command, the phase adjustment is not “real time”; you must exit the menu to output the specified starting phase.

8 Save the change and turn off the menu.

The function generator beeps and displays a message to show that the change is now in effect. You are then exited from the menu.

9 On one instrument, go to the TRIG OUT command in the PHASE MENU.

10 Move down a level and enable the external trigger.
11 Save the change and turn off the menu.

The external trigger setting is stored in volatile memory; the external trigger state is disabled when power has been off or after a remote-interface reset.

12 Enable both instruments for phase-lock operation.

Press the Single trigger key on both function generators to enable phase-lock operation. Next, change the output function both function generators (e.g., change from square wave to sine wave and then back to square wave). The Trig annunciator should be on to indicate that each function generator is in the single trigger mode.

13 Issue a single trigger to initiate the triggered burst.

Press the Single trigger key on the function generator with TRIG OUT enabled. The function generator triggers itself and also outputs a trigger pulse from its rear-panel Ext Trig terminal.

At this point, the two function generators are phase-locked with the specified phase relationship. The two signals will remain locked unless you change the function or output frequency.
To generate a phase unlock error

You can configure the function generator to generate an error condition whenever phase lock is lost. The following steps show you how to enable an unlock error.

1 Turn on the menu.

A: MOD MENU

2 Move across to the PHASE MENU choice on this level.

G: PHASE MENU

3 Move down a level and then across to the UNLOCK ERR command.

4: UNLOCK ERR

4 Move down a level and enable the unlock error.

ENABLE

5 Save the change and turn off the menu.

The unlock error setting is stored in non-volatile memory, and does not change when power has been off or after a remote-interface reset.

See also “The SCPI Status Registers” on page 23.
Remote Interface
Operation
Remote Interface Operation

This chapter gives an overview of the Phase-Lock commands available to program the function generator over the remote interface. Refer to chapter 4 in the 33120A User’s Guide for complete details on configuring the function generator for remote interface operation.

- SCPI Command Summary, on page 17
- Phase-Lock Commands, on page 18
- Simplified Programming Overview, on page 20
- The SCPI Status Registers, on page 23
- Status Reporting Commands, on page 26
- Phase-Lock Error Messages, on page 26
SCPI Command Summary

This section summarizes the SCPI (Standard Commands for Programmable Instruments) commands available to program the Phase-Lock assembly over the remote interface. If you are a first-time user of the SCPI language, refer to “An Introduction to the SCPI Language,” starting on page 211 in the 33120A User’s Guide.

Throughout this manual, the following conventions are used for SCPI command syntax.

- Square brackets ([ ]) indicate optional keywords or parameters.
- Braces ( { } ) enclose parameters within a command string.
- Triangle brackets (< >) indicate that you must substitute a value for the enclosed parameter.
- A vertical bar ( | ) separates multiple parameter choices.

**Phase-Lock Commands (Option 001)**

(see page 18 and 19 for more information)

```
PHASe:ADJ ust {<radians>|MINimum|MAXimum}
PHASe:ADJ ust?

PHASe:REF erence

PHASe:UNLock:ERRor:STATe {OFF|ON}
PHASe:UNLock:ERRor:STATe?

OUTPut:TRIGger:IMMediate

OUTPut:TRIGger:STATe {OFF|ON}
OUTPut:TRIGger:STATe?

*OPT?
```
Phase-Lock Commands

This section describes the SCPI (Standard Commands for Programmable Instruments) commands available to program the Phase-Lock assembly. Refer to chapter 4 in the 33120A User’s Guide for details on the complete set of commands for the function generator.

**PHAS:ADJ (<radians> | MINimum | MAXimum)**
Adjust the phase offset of the output waveform in radians. Select from -2π radians to +2π radians. *The default is 0 radians.* MIN = -2π radians. MAX = +2π radians. [Stored in volatile memory]

- To specify phase in *degrees* instead of radians, specify “DEG” following the phase value as shown below:

  "PHAS:ADJ -90 DEG"

- For sine, square, triangle, and ramp waveforms, 0 radians is the point at which the waveform crosses zero volts (or the dc offset value), in a positive-going direction. For *arbitrary* waveforms, 0 radians is the first point downloaded to memory.

- This phase adjustment for phase-lock is independent of the burst phase as set by the BM:PHAS command. See “Burst Modulation” in the 33120A User’s Guide for more information on burst phase.

**PHAS:ADJ?**
Query the phase offset setting. Returns a value in radians.

**PHAS:REF**
Immediately set the zero-phase reference point. This command does not change the phase offset as set with the PHAS:ADJ command, it only changes the phase reference. This command has no query form.
**PHASE:UNLock:ERRor:STATe {OFF|ON}**
Disable or enable the function generator from generating an error if phase-lock is ever lost. If phase-lock is lost and the error is enabled, 580, “Phase-locked loop is unlocked” is generated. The default is OFF. [Stored in non-volatile memory]

**PHASE:UNLock:ERRor:STATe?**
Query the unlock error state. Returns “0” (OFF) or “1” (ON).

**OUTPut:TRIGger:IMMediate**
Output an immediate TTL “high” pulse from the rear-panel Ext Trig terminal regardless of the present setting of the OUTP:TRIG:STAT command. You can use this command to issue an immediate external trigger for synchronizing phase-lock signals using the rear-panel Ext Trig terminal.

**OUTPut:TRIGger:STATe {OFF|ON}**
Disable or enable the function generator from sourcing an external trigger from its rear-panel Ext Trig terminal. The default is OFF. [Stored in volatile memory]

**OUTPut:TRIGger:STATe?**
Query the external trigger state. Returns “0” (OFF) or “1” (ON).

**OPT?**
Query the presence of the Phase-Lock option. Returns “1:PLL” if the option is present or “0” if no option is present.
Simplified Programming Overview

This section gives an overview of the basic techniques used to program the Phase-Lock assembly over the remote interface. This section is only an overview and does not give all of the details you will need to write your own application programs. Refer to chapter 6, “Application Programs,” in the 33120A User’s Guide for more details and examples. Also refer to the programming reference manual that came with your computer for details on outputting command strings and entering data.

To Phase Lock to an External Clock Signal

The rear-panel Ext Ref In terminal allows you to synchronize one or more function generators with an external 10 MHz signal. The following statements show how to configure a single instrument for synchronization with an external signal:

"APPL:SIN 10E+6, 5.0"  \hspace{1em} \textit{Select sine function at 10 MHz}

"PHAS:ADJ -90 DEG"  \hspace{1em} \textit{Set phase offset to -90 degrees}

"PHAS:REF"  \hspace{1em} \textit{Set phase reference to zero}

![Diagram of Ext Ref In terminal](image-url)
To Phase Lock Multiple Function Generators

The rear-panel *Ref Out* and *Ext Ref In* terminals allow you to synchronize multiple function generators. The following statements show you how to synchronize two function generators at 10 kHz (send the commands to both function generators):

- "APPL:SIN 10E+3, 5.0" *Select sine function at 10 kHz*
- "PHAS:ADJ -90 DEG" *Set phase offset to -90 degrees*
- "PHAS:REF" *Set phase reference to zero*
To Phase Lock Using the Triggered Burst Mode

In the triggered burst mode, you can synchronize phase-lock signals using an external trigger from the rear-panel Ext Trig terminal. The following statements show you how to synchronize two function generators in the triggered burst mode (send the commands to both function generators):

"APPL:SIN 10E+3, 5.0"  
*Set both to the same frequency*

"BM:NCYC INF"  
*Set burst count to “INFINITY”*

"BM:STAT ON"  
*Enable the burst mode*

"TRIG:SOUR EXT"  
*Set trigger source to external*

Send the following command statement to only one function generator:

"OUTP:TRIG:IMM"  
*Issue external trigger to all instruments*
The SCPI Status Registers

The function generator uses the Status Byte, the Standard Event, and the Questionable Data register groups (phase-lock assembly only) to record various instrument conditions. This section discusses only the Questionable Data register group; refer to chapter 4 in the 33120A User's Guide for a complete discussion of the status registers. A diagram of the SCPI status system is shown on the next page.

An example program is included in chapter 6, “Application Programs,” of the 33120A User's Guide which shows the use of the status registers. You may find it useful to refer to the program after reading the following section in this chapter.
Chapter 2 Remote Interface Operation

The SCPI Status Registers

**SCPI Status System**

---

**Questionable Data**

<table>
<thead>
<tr>
<th>Event Register</th>
<th>Enable Register</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Used</td>
<td>0</td>
</tr>
<tr>
<td>Not Used</td>
<td>1</td>
</tr>
<tr>
<td>Not Used</td>
<td>2</td>
</tr>
<tr>
<td>Not Used</td>
<td>3</td>
</tr>
<tr>
<td>Not Used</td>
<td>4</td>
</tr>
<tr>
<td>Not Used</td>
<td>5</td>
</tr>
<tr>
<td>Phase Locked</td>
<td>6</td>
</tr>
<tr>
<td>Not Used</td>
<td>7</td>
</tr>
<tr>
<td>Not Used</td>
<td>8</td>
</tr>
<tr>
<td>Not Used</td>
<td>9</td>
</tr>
<tr>
<td>Not Used</td>
<td>10</td>
</tr>
<tr>
<td>Not Used</td>
<td>11</td>
</tr>
<tr>
<td>Not Used</td>
<td>12</td>
</tr>
<tr>
<td>Not Used</td>
<td>13</td>
</tr>
<tr>
<td>Not Used</td>
<td>14</td>
</tr>
<tr>
<td>Not Used</td>
<td>15</td>
</tr>
</tbody>
</table>

**Binary Weights**

<table>
<thead>
<tr>
<th>Value</th>
<th>Decimal</th>
</tr>
</thead>
<tbody>
<tr>
<td>2^0</td>
<td>1</td>
</tr>
<tr>
<td>2^1</td>
<td>2</td>
</tr>
<tr>
<td>2^2</td>
<td>4</td>
</tr>
<tr>
<td>2^3</td>
<td>8</td>
</tr>
<tr>
<td>2^4</td>
<td>16</td>
</tr>
<tr>
<td>2^5</td>
<td>32</td>
</tr>
<tr>
<td>2^6</td>
<td>64</td>
</tr>
<tr>
<td>2^7</td>
<td>128</td>
</tr>
</tbody>
</table>

**Output Buffer**

- **Summary Register**
- **Enable Register**

**Status Byte**

- **Questionable Data**
- **Message Abnormal**
- **Standard Event**
- **Request Service**
- **Serial Poll (SPOLL)**
- **SST?**

---

24
The Questionable Data Register

The Questionable Data register reports the present lock state on bit 6. The state of this bit can be reported in the Questionable Data summary bit through the enable register. To set the enable register mask, you must write a decimal value to the register using the `STAT:QUE:ENAB` command.

Bit Definitions – Questionable Data Register

<table>
<thead>
<tr>
<th>Bit</th>
<th>Decimal Value</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>Always set to 0.</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>Always set to 0.</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Always set to 0.</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Always set to 0.</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Always set to 0.</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Always set to 0.</td>
</tr>
<tr>
<td>6</td>
<td>64</td>
<td>The function generator has lost phase lock.</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>Always set to 0.</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>Always set to 0.</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>Always set to 0.</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>Always set to 0.</td>
</tr>
<tr>
<td>11</td>
<td></td>
<td>Always set to 0.</td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>Always set to 0.</td>
</tr>
<tr>
<td>13</td>
<td></td>
<td>Always set to 0.</td>
</tr>
<tr>
<td>14</td>
<td></td>
<td>Always set to 0.</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>Always set to 0.</td>
</tr>
</tbody>
</table>

The Questionable Data event register is cleared when:

- You execute a `*CLS` (clear status) command.

The Questionable Data enable register is cleared when:

- You turn on the power (`*PSC` does not apply).
- You execute the `STAT:PRE` command.
- You execute the `STAT:QUE:ENAB 0` command.
Status Reporting Commands

STATus:QUEStionable:CONDition?
Query the Questionable Data condition register and return the real-time value of all bits set. Returns “0” if phase is locked or “64” if phase is unlocked.

STATus:QUEStionable:ENABle <enable value>
Enable bits in the Questionable Data enable register. The selected bits are then reported to the Status Byte.

STATus:QUEStionable:ENABle?
Query the Questionable Data enable register. The function generator returns a decimal value which corresponds to the binary-weighted sum of all bits set in the enable register.

STATus:QUEStionable:EVENt?
Query the Questionable Data event register. The function generator returns a decimal value which corresponds to the binary-weighted sum of all bits set in the event register.

STATus:PRESet
Clear all bits in the Questionable Data enable register.

Phase-Lock Error Messages

This section lists the two error messages that can be generated if the Phase-Lock option is installed. Refer to chapter 5 in the 33120A User's Guide for a complete listing of error messages.

-221 Settings conflict; cannot adjust phase in present configuration
Option 001 Phase-Lock Only. The phase cannot be adjusted real-time if an arbitrary waveform is selected, a modulation mode (other that burst) is enabled, or if burst is enabled with a burst count other than infinity.

580 Phase-locked loop is unlocked
Option 001 Phase-Lock Only. The function generator has detected an “unlock” condition. You must execute the PHAS:UNL:ERR:STAT ON command to enable this error.
Specifications
Timebase Accuracy
Setability: < 0.01 ppm
Stability: ±1 ppm 0°C - 50°C
Aging: < 2 ppm in first 30 days (continuous operation)
        10⁻⁷ / month (after first 30 days operation)

Rear-Panel Input (Ext Ref In terminal)
Lock Range: 10 MHz ±50 Hz
Level: -10 dBm to +15 dBm,
       +25 dBm or 10 Vpp absolute maximum input
Impedance: 50Ω ±2%, 42 Vpk isolation from earth
Locktime: < 2 seconds

Rear-Panel Output (Ref Out terminal)
Frequency: 10 MHz
Level: > 1 Vpp square wave into 50Ω

Phase Offset
Range: +360 to -360 degrees
Resolution: 0.001°
Accuracy: 25 ns

Trigger
Level: 5V zero-going pulse
Pulse Width: > 2 µs
Fanout: Capable of driving up to three 33120As
Replaceable Parts and Schematics
This chapter contains information to help you order replacement parts for your 33120A/Option 001 Phase-Lock assembly. Parts are listed in alphanumeric order according to their schematic reference designators. The parts lists include a brief description of the part with applicable Agilent part number and manufacturer part number.

**To Order Replaceable Parts**

You can order replaceable parts from Agilent using the Agilent part number or directly from the manufacturer using the manufacturer’s part number. Note that not all parts listed in this chapter are available as field-replaceable parts. To order replaceable parts from Agilent, do the following:

1. Contact your nearest Agilent Sales Office or Agilent Service Center.

2. Identify the parts by the Agilent part number shown in the replaceable parts list. Note that not all parts are directly available from Agilent; you may have to order certain parts from the specified manufacturer.

3. Provide the instrument model number and serial number.
## 33120-66503 – Phase-Lock PC Assembly

<table>
<thead>
<tr>
<th>Reference Designator</th>
<th>Agilent Part Number</th>
<th>Qty</th>
<th>Part Description</th>
<th>Mfr. Code</th>
<th>Mfr. Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>C101</td>
<td>0160-5945</td>
<td>11</td>
<td>CAP-FX 0.01 uF 50 V</td>
<td>04222</td>
<td>0805C103KAT A</td>
</tr>
<tr>
<td>C102</td>
<td>0160-5955</td>
<td>1</td>
<td>CAP-FX 68 pF 50 V</td>
<td>04222</td>
<td>08051A600JATRA</td>
</tr>
<tr>
<td>C103</td>
<td>0160-5945</td>
<td>1</td>
<td>CAP-FX 0.01 uF 50 V</td>
<td>04222</td>
<td>0805C103KAT A</td>
</tr>
<tr>
<td>C104-C109</td>
<td>0160-6497</td>
<td>21</td>
<td>CAP-FX 0.1 uF 25 V</td>
<td>04222</td>
<td>12065C104KAT A</td>
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<tr>
<td>C110</td>
<td>0160-5967</td>
<td>1</td>
<td>CAP-FX 100 pF 5%</td>
<td>04222</td>
<td>08051A101JAT A</td>
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<td>C111-C120</td>
<td>0160-6497</td>
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<td>CAP-FX 0.1 uF 25 V</td>
<td>04222</td>
<td>12065C104KAT A</td>
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<tr>
<td>C121</td>
<td>0180-3975</td>
<td>1</td>
<td>CAP-FX 2.2 uF 20 V TA</td>
<td>04222</td>
<td>TA8225M020</td>
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<td>C122</td>
<td>0160-5945</td>
<td>1</td>
<td>CAP-FX 0.01 uF 50 V</td>
<td>04222</td>
<td>0805C103KAT A</td>
</tr>
<tr>
<td>C123-C127</td>
<td>0160-6497</td>
<td>1</td>
<td>CAP-FX 0.1 uF 25 V</td>
<td>04222</td>
<td>12065C104KAT A</td>
</tr>
<tr>
<td>C128-C135</td>
<td>0160-5945</td>
<td>1</td>
<td>CAP-FX 0.01 uF 50 V</td>
<td>04222</td>
<td>0805C103KAT A</td>
</tr>
<tr>
<td>CBL1</td>
<td>33120-61603</td>
<td>1</td>
<td>CABLE-COAX 50 OHM 125MM W/FERRITE</td>
<td>28480</td>
<td>33120-61603</td>
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<td>CBL2</td>
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## Manufacturer’s List

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<tr>
<th>Mfr Code</th>
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</table>
33120-66503 – Component Locator Diagram
If you have questions relating to the operation of the function generator, call 1-800-452-4844 in the United States, or contact your nearest Agilent Technologies Sales Office.
S
safety information, *inside front cover*
schematic diagram, 35
SCPI language
command format, 17
command summary, 17
programming overview, 20 - 22
status registers, 23 - 25
syntax conventions, 17
single trigger, 13
 specifications, 28
STAT:PRES command, 26
STAT:QUES:COND? command, 26
STAT:QUES:ENAB command, 26
STAT:QUES:EVEN? command, 26
status registers (questionable data)
bit definitions, 25
clearing bits, 25
commands, 26
register diagram, 24
syntax conventions, 17

T
technical specifications, 28
timebase accuracy, 28
triggered burst mode (phase lock), 10, 22
triggering
 fanout, 28
 from Ext Trig terminal, 13, 22
 pulse width, 28
 single trigger, 13
 troubleshooting (error messages), 26

U
unlock error
 enabling/disabling, 14, 19
 status register reporting, 23

W
warranty information, *inside front cover*

Z
zero phase reference, 9, 18
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CAUTION
A CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

Earth ground symbol.

Chassis ground symbol.

WARNING
Only qualified, service-trained personnel who are aware of the hazards involved should remove the cover from the instrument.

WARNING
For continued protection against fire, replace the line fuse only with a fuse of the specified type and rating.