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# User's Guide

Part Number 33120-90020  
August 1994

For Safety information and Warranties, see the page behind  
the Index.

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HP 33120A/Option 001  
Phase-Lock Assembly

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Quick Start

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# Quick Start

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

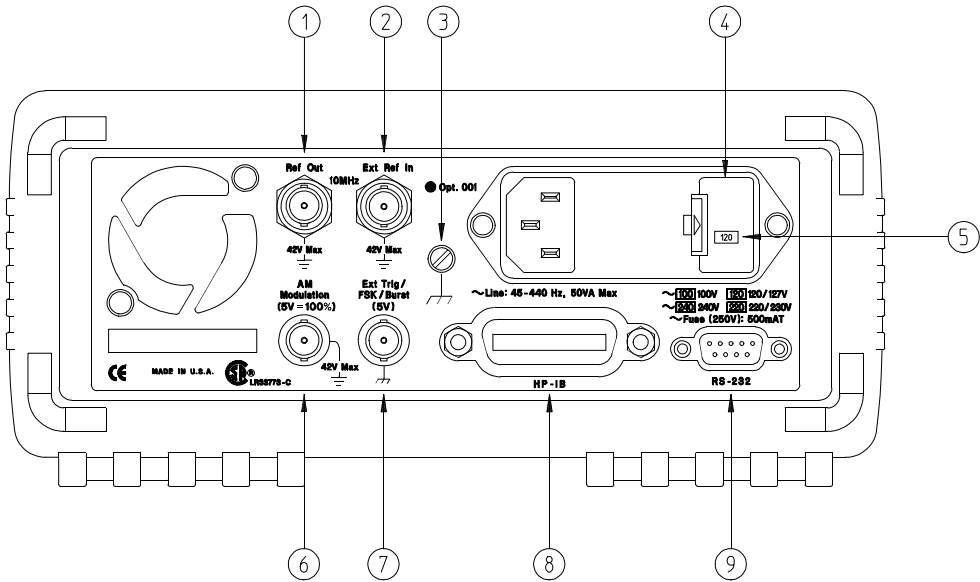
The Phase-Lock assembly (Option 001) adds the following capabilities to the HP 33120A Function Generator/Arbitrary Waveform Generator:

- External clock input and output connectors on the rear panel. These connectors allow synchronization between multiple HP 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 HP 33120As. Option 001 allows the HP 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 HP 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 Hewlett-Packard 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 HP 33120As or to an external 10 MHz clock signal.

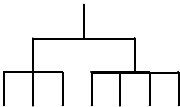


- |   |  |
|---|--|
| 1 Internal 10 MHz reference output terminal | 6 AM modulation input terminal                             |
| 2 External 10 MHz reference input terminal  | 7 External Trigger / FSK / Burst modulation input terminal |
| 3 Chassis ground                            | 8 HP-IB (IEEE-488) interface connector                     |
| 4 Power-line fuse-holder assembly           | 9 RS-232 interface connector                               |
| 5 Power-line voltage setting                |  |

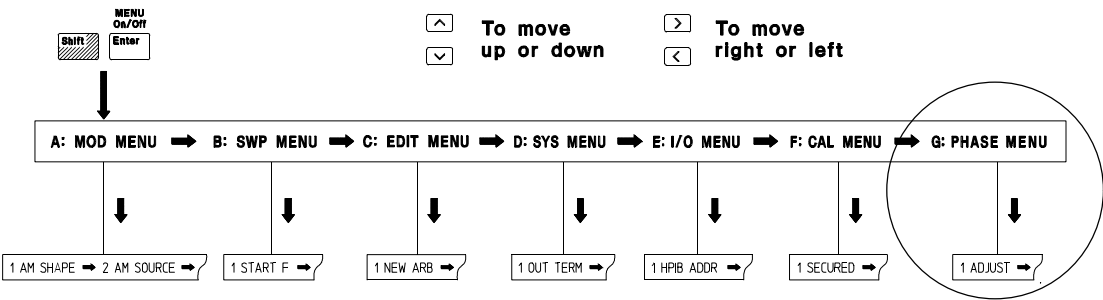
# The Front-Panel Menu at a Glance

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 enter command press:



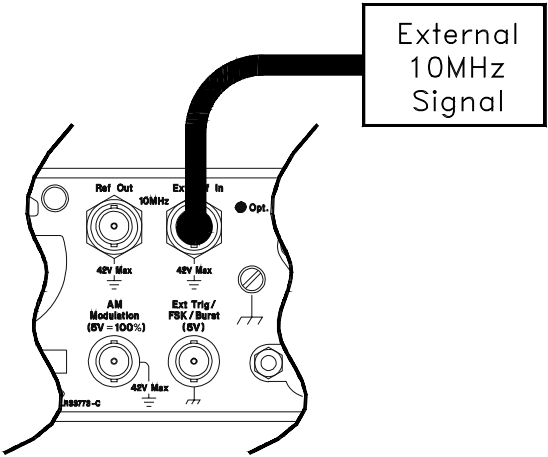
## G: PHASE MENU

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 <i>Ext Trig</i> 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.



Freq

### 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.

10.000,000 MHz

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

Shift

Menu On/Off

**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

Enter

**6 Turn off the menu.**

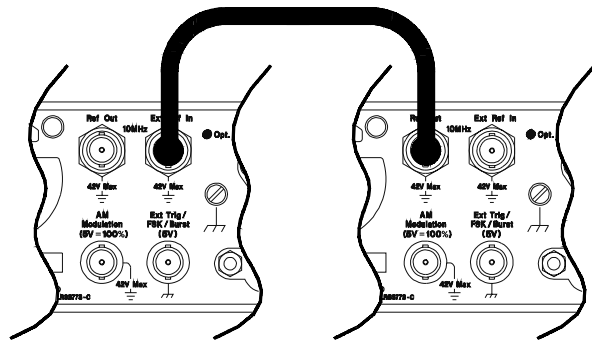
The function generator beeps and displays a message. You are then exited from the menu.

*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.



Freq

### 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.*

Shift

Menu On/Off

**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

Enter

**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”.

Shift

Menu On/Off

### 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

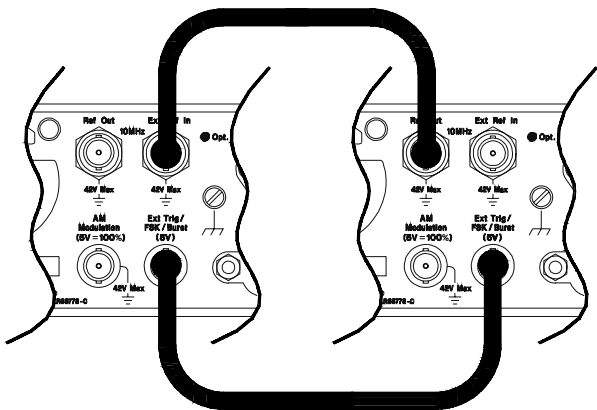
Enter

### 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.



Freq

### 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

Shift

Burst

**2 Enable the burst mode on both instruments.**

Notice that the **Burst** annunciator turns on.

Shift

&lt;

Recall Menu

**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: BURST CNT

v

**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”.

INFINITE

Enter

**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.

ENTERED

*Next, you will set up the starting phase of the burst as shown on the next page.*

Shift  
Menu On/Off

**6 Go to the BURST PHAS command in the MOD MENU.**

6 : BURST PHAS

▼

**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.

^000.000 DEG

Enter

**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.

ENTERED

*Next, you will configure one of the function generators to source an external trigger from its rear-panel Ext Trig terminal.*

Shift  
Menu On/Off

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

3 : TRIG OUT

▼

**10 Move down a level and enable the external trigger.**

ENABLE

Enter

**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.

Single

ENTERED

**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.

Single

**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.

Shift

Menu On/Off

**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

Enter

**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.*



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Remote Interface  
Operation

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# 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 HP 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 27*

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## 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 HP 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:ADJust {<radians>|MINimum|MAXimum}  
PHASe:ADJust?
```

```
PHASe:REference
```

```
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 HP 33120A *User's Guide* for details on the complete set of commands for the function generator.

**PHAS:ADJust** {<*radians*>|**MINimum**|**MAXimum**}

Adjust the phase offset of the output waveform in radians. Select from  $-2\pi$  radians to  $+2\pi$  radians. *The default is 0 radians.* MIN =  $-2\pi$  radians. MAX =  $+2\pi$  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 HP 33120A User's Guide for more information on burst phase.*

**PHAS:ADJust?**

Query the phase offset setting. Returns a value in radians.

**PHAS:REference**

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-Lock Commands****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 OUTPUT:TRIGGER:STATE 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.

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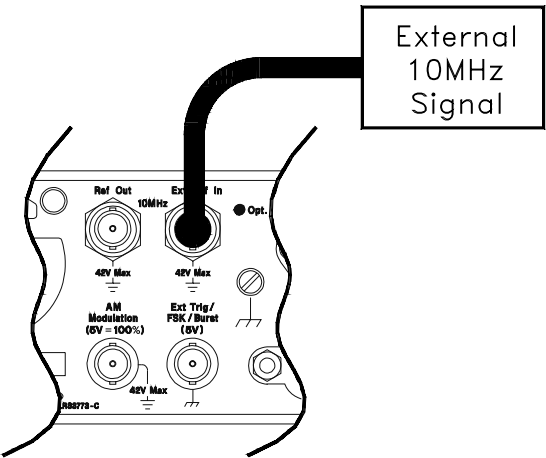
## Simplified Programming Overview

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 HP 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:

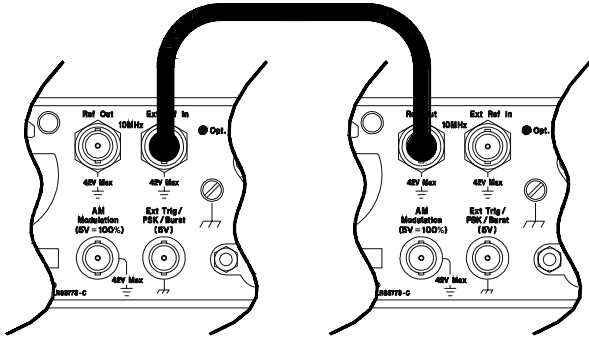
"APPL:SIN 10E+6, 5.0"	<i>Select sine function at 10 MHz</i>
"PHAS:ADJ -90 DEG"	<i>Set phase offset to -90 degrees</i>
" PHAS:REF "	<i>Set phase reference to zero</i>



**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*



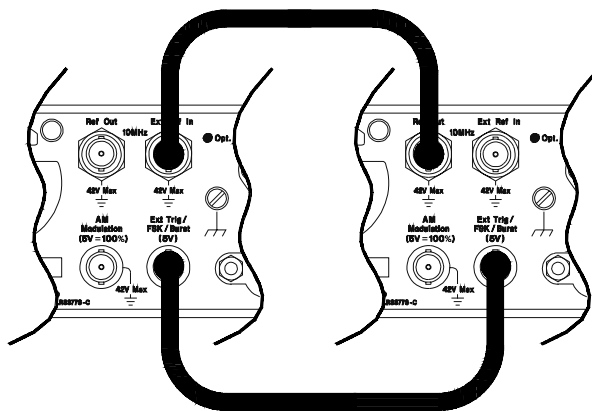
### To Phase Lock Using the Triggered Burst Mode

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"	<i>Set both to the same frequency</i>
"BM:NCYC INF"	<i>Set burst count to "INFINITY"</i>
"BM:STAT ON"	<i>Enable the burst mode</i>
"TRIG:SOUR EXT"	<i>Set trigger source to external</i>

Send the following command statement to only one function generator:

"OUTP:TRIG:IMM"	<i>Issue external trigger to all instruments</i>
-----------------	--





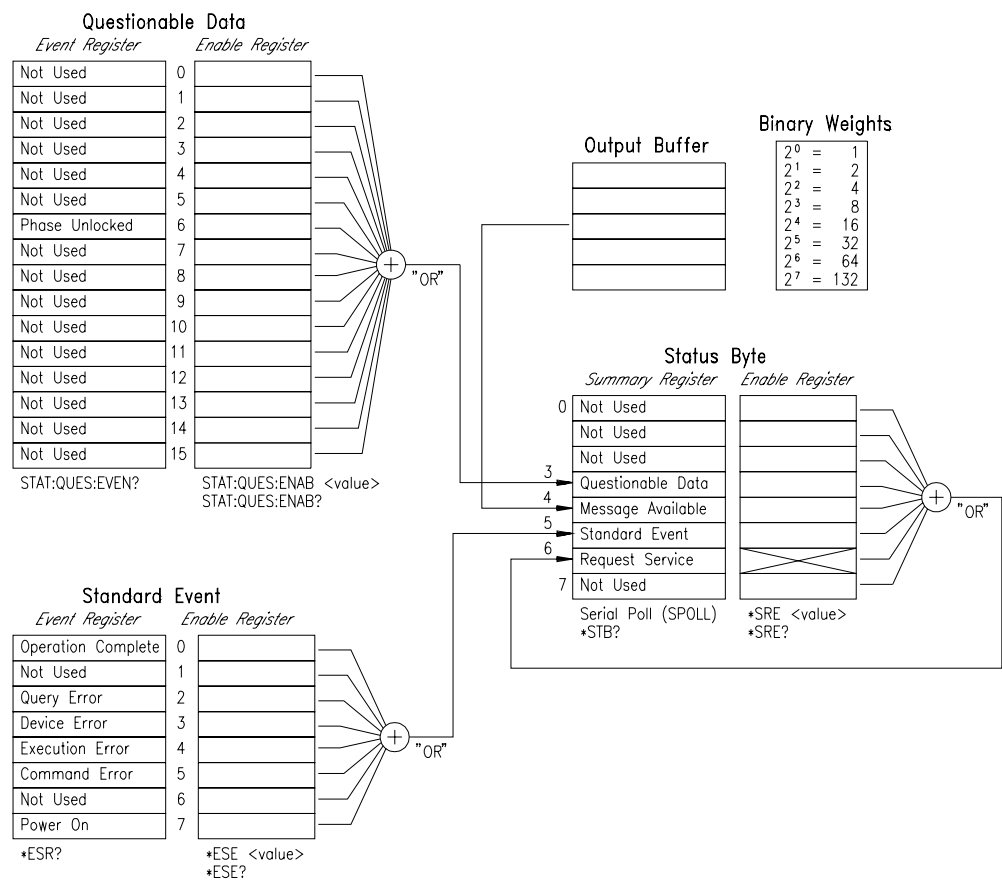
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## The SCPI Status Registers

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 HP 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 HP 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.*

SCPI Status System



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 `STATUS:QUESTionable:ENABle` command.

Bit Definitions – Questionable Data Register

Bit	Decimal Value	Definition
0 Not Used	—	Always set to 0.
1 Not Used	—	Always set to 0.
2 Not Used	—	Always set to 0.
3 Not Used	—	Always set to 0.
4 Not Used	—	Always set to 0.
5 Not Used	—	Always set to 0.
6 Phase Unlocked	64	The function generator has lost phase lock.
7 Not Used	—	Always set to 0.
8 Not Used	—	Always set to 0.
9 Not Used	—	Always set to 0.
10 Not Used	—	Always set to 0.
11 Not Used	—	Always set to 0.
12 Not Used	—	Always set to 0.
13 Not Used	—	Always set to 0.
14 Not Used	—	Always set to 0.
15 Not Used	—	Always set to 0.

The Questionable Data event register is cleared when:

- You execute a `*CLS` (clear status) command.
- You query the event register using `STATUS:QUESTionable:EVENT?`.

The Questionable Data enable register is cleared when:

- You turn on the power (`*PSC` does not apply).
- You execute the `STATUS:PRESet` command.
- You execute the `STATUS:QUESTionable:ENABle 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 HP 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 than 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:  $\pm 2$  ppm 0°C - 50°C  
Aging: < 1 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  $\pm 50$  Hz  
Level: -10 dBm to +15 dBm, +25 dBm  
or 10 Vpp absolute maximum input  
Impedance:  $50\Omega \pm 2\%$ , 42 Vpk isolation from earth  
Locktime: < 2 seconds

**Rear-Panel Output (*Ref Out* terminal)**

Frequency: 10 MHz  
Level: > 1 Vpp square wave into  $50\Omega$

**Phase Offset**

Range: +360 to -360 degrees  
Resolution:  $0.001^\circ$   
Accuracy: 25 ns

**Trigger**

Level: 5V zero-going pulse  
Pulse Width: > 2  $\mu$ s  
Fanout: Four (4) HP 33120As

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## Replaceable Parts and Schematics



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# Replaceable Parts and Schematics

This chapter contains information to help you order replacement parts for your HP 33120A Function Generator/Option 001. Parts are listed in alphanumeric order according to their schematic reference designators. The parts lists include a brief description of the part with applicable HP part number and manufacturer part number.

See the HP 33120A Service Guide for complete details on the servicing and warranty policies of the HP 33120A.

## **To Order Replaceable Parts**

You can order replaceable parts from Hewlett-Packard using the HP part number or directly from the manufacturer using the manufacturer's part number. To order replaceable parts from HP, do the following:

1. Contact your nearest HP Sales Office or HP Service Center.
2. Identify the parts by the HP part number shown in the replaceable parts list.
3. Provide the instrument model number and serial number.

## **Backdating and Parts Changes**

Always refer to chapter 8, "Backdating" in the HP 33120A *Service Guide* before attempting repair or before ordering replacement parts. Parts changes are documented in the backdating chapter.

Chapter 4 Replaceable Parts and Schematics  
**33120-66503 – Phase-Lock PC Assembly**

■ **33120-66503 – Phase-Lock PC Assembly**

Reference Designator	HP Part Number	Qty	Part Description	Mfr. Code	Mfr. Part Number
C101	0160-5945	11	CAP-FXD 0.01 uF 50 V	04222	08055C103KAT A
C102	0160-5955	1	CAP-FXD 68 pF 50 V	04222	08051A680JATRA
C103	0160-5945	1	CAP-FXD 0.01 uF 50 V	04222	08055C103KAT A
C104-C109	0160-6497	21	CAP-FXD 0.1 uF 25 V	04222	12065C104KAT A
C110	0160-5967	1	CAP-FXD 100 pF 5%	04222	08051A101JAT A
C111-C120	0160-6497	1	CAP-FXD 0.1 uF 25 V	04222	12065C104KAT A
C121	0180-3975	1	CAP-FXD 2.2 uF 20 V TA	04222	TAJB225M020
C122	0160-5945	1	CAP-FXD 0.01uF 50 V	04222	08055C103KAT A
C123-C127	0160-6497	1	CAP-FXD 0.1 uF 25 V	04222	12065C104KAT A
C128-C135	0160-5945	1	CAP-FXD 0.01uF 50 V	04222	08055C103KAT A
CR101	1906-0291	1	DIODE- 70V 100MA	04713	MBAV9902037
CR102	1902-1565	2	DIODE-ZNR 4.7V 5% TO-236 (SOT-23)	25403	BZX84-C4V7
CR103	1990-1523	2	LED-LAMP LUM-INT=2MCD IF=30MA-MAX	28480	HSMS-T400
CR104	1906-0291	1	DIODE- 70V 100MA	04713	MBAV99
CR105	1990-1521	1	LED-LAMP LUM-INT=2MCD IF=20MA-MAX	28480	HSMT-T400
CR106	1902-1565	1	DIODE-ZNR 4.7V 5% TO-236 (SOT-23)	25403	BZX84-C4V7
CR107	1990-1523	1	LED-LAMP LUM-INT=2MCD IF=30MA-MAX	28480	HSMS-T400
FB101	9170-1506	1	CORE-SHIELDING BEAD	06352	HF50ACB201209
HDW1-HDW2	2190-0699	2	WASHER-LK INTL T 1/2 IN .5-IN-ID	00779	1-329632-2
HDW3-HDW4	2940-0256	2	NUT-HEX-DBL-CHAM 1/2-28-THD .095-IN-THK	00779	1-329631-2
J1-J2	1250-1884	2	CONNECTOR-RF BNC RCPT PC-W-STDFS	00779	227161-6
MNL1	33120-90020	1	ENGLISH MANUAL (USER'S AND SERVICE)	28480	33120-90020
P2	1250-0257	1	CONNECTOR-RF SMB PLUG PC-W-STDFS	00779	413990-3
Q101	1853-0724	1	TRANSISTOR PNP SI TO-261AA FT=200MHz	04713	PZT2907A
R101-R102	0699-2103	7	RESISTOR 49.9 +-1% .125W TKF TC=0+-100	19701	9C12063AFKR
R103	0699-1394	2	RESISTOR 14.7K +-1% .125W TKF TC=0+-100	19701	9C12063AFKR
R104	0699-1378	1	RESISTOR 2.61K +-1% .125W TKF TC=0+-100	19701	9C12063AFKR
R105	0699-1401	1	RESISTOR 28.7K +-1% .125W TKF TC=0+-100	19701	9C12063AFKR
R106	0699-1394	1	RESISTOR 14.7K +-1% .125W TKF TC=0+-100	19701	9C12063AFKR
R107-R108	0699-1330	4	RESISTOR 100K +-1% .125W TKF TC=0+-100	19701	9C12063AFKR
R109	0699-1384	3	RESISTOR 4.64K +-1% .125W TKF TC=0+-100	19701	9C12063AFKR
R110	0699-1435	1	RESISTOR 681 +-1% .125W TKF TC=0+-100	19701	9C12063AFKR
R111	0699-1330	1	RESISTOR 100K +-1% .125W TKF TC=0+-100	19701	9C12063AFKR
R112	0699-1544	1	RESISTOR 78.7K +-1% .125W TKF TC=0+-100	19701	9C12063AFKR

Chapter 4 Replaceable Parts and Schematics  
**33120-66503 – Phase-Lock PC Assembly**

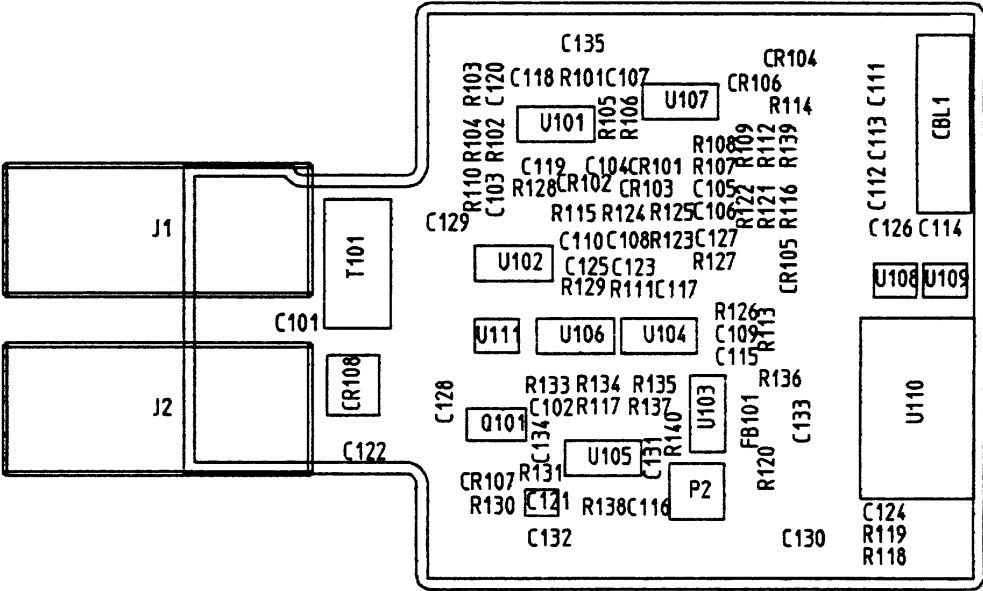
Reference Designator	HP Part Number	Qty	Part Description	Mfr. Code	Mfr. Part Number
R113	0699-1392	2	RESISTOR 11K +-1% .125W TKF TC=0+-100	19701	9C12063AFKR
R114	0699-1372	1	RESISTOR 1.47K +-1% .125W TKF TC=0+-100	19701	9C12063AFKR
R115	0699-1384		RESISTOR 4.64K +-1% .125W TKF TC=0+-100	19701	9C12063AFKR
R116	0699-1414	1	RESISTOR 90.9K 1% 1206 .125W TC=100 200V	19701	9C12063AFKR
R117	0699-2103		RESISTOR 49.9 +-1% .125W TKF TC=0+-100	19701	9C12063AFKR
R118	0699-1320	1	RESISTOR 19.6K +-1% .125W TKF TC=0+-100	19701	9C12063AFKR
R119	0699-3218	2	RESISTOR 33.2K +-1% .125W TKF TC=0+-100	91637	CRCW1206-33R2KF
R120	0699-3287	1	RESISTOR 49.9K +-1% .125W TKF TC=0+-100	19701	9C12063A4992FK
R121	0699-1456	1	RESISTOR 562K +-1% .125W TKF TC=0+-100	19701	9C12063AFKR
R122	0699-1413	1	RESISTOR 82.5K +-1% .125W TKF TC=0+-100	19701	9C12063AFKR
R123	0699-1330		RESISTOR 100K +-1% .125W TKF TC=0+-100	19701	9C12063AFKR
R124-R126	0699-1403	3	RESISTOR 31.6K +-1% .125W TKF TC=0+-100	91637	CRCW1206F
R127	0699-1392		RESISTOR 11K +-1% .125W TKF TC=0+-100	19701	9C12063AFKR
R128	0699-3218		RESISTOR 33.2K +-1% .125W TKF TC=0+-100	91637	CRCW1206-33R2KF
R129	0699-1384		RESISTOR 4.64K +-1% .125W TKF TC=0+-100	19701	9C12063AFKR
R130	0699-1423	1	RESISTOR 215 +-1% .125W TKF TC=0+-100	80031	9C12063AFKR
R131	0699-1344	1	RESISTOR 10 +-1% .125W TKF TC=0+-100	19701	9C12063AFKR
R133-R135	0699-2103		RESISTOR 49.9 +-1% .125W TKF TC=0+-100	19701	9C12063AFKR
R136-R138	0699-1415	4	RESISTOR 100 +-1% .125W TKF TC=0+-100	80031	FKR04935
R139	0699-2103		RESISTOR 49.9 +-1% .125W TKF TC=0+-100	19701	9C12063AFKR
R140	0699-1415		RESISTOR 100 +-1% .125W TKF TC=0+-100	80031	FKR04935
T101	9100-4902	1	TRANSFORMR-RF FREQ. RNGE: 15-400 MHz	15542	T1-1-KK81-TR
U101	1826-2387	1	IC COMPARATOR HS 14 PIN PLSTC-SOIC	27014	LM361M
U102	1821-0055	1	IC SCHMITT-TRG CMOS/ACT NAND	04713	MC74ACT132D
U103	1820-4687	1	IC GATE TTL/F NOR QUAD 2-INP	27014	74F02SC
U104	1820-8825	1	IC GATE CMOS/ACT EXCL-OR QUAD	04713	MC74ACT86D
U105	1820-5040	1	IC FF TTL/F D-TYPE POS-EDGE-TRIG	27014	74F74SC
U106	1820-5788	1	IC SW CMOS/74HC ANALOG QUAD	04713	MC74HC4066D
U107	1826-1622	1	IC OP AMP LOW-BIAS-H-IMPD QUAD 14 PIN	04713	TL074CD
U108	1826-2202	1	IC V RGLTR-FXD-POS 11.5/12.5V 8-P-SOIC	04713	MC78L12ACD
U109	1826-2201	1	IC V RGLTR-FXD-NEG -11.5/-12.5V 8-P-SOIC	04713	MC79L12ACD
U110	1813-1030	1	CLK-OSC-XTAL PRC 40.000-MHZ 0.0001%	09793	HTV1611
U111	1826-1838	1	IC V RGLTR-V-REF-FXD 4.95/5.05V 8-P-SOIC	10858	LT1021DCS8-5

■ **Manufacturer's List**

Mfr Code	Manufacturer's Name	Manufacturer's Address	Zip Code
00779	Amp Inc	Harrisburg, PA, U.S.A.	17111
04222	AVX Corp	Great Neck, NY, U.S.A.	11021
04713	Motorola Inc	Roselle, IL, U.S.A.	60195
06352	TDK Corporation of America	Skokie, IL, U.S.A.	60076
09793	Connor-Winfield Corp	West Chicago, IL, U.S.A.	60606
10858	Linear Technology Corporation	Milpitas, CA, U.S.A.	95035
15542	Mini-Circuits Lab	Brooklyn, NY, U.S.A.	11235
19701	North America Philips Corp	New York, NY, U.S.A.	10017
25403	NV Philips Elcoma	Eindhoven, Netherlands	02876
27014	National Semiconductor Corp	Santa Clara, CA, U.S.A.	95052
28480	HP Div 01 San Jose Components	San Jose, CA, U.S.A.	95131
80031	Mepco Electra Corp	Morristown, NJ, U.S.A.	07960
91637	Vishay Electronic Components	Columbus, NE, U.S.A.	68601



■ Component Locator Diagram



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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 Hewlett-Packard Sales Office.

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## Printing History

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Calls attention to a procedure, practice, or condition, that could possibly cause bodily injury or death.

### Caution

Calls attention to a procedure, practice, or condition that could possibly cause damage to equipment or permanent loss of data.



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.