User's and Service Guide

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For Safety information, Warranties, and Regulatory information, see the last page in this manual.

Agilent 33120A
Option 001 Phase-Lock Assembly

Contents

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.

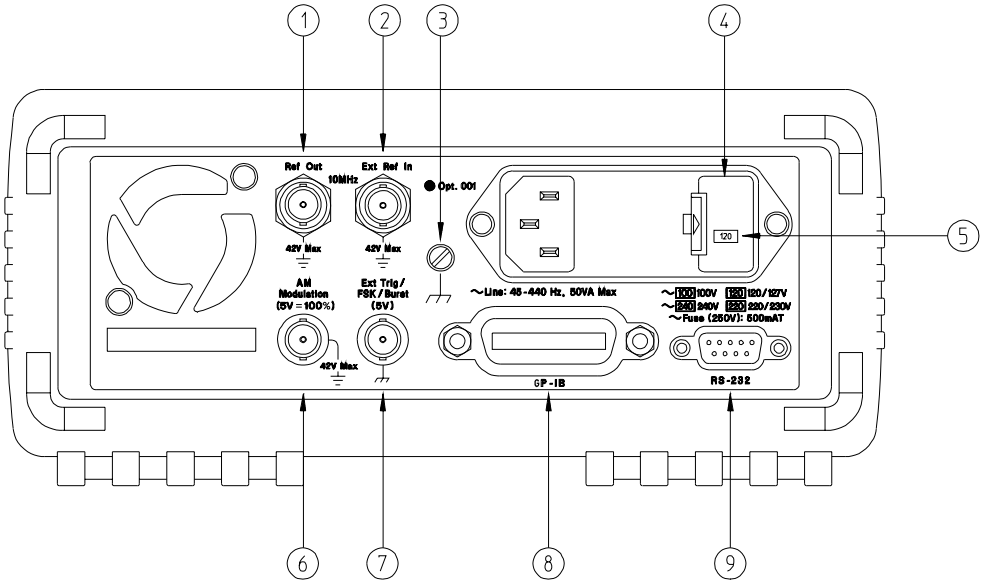
The Phase-Lock assembly (*Option 001*) adds the following capabilities to the 33120A Function/Arbitrary Waveform Generator:

- 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.

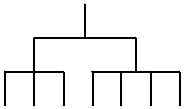


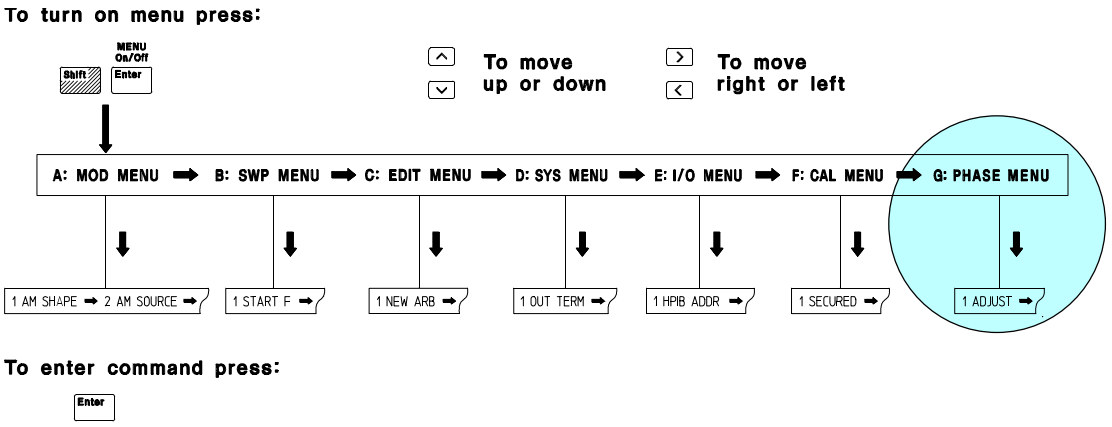
1 Internal 10 MHz reference output terminal
2 External 10 MHz reference input terminal
3 Chassis ground
4 Power-line fuse-holder assembly
5 Power-line voltage setting
6 AM modulation input terminal
7 External Trigger / FSK / Burst modulation input terminal
8 GPIB (IEEE-488) interface connector
9 RS-232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





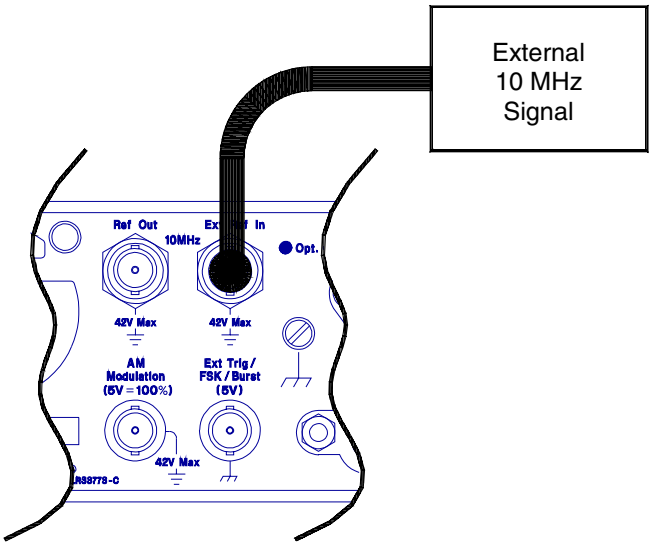
G: PHASE MENU

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.



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

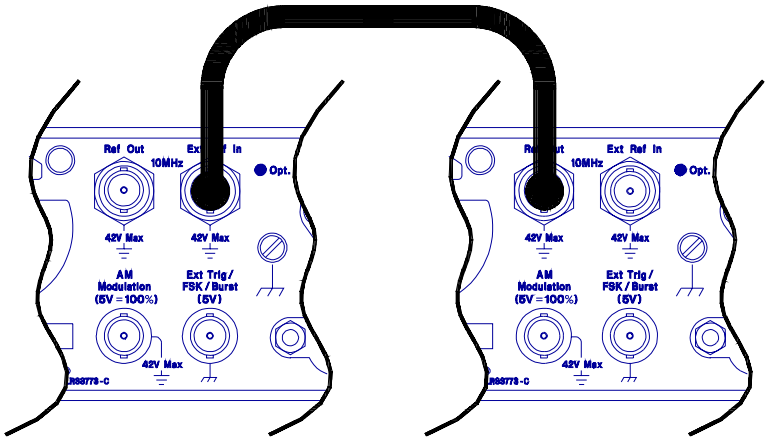
6 Turn off the menu.

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
```

v

4 Move down a level to the ADJUST command.

```
1: ADJUST
```

v

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
```

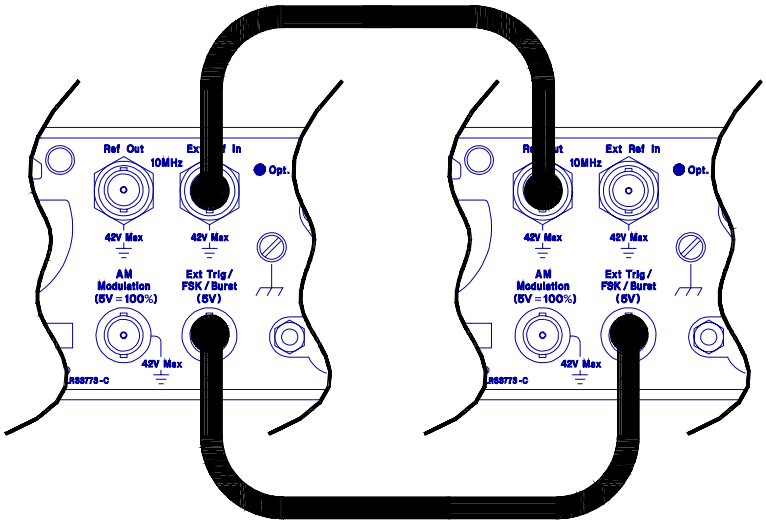
Enter

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

< 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
```

∨

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.

∨

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.

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.

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.

∨

10 Move down a level and enable the external trigger.

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.

```
ENTERED
```

Single

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
```

v <

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

```
4:UNLOCK ERR
```

v

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.

2

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

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

PHASe:ADJust {<*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.*

PHASe:ADJust?
Query the phase offset setting. Returns a value in radians.

PHASe: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: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.

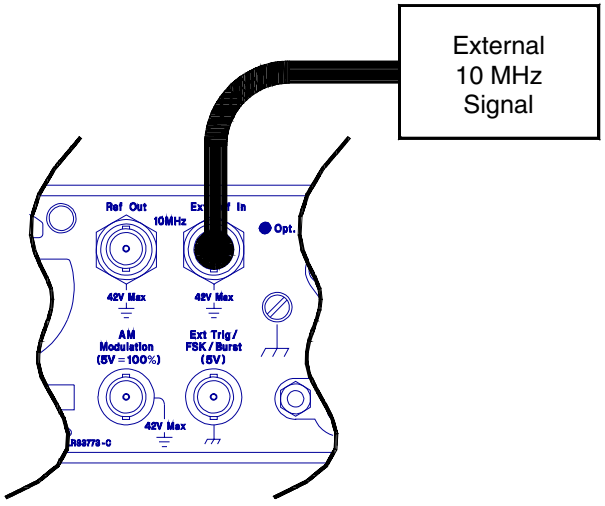
To Phase Lock to an External Clock Signal

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"
```
Select sine function at 10 MHz

```
"PHAS:ADJ -90 DEG"
```
Set phase offset to -90 degrees

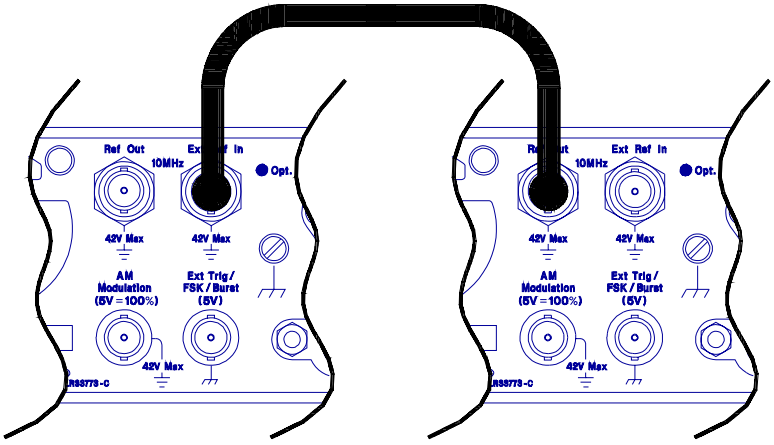
```
"PHAS:REF"
```
Set phase reference to zero



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*



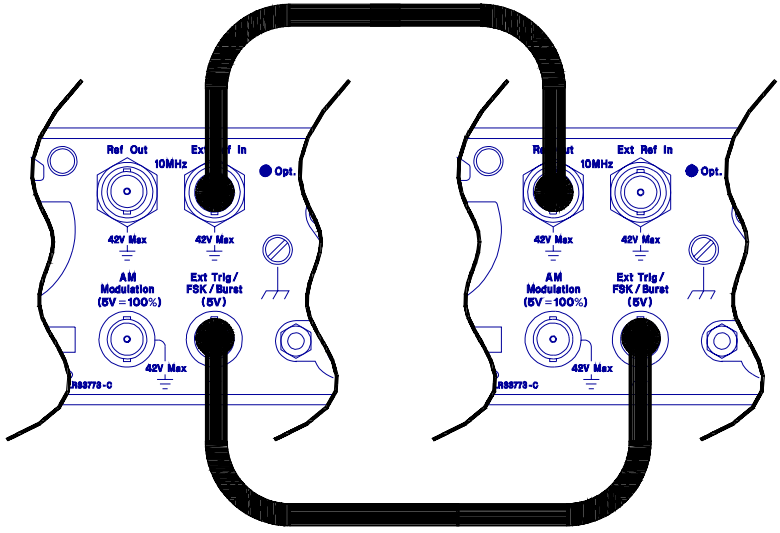
To Phase Lock Using the Triggered Burst Mode

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*

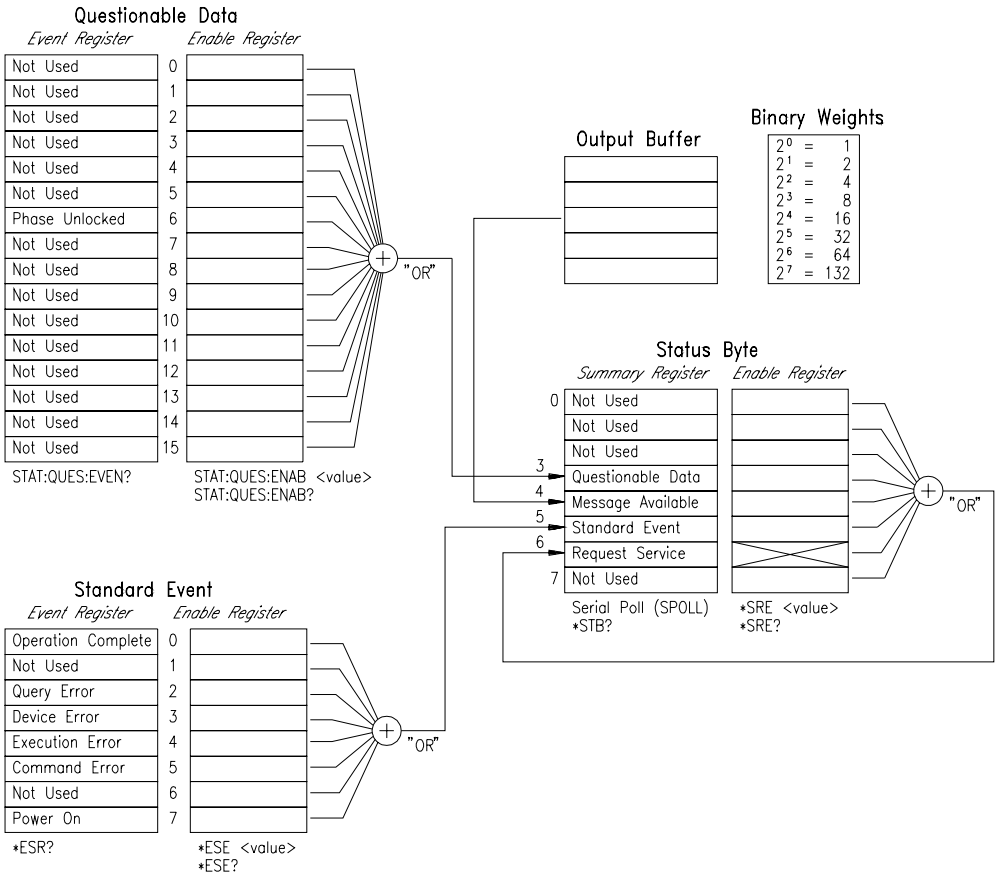


The SCPI Status Registers

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.*

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 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

4

Replaceable Parts and Schematics

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

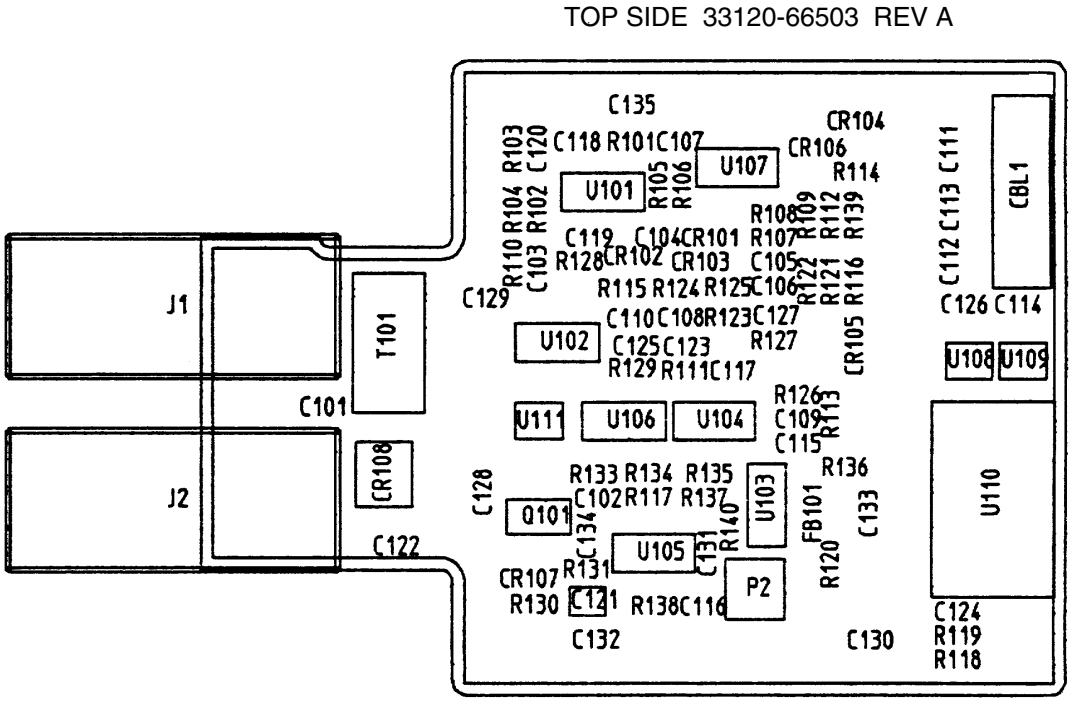
Reference Designator	Agilent Part Number	Qty	Part Description	Mfr. Code	Mfr. Part Number
C101	0160-5945	11	CAP-FXD 0.01 uF 50 V	04222	08055C103KAT A
C102	0160-5955	1	CAP-FXD 68 pF 50 V	04222	08051A680JATRA
C103	0160-5945		CAP-FXD 0.01 uF 50 V	04222	08055C103KAT A
C104-C109	0160-6497	21	CAP-FXD 0.1 uF 25 V	04222	12065C104KAT A
C110	0160-5967	1	CAP-FXD 100 pF 5%	04222	08051A101JAT A
C111-C120	0160-6497		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		CAP-FXD 0.01uF 50 V	04222	08055C103KAT A
C123-C127	0160-6497		CAP-FXD 0.1 uF 25 V	04222	12065C104KAT A
C128-C135	0160-5945		CAP-FXD 0.01uF 50 V	04222	08055C103KAT A
CBL1	33120-61603	1	CABLE-COAX 50 0HM 125MM W/FERRITE	28480	33120-61603
CBL2	33120-61604	1	CABLE-RIBBON PHASE LK OPT	28480	33120-61604
CR101	1906-0291	2	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		DIODE- 70V 100MA	04713	MBAV99
CR105	1990-1521	1	LED-LAMP LUM-INT=2MCD IF=20MA-MAX	28480	HSMY-T400
CR106	1902-1565		DIODE-ZNR 4.7V 5% TO-236 (SOT-23)	25403	BZX84-C4V7
CR107	1990-1523		LED-LAMP LUM-INT=2MCD IF=30MA-MAX	28480	HSMS-T400
CR108	1901-1346	1	DIODE-V-SUPPR DO-214AB	91637	SMCJ43CA
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
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		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		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

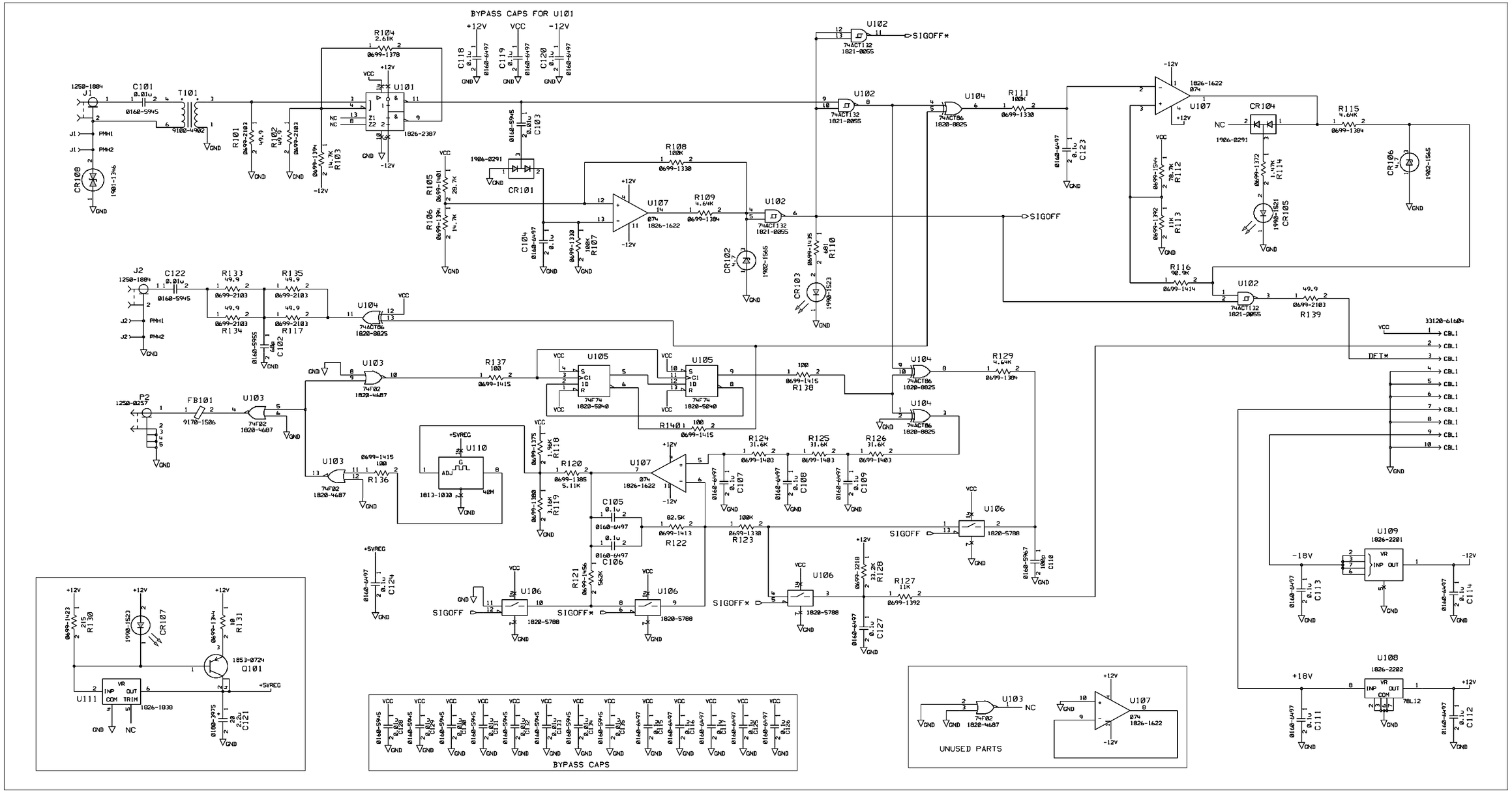
Reference Designator	Agilent Part Number	Qty	Part Description	Mfr. Code	Mfr. Part Number
R113	0699-1392	2	RESISTOR 11K +-1% .125W TKF TC=0+-100	19701	9C12063AFKR
R114	0699-1372	1	RESISTOR 1.47K +-1% .125W TKF TC=0+-100	19701	9C12063AFKR
R115	0699-1384		RESISTOR 4.64K +-1% .125W TKF TC=0+-100	19701	9C12063AFKR
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	0699-1375	1	RESISTOR 1.96K +-1% .125W TKF TC=0+-100	91637	CRCW12061961F
R119	0699-1380	1	RESISTOR 3.16K +-1% .125W TKF TC=0+-100	91637	CRCW12063161F
R120	0699-1385	1	RESISTOR 5.11K +-1% .125W TKF TC=0+-100	91637	CRCW12065111F
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	1	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	Agilent Technologies, Inc.	Palo Alto, CA, U.S.A.	94303
80031	Mepco Electra Corp	Morristown, NJ, U.S.A.	07960
91637	Vishay Electronic Components	Columbus, NE, U.S.A.	68601

■ 33120-66503 – Component Locator Diagram




BYPASS CAPS FOR U101
+12V
VCC
-12V
C118 0.1u 0160-6497
C119 0.1u 0160-6497
C120 0.1u 0160-6497
GND
J1 1250-1884
C101 0.01u 0160-5945
T101 9100-4902
PM#1
PM#2
CR108 1901-1346
R101 49.9 0699-2103
R102 49.9 0699-2103
R104 2.61K 0699-1378
R103 14.7K 0699-1394
U101 1826-2387
NC
Z1
Z2
C103 2.01u 0160-5945
CR101 1906-0291
R105 28.7K 0699-1401
R106 14.7K 0699-1394
R108 100K 0699-1330
R107 100K 0699-1330
C104 0.1u 0160-6497
U107 074 1826-1622
R109 4.64K 0699-1384
U102 74ACT132 1821-0055
SIGOFF
CR102 1902-1565
CR103 1990-1523
R110 681 0699-1435
U104 74ACT86 1820-0825
R111 100K 0699-1330
C123 0.1u 0160-6497
U107 1826-1622 074
CR104 1906-0291
R115 4.64K 0699-1384
R112 28.7K 0699-1394
R113 1K 0699-1392
R114 1.47K 0699-1372
CR105 1990-1521
CR106 1902-1565
R116 90.9K 0699-1414
U102 74ACT132 1821-0055
R139 49.9 0699-2103
J2 1250-1884
C122 0.01u 0160-5945
R133 49.9 0699-2103
R135 49.9 0699-2103
R134 49.9 0699-2103
R117 49.9 0699-2103
C102 68p 0160-5955
U104 74ACT86 1820-0825
U103 74F02 1820-4687
R137 100 0699-1415
U105 74F74 1820-5040
R138 100 0699-1415
R140 100 0699-1415
R129 4.64K 0699-1384
U104 74ACT86 1820-0825
P2 1250-0257
FB101 9170-1506
U103 74F02 1820-4687
U110 +5VREG 1813-1030 40M
R118 1.96K 0699-1375
R119 1.96K 0699-1375
R120 5.11K 0699-1385
R124 31.6K 0699-1403
R125 31.6K 0699-1403
R126 31.6K 0699-1403
C107 0.1u 0160-6497
C108 0.1u 0160-6497
C109 0.1u 0160-6497
U106 1820-5788
SIGOFF
C110 100p 0160-5967
C105 0.1u 0160-6497
C106 0.1u 0160-6497
R122 82.5K 0699-1413
R123 100K 0699-1330
R121 562K 0699-1456
R128 33.2K 0699-1218
R127 11K 0699-1392
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C124 0.1u 0160-6497
33120-61604
CBL1
DET*
U109 1826-2201 VR INP OUT
-18V
-12V
C113 0.1u 0160-6497
C114 2.2u 0160-3975
U108 1826-2202 VR INP OUT COM 78L12
+18V
+12V
C111 0.1u 0160-6497
C112 2.2u 0160-3975
R130 215 0699-1423
CR107 1990-1523
R131 10 0699-1344
Q101 1853-0724
U111 VR INP OUT COM TRIM 1826-1838
C121 2.2u 0160-3975
BYPASS CAPS
UNUSED PARTS
U103 74F02 1820-4687 NC
U107 074 1826-1622

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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 Agilent Technologies Sales Office.*

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A WARNING 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 personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

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.