Agilent 33220A
Function/Arbitrary Waveform Generator
Quick Reference Guide

- Square brackets (**[ ]**) indicate optional keywords or parameters.
- Braces (**{ }**) enclose parameters within a command. Default parameters are shown in **bold**.
- Triangle brackets (**< >**) enclose parameters for which you must substitute a value.
- A vertical bar (**|**) separates multiple choices.

The APPLy Commands

See page 163 in *User's Guide* (English)

```
APPLy
  :SINusoid [<frequency> [,<amplitude> [,<offset>] ]]
  :SQUare [<frequency> [,<amplitude> [,<offset>] ]]
  :RAMP [<frequency> [,<amplitude> [,<offset>] ]]
  :PULSe [<frequency> [,<amplitude> [,<offset>] ]]
  :NOISe [<frequency|DEF>[1] [,<amplitude> [,<offset>] ]]
  :DC [<frequency|DEF>[1] [,<amplitude>|DEF>[1] [,<offset>] ]]
  :USER [<frequency> [,<amplitude> [,<offset>] ]]
APPLy?
```

[1] *This parameter has no effect for this command but you MUST specify a value or "DEFault".*

State Storage Commands

See page 238 in *User's Guide* (English)

```
*SAV {0|1|2|3|4}
*RCL {0|1|2|3|4}
MEMory:STATe
  :NAME {0|1|2|3|4} [,<name>]
  :NAME? {0|1|2|3|4}
  :DELete {0|1|2|3|4}
  :RECall:AUTO {OFF|ON}
  :RECall:AUTO?
  :VALid? {0|1|2|3|4}
MEMory:NSTates?
```

Output Configuration Commands

See page 172 in *User's Guide* (English)

```
FUNCtion {SINu|SQU|RAMP|PULSe|NOISe|DC|USER}
FUNCtion?

FREQuency {<frequency>|MINimum|MAXimum}
FREQuency? [MINimum|MAXimum]

VOLTage {<amplitude>|MINimum|MAXimum}
VOLTage? [MINimum|MAXimum]

VOLTage:OFFSet {<offset>|MINimum|MAXimum}
VOLTage:OFFSet? [MINimum|MAXimum]

VOLTage
  :HIGH {<voltage>|MINimum|MAXimum}
  :HIGH? [MINimum|MAXimum]
  :LOW {<voltage>|MINimum|MAXimum}
  :LOW? [MINimum|MAXimum]

VOLTage:RANGe:AUTO {OFF|ON|ONCE}
VOLTage:RANGe:AUTO?

VOLTage:UNIT {VPP|VRMS|DBM}
VOLTage:UNIT?

FUNCtion:SQUare:DCYCle {<percent>|MINimum|MAXimum}
FUNCtion:SQUare:DCYCle? [MINimum|MAXimum]

FUNCtion:RAMP:SYMMetry {<percent>|MINimum|MAXimum}
FUNCtion:RAMP:SYMMetry? [MINimum|MAXimum]

OUTPut {OFF|ON}
OUTPut?

OUTPut:LOAD {<ohms>|INFinity|MINimum|MAXimum}
OUTPut:LOAD? [MINimum|MAXimum]

OUTPut:POLarity {NORMal|INVerted}
OUTPut:POLarity?

OUTPut:SYNC {OFF|ON}
OUTPut:SYNC?
```

Pulse Configuration Commands

See page 185 in *User's Guide* (English)

```
PULSe:PERiod {<seconds>|MINimum|MAXimum}
PULSe:PERiod? [MINimum|MAXimum]

FUNCtion:PULSe
  :HOLD {WIDTh|DCYCle}
  :HOLD? [WIDTh|DCYCle]
  :WIDTh {<seconds>|MINimum|MAXimum}
  :WIDTh? [MINimum|MAXimum]
  :DCYCle {<percent>|MINimum|MAXimum}
  :DCYCle? [MINimum|MAXimum]
  :TRANsition {<seconds>|MINimum|MAXimum}
  :TRANsition? [MINimum|MAXimum]
```

Modulation Commands

See page 190 in *User's Guide* (English)

AM Commands

```
AM:INTernal
  :FUNCtion {SIN|SQU|RAMP|NRAMp|TRI|NOISe|USER}
  :FUNCtion?
```

```
AM:INTernal
  :FREQuency {<frequency>|MINimum|MAXimum}
  :FREQuency? [MINimum|MAXimum]
```

```
AM:DEPTh {<depth in percent>|MINimum|MAXimum}
AM:DEPTh? [MINimum|MAXimum]
```

```
AM:SOURce {INTernal|EXTernal}
AM:SOURce?
```

```
AM:STATe {OFF|ON}
AM:STATe?
```

FM Commands

```
FM:INTernal
  :FUNCtion {SIN|SQU|RAMP|NRAMp|TRI|NOISe|USER}
  :FUNCtion?
```

```
FM:INTernal
  :FREQuency {<frequency>|MINimum|MAXimum}
  :FREQuency? [MINimum|MAXimum]
```

```
FM:DEViation {<peak deviation in Hz>|MINimum|MAXimum}
FM:DEViation? [MINimum|MAXimum]
```

```
FM:SOURce {INTernal|EXTernal}
FM:SOURce?
```

```
FM:STATe {OFF|ON}
FM:STATe?
```

PM Commands

```
PM:INTernal
  :FUNCtion {SIN|SQU|RAMP|NRAMp|TRI|NOISe|USER}
  :FUNCtion?
```

```
PM:INTernal
  :FREQuency {<frequency>|MINimum|MAXimum}
  :FREQuency? [MINimum|MAXimum]
```

```
PM:DEViation {<deviation in degrees>|MINimum|MAXimum}
PM:DEViation? [MINimum|MAXimum]
```

```
PM:SOURce {INTernal|EXTernal}
PM:SOURce?
```

```
PM:STATe {OFF|ON}
PM:STATe?
```

FSK Commands

```
FSKey:FREQuency {<frequency>|MINimum|MAXimum}
FSKey:FREQuency? [MINimum|MAXimum]

FSKey:INTernal:RATE {<rate in Hz>|MINimum|MAXimum}
FSKey:INTernal:RATE? [MINimum|MAXimum]

FSKey:SOURce {INTernal|EXTernal}
FSKey:SOURce?

FSKey:STATe {OFF|ON}
FSKey:STATe?
```

PWM Commands

```
PWM:INTernal
  :FUNCtion {SIN|SQU|RAMP|NRAMp|TRI|NOISe|USER}
  :FUNCtion?

PWM:INTernal
  :FREQuency {<frequency>|MINimum|MAXimum}
  :FREQuency? [MINimum|MAXimum]

PWM:DEViation {<deviation in seconds>|MIN|MAX}
PWM:DEViation? [MINimum|MAXimum]

PWM:DEViation:DCYCle {<deviation in percent>|MIN|MAX}
PWM:DEViation:DCYCle? [MINimum|MAXimum]

PWM:SOURce {INTernal|EXTernal}
PWM:SOURce?

PWM:STATe {OFF|ON}
PWM:STATe?
```

Burst Commands

See page 216 in *User's Guide* (English)

```
BURSt:MODE {TRIGgered|GATed}
BURSt:MODE?

BURSt:NCYCles {<# cycles>|INFinity|MINimum|MAXimum}
BURSt:NCYCles? [MINimum|MAXimum]

BURSt:INTernal:PERiod {<seconds>|MINimum|MAXimum}
BURSt:INTernal:PERiod? [MINimum|MAXimum]

BURSt:PHASe {<angle>|MINimum|MAXimum}
BURSt:PHASe? [MINimum|MAXimum]

BURSt:STATe {OFF|ON}
BURSt:STATe?

UNIT:ANGLe {DEGree|RADian}
UNIT:ANGLe?

TRIGger:SOURce {IMMediate|EXTernal|BUS}
TRIGger:SOURce?

TRIGger:SLOPe {POSitive|NEGative}
TRIGger:SLOPe?

BURSt:GATE:POLarity {NORMal|INVerted}
BURSt:GATE:POLarity?

OUTPut
  :TRIGger:SLOPe {POSitive|NEGative}
  :TRIGger:SLOPe?
  :TRIGger {OFF|ON}
  :TRIGger?
```

Sweep Commands

See page 208 in *User's Guide* (English)

```
FREQuency
  :STARt {<frequency>|MINimum|MAXimum}
  :STARt? [MINimum|MAXimum]
  :STOP {<frequency>|MINimum|MAXimum}
  :STOP? [MINimum|MAXimum]

FREQuency
  :CENTer {<frequency>|MINimum|MAXimum}
  :CENTer? [MINimum|MAXimum]
  :SPAN {<frequency>|MINimum|MAXimum}
  :SPAN? [MINimum|MAXimum]

SWEep
  :SPACing {LINear|LOGarithmic}
  :SPACing?
  :TIME {<seconds>|MINimum|MAXimum}
  :TIME? [MINimum|MAXimum]

SWEep:STATe {OFF|ON}
SWEep:STATe?

TRIGger:SOURce {IMMediate|EXTernal|BUS}
TRIGger:SOURce?

TRIGger:SLOPe {POSitive|NEGative}
TRIGger:SLOPe?

OUTPut
  :TRIGger:SLOPe {POSitive|NEGative}
  :TRIGger:SLOPe?
  :TRIGger {OFF|ON}
  :TRIGger?

MARKer:FREQuency {<frequency>|MINimum|MAXimum}
MARKER:FREQuency? [MINimum|MAXimum]

MARKer {OFF|ON}
MARKer?
```

Triggering Commands

See page 224 in *User's Guide* (English)

These commands are used for Sweep and Burst only.

```
TRIGger:SOURce {IMMediate|EXTernal|BUS}
TRIGger:SOURce?

TRIGger

*TRG

TRIGger:SLOPe {POSitive|NEGative}
TRIGger:SLOPe?

BURSt:GATE:POLarity {NORMal|INVerted}
BURSt:GATE:POLarity?

OUTPut
  :TRIGger:SLOPe {POSitive|NEGative}
  :TRIGger:SLOPe?
  :TRIGger {OFF|ON}
  :TRIGger?
```

System-Related Commands

See page 242 in *User's Guide* (English)

```
SYSTem:ERRor?

*IDN?

DISPlay {OFF|ON}
DISPlay?

DISPlay
  :TEXT <quoted string>
  :TEXT?
  :TEXT:CLEar

*RST

*TST?

SYSTem:VERSion?

SYSTem
  :BEEPer
  :BEEPer:STATe {OFF|ON}
  :BEEPer:STATe?

SYSTem
  :KLOCk[:STATe] {OFF|ON}
  :KLOCk:EXCLude {NONE|LOCal}
  :KLOCk:EXCLude?

SYSTem:SECurity:IMMediate    Caution. Clears all
                             memory. Not recom-
                             mended for routine
                             applications.

*LRN?

*OPC

*OPC?

*WAI
```

Interface Configuration Commands

See page 247 in *User's Guide* (English)

```
SYSTem:COMMunicate:RLSTate {LOCal|REMote|RWLock}
```


Printed in Malaysia March 2005 E0305

33220-90008

Arbitrary Waveform Commands

See page 227 in *User's Guide* (English)

```
DATA VOLATILE, <value>, <value>, ...

DATA
  :DAC VOLATILE, {<binary block>|<value>, <value>, ... }

FORMat:BORDer {NORMal|SWAPped}
FORMat:BORDer?

DATA:COPY <destination arb name> [,VOLATILE]

FUNCtion:USER {<arb name>[1]|VOLATILE}
FUNCtion:USER?

FUNCtion USER
FUNCtion?

DATA
  :CATalog?
  :NVOLatile:CATalog?
  :NVOLatile:FREE?

DATA:DELete <arb name>
DATA:DELete:ALL

DATA
  :ATTRibute:AVERage? [<arb name>[1]]
  :ATTRibute:CFACtor? [<arb name>[1]]
  :ATTRibute:POINts? [<arb name>[1]]
  :ATTRibute:PTPeak? [<arb name>[1]]
```

[1] *The names of the built-in arb waveforms are:* EXP_RISE, EXP_FALL, NEG_RAMP, SINC, and CARDIAC.

Status Reporting Commands

See page 260 in *User's Guide* (English)

```
*STB?

*SRE <enable value>
*SRE?

STATus
  :QUEStionable:CONDition?
  :QUEStionable[:EVENt]?
  :QUEStionable:ENABle <enable value>
  :QUEStionable:ENABle?

*ESR?

*ESE <enable value>
*ESE?

*CLS

STATus:PRESet

*PSC {0|1}
*PSC?

*OPC
```

See page 251 in the User's Guide (English) for a diagram of the SCPI status system.

Phase-Lock Commands

These commands require Option 001, External Timebase Reference. See page 248 in *User's Guide* (English).

```
PHASe {<angle>|MINimum|MAXimum}
PHASe? [MINimum|MAXimum]

PHASe:REFerence

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

UNIT:ANGLe {DEGree|RADian}
UNIT:ANGLe?
```

Calibration Commands

See page 264 in *User's Guide* (English)

```
CALibration?

CALibration
  :SECure:STATe {OFF|ON},<code>
  :SECure:STATe?
  :SECure:CODE <new code>
  :SETup <0|1|2|3| . . . |94>
  :SETup?
  :VALue <value>
  :VALue?
  :COUNt?
  :STRing <quoted string>
  :STRing?
```

IEEE 488.2 Common Commands

```
*CLS

*ESR?
*ESE <enable value>
*ESE?

*IDN?

*LRN?

*OPC

*OPC?

*PSC {0|1}
*PSC?

*RST

*SAV {0|1|2|3|4}
*RCL {0|1|2|3|4}

*STB?
*SRE <enable value>
*SRE?

*TRG

*TST?
```

Using the APPLy Command

The APPLy command provides the most straightforward method to program the function generator over the remote interface. For example, the following command string sent from your computer will output a 3 Vpp sine wave at 5 kHz with a -2.5 volt offset.

```
APPL:SIN 5.0E+3, 3.0, -2.5
```

Using the Low-Level Commands

Although the APPLy command provides the most straightforward method to program the function generator, the low-level commands give you more flexibility to change individual parameters. For example, the following command strings sent from your computer will output a 3 Vpp sine wave at 5 kHz with a -2.5 volt offset.

```
FUNC SIN
FREQ 5000
VOLT 3.0
VOLT:OFFS -2.5
```

Reading a Query Response

Only the query commands (commands that end with "?") will instruct the function generator to send a response message. Queries return internal instrument settings. For example, the following command string sent from your computer will read the function generator's error queue and retrieve the response from the most recent error.

```
SYST:ERR?
enter statement
```

Selecting a Trigger Source

When *Sweep* or *Burst* is enabled, the function generator will accept an immediate internal trigger, a hardware trigger from the rear-panel *Trig In* connector, a manual trigger from the (Trigger) key, or a software (bus) trigger. By default, the internal trigger source is selected. If you want to use an external or a software trigger source, you must first select that source. For example, the following command strings sent from your computer will output a 3-cycle burst each time the rear-panel *Trig In* connector receives the rising edge of a TTL pulse.

```
BURS:NCYC 3
TRIG:SLOP POS
TRIG:SOUR EXT
BURS:STAT ON
```

Factory Default Settings

Output Configuration	Factory Setting
Function	Sine wave
Frequency	1 kHz
Amplitude / Offset	100 mVpp / 0.0 Vdc
Output Units	Vpp
Output Termination	50 Ω
Autorange	On
Modulation	**Factory Setting**
Carrier (AM, FM, PM, FSK)	1 kHz Sine wave
Carrier (PWM)	1 kHz Pulse
Modulating Waveform:	
(AM)	100 Hz Sine wave
(FM, PM, PWM)	10 Hz Sine wave
AM Depth	100%
FM Deviation	100 Hz
PM Deviation	180 degrees
FSK Hop Frequency	100 Hz
FSK Rate	10 Hz
PWM Width Deviation	10 µs
Modulation State	Off
Sweep	**Factory Setting**
Start / Stop Frequency	100 Hz / 1 kHz
Sweep Time	1 Second
Sweep Mode	Linear
Sweep State	Off
Burst	**Factory Setting**
Burst Count	1 Cycle
Burst Period	10 ms
Burst Start Phase	0 degrees
Burst State	Off
System-Related Operations	**Factory Setting**
• Power-Down Recall	• Disabled
Display Mode	On
Error Queue	Errors are Cleared
Stored States, Stored Arbs	No Change
Output State	Off
Triggering Operations	**Factory Setting**
Trigger Source	Internal (Immediate)
Remote Interface Config.	**Factory Setting**
• GPIB Address	• 10
• DHCP	• On
• IP Address	• 169.254.2.20
• Subnet Mask	• 255.255.0.0
• Default Gateway	• 0.0.0.0
• DNS Server	• 0.0.0.0
• Host Name	• *none*
• Domain Name	• *none*
Calibration	**Factory Setting**
Calibration State	Secured

Parameters marked with a bullet (•) are stored in *non-volatile* memory.