任意波形訊號產生器

AFG-3000 系列

使用手冊
固緯料號 NO.

ISO-9001 認證企業

2010.10

固緯電子實業股份有限公司
臺灣臺北縣土城市中興路 7-1 號

目錄

安全說明

本章節包含操作和存儲訊號產生器時必須遵照的重要安全說明。在操作前請詳細閱讀以下內容，確保安全和優化的使用。

安全符號

這些安全符號會出現在本使用手冊或 AFG-3000 上。

 警告	警告：產品在某一特定情況下或實際應用中可能對人體造成傷害或危及生命
 注意	注意：產品在某一特定情況下或實際應用中可能對產品本身或其它產品造成損壞
	高壓危險
	注意: 請參考使用手冊
	保護導體端子
	接地端子
	表面高溫危險
	雙層絕緣

勿將電子設備作為未分類的市政廢棄物處理。請單獨收集處理或聯繫設備供應商

安全指南

通常 注意	• 勿將重物置於儀器上 • 勿將易燃物置於儀器上 • 避免嚴重撞擊或不當放置而損壞儀器 • 避免靜電釋放至儀器 • 請使用匹配的連接線，切不可用裸線連接 • 若非專業技術人員，請勿自行拆裝儀器 (測量等級) EN 61010-1:2001 規定了如下測量等級，AFG-3000系列屬於等級II。 • 測量等級 IV：測量低電壓設備電源 • 測量等級 III：測量建築設備 • 測量等級 II： 測量直接連接到低電壓設備的電路 • 測量等級 I： 測量未直接連接電源的電路
電源 警告	• 交流輸入電壓: 100 ~ 240V AC, 50 ~ 60Hz • 將交流電源插座的保護接地端子接地，避免電擊觸電
保險絲 警告	• 保險絲類型: T0.63A/250V • 請專業技術人員更換保險絲 • 請更換指定類型和額定值的保險絲 • 更換前請斷開電源插座和所有測試導線 • 更換前請查明保險絲的熔斷原因
清潔儀器	• 清洁前先切断电源 • 以中性洗滌劑和清水沾濕軟布擦拭儀器。不要直接將任何液體噴灑到儀器上 • 不要使用含苯，甲苯，二甲苯和丙酮等烈性物質的化學藥品或清潔劑

操作環境	• 地點: 室內，避免陽光直射，無灰塵，無導電污染(下注)，避免強磁場 • 相對濕度: < 80% • 海拔: < 2000m • 溫度: 0°C~40°C (污染等級) EN 61010-1:2001 規定了如下污染程度。AFG-3000 系列屬於等級 2。 污染指"可能引起絕緣強度或表面電阻率降低的外界物質，固體，液體或氣體(電離氣體)"。 • 污染等級 1：無污染或僅乾燥，存在非導電污染，污染無影響 • 污染等級 2：通常只存在非導電污染，偶爾存在由凝結物引起的短暫導電 • 污染等級 3：存在導電污染或由於凝結原因使乾燥的非導電性污染變成導電性污染。此種情況下，設備通常處於避免陽光直射和充分風壓條件下，但溫度和濕度未受控制
存儲環境	• 地點: 室內 • 相對濕度: < 70% • 溫度: -10°C~70°C
處理 	勿將電子設備作為未分類的市政廢棄物處理。請單獨收集處理或聯繫設備供應商。請務必妥善處理丟棄的電子廢棄物，減少對環境的影響

英制電源線

在英國使用訊號產生器時，確保電源線符合以下安全說明。

注意: 導線/設備連接必須由專業人員操作

警告: 此裝置必須接地

重要: 導線顏色應與下述規則保持一致:

綠色/黃色:	接地
藍色:	零線
棕色:	火線(相線)

導線顏色可能與插頭/儀器中所標識的略有差異，請遵循如下操作:

顏色為綠色/黃色的線需與標有字母“E”，或接地標誌⏚，或顏色為綠色/黃綠色的接地端子相連；

顏色為藍色的線需與標有字母“N”，或顏色為藍色或黑色的端子相連；

顏色為棕色的線需與標有字母“L”或“P”，或者顏色為棕色或紅色的端子相連；

若有疑問，請參照本儀器提供的用法說明或與經銷商聯繫。

電纜/儀器需有符和額定值和規格的 HBC 保險絲保護：保險絲額定值請參照儀器說明或使用手冊。如: 0.75mm^{2}的電纜需要 3A 或 5A 的保險絲。保險絲型號與連接方法有關，再大的導體通常應使用 13A 保險絲。

在移動保險絲或保險絲座時連接器定會被損壞，然而將帶有裸線的插頭插入火線插座是非常危險的。若需重複連接，必須嚴格按照本手冊說明操作。

產品介紹

本章節介紹了訊號產生器的主要特點、外觀、設置過程和開機。

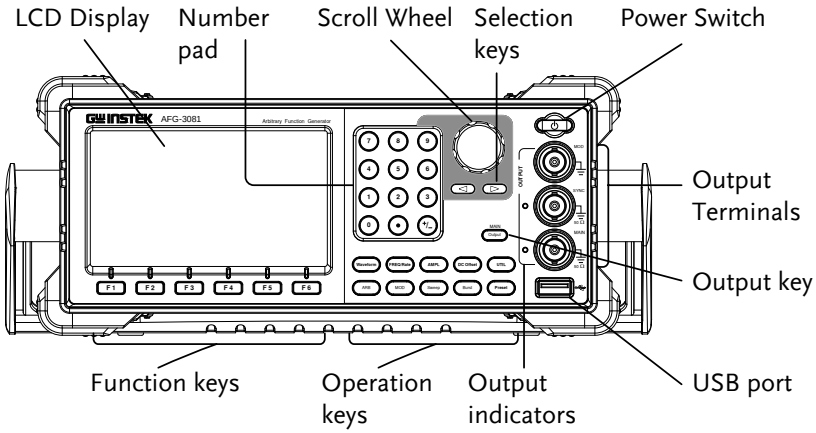
主要特點

型號	頻寬
AFG-3081	80MHz
AFG-3051	50MHz
性能	• DDS 信号发生器系列 • 全频段 1μHz 高频分辨率 • 1ppm 频率稳定度 • 任意波形能力 • 200 MSa/s 采样率 • 100 MSa/s 重复率 • 1 M 点波形长度 • 16 位幅值分辨率 • 10 組 1M 的波形記憶體 • 显示真实波形输出 • 用户定义输出部分 • 用户定义标记输出部分 • DWR(直接波形重建)能力 • 无需 PC 就可编辑波形 • 可选的 N 次循环和无限次输出模式 • -60dBc 低失真正弦波

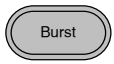
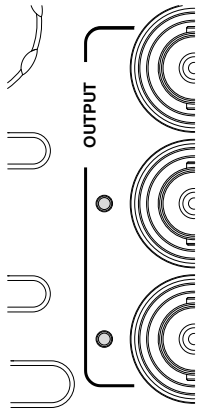
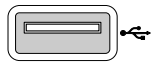
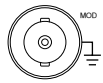
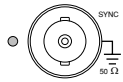
特點	• 正弦波, 方波, 斜波, 脈衝波, 雜訊波, Sinc 標準波形 • 內部和外部 LIN/LOG 掃描，帶標記輸出 • 內部/外部 AM, FM, PWM, FSK 調製 • 調製/掃描訊號輸出 • 內部和外部觸發的脈衝串訊號，無標記輸出 • 存儲/調取 10 組設置記憶體 • 輸出超載保護
介面	• GPIB, RS232, USB 標準介面 • 4.3’’彩色 TFT LCD (480 × 272)使用者介面 • AWES (任意波形編輯軟體) PC 軟體

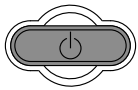
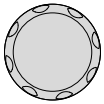
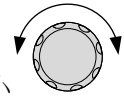
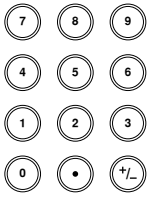
面板介紹

前面板

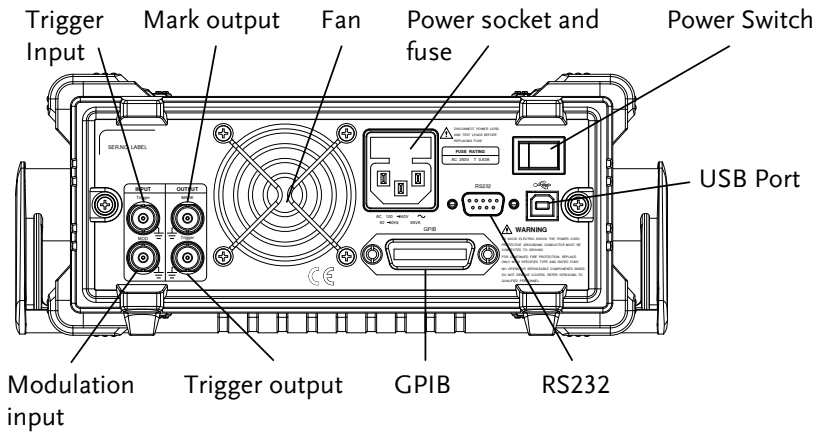


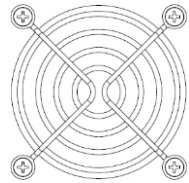
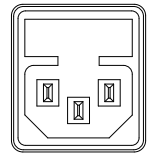
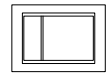
LCD 顯示	TFT 彩色 LCD 顯示, 480 x 272 解析度	
功能鍵: F1~F6	F 1	位於 LCD 屏的底部，用於功能啟動
操作鍵	Waveform	用於選擇波形類型
	FREQ/Rate	用於設置頻率或取樣速率
	AMPL	用於設置波形幅值
	DC Offset	設置直流偏置
	UTIL	用於進入存儲和調取選項、設置遠端介面(USB, GPIB, RS232)、使用 DSO 連接、更新和查閱固件版本、 進入校正選項、輸出阻抗設置、設置語言和進入說明功能表

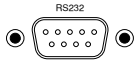
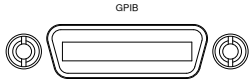
		用於設置任意波形參數
	  	MOD, Sweep 和 Burst 鍵用於設置調製、掃描和脈衝串選項和參數
復位鍵		用於調取預設狀態
輸出鍵		用於打開或關閉波形輸出
輸出指示燈		當輸出指示燈變綠，輸出啟動
USB host 介面		用於存儲、還原波形資料和圖像，以及更新固件
輸出端子		調製輸出端子
		SYNC 輸出端子。50Ω 輸出阻抗。
		主輸出端子。50Ω 輸出阻抗。

待機鍵		使訊號產生器處於開機(綠色)或待機模式(紅色)
方向鍵		當編輯參數時，可用於選擇數位
可調旋鈕		用於編輯值和參數  減小 增加
數位鍵盤		用於鍵入值和參數，常與方向鍵和可調旋鈕一起使用

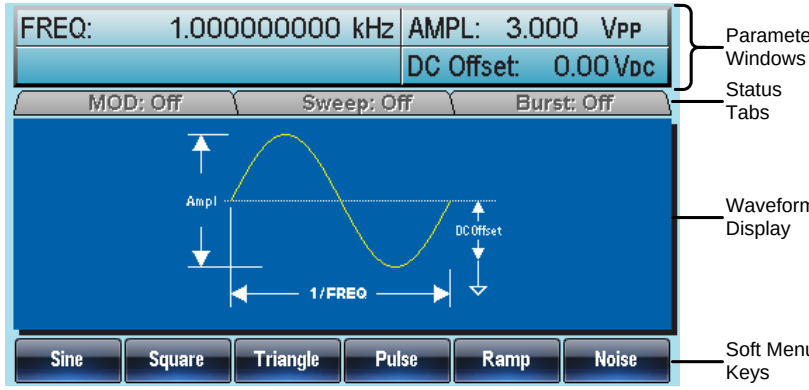
後面板



觸發輸入		外部觸發輸入。用於接收外部觸發訊號
MARK 輸出		標記輸出訊號。僅用於掃描和 ARB 模式
風扇		風扇
電源插座 輸入和保險絲		電源輸入: 100~240V AC 50~60Hz. 保險絲: T0.63A/250V
電源開關		主電源開關

USB 介面		Mini-B 類 USB 介面用於連接 PC 機和遠端控制
RS232 介面		9 針母頭 RS232 插孔用於 PC 遠程控制
GPIB		24 針母頭 GPIB 介面用於 PC 遠端控制
觸發輸出		觸發輸出端子
MOD 輸入		調製輸入端子

顯示



參數窗口	參數顯示和編輯視窗
狀態功能表	顯示調製、掃描和脈衝串模式的狀態
波形顯示	用於顯示波形
軟選單鍵	功能鍵(F1~F6)與下方的軟選單鍵對應

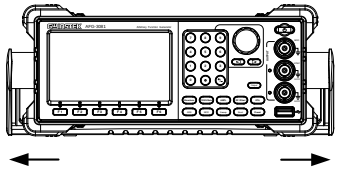
設置訊號產生器

背景

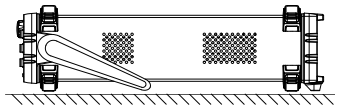
本章節介紹了如何調整訊號產生器的把手以及如何開機。

調整把手

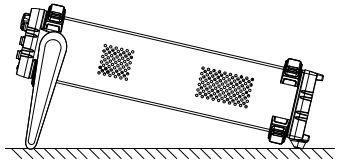
將把手拉至側面並旋轉



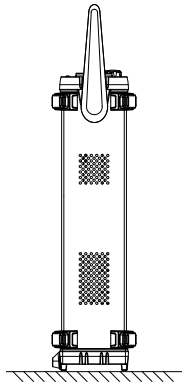
水準放置 AFG



或傾斜放置

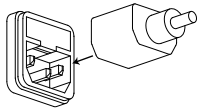


手把垂直放置以方便手提

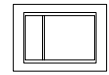


開機

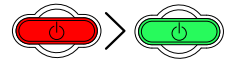
1. 將電源線接入後面板插座



2. 打開位於後面板的電源開關



3. 按下前面板的待機鍵打開儀器，待機鍵將由紅(待機)轉綠(打開)



4. 當待機鍵為綠色時，螢幕顯示載入狀態

此時，訊號產生器已經可以使用。

快速操作

本章節介紹了 AFG-3000 的快捷方式、內置說明和預設出廠設置，方便用戶快速入門。有關參數、設置和限制的詳細內容，參見操作章節或規格(291 頁)。

如何使用數位輸入

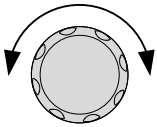
背景

AFG-3000 有三類主要的數位輸入: 數位鍵盤, 方向鍵和可調旋鈕。下面將為您介紹如何使用數字輸入編輯參數。

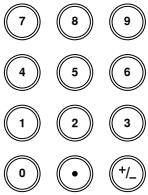
1. 按(F1~F6)對應功能鍵選擇選單項。例如，功能鍵 F1 對應軟鍵“Sine”

2. 使用方向鍵將游標移至需要編輯的數位

3. 使用可調旋鈕編輯數位。順時針增大，逆時針減小



4. 數位鍵盤用於設置高光處的參數值



如何使用說明功能表

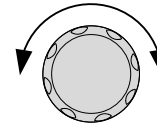
背景　　說明功能表詳細描述了每個鍵的含義和它的功能

1. 按 UTIL

2. 按 System (F5)

3. 按 Help (F3)

4. 可調旋鈕用於導航說明選單。按 Select 選擇該項

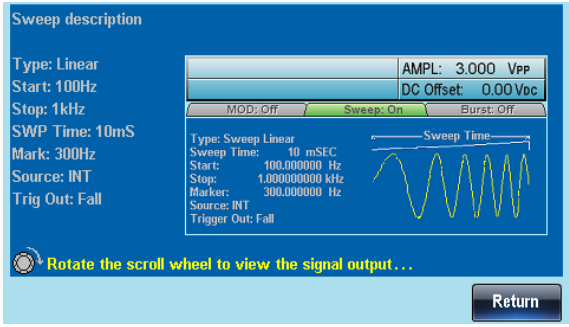


Keypad	用於解釋任一前面板鍵
Create Arbitrary Waveform	解釋如何建立任意波形
Modulation Function	解釋如何建立調製波形
Sweep Function	解釋掃描功能
Burst Function	解釋脈衝串功能

DSO Link	提供 DSO 連接
Hardcopy	解釋如何使用硬拷貝功能

5. 例如，選擇專案 4 可以查看掃描功能

6. 可調旋鈕用於導航說明頁面



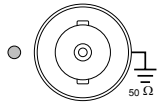
7. 按 F6 返回上級選單

選擇波形

方波

例子: 方波, 3Vpp, 75%占空比, 1 kHz

輸出



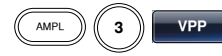
輸入: N/A

1. 按 Waveform 鍵, 選擇 Square (F2)

2. 分別按(F1), 7 + 5 + %(F5)

3. 分別按 Freq/Rate, 1 + kHz (F5)

4. 分別按 AMPL, 3 + VPP (F6)

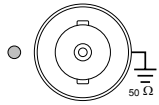


5. 按 Output 鍵

三角波

例子: 三角波, 5Vpp,10kHz

輸出



輸入: N/A

1. 按 Waveform 鍵, 選擇 Triangle (F3)

2. 分別按 Freq/Rate 鍵, 1 + 0 + kHz (F5)

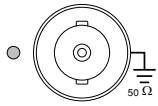
3. 分別按 AMPL 鍵, 5 +VPP (F6)

4. 按 Output 鍵

正弦波

例子: 正弦波, 10Vpp,100kHz

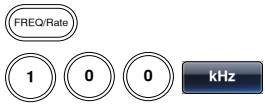
輸出



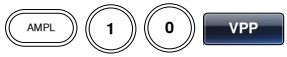
輸入: N/A

1. 按 Waveform 鍵, 選擇 Sine (F1)

2. 分別按 Freq/Rate 鍵, 1 + 0 +0 + kHz (F5)



3. 分別按 AMPL 鍵, 1 + 0 +VPP (F6)



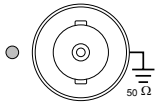
4. 按 Output 鍵

調製

AM

例子: AM 調製. 100Hz 調製方波. 1kHz 正弦載波. 80%調製深度

輸出



輸入: N/A

1. 按 MOD 鍵, 選擇 AM (F1)

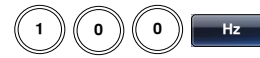
2. 按 Waveform, 選擇 Sine (F1)

3. 分別按 Freq/Rate 鍵, 1 + kHz (F5)

4. 按 MOD 鍵, 選擇 AM (F1), Shape (F4), Square (F2)

5. 按 MOD 鍵, 選擇 AM (F1), AM Freq (F3)

6. 按 1 + 0 + 0 + Hz (F2)



7. 按 MOD 鍵, 選擇 AM (F1), Depth (F2)

8. 按 8 + 0 + % (F1)

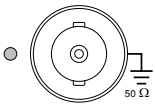
9. 按 MOD, AM (F1), Source (F1), INT (F1)

10. 按 Output 鍵 

FM

例子: FM 調製. 100Hz 調製方波, 1kHz 正弦載波, 100 Hz 頻移, 內部源

輸出



輸入: N/A

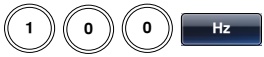
1. 按 MOD 鍵, 選擇 FM (F2) 

2. 按 Waveform, 選擇 Sine (F1) 

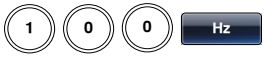
3. 分別按 Freq/Rate 鍵, 1 + kHz (F5) 

4. 按 MOD 鍵, 選擇 FM (F2), Shape (F4), Square (F2) 

5. 按 MOD 鍵, 選擇 FM (F2), FM Freq (F3) 

6. 按 1 + 0 + 0 + Hz (F2) 

7. 按 MOD 鍵, 選擇 FM (F2), Freq Dev (F2) 

8. 按 1 + 0 + 0 + Hz (F3) 

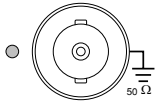
9. 按 MOD, FM (F2), Source (F1), INT (F1) 

10. 按 Output 鍵 

FSK 調製

例子: FSK 調製, 100Hz 跳躍頻率, 1kHz 載波, 三角波, 10 Hz 頻率, 內部源

輸出



輸入: N/A

1. 按 MOD 鍵, 選擇 FSK (F3) 

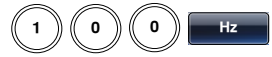
2. 按 Waveform, 選擇 Triangle (F3) 

3. 分別按 Freq/Rate 鍵, 1 + kHz (F5) 

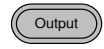
4. 按 MOD 鍵, 選擇 FSK (F3), FSK Rate (F3) 

5. 按 1 + 0 + Hz (F2) 

6. 按 MOD 鍵, 選擇 FSK (F3), Hop Freq (F2) 

7. 按 1 + 0 + 0 + Hz (F3) 

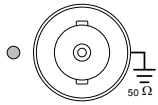
8. 按 MOD, FSK (F3), Source (F1), INT (F1) 

9. 按 Output 鍵 

PWM 調製

例子: PWM 調製, 800Hz 載波, 15 kHz 調製正弦波, 50%占空比, 內部源

輸出

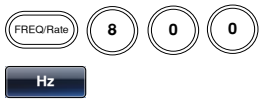


輸入: N/A

1. 按 Waveform, 選擇 Square (F2)

2. 按 MOD 鍵, 選擇 PWM (F4)

3. 分別按 Freq/Rate 鍵, 8 + 0 + 0 + Hz (F4)



4. 按 MOD 鍵, 選擇 PWM (F4), Shape (F4), Sine (F1)

5. 按 MOD 鍵, PWM (F4), PWM Freq (F3)

6. 按 1 + 5 + kHz (F3)

7. 按 MOD, PWM (F4), Duty (F2)

8. 按 5 + 0 + % (F1)

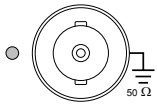
9. 按 MOD, PWM (F4), Source (F1), INT (F1)

10. 按 Output 鍵

掃描

例子: 頻率掃描. 起始頻率 10mHz, 截止頻率 1MHz. Log 掃描, 1 s 掃描, 標記頻率 550 Hz, 手動觸發, 上升沿觸發

輸出



輸入: N/A

1. 按 Sweep, Start (F3)

2. 按 1 + 0 + mHz (F2)

3. 按 Sweep, Stop (F4)

4. 按 1 + MHz (F5)

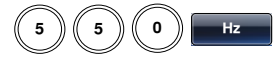
5. 按 Sweep, Type (F2), Log (F2)

6. 按 Sweep, SWP Time (F5)

7. 按 1 + SEC (F2)

8. 按 Sweep, More (F6), Marker (F3), ON/OFF (F2), Freq (F1)

9. 按 5 + 5 + 0 + Hz (F3)



10. 按 Sweep, More (F6), TRIG out (F4), ON/OFF (F3), Rise (F1)

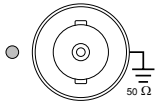
11. 按 Output 鍵

12. 按 Sweep, Source (F1), Manual (F3), Trigger (F1)

脈衝串

例子: 脈衝串模式, N 次迴圈(內部觸發), 1kHz 脈衝串頻率, 脈衝串數= 5, 10 ms 脈衝串週期, 0˚脈衝串相位, 內部觸發, 10 us 延遲, 上升沿觸發

輸出



輸入: N/A

1. 按 FREQ/Rate 1 kHz (F5)

2. 按 Burst, N Cycle (F1), Cycles (F1)

3. 按 5 + Cyc (F5)

4. 按 Burst, N Cycle (F1), Period (F4)

5. 按 1 +0 + msec (F2)

6. 按 Burst, N Cycle (F1), Phase (F3)

7. 按 0 + Degree (F5)

8. 按 Burst, N Cycle (F1), TRIG Setup (F5), INT (F1)

9. 按 Burst, N Cycle (F1), TRIG Setup (F5), Delay (F4)

10. 按 1 + 0 + uSEC (F2)

11. 按 Burst, N Cycle (F1), TRIG Setup (F5), TRIG out (F5), ON/OFF (F3), Rise (F1)

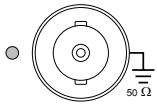
12. 按 Output 鍵

ARB

ARB–增加內置波形

例子: ARB 模式, 上升指數函數. Start 0, Length 100, Scale 32767

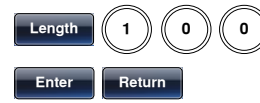
輸出



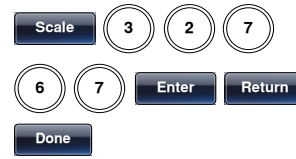
1. 按 ARB, Built in (F3), More (F5), Exp Rise (F1)

2. 按 Start (F1), 0 + Enter (F5), Return (F6)

3. 按 Length (F2), 100, Enter (F5), Return (F6)



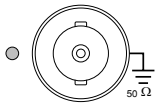
4. 按 Scale (F3), 32767, Enter (F5), Return (F6), Done (F4)



ARB–增加內置波形-脈衝

例子: ARB 模式, 脈衝波. Start 0, 頻率 1kHz, 占空比 25%

輸出

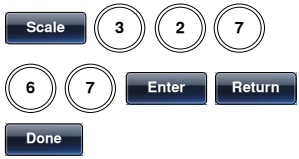


1. 按 ARB, Built in (F3), More (F5), Exp Rise (F1)

2. 按 Freq.(F1),1, kHz (F5), Return (F6)

3. 按 Duty (F2), 25, %(F5), Return (F6)

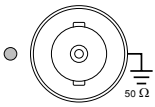
4. 按 Scale (F3), 32767, Enter (F5), Return (F6), Done (F4)



ARB-增加點

例子: ARB 模式, 增加點, 位址 40, 資料 30,000

輸出



1. 按 ARB, Edit (F2), Point (F1), Address (F1)

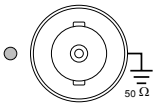
2. 按 4 + 0 + Enter (F5), Return (F6)

3. 按 Data (F2), 3+0+0+0+0, Enter (F5)

ARB-增加線

例子: ARB 模式, 增加線, 位址: 數據(10:30, 50:100)

輸出



1. 按 ARB, Edit (F2), Line (F2), Start ADD (F1)

2. 按 1 + 0 + Enter (F5), Return (F6)

3. 按 Start Data (F2), 3 + 0, Enter (F5), Return (F6)

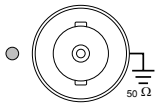
4. 按 Stop ADD (F3), 5 + 0, Enter (F5), Return (F6)

5. 按 Stop Data (F4), 1 + 0 + 0, Enter (F5), Return (F6), Done (F5)

ARB–輸出部分

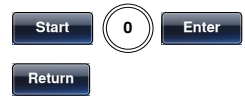
例子: ARB 模式, 輸出 ARB 波形, Start 0, Length 1000

輸出

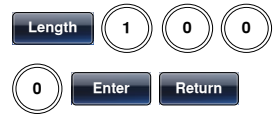


1. 按 ARB, Output (F6)

2. 按 Start (F1), 0 + Enter (F5), Return (F6)



3. 按 Length (F2), 1 + 0 + 0, Enter (F5), Return (F6)

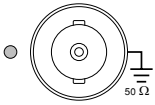


ARB–輸出 N 次迴圈

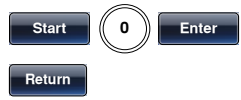
例子: ARB 模式, 輸出 N 次迴圈, Start 0, Length 1000, N 次, 10

輸出

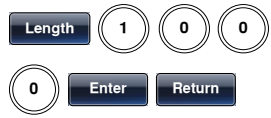
1. 按 ARB, Output (F6)



2. 按 Start (F1), 0 + Enter (F5), Return (F6)



3. 按 Length (F2), 1 + 0 + 0, Enter (F5), Return (F6)



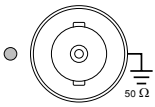
4. 按 N Cycle (F4)

5. 按 Cycles (F1), 1 + 0

6. 按 Trigger (F5)，觸發一次輸出

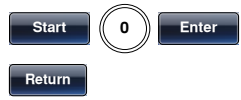
ARB–輸出無限次迴圈

例子: ARB 模式, 輸出 N 次迴圈, Start 0, Length 1000, 迴圈無限次輸出

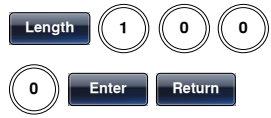


1. 按 ARB, Output (F6)

2. 按 Start (F1), 0 + Enter (F5), Return (F6)



3. 按 Length (F2), 1 + 0 + 0, Enter (F5), Return (F6)

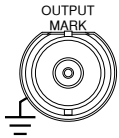


4. 按 Infinite (F5), Return (F6)

ARB–輸出標記

例子: ARB 模式, 輸出標記, Start 0, Length 80

輸出



1. 按 ARB, Output (F6), Marker (F3)

2. 按 Start (F1), 3+0, Enter (F5), Return (F6)

3. 按 Length (F2), 8 + 0, Enter (F5), Return (F6)

工具功能表

存儲

例子: 存儲至記憶體檔#5

1. 按 UTIL, Memory (F1), Store (F1)

2. 使用可調旋鈕和 Select (F1)選擇檔，按 Done (F5)

調取

例子: 調取記憶體檔#5

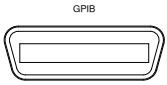
1. 按 UTIL, Memory (F1), Recall (F2)

2. 使用可調旋鈕和 Select (F1)選擇檔，按 Done (F5)

介面 GPIB

例子: GPIB 介面, 位址 10

GPIB



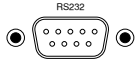
1. 按 UTIL, Interface (F2), GPIB (F1), Address (F1)

2. 按 1 + 0 + Done (F5)

介面 RS232

例子: RS232 介面, 串列傳輸速率 115200, 無奇偶性, 8 位

RS232



1. 按 UTIL, Interface (F2), RS232 (F2)

2. 按串列傳輸速率(F1), 115k (F5)

3. 按 UTIL, Interface (F2), RS232 (F2)

4. 按 Parity/Bits (F2), None/8Bits (F1)

介面 USB

例子: USB 介面

USB B

1. 按 UTIL, Interface (F2), USB (F3)

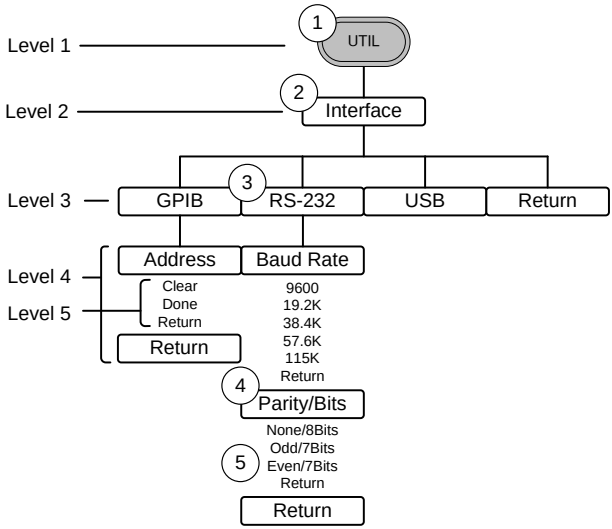
選單樹

常規

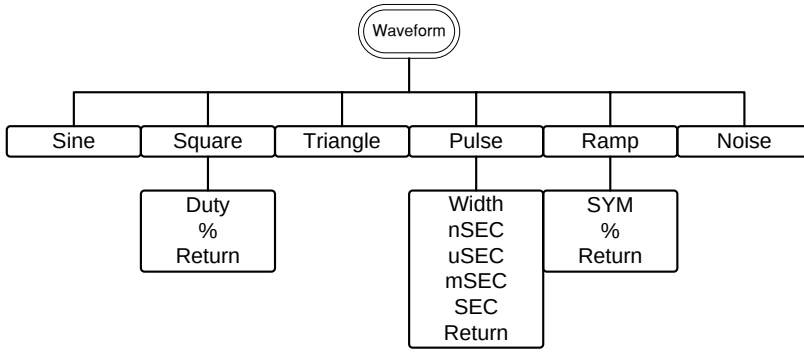
使用者可以將功能表樹用作對訊號產生器的功能和特性的簡易參考。AFG-3000 功能表系統逐層排列，每層都由操作或軟鍵導航。返回軟鍵用於返回上級選單。

例子: 將奇偶性設置為偶數/7Bits;

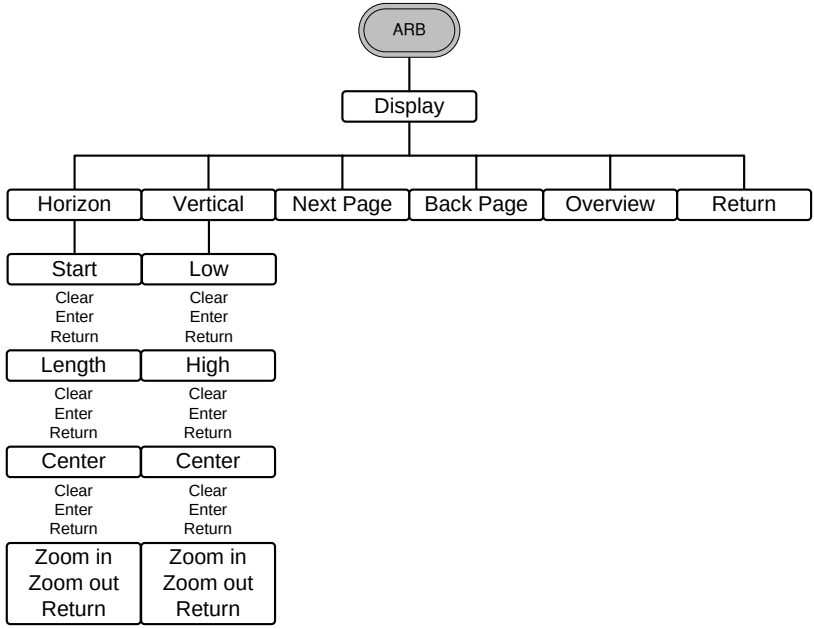
(1) 按 UTIL 鍵
(2) Interface 軟鍵
(3) RS232
(4) 奇偶性/Bits
(5) 偶數/7Bits



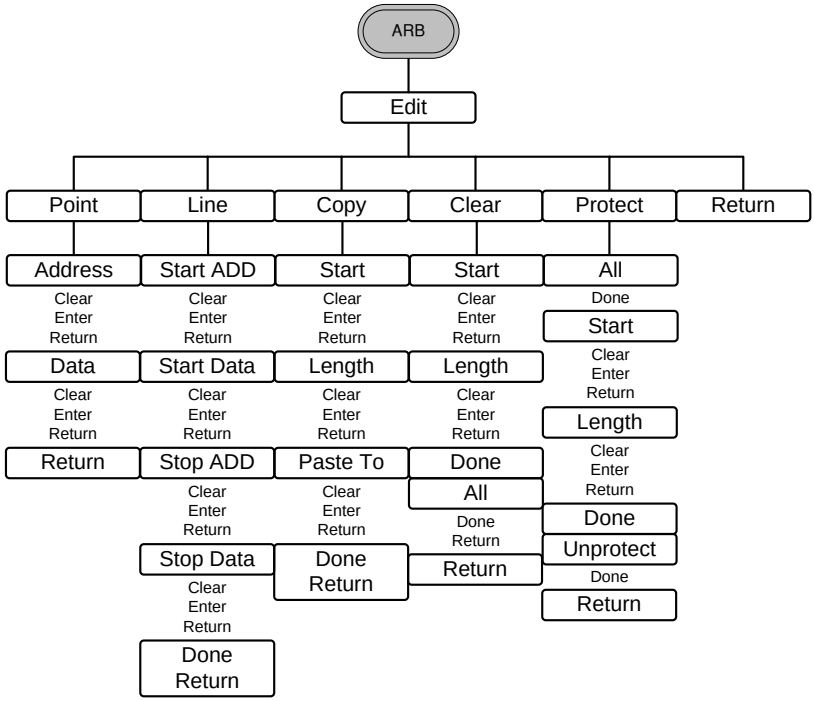
波形


Waveform
Sine
Square
Triangle
Pulse
Ramp
Noise
Duty
%
Return
Width
nSEC
uSEC
mSEC
SEC
Return
SYM
%
Return

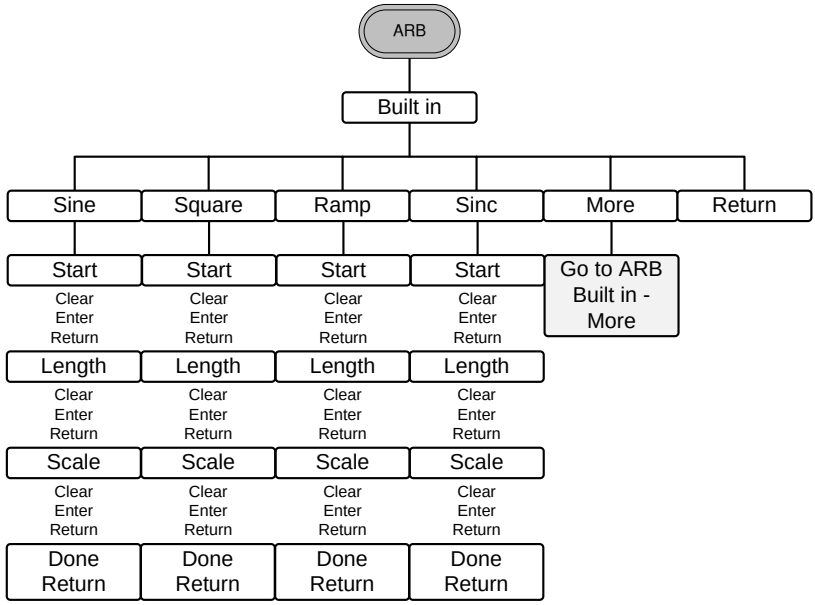
ARB-顯示


ARB
Display
Horizon
Vertical
Next Page
Back Page
Overview
Return
Start
Clear
Enter
Return
Low
Clear
Enter
Return
Length
Clear
Enter
Return
High
Clear
Enter
Return
Center
Clear
Enter
Return
Center
Clear
Enter
Return
Zoom in
Zoom out
Return
Zoom in
Zoom out
Return

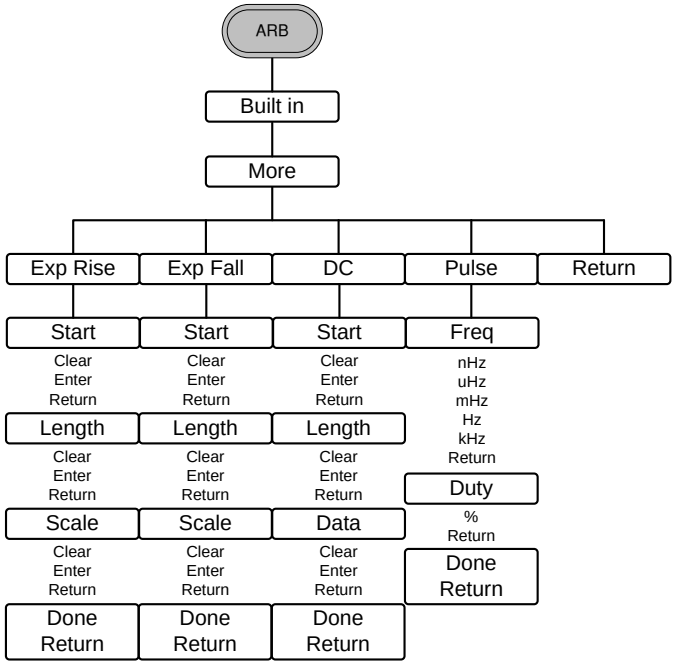
ARB-編輯


ARB
Edit
Point
Line
Copy
Clear
Protect
Return
Address
Clear
Enter
Return
Data
Clear
Enter
Return
Return
Start ADD
Clear
Enter
Return
Start Data
Clear
Enter
Return
Stop ADD
Clear
Enter
Return
Stop Data
Clear
Enter
Return
Done
Return
Start
Clear
Enter
Return
Length
Clear
Enter
Return
Paste To
Clear
Enter
Return
Done
Return
Start
Clear
Enter
Return
Length
Clear
Enter
Return
Done
All
Done
Return
Return
All
Done
Start
Clear
Enter
Return
Length
Clear
Enter
Return
Done
Unprotect
Done
Return

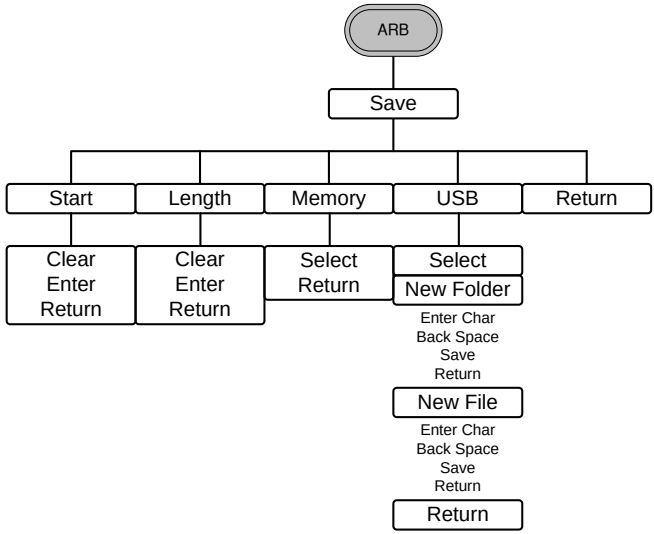
ARB–內置


ARB
Built in
Sine
Square
Ramp
Sinc
More
Return
Start
Start
Start
Start
Go to ARB Built in - More
Clear Enter Return
Clear Enter Return
Clear Enter Return
Clear Enter Return
Length
Length
Length
Length
Clear Enter Return
Clear Enter Return
Clear Enter Return
Clear Enter Return
Scale
Scale
Scale
Scale
Clear Enter Return
Clear Enter Return
Clear Enter Return
Clear Enter Return
Done Return
Done Return
Done Return
Done Return

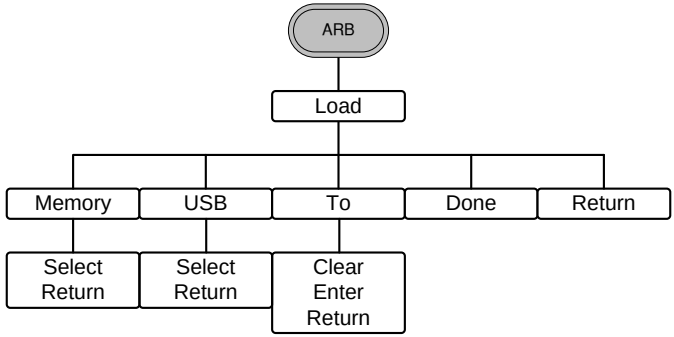
ARB–內置–更多


ARB
Built in
More
Exp Rise
Exp Fall
DC
Pulse
Return
Start
Start
Start
Freq
Clear
Enter
Return
Clear
Enter
Return
Clear
Enter
Return
nHz
uHz
mHz
Hz
kHz
Return
Length
Length
Length
Clear
Enter
Return
Clear
Enter
Return
Clear
Enter
Return
Duty
%
Return
Scale
Scale
Data
Clear
Enter
Return
Clear
Enter
Return
Clear
Enter
Return
Done
Return
Done
Return
Done
Return
Done
Return

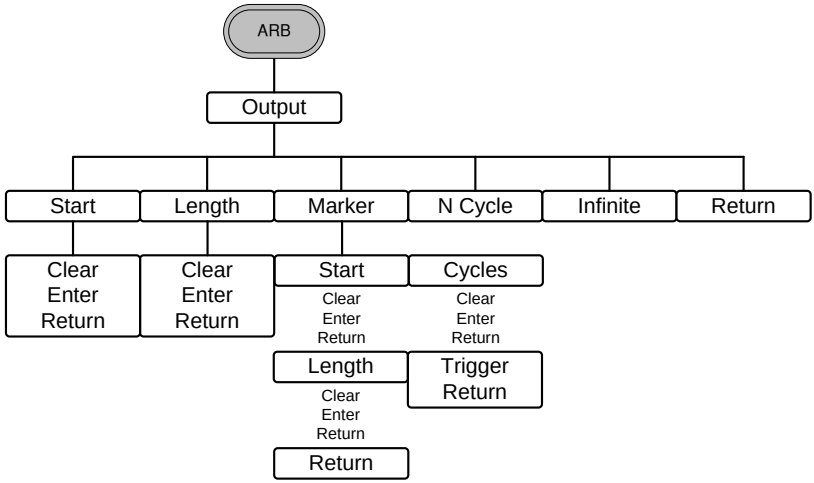
ARB–存儲


ARB
Save
Start
Length
Memory
USB
Return
Clear
Enter
Return
Clear
Enter
Return
Select
Return
Select
New Folder
Enter Char
Back Space
Save
Return
New File
Enter Char
Back Space
Save
Return
Return

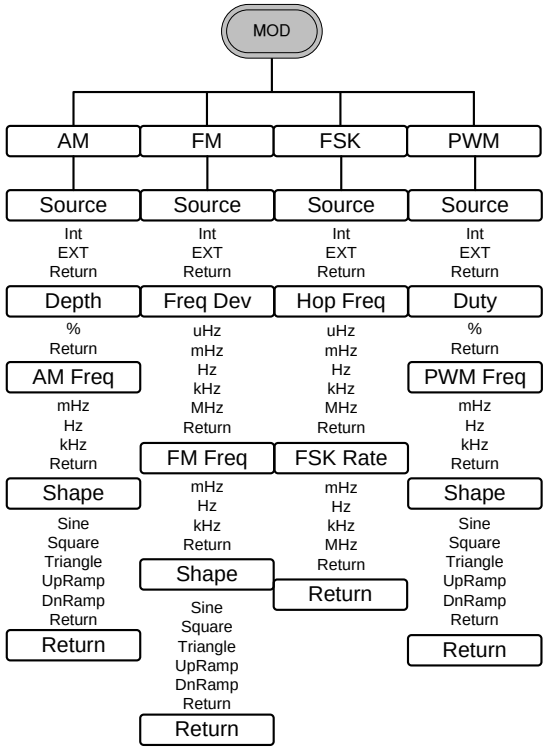
ARB-調取


ARB
Load
Memory
USB
To
Done
Return
Select
Return
Select
Return
Clear
Enter
Return

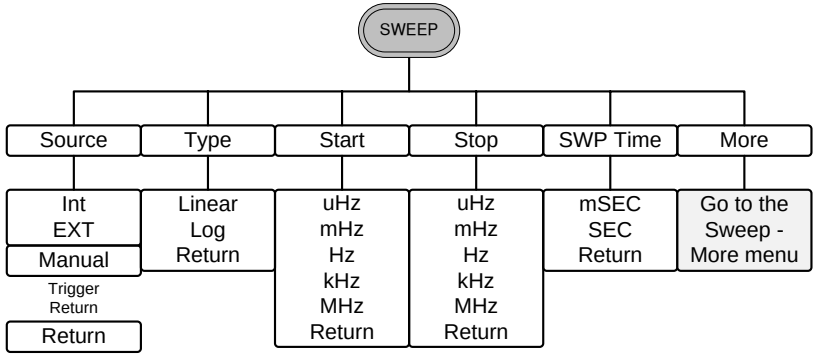
ARB-輸出


ARB
Output
Start
Length
Marker
N Cycle
Infinite
Return
Clear
Enter
Return
Clear
Enter
Return
Start
Clear
Enter
Return
Cycles
Clear
Enter
Return
Length
Clear
Enter
Return
Trigger
Return
Return

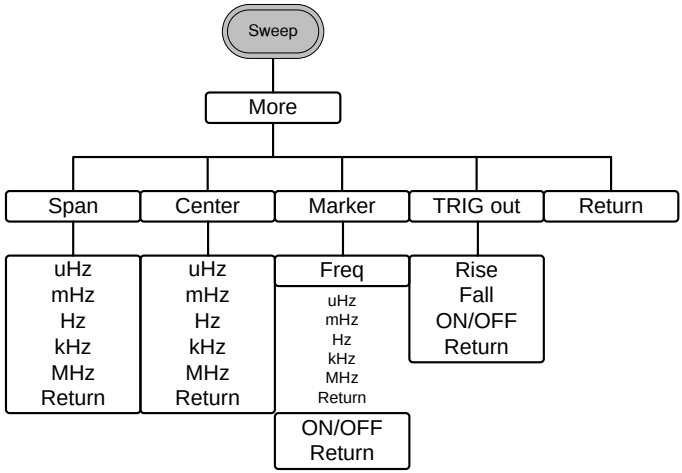
MOD


MOD
AM
FM
FSK
PWM
Source
Source
Source
Source
Int
EXT
Return
Int
EXT
Return
Int
EXT
Return
Int
EXT
Return
Depth
Freq Dev
Hop Freq
Duty
%
Return
uHz
mHz
Hz
kHz
MHz
Return
uHz
mHz
Hz
kHz
MHz
Return
%
Return
AM Freq
PWM Freq
mHz
Hz
kHz
Return
mHz
Hz
kHz
Return
FM Freq
FSK Rate
mHz
Hz
kHz
Return
mHz
Hz
kHz
MHz
Return
Shape
Shape
Sine
Square
Triangle
UpRamp
DnRamp
Return
Sine
Square
Triangle
UpRamp
DnRamp
Return
Return
Return
Return
Return

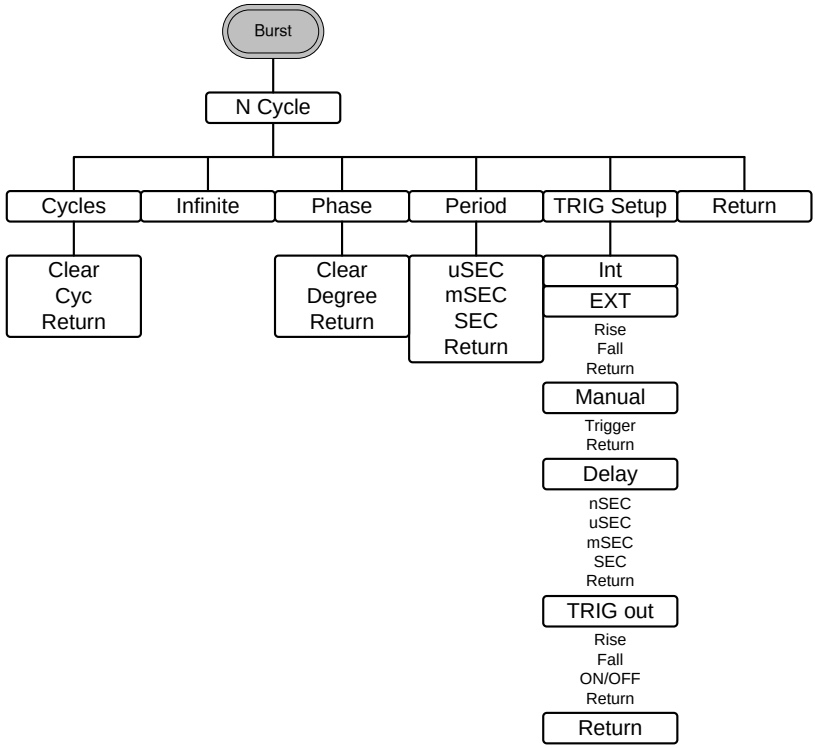
掃描


SWEEP
Source
Type
Start
Stop
SWP Time
More
Int
EXT
Manual
Trigger
Return
Return
Linear
Log
Return
uHz
mHz
Hz
kHz
MHz
Return
uHz
mHz
Hz
kHz
MHz
Return
mSEC
SEC
Return
Go to the
Sweep -
More menu

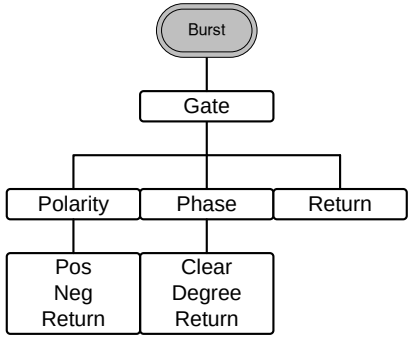
掃描–更多


Sweep
More
Span
Center
Marker
TRIG out
Return
uHz
mHz
Hz
kHz
MHz
Return
uHz
mHz
Hz
kHz
MHz
Return
Freq
uHz
mHz
Hz
kHz
MHz
Return
ON/OFF
Return
Rise
Fall
ON/OFF
Return

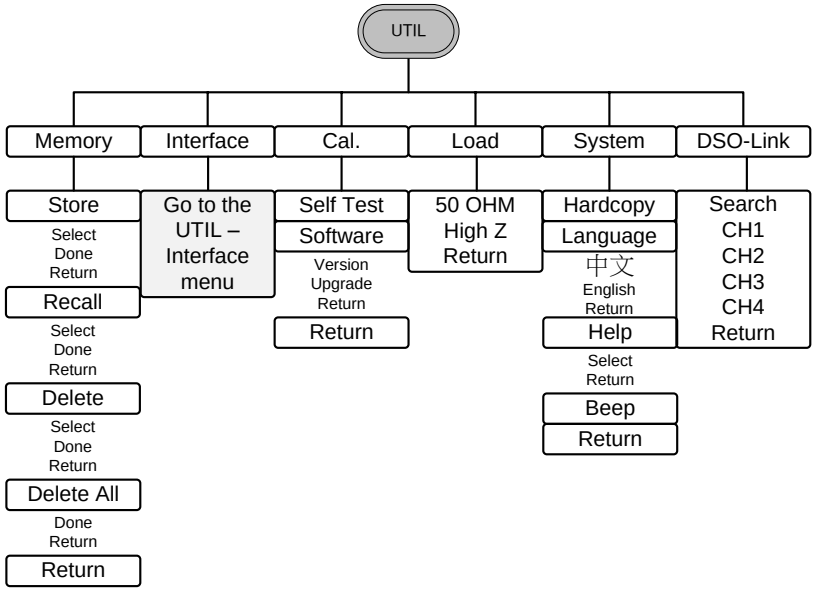
脈衝串–N 次迴圈



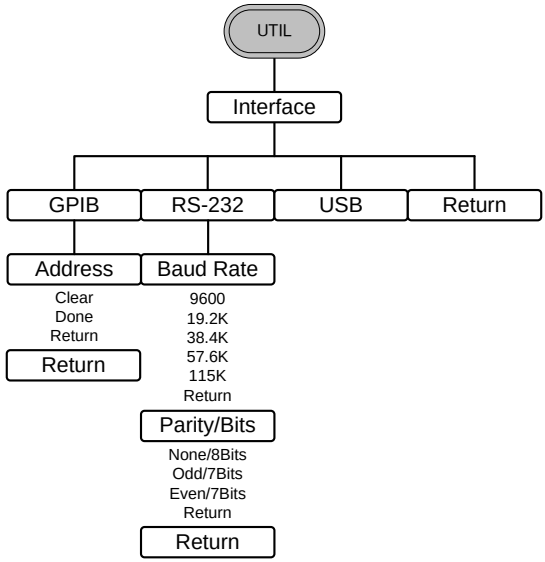
脈衝串–門控



UTIL


UTIL
Memory
Interface
Cal.
Load
System
DSO-Link
Store
Select
Done
Return
Recall
Select
Done
Return
Delete
Select
Done
Return
Delete All
Done
Return
Return
Go to the UTIL – Interface menu
Self Test
Software
Version
Upgrade
Return
Return
50 OHM
High Z
Return
Hardcopy
Language
中文
English
Return
Help
Select
Return
Beep
Return
Search
CH1
CH2
CH3
CH4
Return

UTIL–介面


UTIL
Interface
GPIB
RS-232
USB
Return
Address
Baud Rate
Clear
Done
Return
Return
9600
19.2K
38.4K
57.6K
115K
Return
Parity/Bits
None/8Bits
Odd/7Bits
Even/7Bits
Return
Return

預設設置

復位鍵用於恢復預設面板設置。

輸出設置	功能	正弦波
	頻率	1kHz
	幅值	3.000 Vpp
	偏置	0.00V dc
	輸出單位	Vpp
	輸出端	50Ω
調製 (AM/FM/FSK)	載波	1kHz 正弦波
	調製波形	100Hz 正弦波
	AM 深度	100%
	FM 偏移	100Hz
	FSK 跳躍頻率	100Hz
	FSK 頻率	10Hz
	PWM 占空比	50%
	PWM 頻率	20kHz
	數據機狀態	Off
掃描	起始/停止頻率	100Hz/1kHz
	掃描時間	1s
	掃描類型	線性
	掃描狀態	Off

脈衝串	脈衝串頻率	1kHz
	N 次迴圈	1
	脈衝串週期	10ms
	脈衝串起始相位	0°
	脈衝串狀態	Off
系統設置	斷電調用	On
	顯示模式	On
	錯誤佇列	已清除
	記憶體設置	無更改
	輸出	Off
觸發	觸發源	內部(立即)
介面設置	GPIB 地址	10
	介面	RS232
	串列傳輸速率	115200
	奇偶性	無(8 個數據位元)
校正	校正選單	加密

操作

本章節介紹了如何輸出基本波形。有關調製、掃描、脈衝串和任意波形的部分，

選擇波形

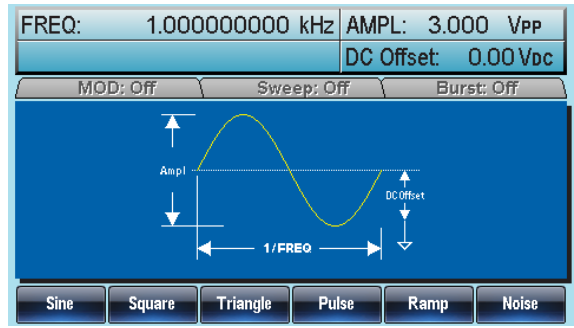
AFG-3000 可以輸出六種標準波形: 正弦波, 方波, 三角波, 脈衝波, 斜波和雜訊波。

正弦波

面板操作

1. 按 Waveform 鍵

2. 按 F1 (Sine)



設置方波

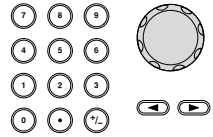
面板操作

1. 按 Waveform 鍵

2. 按 F2 (Square)建立一個方波

3. 按 F1 (Duty)將使位於參數窗口處的占空比參數變亮

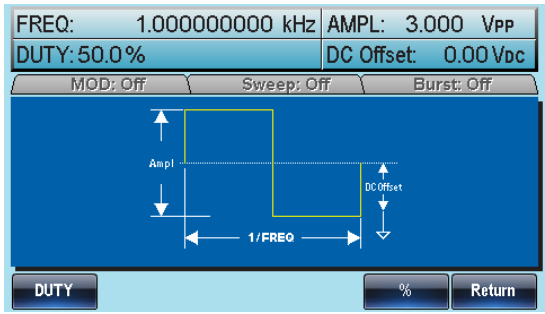
4. 使用方向鍵和可調旋鈕或數位鍵盤輸入占空比範圍



5. 按 F5 (%)選擇%單位

範圍

頻率	占空比範圍
≤25MHz	20%~80%
25MHz~≤50MHz	40%~60%
>50MHz~80MHz	50% (固定的)

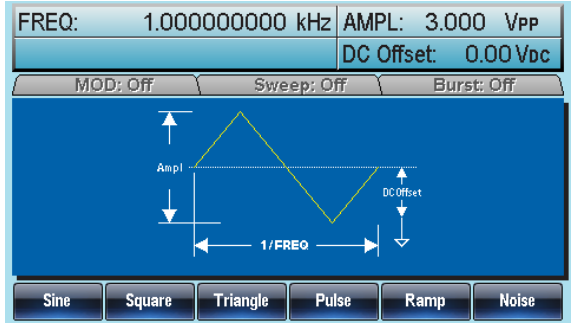


三角波

面板操作

1. 按 Waveform 鍵

2. 按 F3 (Triangle)



設置脈衝寬度

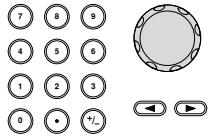
面板操作

1. 按 Waveform 鍵

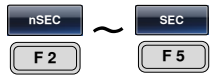
2. 按 F4 (Pulse)建立一個脈衝波

3. 按 F1 (Width)將使位於參數窗口處的脈寬參數變亮

4. 使用方向鍵和可調旋鈕或數位鍵盤輸入脈衝寬度

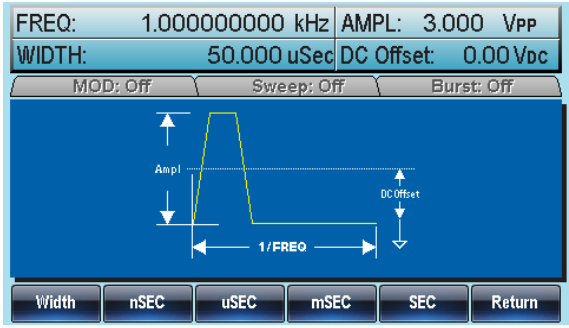


5. 按 F2~F5 選擇單位範圍



範圍	脈衝寬度	8ns~1999.9s
注意	最小脈衝寬度	頻率 ≤ 50MHz: 8ns 脈衝寬度 頻率 ≤ 6.25 MHZ: 5% 占空比

	解析度	頻率 ≤ 50MHz: 1ns 脈衝寬度 頻率 ≤ 6.25 MHZ: 1% 占空比



設置斜波

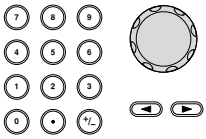
面板操作

1. 按 Waveform 鍵

2. 按 F5 (Ramp)建立一個斜波

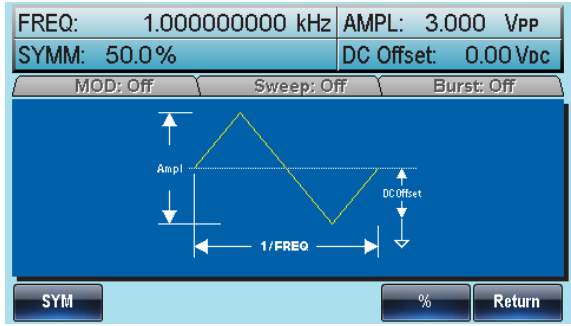
3. 按 F1 (SYM)將使位於參數窗口處的 SYMM 參數變亮

4. 使用方向鍵和可調旋鈕或數位鍵盤輸入對稱百分比



5. 按 F5 (%)選擇%單位

範圍	對稱	0%~100%

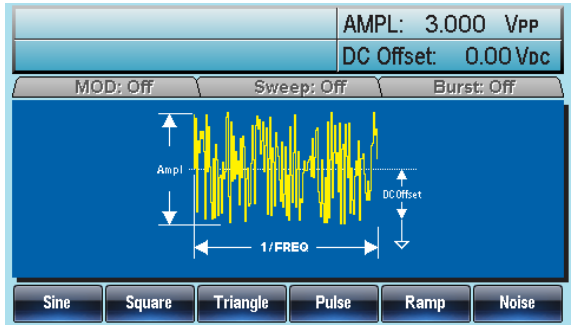


雜訊波

面板操作

1. 按 Waveform 鍵

2. 按 F6 (Noise)



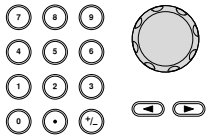
設置頻率

面板操作

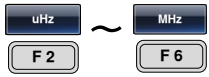
1. 按 FREQ/Rate 鍵

2. 位於參數窗口處的 FREQ 參數將變亮

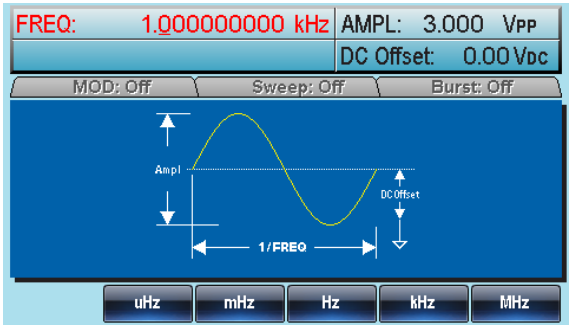
3. 使用方向鍵和可調旋鈕或數位鍵盤輸入頻率



4. 按 F2~F6 選擇頻率單位



範圍		
	正弦波	1μHz~80MHz(3081)/50MHz(3051)
	方波	1μHz~80MHz(3081)/50MHz(3051)
	三角波	1μHz~1MHz
	脈衝波	500μHz~50MHz
	斜波	1μHz~1MHz



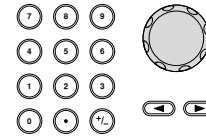
設置幅值

面板操作

1. 按 AMPL 鍵

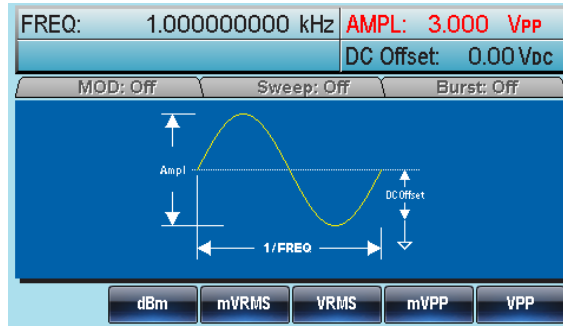
2. 位於參數窗口處的 AMPL 參數將變亮

3. 使用方向鍵和可調旋鈕或數位鍵盤輸入幅值



4. 按 F2~F6 選擇單位類型

	50Ω 負載	高阻抗
範圍	10mVpp~10Vpp	20mVpp~20Vpp
單位	Vpp, Vrms, dBm	



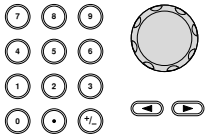
設置 DC 偏置

面板操作

1. 按 DC 偏置鍵

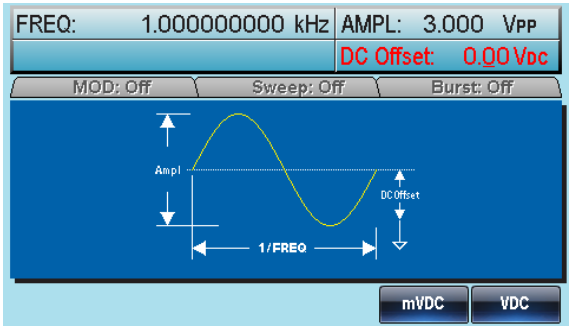
2. 位於參數窗口處的 DC 偏置參數將變亮

3. 使用方向鍵和可調旋鈕或數位鍵盤輸入 DC 偏置



4. 按 F5 (mVDC)或 F6 (VDC) 選擇電壓範圍

	50Ω 負載	高阻抗
範圍	±5Vpk	±10Vpk

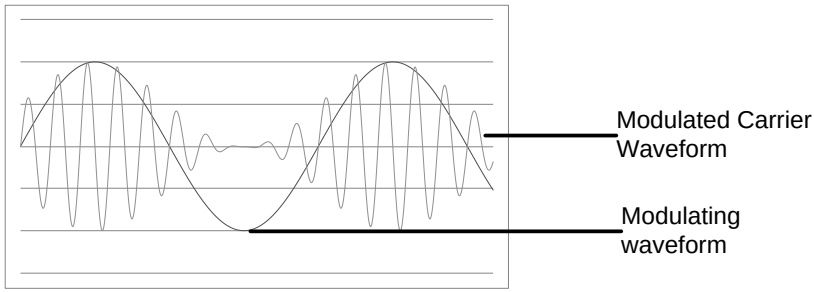


調製

AFG-3000 系列任意波形訊號產生器能夠產生 AM, FM, FSK 和 PWM 調製波形。調製類型不同，調製參數的設置也有所不同。無論何時，只允許啟動一種調製模式，且掃描或脈衝串模式不能與 AM/FM 同時啟用。一旦啟動一種調製模式，就意味著關閉前一個調製模式。

幅值調製 (AM)

AM 波形由載波和調製波組成。載波幅值與調製波幅值有關。AFG-3000 訊號產生器可以設置載波頻率、幅值、偏置電壓以及內部或外部調製源。

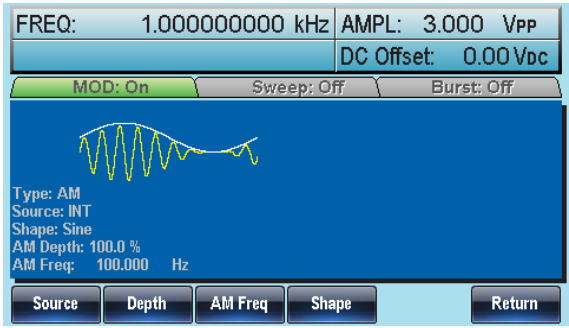


選擇 AM 調製

面板操作

1. 按 MOD 鍵

2. 按 F1 (AM)



AM 載波波形

背景

AM 載波波形：正弦波、方波、三角波、斜波、脈衝波或任意波。預設情況為正弦波。不能使用雜訊波作為載波波形。在選擇載波波形前，請先選擇 AM 調製模式

選擇一個標準載波波形

1. 按 Waveform 鍵

2. 按 F1~F5 選擇載波波形

選擇一個任意波的載波波形

3. 有關任意波的使用部分，詳見任意波快速指南或章節 35 頁 132 頁

範圍		
	AM 載波波形	正弦波, 方波, 三角波, 上斜波, 下斜波, 任意波

載波頻率

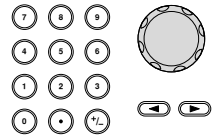
最大載波頻率與載波波形的選擇有關。預設載波頻率為 1kHz。

面板操作

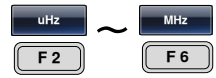
1. 對任一載波波形，按 FREQ/Rate 鍵

2. 位於參數視窗處的頻率參數將變亮

3. 使用方向鍵和可調旋鈕或數位鍵盤輸入載波頻率



4. 按 F2~F6 選擇頻率範圍



範圍

載波波形	Carrier Frequency
正弦波	1μHz~80MHz(3081)/ 50MHz(3051)
方波	1μHz~80MHz(3081)/ 50MHz(3051)
三角波	1μHz~1MHz
脈衝波	500μHz~50MHz
斜波	1μHz~1MHz

調製波形

訊號產生器可以接收內部和外部源。AFG-3000 的調製波形包括正弦波, 方波, 三角波, 上斜波, 下斜波。預設波形為正弦波。

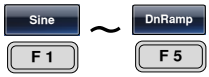
面板操作

1. 選擇 MOD

2. 按 F1 (AM)

3. 按 F4 (Shape)

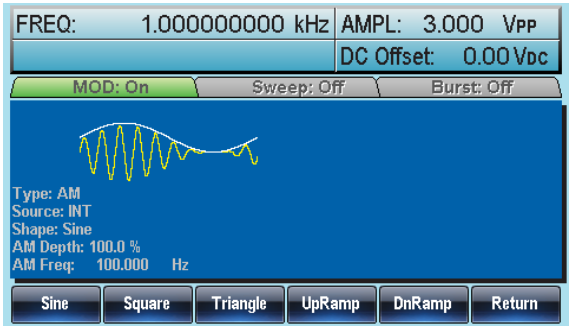
4. 按 F1~F5 選擇波形



5. 按 F6 (Return)返回選單

注意

方波	50% 占空比
上斜波	100% 對稱
三角波	50% 對稱
下斜波	0% 對稱



AM 頻率

調製波形的頻率(AM 頻率)可設為 2mHz~20kHz。

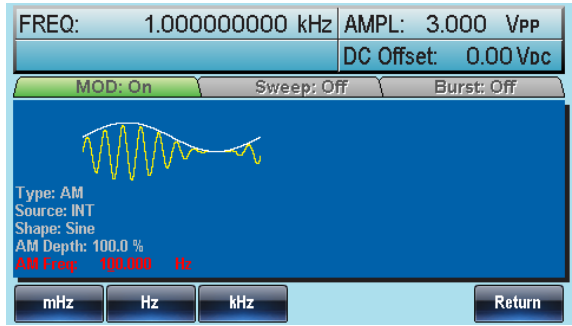
面板操作

1. 按 MOD 鍵

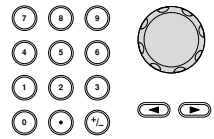
2. 按 F1 (AM)

3. 按 F3 (AM Freq)

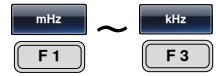
4. 位於波形顯示區域處的 AM 頻率參數將變亮



5. 使用方向鍵和可調旋鈕或數位鍵盤輸入 AM 頻率



6. 按 F1~F3 選擇頻率範圍



範圍		
	調製頻率	2mHz~20kHz
	預設頻率	100Hz

調製深度

調製深度為未調載波幅值與調製波形最小幅值偏差的比值(以百分比顯示)。換句話說， 調製深度就是調製波形與載波波形的最大幅值之比。

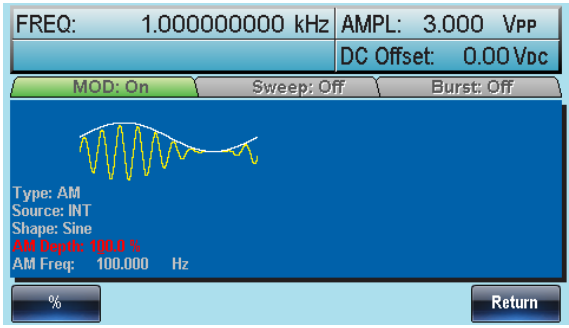
面板操作

1. 按 MOD 鍵

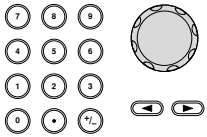
2. 按 F1 (AM)

3. 按 F2 (Depth)

4. 位於波形顯示區域處的 AM 深度參數將變亮



5. 使用方向鍵和可調旋鈕或數位鍵盤輸入 AM 深度



6. 按 F1 (%)選擇%單位

範圍	深度	0%~120%
	預設深度	100%

注意 即使調製深度大於 100%, 輸出也不超過±5V 的峰值 (10kΩ 負載)

如果選擇外部調製源, 那麼調製深度將由後面板 MOD INPUT 上的± 5V 訊號電壓控制。例如, 如果調製深度設置為 100%, 那麼最大幅值為+5V, 最小幅值為-5V

設置 (AM) 調製源

訊號產生器將接受用於 AM 調製的內部或外部源。預設為內部源。

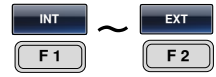
面板操作

1. 按 MOD 鍵

2. 按 F1 (AM)

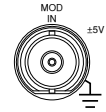
3. 按 F1 (Source)

4. 按 F1 (INT)或 F2 (EXT)選擇調製源

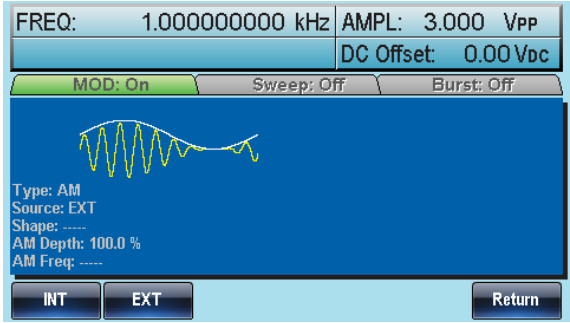


5. 按 F6 (Return)返回選單

外部源 從後面板的 MOD 輸入端子接收外部調製訊號

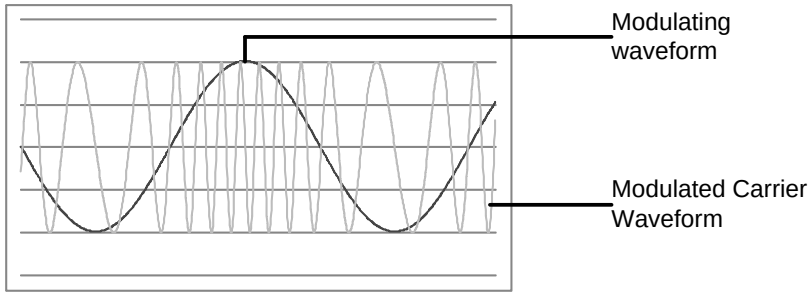


注意 如果選擇外部調製源, 那麼調製深度將由後面板 MOD INPUT 上的± 5V 訊號電壓控制。例如, 如果調製深度設置為 100%, 那麼最大幅值為+5V, 最小幅值為-5V


FREQ: 1.000000000 kHz
AMPL: 3.000 VPP
DC Offset: 0.00 VDC
MOD: On
Sweep: Off
Burst: Off
Type: AM
Source: EXT
Shape: -----
AM Depth: 100.0 %
AM Freq: -----
INT
EXT
Return

頻率調製 (FM)

FM 波形由載波和調製波組成。載波的暫態頻率隨調製波形的幅值而變化。當使用 AFG-3000 時，無論何時只允許啟用一種調製模式。



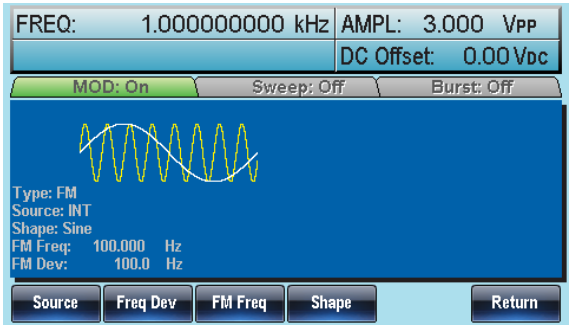
選擇頻率調製 (FM)

選擇 FM 後, 調製波形由載波頻率、輸出幅值和偏置電壓決定。

面板操作

1. 按 MOD 鍵

2. 按 F2 (FM)



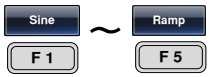
FM 載波波形

背景 FM 載波預設為正弦波。雜訊波和脈衝波不能用作載波

面板操作

1. 按 Waveform 鍵

2. 按 F1~F5 選擇載波波形(bar F4)



範圍	載波波形	正弦波, 方波, 三角波, 斜波

FM 載波頻率

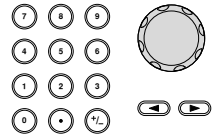
使用 AFG-3000 時，載波頻率必須大於或等於頻率偏移。如果頻率偏移大於載波頻率，函數產生器會自動將偏移調整到當前載波頻率所允許的最大值。載波最大頻率與所選波形有關。

面板操作

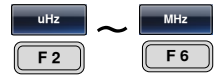
1. 按 FREQ/Rate 鍵選擇載波頻率

2. 位於參數窗口處的 FREQ 參數將變亮

3. 使用方向鍵和可調旋鈕或數位鍵盤輸入載波頻率



4. 按 F2~F6 選擇頻率單位



範圍

載波波形	載波頻率
正弦波	1μHz~80MHz(3081)/ 50MHz(3051)
方波	1μHz~80MHz(3081)/ 50MHz(3051)
三角波	1μHz~1MHz
斜波	1μHz~1MHz
預設頻率	1 kHz

FM 波形

訊號產生器能接受內部和外部源。AFG-3000 的內部調製波形包括正弦波、方波、三角波、正和負斜波(UpRamp, DnRamp)。預設情況為正弦波。

面板操作

1. 選擇 MOD

2. 按 F2 (FM)

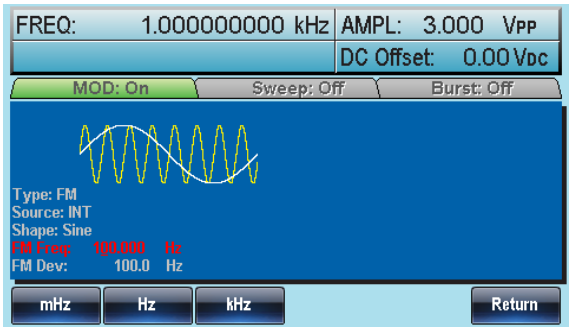
3. 按 F4 (Shape)

4. 按 F1~F5 選擇波形

5. 按 F6 (Return)返回選單

注意

方波	50% 占空比
上升波	100% 對稱
三角波	50% 對稱
下降波	0% 對稱



頻率調製波形

訊號產生器將接受用於 FM 的內部或外部調製源。

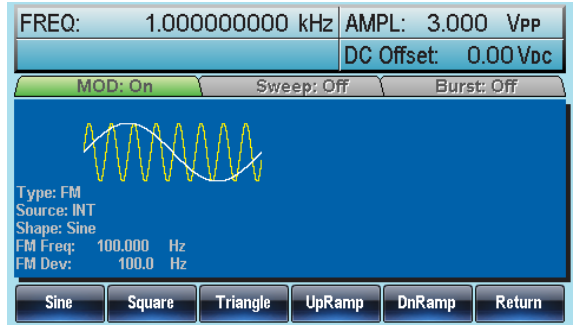
面板操作

1. 按 MOD 鍵

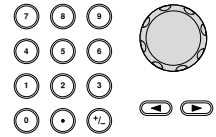
2. 按 F2 (FM)

3. 按 F3 (FM Freq)

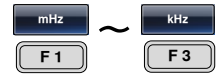
4. 位於波形顯示區域處的 FM 頻率參數將變亮



5. 使用方向鍵和可調旋鈕或數位鍵盤輸入 FM 頻率



6. 按 F1~F3 選擇頻率單位



範圍	調製頻率	2mHz~20kHz
	預設頻率	100Hz

頻率偏移

頻率偏移是載波與調製波的頻率最大偏差。

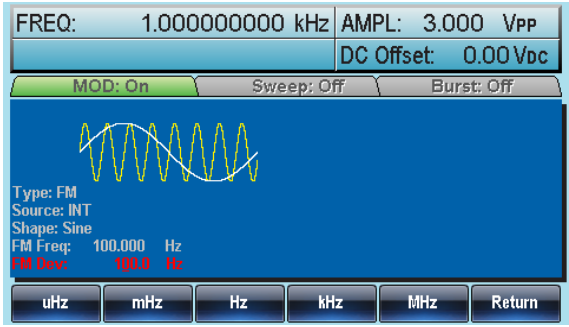
面板操作

1. 按 MOD 鍵

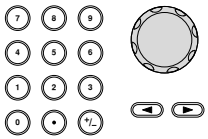
2. 按 F2 (FM)

3. 按 F2 (Freq Dev)

4. 位於波形顯示區域處的 Freq Dev 參數將變亮



5. 使用方向鍵和可調旋鈕或數位鍵盤輸入頻率偏移



6. 按 F1~ F5 選擇頻率單位

範圍	頻率偏移	DC~80MHz (3081) DC~50MHz (3051) DC~1MHz (三角波)
	預設深度	100kHz

選擇 (FM) 調製源

訊號產生器將接受用於 FM 調製的內部或外部源。預設為內部源。

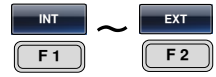
面板操作

1. 按 MOD 鍵

2. 按 F2 (FM)

3. 按 F1 (Source)

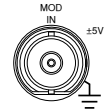
4. 按 F1 (INT)或 F2 (EXT)選擇調製源



5. 按 F6 (Return)返回選單

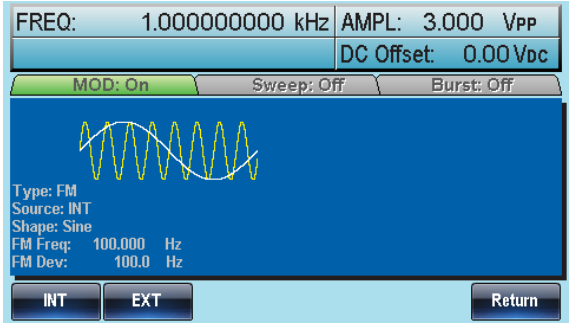
外部源

從後面板的 MOD 輸入端子接收外部調製訊號



注意

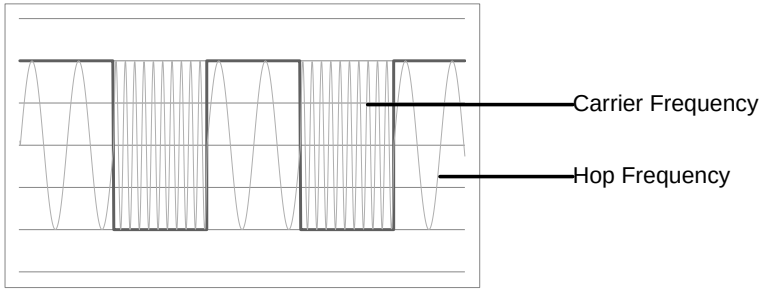
如果選擇外部調製源, 那麼頻偏將由後面板 MOD INPUT 上的± 5V 訊號電壓控制。頻偏與調製訊號準位成比例。例如，如果調製電壓為+5V, 那麼頻偏將等於設置的頻偏。外部訊號準位越低，偏移就越小；而負訊號準位將會使頻偏頻率降至載波頻率之下。


FREQ: 1.000000000 kHz
AMPL: 3.000 VPP
DC Offset: 0.00 VDC
MOD: On
Sweep: Off
Burst: Off
Type: FM
Source: INT
Shape: Sine
FM Freq: 100.000 Hz
FM Dev: 100.0 Hz
INT
EXT
Return

頻移鍵控 (FSK) 調製

FSK 調製用於在兩個預設頻率(載波頻率和跳躍頻率)間交替輸出頻率。內部頻率產生器或後面板 Trigger INPUT 上的訊號準位決定交替頻率。

函數產生器一次只允許啟用一種調製模式。當開啟 FSK 調製時，其它調製模式將禁用。在啟用掃描和脈衝串時不允許啟用 FSK 調製。在啟用 FSK 時，將關閉掃描或脈衝串模式。



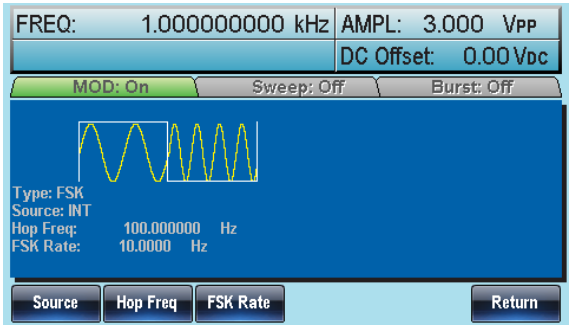
選擇 FSK 調製

當使用 FSK 模式時, 輸出波形使用預設載波頻率、幅值和偏置電壓。

面板操作

1. 按 MOD 鍵

2. 按 F3 (FSK)



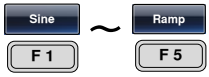
FSK 載波波形

背景 預設波形為正弦波。雜訊波不能用作載波

面板操作

1. 按 Waveform 鍵

2. 按 F1~F5 選擇載波波形(bar F4)



範圍	載波波形	正弦波, 方波, 三角波, 斜波, 脈衝波

FSK 載波頻率

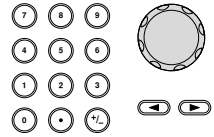
最大載波頻率與載波波形有關。預設載波頻率均為 1kHz。選擇外部源時，Trigger INPUT 訊號的訊號準位控制輸出頻率。當訊號為邏輯低準位時，輸出載波頻率；當訊號為邏輯高準位時，輸出跳躍頻率。

面板操作

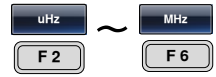
1. 按 FREQ/Rate 鍵選擇載波頻率

2. 位於參數窗口處的 FREQ 參數將變亮

3. 使用方向鍵和可調旋鈕或數位鍵盤輸入載波頻率



4. 按 F2~F6 選擇 FSK 頻率單位



範圍	載波波形	載波頻率
	正弦波	1μHz~80MHz(3081)/ 50MHz(3051)
	方波	1μHz~80MHz(3081)/ 50MHz(3051)
	三角波	1μHz~1MHz
	斜波	1μHz~1MHz
	脈衝波	500μHz~50MHz

FSK 跳躍頻率

預設跳躍頻率均為 100 Hz。內部調製波是占空比為 50%的方波。選擇外部源時，Trigger INPUT 訊號的訊號準位控制輸出頻率。當訊號為邏輯低準位時，輸出載波頻率；當訊號為邏輯高準位時，輸出跳躍頻率。

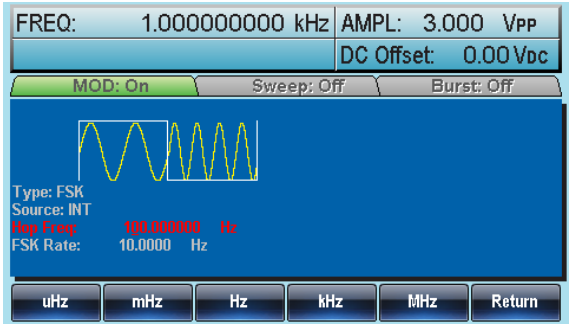
面板操作

1. 按 MOD 鍵

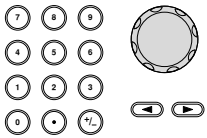
2. 按 F3 (FSK)

3. 按 F2 (Hop Freq)

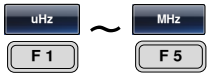
4. 位於波形顯示區域處的 Hop Freq 參數將變亮



5. 使用方向鍵和可調旋鈕或數位鍵盤輸入跳躍頻率



6. 按 F1~F5 選擇頻率範圍



範圍	波形	載波頻率
	正弦波	1μHz~80MHz(3081)/ 50MHz(3051)
	方波	1μHz~80MHz(3081)/ 50MHz(3051)
	三角波	1μHz~1MHz
	斜波	1μHz~1MHz
	脈衝波	500μHz~50MHz

FSK 頻率

FSK 頻率是決定輸出載波頻率或跳躍頻率的頻率值。

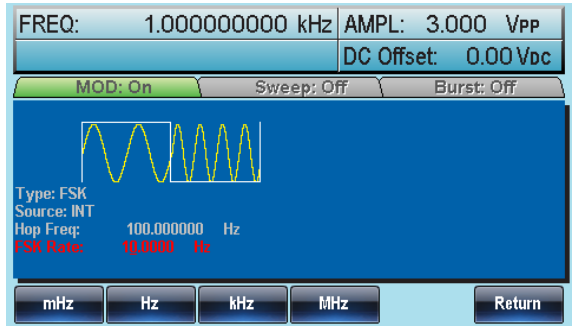
面板操作

1. 選擇 MOD

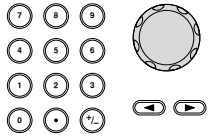
2. 按 F3 (FSK)

3. 按 F3 (FSK Rate)

4. 位於波形顯示區域處的 FSK Rate 參數將變亮



5. 使用方向鍵和可調旋鈕或數位鍵盤輸入 FSK 頻率



6. 按 F1~F5 選擇頻率單位

範圍	FSK 頻率	2mHz~100kHz
	預設	10Hz
注意	如果選擇外部源, 忽視 FSK 頻率設置	

FSK 源

AFG-3000 接受內部和外部 FSK 源，預設為內部 FSK 源。當選擇內部 FSK 源時，使用 FSK Rate 功能設置 FSK 頻率。當選擇外部源時，FSK 頻率與後面板 Trigger INPUT 訊號的頻率一致。

面板操作

1. 按 MOD 鍵

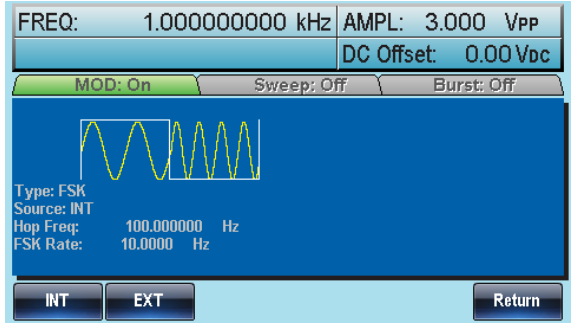
2. 按 F3 (FSK)

3. 按 F1 (Source)

4. 按 F1 (Internal) or F2 (External)選擇 FSK 源

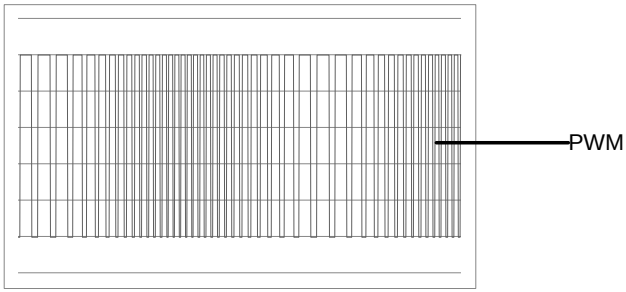
5. 按 F6 (Return)返回選單

注意 Trigger INPUT 端子不能設置邊沿極性


FREQ: 1.000000000 kHz
AMPL: 3.000 VPP
DC Offset: 0.00 VDC
MOD: On
Sweep: Off
Burst: Off
Type: FSK
Source: INT
Hop Freq: 100.000000 Hz
FSK Rate: 10.0000 Hz
INT
EXT
Return

脈衝寬度調製

對於脈寬調製，脈衝寬度由調製波形的暫態電壓決定。無論何時僅允許啟用一種調製模式。若使用 PWM，將禁用其它調製模式。此外不允許掃描和脈衝串模式與 PWM 同時使用。若使用 PWM，將關閉掃描和脈衝串模式。



選擇脈衝寬度調製

選擇 PWM, 需要考慮載波頻率的當前設置、幅值調製頻率、輸出和偏移電壓。

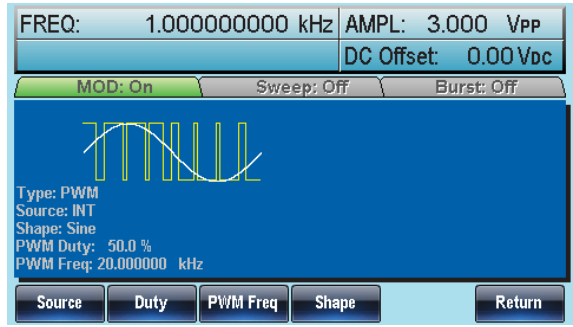
面板操作

1. 按 MOD 鍵

2. 按 F2 (Square)

3. 按 MOD 鍵

4. 按 F4 (PWM)



PWM 載波波形

PWM 僅使用方波作為載波波形，否則會彈出錯誤資訊。

PWM 載波頻率

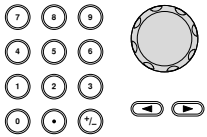
載波頻率與方波有關。預設載波頻率為 1kHz。

面板操作

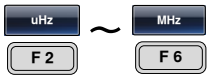
1. 按 FREQ/Rate 鍵選擇載波頻率

2. 位於參數窗口處的 FREQ 參數將變亮

3. 使用方向鍵和可調旋鈕或數位鍵盤輸入載波頻率



4. 按 F2~F6 選擇 PWM 頻率單位



PWM 調製波形

調製波形(內部源)包括正弦波、方波、三角波、正斜波和負斜波。預設波形為正弦波。

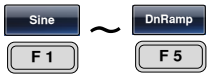
面板操作

1. 按 MOD 鍵

2. 按 F4 (PWM)

3. 按 F4 (Shape)

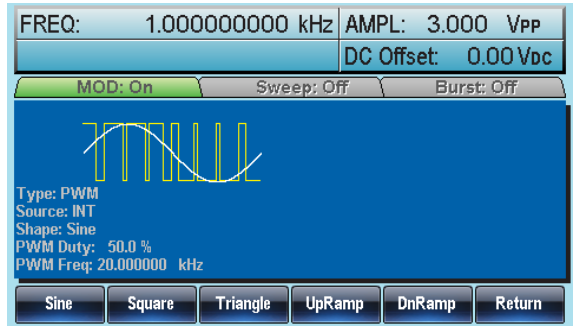
4. 按 F1~F5 選擇波形



5. 按 F6 (Return)返回選單 

範圍

波形	
方波	50%占空比
正斜波	100%對稱
三角波	50%對稱
負斜波	0%對稱



調製波形頻率

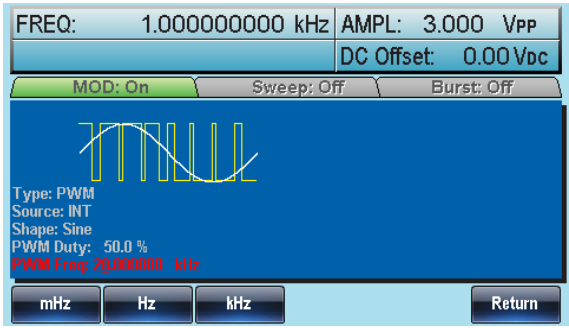
面板調製

1. 選擇 MOD 

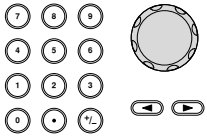
2. 按 F4 (PWM) 

3. 按 F3 (PWM Frequency) 

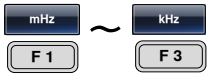
4. 位於波形顯示區域處的 PWM Freq 參數將變亮



5. 使用方向鍵和可調旋鈕或數位鍵盤輸入 PWM 頻率



6. 按 F1~F3 選擇頻率單位



範圍	PWM 頻率	2mHz~20kHz
	預設	20kHz

調製占空比

用於設置占空比(%)

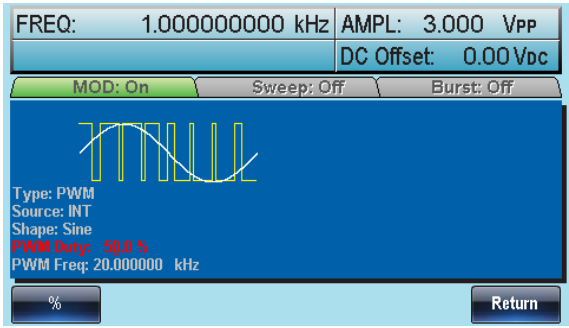
面板操作

1. 按 MOD 鍵

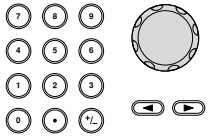
2. 按 F4 (PWM)

3. 按 F2 (Duty)

4. 位於波形顯示區域處的 Duty 參數將變亮



5. 使用方向鍵和可調旋鈕或數位鍵盤輸入占空比



6. 按 F1 (%)選擇百分號

範圍	占空比	0% ~ 100%
	預設	50%

注意　如果使用外部調製源，則脈衝波形由外部調製源調製。此時，MOD INPUT 端子上的±5V 電壓控制脈寬。

PWM 調製源

AFG-3000 接受內部和外部 PWM 調製源。預設為內部調製源。

面板操作

1. 按 MOD 鍵

2. 按 F4 (PWM)

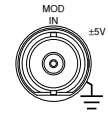
3. 按 F1 (Source)

4. 按 F1 (INT)或 F2 (EXT)選擇調製源

5. 按 F6 (Return)返回選單

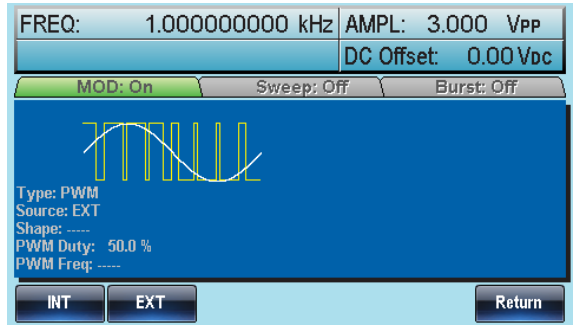
外部源

選擇外部調製源時，需要使用後面板的 MOD INPUT 端子



注意

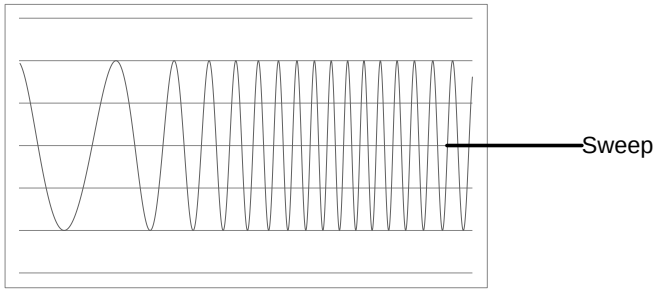
當您選擇外部調製源時，脈寬調製由後面板 MOD INPUT 端子上的±5V 電壓控制。例如：如果您已將調製深度設為 100%，則在調製訊號為+5V 時，輸出最大脈寬；在調製訊號為-5V 時，輸出最小脈寬。



頻率掃描

除雜訊波和脈衝波外，訊號產生器可以對正弦波、方波或斜波產生一個掃頻。在啟動掃描模式時，將關閉脈衝串或其它調製模式。

在掃描模式下，訊號產生器以指定步進從起始頻率到停止頻率掃描。您能夠以線性或對數間隔由高頻向低頻掃描，或者由低頻向高頻掃描。您也可以配置訊號產生器，使其用外部觸發或手動觸發輸出單個掃描。



選擇掃描模式

選擇 Sweep 按鈕，進入掃描模式。如果不預先設置，輸出幅值、偏移和頻率使用預設值。

設置起始和停止頻率

起始頻率和停止頻率定義掃描上限和下限。訊號產生器從起始頻率開始，一直掃描到停止頻率，然後又重定回起始頻率。在整個掃描範圍內，相位連續(100μHz-80MHz: AFG-3081/50MHz: AFG-3051)。

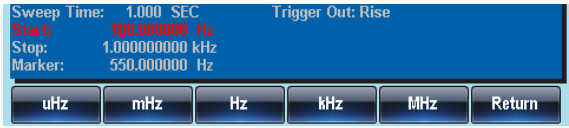
面板操作

1. 按 SWEEP 鍵

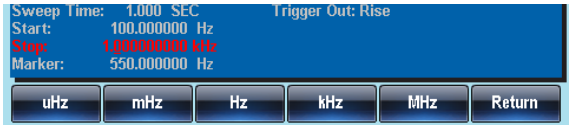
2. 按 F3 (Start)或 F4 (Stop)選擇起始或停止頻率

3. 位於波形顯示區域處的 Start 或 Stop 參數將變亮

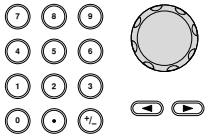
起始

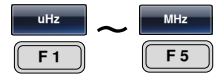


停止



4. 使用方向鍵和可調旋鈕或數位鍵盤輸入 Stop/Start 頻率



5. 按 F1~F5 選擇 Start/Stop 頻率單位 

範圍	掃描範圍	100μHz~80MHz(3081) 100μHz~50MHz(3051) (正弦波/方波) 100μHz~1MHz (三角波)
	起始 – 預設	100Hz
	停止 – 預設	1kHz

注意

從低頻到高頻掃描，設置起始頻率＜停止頻率。從高頻到低頻掃描，設置起始頻率＞停止頻率。關閉標記後，同步訊號為 50%占空比的方波。在掃描開始時，同步訊號處於 TTL 低準位，掃描中點上升到 TTL 高準位。同步訊號頻率與指定掃描時間相等。打開標記，在掃描開始時同步訊號處於 TTL 高準位，到達標識頻率處下降到 TTL 低準位。標記輸出端輸出同步訊號。

中心頻率和跨距

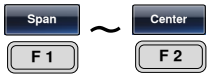
使用中心頻率和跨距來設置掃描上限和下限(起始/停止)。

面板操作

1. 按 SWEEP 鍵

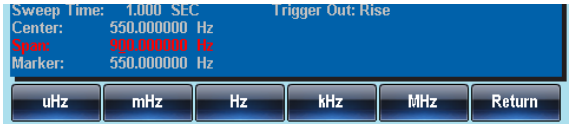
2. 按 F6 (More)

3. 按 F1 (Span)或 F2 (Center)選擇跨距或中心

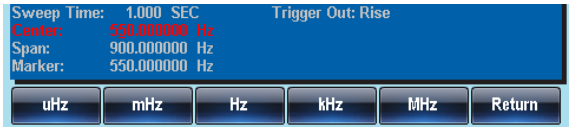


4. 位於波形顯示區域處的 Span 或 Center 參數將變亮

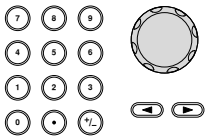
跨距



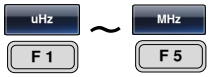
中心



5. 使用方向鍵和可調旋鈕或數位鍵盤輸入 Span/Center 頻率



6. 按 F1~F5 選擇 Start/Stop 頻率單位



範圍

中心頻率	100μHz~80MHz(3081) 100μHz~50MHz(3051) (正弦波/方波)

		100μHz~1MHz (三角波)
	跨距頻率	DC~80MHz(3081) DC~50MHz(3051) (正弦波/方波) DC ~1MHz (三角波)
	中心 – 預設	550Hz
	跨距 – 預設	900Hz

注意　從低頻到高頻掃描，設置正頻率跨距。從高頻到低頻掃描，設置負頻率跨距。關閉標記後，同步訊號為 50%占空比的方波。在掃描開始時，同步訊號處於 TTL 低準位，掃描中點上升到 TTL 高準位。同步訊號頻率與指定掃描時間相等。打開標記，在掃描開始時同步訊號處於 TTL 高準位，到達標識頻率處下降到 TTL 低準位。標記輸出端輸出同步訊號。

掃描模式

掃描模式用於選擇線性或對數掃描。預設線性掃描。

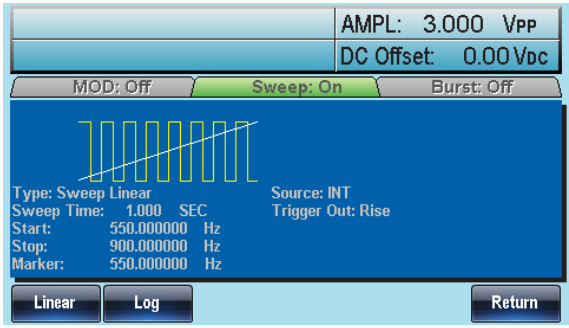
面板操作

1. 按 SWEEP 鍵

2. 按 F2 (Type)

3. 按 F1 (Linear)或 F2 (Log)選擇線性或對數掃描

4. 按 F6 (Return)返回選單



掃描時間

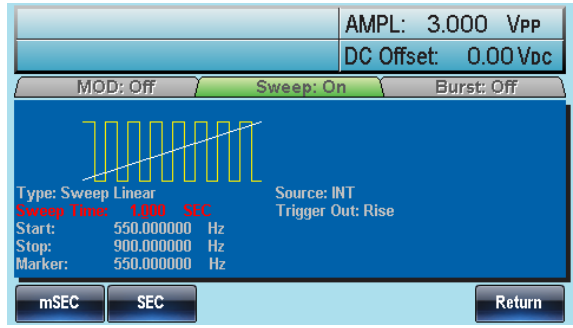
從起始頻率到截止頻率完成一次掃描所需的時間稱為掃描時間。訊號產生器自動限定掃描的離散頻率點，該數目與掃描長度有關。

面板操作

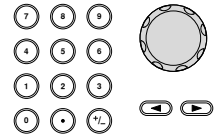
1. 按 SWEEP 鍵

2. 按 F5 (SWP Time)

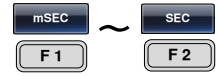
3. 位於波形顯示區域處的掃描時間參數將變亮



4. 使用方向鍵和可調旋鈕或數位鍵盤輸入掃描時間



5. 按 F1~F2 選擇時間單位



範圍	掃描時間	1ms ~ 500s
	預設	1s

標記頻率

標記訊號變為低準位時的頻率稱為標記頻率(掃描開始時標記訊號都處於高準位)。後面板 MARK 端子輸出標記訊號。預設 550 Hz。

面板操作

1. 按 SWEEP 鍵

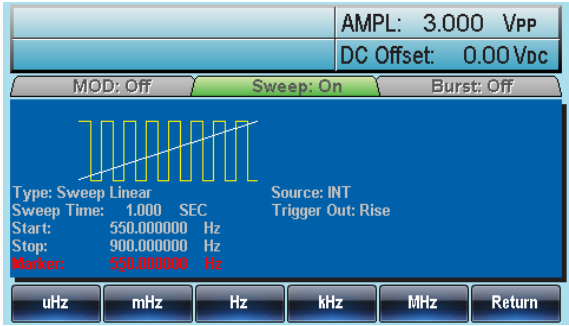
2. 按 F6 (More)

3. 按 F3 (Marker)

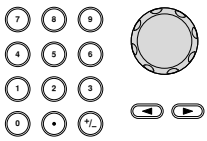
4. 按 F2 (ON/OFF)打開/關閉標記

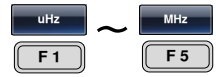
5. 按 F1 (Freq)選擇標記頻率

6. 位於波形顯示區域處的頻率參數將變亮



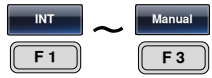
7. 使用方向鍵和可調旋鈕或數位鍵盤輸入頻率



	8. 按 F1~F5 選擇頻率單位	
範圍	頻率	100μHz~80MHz(3081) 100μHz~50MHz(3051) 100μHz~1MHz (斜波)
	預設	550Hz
注意	標記頻率必須設置在起始頻率和停止頻率之間。如果無設置，標記頻率將等於起始頻率和停止頻率的均值。 啟用掃描模式後，標記模式將忽略同步模式的設置。	

掃描觸發源

掃描模式下，訊號產生器在收到觸發訊號時輸出一個掃描。掃描輸出完成後，訊號產生器輸出起始頻率，並等待下一次觸發。預設內部觸發源。

面板掃描	1. 按 SWEEP 鍵	
	2. 按 F1 (Source)	
	3. 按 F1 (Internal), F2 (External)或 F3 (Manual)選擇觸發源	
	4. 按 F6 (Return)返回選單	

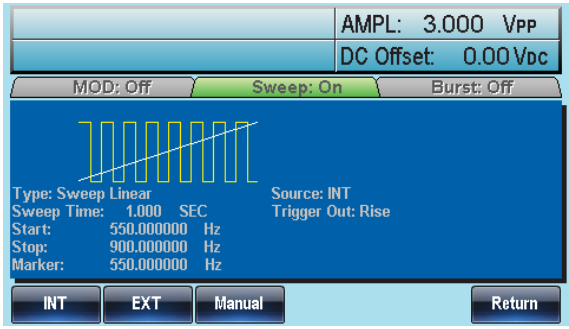
注意

選擇內部源時，訊號產生器輸出一個連續的掃描，其頻率由掃描時間決定。

選擇外部源時，每收到一個從後面板 Trig Out 的 TTL 脈衝，訊號產生器就輸出一個掃描。

觸發週期必須大於或等於掃描時間+1ms。

5. 如果選擇手動觸發，按 F1 (Trigger)執行手動掃描



觸發輸出

後面板的 Trig Out 端子輸出觸發輸出訊號(掃描和脈衝串模式)。預設在掃描開始時輸出具有上升沿的 TTL 方波。訊號也可以設為下降沿。

面板操作

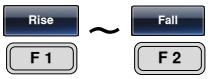
1. 按 SWEEP 鍵

2. 按 F6 (More)

3. 按 F4 (TRIG out)

4. 按 F3 (ON/OFF)

5. 按 F1 (Rise)或 F2 (Fall)選擇觸發沿

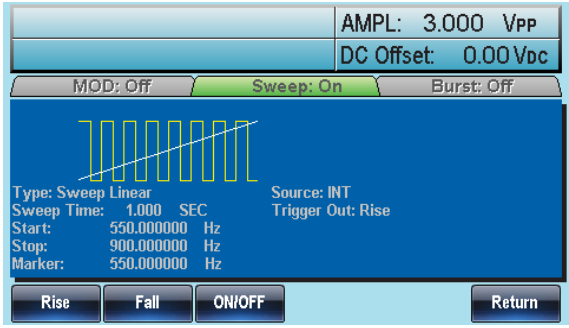


注意

選擇內部觸發源，在每次掃描開始時，訊號產生器就從 Trig out 端輸出占空比為 50%的方波。波形頻率與掃描時間相等。

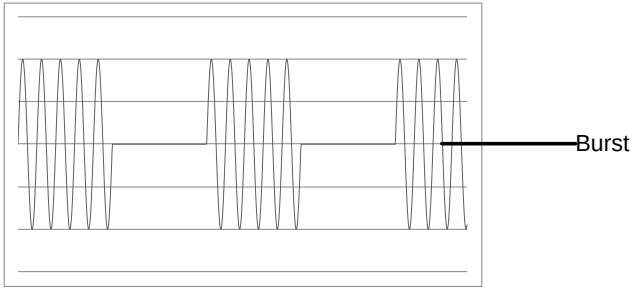
選擇外部觸發源時，訊號產生器自動禁用觸發輸出訊號。

選擇手動觸發，在每次掃描或脈衝串開始時，訊號產生器從 Trig Out 端輸出一個>1us 的脈衝。



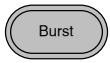
脈衝串模式

訊號產生器能建立一個具有指定迴圈數的波形脈衝串。脈衝串模式支援正弦波、方波、三角波和斜波。



選擇脈衝串模式

選擇脈衝串模式後，任何調製或掃描模式都將自動關閉。如果無設置，輸出幅值、偏移和頻率啟用預設值。



脈衝串模式

觸發(N 次迴圈模式)或閘控模式可以設置脈衝串模式。在 N 次迴圈/觸發模式下，每次接收觸發時訊號產生器都將輸出一個指定迴圈次數的波形(脈衝串)。執行完成後，訊號產生器將停止並等待下一次觸發。預設為 N 次迴圈模式。內部或外部觸發均可使用。

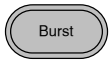
相比指定迴圈次數，門控模式使用外部觸發打開或關閉輸出。當觸發輸入訊號為高準位時，波形持續輸出。當觸發輸入訊號為低準位時，訊號產生器在輸出最後一個完整波形後停止。輸出電壓準位仍與脈衝串波形的起始相位相同。

脈衝串模式	脈衝串計數	脈衝串週期	相位	觸發源
Triggered (Int)	可用	可用	可用	立即
Triggered (Ext)	可用	不可用	可用	EXT, Bus
Gated pulse (Ext)	不可用	不可用	可用	不可用

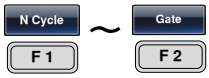
門控模式下，關閉脈衝串計數、脈衝串週期和觸發源。如果此時觸發，將不會有任何效果，也不會產生任何錯誤。

面板操作

1. 按 Burst 鍵



2. 選擇 N 次迴圈(F1)或閘控(F2)



脈衝串頻率

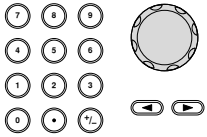
在 N 次迴圈和門控模式下，波形頻率定義了脈衝串波形的重複率。在 N 次迴圈模式下，以指定迴圈次數輸出波形。在門控模式下，當觸發訊號為高準位時輸出波形頻率。脈衝串模式支援正弦波、方波、三角波或斜波。

面板操作

1. 按 FREQ/Rate 鍵

2. 位於參數窗口處的 FREQ 參數將變亮

3. 使用方向鍵和可調旋鈕或數位鍵盤輸入頻率



4. 按 F2~F6 選擇頻率單位

範圍		
	頻率	2mHz~80MHz(3081)/ 50MHz(3051)
	頻率 – 斜波	2mHz~1MHz
	預設	1kHz

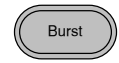
注意　波形頻率不同於脈衝串週期。脈衝串週期指 N 次迴圈模式下脈衝串波形之間的時間間隔。

脈衝串迴圈/計數

脈衝串迴圈/計數是指脈衝串波形的迴圈次數。僅用於 N Cycle 模式 (內部, 外部或手動觸發)。預設 1 次迴圈。

面板操作

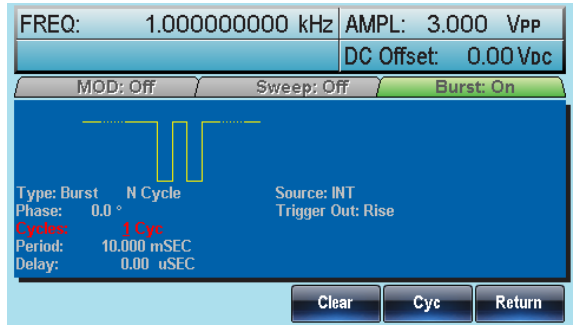
1. 按 Burst 鍵



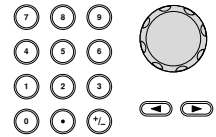
2. 按 F1 (N Cycle)

3. 按 F1 (Cycles)

4. 位於波形顯示區域處的 Cycles 參數將變亮



5. 使用方向鍵和可調旋鈕或數位鍵盤輸入迴圈數



6. 按 F5 選擇 Cyc 單位

範圍	迴圈	1~1,000,000

注意

選擇內部觸發源時，持續輸出迴圈數。脈衝串週期決定脈衝串頻率和脈衝串之間的時間間隔。

脈衝串計數須小於脈衝串週期和波形頻率的乘積。

脈衝串計數 < (脈衝串週期 x 波形頻率)

如果脈衝串計數超出上述限制，訊號產生器將自動增大脈衝串週期，以滿足條件。

選擇門控脈衝串模式時，忽略脈衝串計數。如果從遠端介面更改計數，訊號產生器將記錄新計數，並在下次使用。

無限脈衝串計數

面板操作

1. 按 Burst 鍵

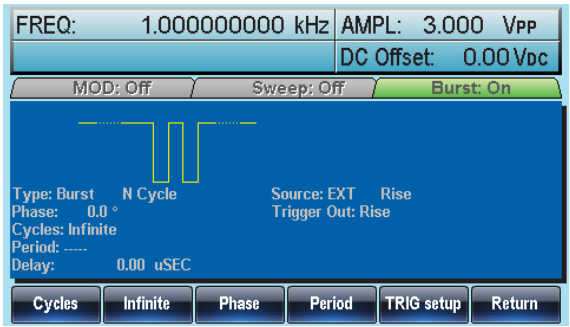
2. 按 F1 (N Cycle)

3. 按 F2 (Infinite)

注意

無限脈衝串僅用在手動觸發模式

25MHz 以上, 無限脈衝串僅適合方波和正弦波



脈衝串週期

從一個脈衝串的開始至下一個脈衝串的開始所經歷的時間稱為脈衝串週期。僅用於內部觸發脈衝串模式。

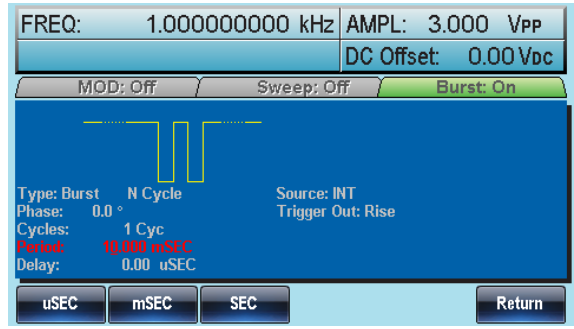
面板操作

1. 按 Burst 鍵

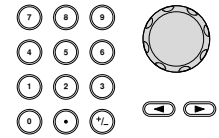
2. 按 F1 (N Cycle)

3. 按 F4 (Period)

4. 位於波形顯示區域處的週期參數將變亮



5. 使用方向鍵和可調旋鈕或數位鍵盤輸入週期



6. 按 F1~F3 選擇週期單位

範圍	週期	1ms~500s
	預設	10ms

注意

脈衝串週期僅用於內部觸發。當使用門控脈衝串模式或外部和手動觸發時，關閉脈衝串週期設置。

脈衝串週期一定要夠長，且滿足如下條件:

脈衝串週期>脈衝串計數/波形頻率 + 200ns

脈衝串相位

脈衝串波形的起始相位稱為脈衝串相位，預設 0˚。

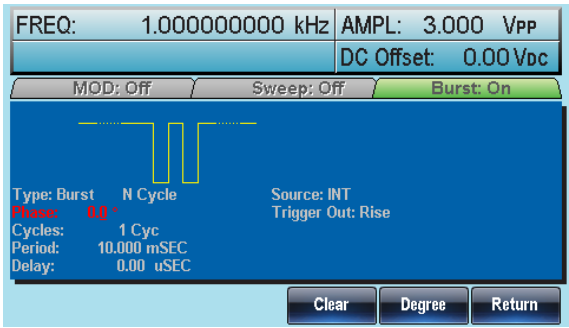
面板操作

1. 按 Burst 鍵

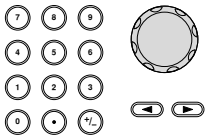
2. 按 F1 (N Cycle)

3. 按 F3 (Phase)

4. 位於波形顯示區域處的相位參數將變亮



5. 使用方向鍵和可調旋鈕或數位鍵盤輸入相位



6. 按 F5 (Degree)選擇相位單位

範圍	相位	-360˚~+360˚
	預設	0˚

注意

當使用正弦波、方波、三角波或斜波時，0˚與波形 0V 點相對應。

0˚是波形的起始點。對於正弦波、方波或三角波、斜波，0˚對應 0V 電壓(假設沒有 DC 偏置)

脈衝串相位用於 N 次迴圈和門控脈衝串模式。在門控脈衝串模式下，當觸發 INPUT 訊號下降到低準位時，訊號產生器完成當前波形後停止輸出。電壓輸出準位仍與起始脈衝串相位對應的電壓值相同。

脈衝串觸發源

觸發脈衝串(N-Cycle)模式下，訊號產生器在收到觸發後輸出一個波形脈衝串。脈衝串迴圈(脈衝串計數)指定每個脈衝串的波形數。輸出完成後，訊號產生器停止並等待下一次觸發。預設啟用內部觸發的脈衝串(N-cycle)模式。

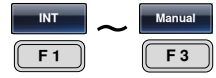
面板操作

1. 按 Burst 鍵

2. 按 F1 (N Cycle)

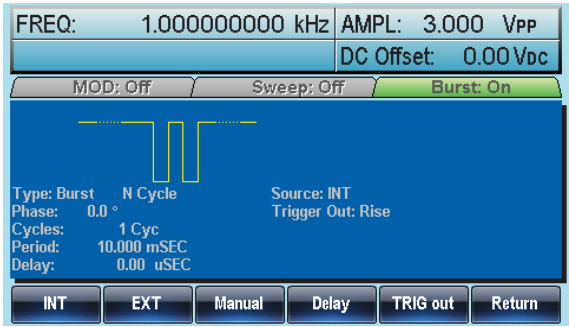
3. 按 F5 (TRIG setup)

4. 按 F1 (INT), F2 (EXT)或 F3 (Manual)選擇觸發類型



手動觸發

如果選擇手動觸發，每按一次觸發軟鍵(F1)輸出一個脈衝串



注意

選擇內部觸發源時，脈衝串以指定頻率持續輸出，該頻率和脈衝串之間的時間間隔由脈衝串週期決定。

選擇外部觸發時，訊號產生器接收後面板觸發輸入端的觸發訊號(TTL)。每收到一個觸發訊號，訊號產生器就輸出一個脈衝串(迴圈數已設)。輸出脈衝串期間接收到的觸發訊號將被忽略。

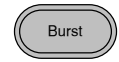
若使用手動或外部觸發，僅可用脈衝串相位和脈衝串迴圈/計數，脈衝串週期不可用。

在接收觸發後、脈衝串開始之間可以插入時間延遲。

脈衝串延遲

面板操作

1. 按 Burst 鍵

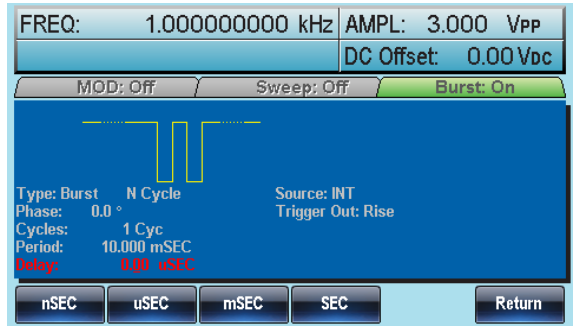


2. 按 F1 (N Cycle)

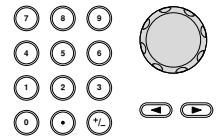
3. 按 F5 (TRIG setup)

4. 按 F4 (Delay)

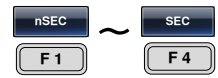
5. 位於波形顯示區域處的 Delay 參數將變亮



6. 使用方向鍵和可調旋鈕或數位鍵盤輸入週期



7. 按 F1~F4 選擇延遲時間單位



範圍	延遲時間	0s~80s
	預設	0s

脈衝串觸發輸出

後面板的 Trig Out 端子提供觸發輸出訊號(僅用於脈衝串和掃描模式)。在脈衝串開始時預設輸出具有上升沿的 TTL 相容觸發訊號。

面板操作

1. 按 Burst 鍵

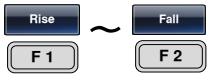
2. 按 F1 (N Cycle)

3. 按 F5 (TRIG setup)

4. 按 F5 (TRIG out)

5. 按 F3 (ON/OFF)打開/關閉觸發輸出

6. 選擇 F1 (Rise)或 F2 (Fall)邊沿觸發

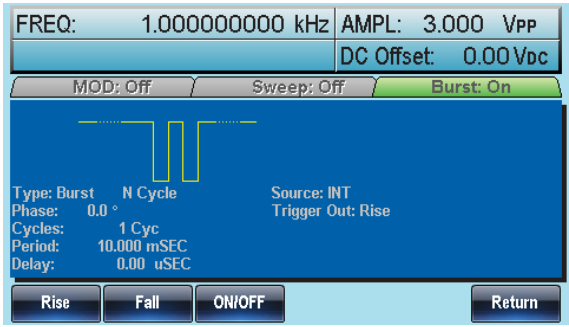


注意

選擇內部觸發源，在每個脈衝串開始時，訊號產生器輸出占空比為 50%的方波。

選擇手動觸發時，訊號產生器自動禁用觸發輸出。

對於手動觸發，在每個脈衝串開始時，訊號產生器從 Trig Out 端輸出一個>1us 的脈衝。



輔助系統功能設置

輔助系統功能設置包括存儲和調取設置、RS232/USB/GPIB 設置、查看軟體版本、更新固件、自我校準、輸出阻抗設置、改變語言和 DSO 連接設置。

存儲和調取

AFG-3000 的非易失性記憶體有 10 個記憶體檔 0~9，可以保存儀器狀態、波形資料(ARB)和設置。記憶體檔中的資料(ARB 或設置資料)以紅色字體顯示。若沒有資料則呈現藍色。

存儲/調取內容

ARB

- 速率
- 頻率
- 長度
- 顯示水準位置
- 顯示垂直位置
- 輸出開始
- 輸出長度

設置

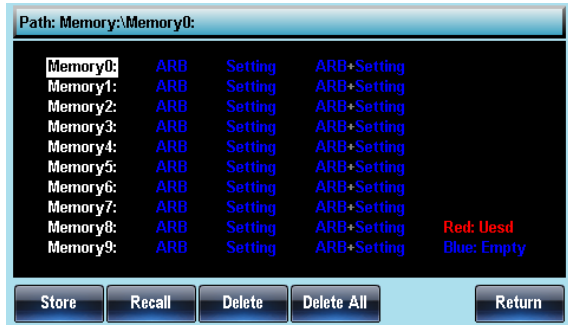
- 功能
  - 波形
  - 頻率
  - 脈衝寬度
  - 方波占空比
  - 斜波對稱性
  - 幅值
  - 幅值單位
  - 偏移
  - 調製類型
  - 蜂鳴器設置
  - 阻抗
  - 主輸出
- 掃描
  - 源
  - 類型
  - 觸發
  - 標記
- AM
  - 調製源
  - 波形
  - 深度
  - AM 頻率
- FM
  - 調製源
  - 波形
  - 偏移
  - FM 頻率
- FSK
  - 調製源
  - 波形
  - 速率
  - 跳躍頻率
- PWM
  - 調製源
  - 波形

- 時間
- 起始頻率
- 停止頻率
- 中心頻率
- 跨距頻率
- 標記頻率
- 占空比
- 頻率
- 脈衝串類型
  - 源
  - 觸發
  - 類型
  - 迴圈數
  - 相位
  - 週期
  - 延遲

面板操作

1. 按 UTIL 鍵

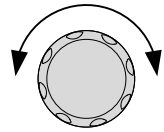
2. 按 F1 (Memory)



3. 選擇檔操作:

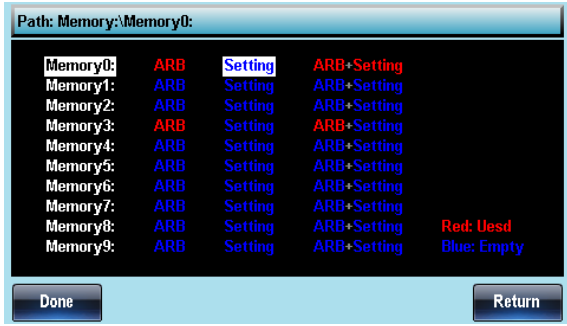
F1 存儲檔, F2 調取檔, F3 刪除檔

4. 使用可調旋鈕選擇一個記憶體檔。按 F1 (Select)確認



5. 使用可調旋鈕選擇資料類型。按 F1 (Select)確認

範圍	記憶體檔	Memory0 ~ Memory9
	資料類型	ARB, 設置, ARB+設置



6. 按 F5 (Done)確認操作

刪除所有

7. 按 F4 刪除 Memory0 ~ Memory9 所有檔

8. 按 F1 (Done)確認刪除

選擇遠端介面

AFG-3000 具有 RS232, GPIB 和 USB 介面，方便遠端控制。一次僅可以使用一個遠端介面。

GPIB 介面

背景　使用 GPIB 介面必須指定 GPIB 位址。預設 GPIB 介面為 10

面板操作

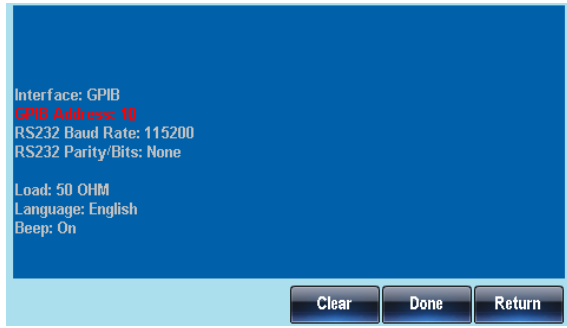
1. 按 UTIL 鍵

2. 按 F2 (Interface)

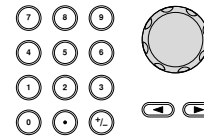
3. 按 F1 (GPIB)

4. 按 F1 (Address)

5. GPIB 將變亮



6. 使用方向鍵和可調旋鈕或數位鍵盤輸入 GPIB 位址



7. 按 F5 (Done)確認 GPIB 地址

範圍	GPIB 地址	1~30

RS232 介面

背景　使用 RS232 介面必須指定串列傳輸速率

面板操作

1. 按 UTIL 鍵

2. 按 F2 (Interface)

3. 按 F2 (RS-232)

4. 按 F1 (Baud Rate)

5. 位於參數窗口處的 RS232 Baud Rate 將變亮

6. 按 F1~F5 選擇串列傳輸速率 

範圍	串列傳輸速率	9600, 19200, 38400, 57600, 115200

RS232 奇偶性/數據位元設置

背景 RS232 用作遠端介面時可以設置同位元。預設無同位元/8 個數據位元

面板操作

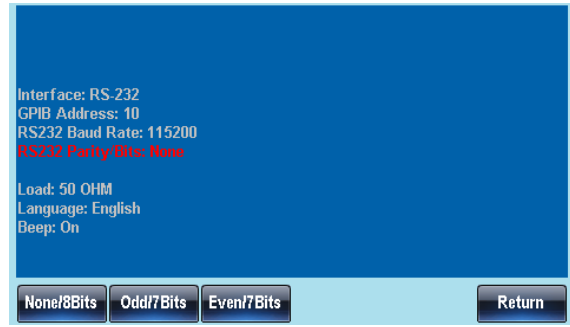
1. 按 UTIL 鍵 

2. 按 F2 (Interface) 

3. 按 F2 (RS-232) 

4. 按 F2 (Parity) 

5. 位於參數窗口處的 RS232 Parity/Bits 參數將變亮



6. 按 F1, F2 或 F3 選擇奇偶性和資料位元

範圍 無同位/8 位, 奇數同位檢查/7 位, 偶校驗/7 位

USB 介面

背景 用於遠程控制

面板操作

1. 按 UTIL 鍵

2. 按 F2 (Interface)

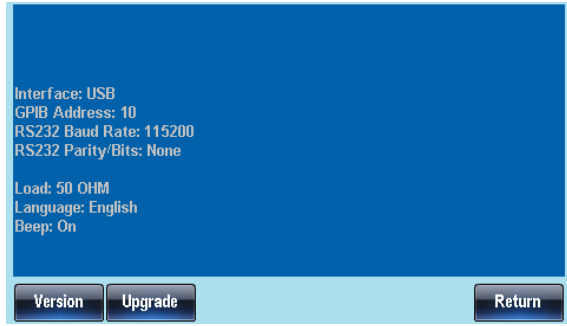
3. 按 F3 (USB)

系統和設置

使用者也可以設置語言選項、輸出阻抗、DSO 連接以及固件配置等。

查看和更新固件版本

面板操作	1. 按 UTIL 鍵	UTIL
	2. 按 F3 (Cal.)	Cal. F3
	3. 按 F2 (Software)	Software F2
查看版本	4. 按 F1(Version)查看固件版本	Version F1
	螢幕顯示版本資訊: 儀器, 版本, FPGA 版次, Bootload 版本	
更新固件	5. 將包含固件檔的 USB 閃盤插入 USB host 驅動中，按 F2 (Upgrade)更新固件	Upgrade F2
⚠注意	固件文件(*.bin)一定要放在 UPGRADE 目錄下，直接使用 USB 根目錄。UPGRADE 必須大寫。	



設置輸出阻抗

背景

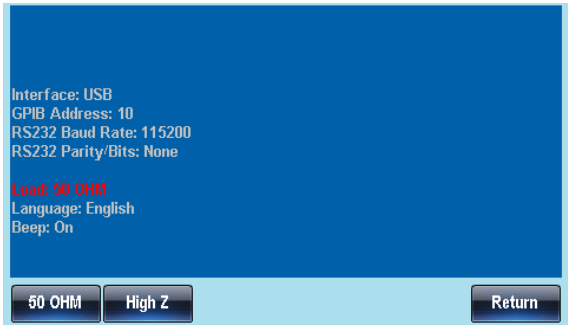
AFG-3000 提供可選輸出阻抗: 50Ω(預設)或 High-Z。輸出阻抗僅供參考，如果與實際負載阻抗不同，那麼實際幅值和偏移也將相應改變。

面板操作

1. 按 UTIL 鍵

2. 按 F4 (Load)

3. Load 將變亮變紅



4. 按 F1 (50 OHM)或 F2 (High Z)選擇輸出阻抗

語言選擇

背景 AFG-3000 提供英語(預設)和簡體中文兩種語言操作環境。

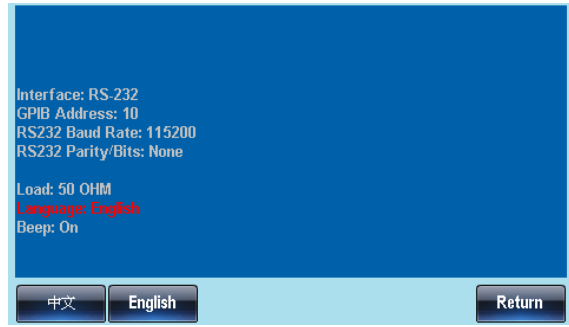
面板操作

1. 按 UTIL 鍵

2. 按 F5 (System)

3. 按 F2 (Language)

4. Language 參數將變亮



5. 按 F1 (中文)或 F2 (English) 選擇語言

設置蜂鳴器

背景　　打開或關閉蜂鳴器。

面板操作

1. 按 UTIL 鍵

2. 按 F5 (System)

3. 按 F3 (Beep)打開或關閉蜂鳴器

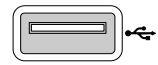
4. Beep 參數將變亮

螢幕截圖

背景　訊號產生器能截取螢幕圖像並將它們保存在 U 盤中

連接

1. 將 USB key 插入前面板的 USB 端子



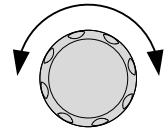
面板操作

2. 按 UTIL 鍵

3. 按 F5 (System)

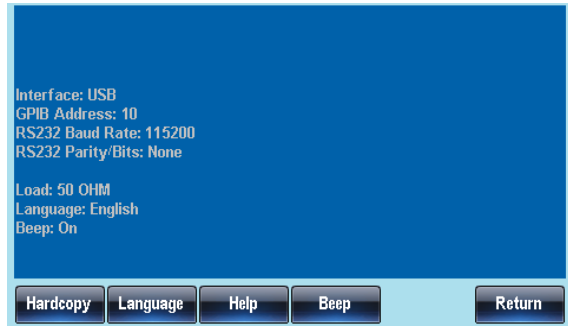
4. 按 F1 (Hardcopy)

5. 使用可調旋鈕選擇螢幕圖像，每次截取一張



功能: 波形, ARB, MOD (AM, FM, FSK, PWM), Sweep, Burst, UTIL

6. 選擇螢幕圖像，按 F1 保存。2s 後再次出現 Utility 功能表，說明螢幕圖像已經保存

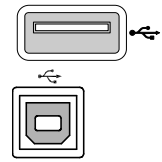


DSO 連接

背景

DSO 連接使 AFG-3000 和 GDS-2000 系列數位存儲示波器之間進行無損資料傳輸。

1. 將 AFG-3000 USB host 介面與 GDS-2000 的 USB B device 介面相連



面板操作

2. 按 UTIL 鍵

3. 按 F6 (DSO Link)

4. 按 F1 (Search)

5. 按 F2 (CH1), F3 (CH2), F4 (CH3)或 F5 (CH4)選擇 DSO 通道。螢幕顯示捕獲的資料

任意波形

AFG-3000 系列訊號產生器能夠建立自訂的任意波形，取樣速率 200MHz。每個波形 1M 資料點，垂直範圍在±32767(65535)以內。

插入內置波形

AFG-3000 系列訊號產生器可以建立一些常見波形，包括正弦波、方波、斜波、sinc、指數上升、指數下降和 DC 波形。

建立正弦波

面板操作

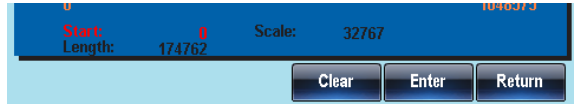
1. 按 ARB 鍵

2. 按 F3(Built in)

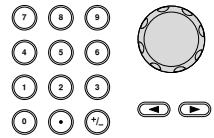
3. 按 F1 (Sine)

4. 按 F1 (Start)

5. Start 將變亮



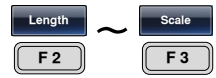
6. 使用方向鍵和可調旋鈕或數位鍵盤輸入起始位址



7. 按 F5 (Enter)確認 Start 點

8. 按 F6 (Return)返回上級選單

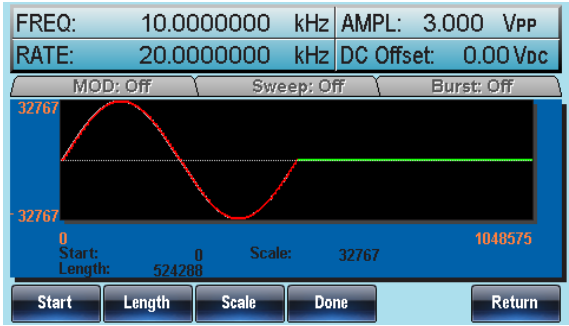
9. 重複 4~8 步完成 Length (F2)和 Scale (F3)設置



10. 按 F4 (Done)完成操作

11. 按 F6 (Return)返回上級選單

如下建立一個正弦波，start:0, Length: 524288, Scale: 32767



建立方波

面板操作

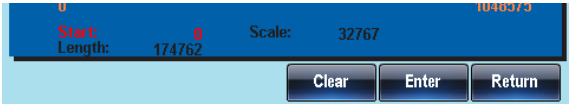
1. 按 ARB 鍵

2. 按 F3 (Built in)

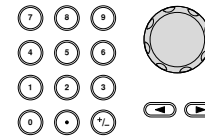
3. 按 F2 (Square)

4. 按 F1 (Start)

5. Start 變亮



6. 使用方向鍵和可調旋鈕或數位鍵盤輸入起始位址



7. 按 F5 (Enter)確認 Start 點

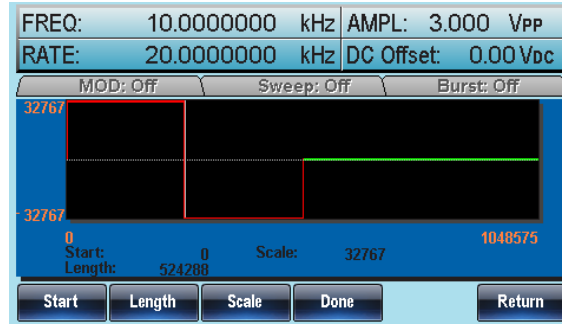
8. 按 F6 (Return)返回上級選單

9. 重複 4~8 步完成 Length (F2)和 Scale (F3)設置

10. 按 F4 (Done)完成操作

11. 按 F6 (Return)返回上級選單

如下建立一個方波，start:0, Length: 524288, Scale: 32767



建立斜波

面板操作

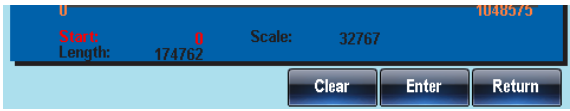
1. 按 ARB

2. 按 F3 (Built in)

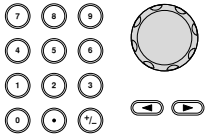
3. 按 F3 (Ramp)

4. 按 F1 (Start)

5. Start 呈現亮紅色



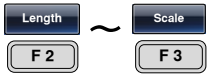
6. 使用方向鍵和可調旋鈕或數位鍵盤輸入起始位址



7. 按 F5 (Enter)確認起始點

8. 按 F6 (Return)返回上級選單

9. 重複 4~8 步完成 Length (F2)和 Scale (F3)設置



10. 按 F4 (Done)完成操作

11. 按 F6 (Return)返回上級選單

如下建立一個斜波，start:0, Length: 524288, Scale: 32767

建立 Sinc 波形

面板操作

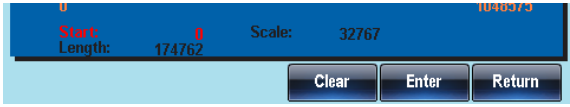
1. 按 ARB 鍵

2. 按 F3 (Built in)

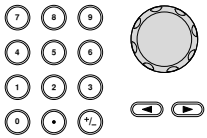
3. 按 F4 (Sinc)

4. 按 F1 (Start)

5. Start 呈現亮紅色

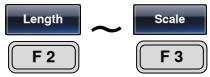


6. 使用方向鍵和可調旋鈕或數位鍵盤輸入起始位址



7. 按 F5 (Enter)確認起始點 

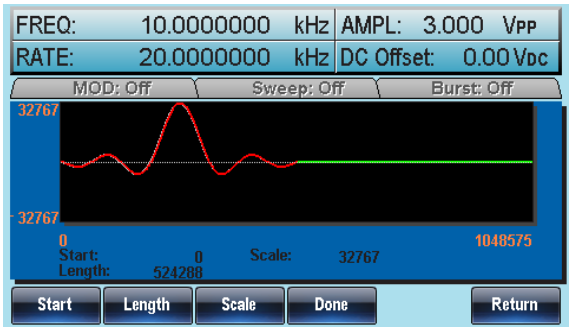
8. 按 F6 (Return)返回上級選單 

9. 重複 4~8 步完成 Length (F2) 和 Scale (F3)設置 

10. 按 F4 (Done)完成操作 

11. 按 F6 (Return)返回上級選單 

如上建立一個 sinc 波形，start:0, Length: 524288, Scale: 32767



建立指數上升波形

面板操作

1. 按 ARB 鍵 

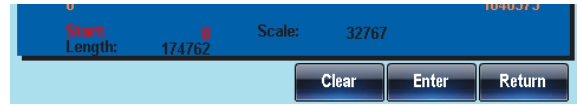
2. 按 F3 (Built in) 

3. 按 F5 (More) 

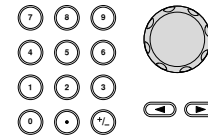
4. 按 F1 (Exp Rise)

5. 按 F1 (Start)

6. Start 呈現亮紅色



7. 使用方向鍵和可調旋鈕或數位鍵盤輸入起始位址



8. 按 F5 (Enter)確認起始點

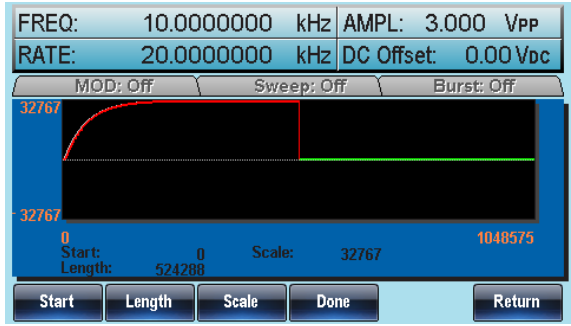
9. 按 F6 (Return)返回上級選單

10. 重複 4~8 步完成 Length (F2) 和 Scale (F3)設置

11. 按 F4 (Done)完成操作

12. 按 F6 (Return)返回上級選單

如下建立一個指數上升波形，start:0, Length: 524288, Scale: 32767



建立指數下降波形

面板操作

1. 按 ARB 鍵

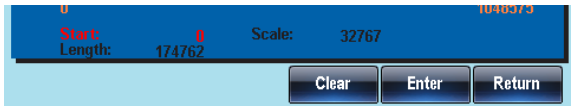
2. 按 F3 (Built in)

3. 按 F5 (More)

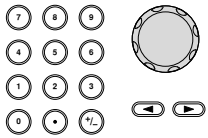
4. 按 F2 (Exp Fall)

5. 按 F1 (Start)

6. Start 呈現亮紅色



7. 使用方向鍵和可調旋鈕或數位鍵盤輸入起始位址



8. 按 F5 (Enter)確認起始點 

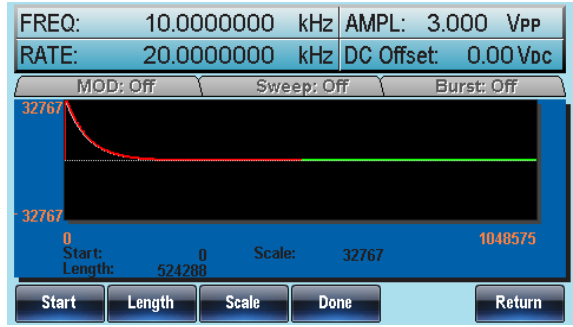
9. 按 F6 (Return)返回上級選單 

10. 重複 4~8 步完成 Length (F2) 和 Scale (F3)設置 

11. 按 F4 (Done)完成操作 

12. 按 F6 (Return)返回上級選單 

如下建立一個指數下降波形，start:0, Length: 524288, Scale: 32767



建立 DC 波形

面板操作

1. 按 ARB 鍵

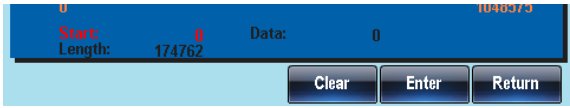
2. 按 F3 (Built in)

3. 按 F5 (More)

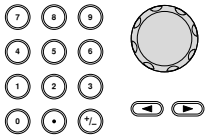
4. 按 F3 (DC)

5. 按 F1 (Start)

6. Start 呈現亮紅色



7. 使用方向鍵和可調旋鈕或數位鍵盤輸入起始位址



8. 按 F5 (Enter)確認起始點

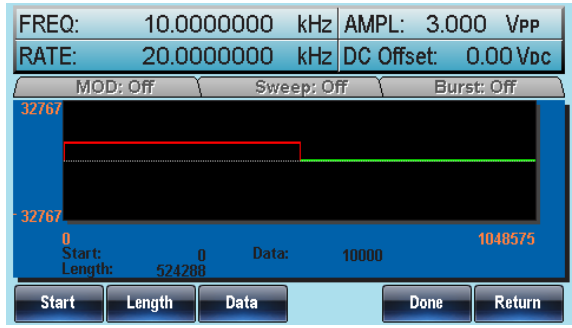
9. 按 F6 (Return)返回上級選單

10. 重複 4~8 步完成 Length (F2) 和 Data (F3)設置

11. 按 F5 (Done)完成操作

12. 按 F6 (Return)返回上級選單

如下建立一個 DC 波形，start:0, Length: 524288, Data: 10000



建立脈衝波形

範圍	頻率	解析度	占空比解析度
	1pHz~5Hz	1pHz	0.0001%
	>5Hz~50Hz	1uHz	0.0001%
	>50Hz~500Hz	10uHz	0.001%
	>500Hz~5kHz	100uHz	0.01%
	>5kHz~50kHz	1mHz	0.1%
	>50kHz~500kHz	10mHz	1%

面板操作

1. 按 ARB 鍵

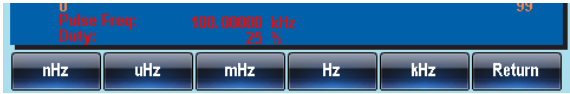
2. 按 F3 (Built in)

3. 按 F5 (More)

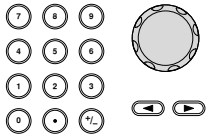
4. 按 F4 (Pulse)

5. 按 F1 (Freq)

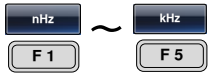
6. Pulse Freq 呈現亮紅色



7. 使用方向鍵和可調旋鈕或數位鍵盤輸入脈衝頻率

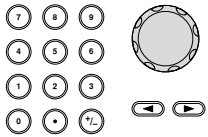


8. 按 F1~F5 選擇頻率單位



9. 按 F6 (Return)返回上級選單

10. 按 F2 (Duty)並使用數位鍵盤或可調旋鈕選擇占空比



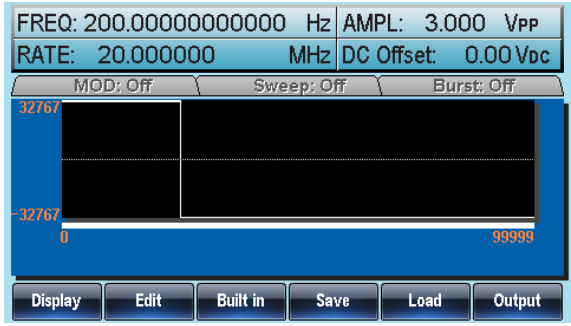
11. 按 F5 (%)完成操作

12. 按 F6 (Return)返回上級選單

13. 按 F5 (Done)完成操作

14. 按 F6 (Return)返回上級選單

如下建立一個脈衝波(200Hz 頻率、25%占空比)



顯示任意波形

設置水準顯示範圍

兩種方式設置水準顯示範圍: 使用起始點和長度或者使用中心點和長度

面板操作

1. 按 ARB 鍵

2. 按 F1 (Display)進入顯示功能表

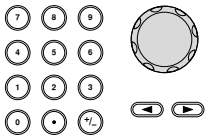
3. 按 F1 (Horizon)進入水準選單

使用起始點

4. 按 F1(Start)

5. Horizontal From 參數變亮

6. 使用方向鍵和可調旋鈕或數位鍵盤輸入水準值



7. 按 Clear (F4, Not F1)取消

8. 按 F5 (Enter)保存設置

9. 按 F6 (Return)返回上級選單

設置長度

10. 重複 4~9 步完成 Length (F2) 設置

使用中心點

11. 重複 4~9 步完成 Center (F3) 設置

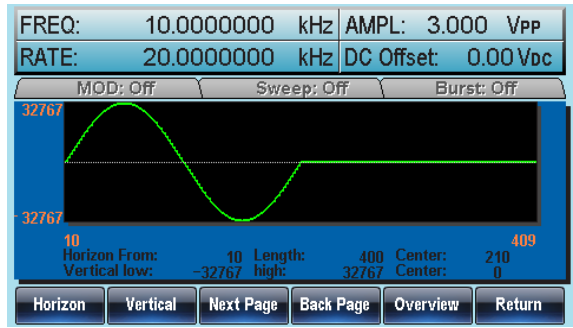
Zoom in

12. 按 F4 (Zoom In)放大波形。長度每次減小一半。允許的最小長度為 3

Zoom out

13. 按 F5 (Zoom out)沿波形中點縮小。長度每次增加一倍。允許的最大長度為 1048576

如下任意正弦波：start 10、length 400、center 210



設置垂直顯示範圍

與水準視窗類似，兩種方式設置垂直顯示範圍：設置高和低值，或者設置中心點。

面板操作

1. 按 ARB 鍵

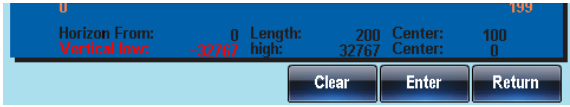
2. 按 F1 (Display)

3. 按 F2 (Vertical)

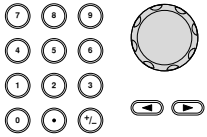
設置最低點

4. 按 F1 (Low)

5. Vertical Low 參數變亮



6. 使用方向鍵和可調旋鈕或數位鍵盤輸入垂直最小值



7. 按 Clear (F4)取消

8. 按 F5 (Enter)保存設置

9. 按 F6 (Return)返回上級選單

設置最高點

10. 重複 4~9 步完成 High (F2)設置

設置中心點

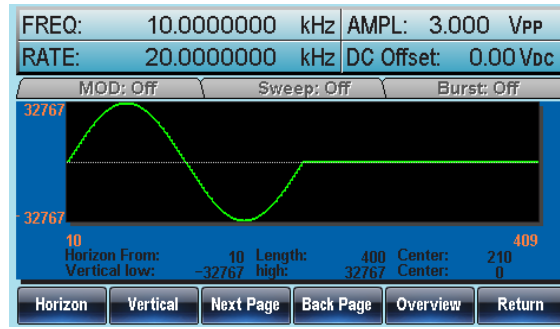
11. 重複 4~9 步完成 Center (F3) 設置

Zoom

12. 按 F4 (Zoom In)沿波形的中心放大。長度每次減小一半。允許的最小垂直低點為-2，最小垂直高點為 2

13. 按 F5 (Zoom out)縮小波形。長度每次增加一倍。允許的最大垂直低點為- 32767，最大垂直高點為+32767

如下正弦波：垂直最低點-32767、垂直最高點 32767、中心點 0



頁面導航(前移)

背景

觀察波形時，使用 Next/Back Page 功能可以向前/向後移動顯示視窗。

面板操作

1. 按 ARB 鍵

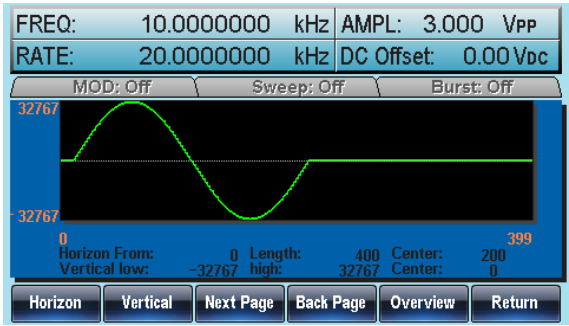
2. 按 F1 (Display)

3. 按 F4 (Back Page)將顯示視窗向前移動一個觀察長度

Horizon start*＝Horizon start - Length
Center*=Center – Length
*Length 不小於 0

選擇 Back Page 後，螢幕顯示如下：

Horizon From: 10 → 0
Length: 400
Center:210→ 200



頁面導航(後移)

背景

觀察波形時，使用 Next/Back Page 功能可以向前/向後移動顯示視窗。

面板操作

1. 按 ARB 鍵

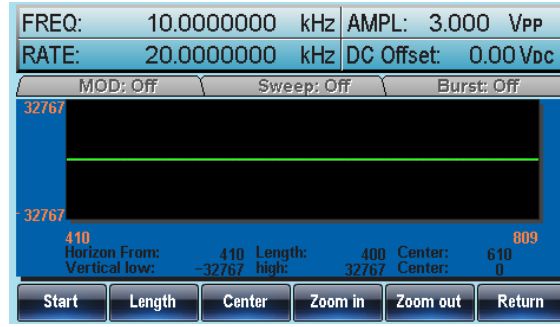
2. 按 F1 (Display)

3. 按 F3 (Next Page)將顯示視窗向後移動一個觀察長度

Horizon start*＝Horizon start + Length
Center=Center + Length
*Horizon start +Length≤1048576

選擇 Next Page 後，螢幕顯示如下：

Horizon From: 10 → 410
Length: 400
Center:210→ 610



顯示

面板操作

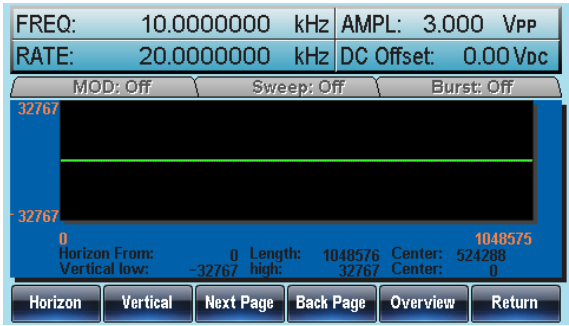
1. 按 ARB 鍵

2. 按 F1 (Display)

3. 按 F5 (Overview)顯示整個波形

水準: 0~1048575,
垂直: 32767~ -328767

選擇 Overview 後，螢幕顯示如下：
Horizon From: 0 → 0
Length: 400→1048576
Center:200→ 524288
Vertical low/high: ±32767



編輯任意波形

增加一個點

背景 AFG-3000 提供強大的編輯功能，用戶可以在波形的任何位置建立點或線

面板操作

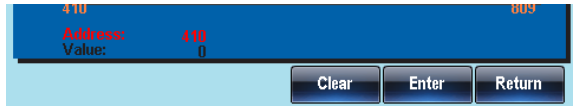
1. 按 ARB 鍵

2. 按 F2 (Edit)

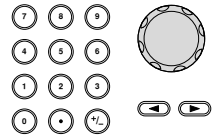
3. 按 F1 (Point)

4. 按 F1 (Address)

5. Address 參數呈現亮紅色



6. 使用方向鍵和可調旋鈕或數位鍵盤輸入位址



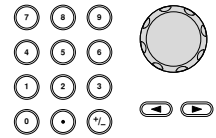
7. 按 F5 (Enter)保存設置

8. 按 F6 (Return)返回上級選單

9. 按 F2 (Data)

10. Value 參數呈現亮紅色

11. 使用方向鍵和可調旋鈕或數位鍵盤輸入 Data 值



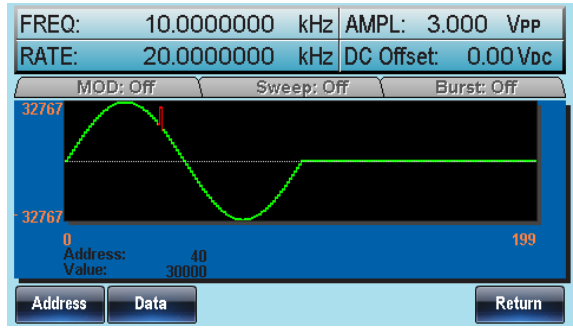
12. 按 F5 (Enter)保存設置

13. 按 F6 (Return)返回上級選單

14. 再按 F6 (Return)返回 ARB 選單

如下圖，編輯區域顯示紅色：

Address 40，Data 30,000



增加一條線

背景

AFG-3000 提供強大的編輯功能，用戶可以在波形的任何位置建立點或線

面板操作

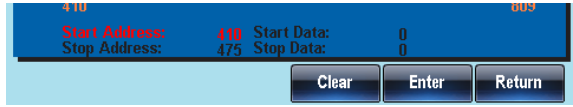
1. 按 ARB 鍵

2. 按 F2 (Edit)

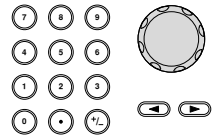
3. 按 F2 (Line)

4. 按 F1 (Start ADD)

5. Start Address 參數呈現亮紅色



6. 使用方向鍵和可調旋鈕或數位鍵盤輸入起始位址



7. 按 F5 (Enter)保存設置

8. 按 F6 (Return)返回上級選單

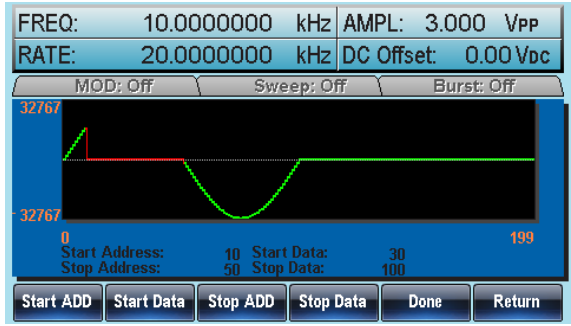
9. 重複 4~8 步，完成 Start Data (F2), Stop Address (F3)和 Stop Data (F4)設置

10. 按 F5 (Done)確認編輯

11. 按 F6 (Return)返回上級選單

建立一條紅線，參數如下:

Start Address: 10, Start Data: 30
Stop Address: 50, Stop Data: 100



複製波形

面板操作

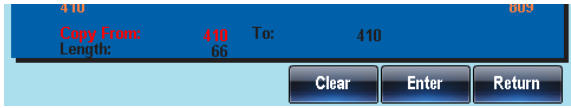
1. 按 ARB 鍵

2. 按 F2 (Edit)

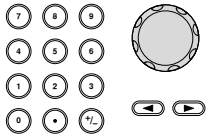
3. 按 F3 (Copy)

4. 按 F1 (Start)

5. Copy From 呈現亮紅色



6. 使用方向鍵和可調旋鈕或數位鍵盤輸入複製波形的位址



7. 按 F5 (Enter)保存設置

8. 按 F6 (Return)返回上級選單 

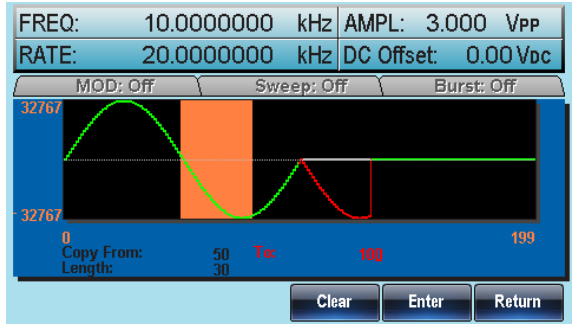
9. 重複 4~8 步完成 Length (F2)和 Paste To (F3)

10. 按 F5 (Done)確定選擇 

11. 按 F6 (Return)返回上級選單 

將點 50~80 內的波形複製到點 100~130:

Copy From: 50
Length: 30
To: 100



清除波形

面板操作

1. 按 ARB 鍵 

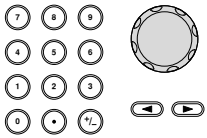
2. 按 F2 (Edit) 

3. 按 F4 (Clear) 

4. 按 F1 (Start)

5. Clear From 呈現亮紅色

6. 使用方向鍵和可調旋鈕或數位鍵盤輸入清除波形的位址



7. 按 F5 (Enter)保存設置

8. 按 F6 (Return)返回上級選單

9. 重複 4~8 步完成 Length (F2) 設置

10. 按 F3 (Done)清除部分任意波形

11. 按 F6 (Return)返回上級選單

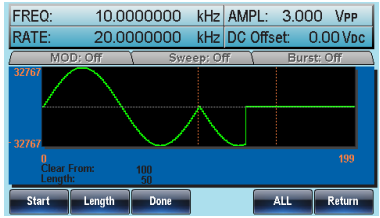
刪除所有

12. 按 F5 (ALL)刪除整個波形

13. 再按 F5 (Done)確認刪除

14. 按 F6 (Return)返回上級選單

Start: 100, Length: 50.



清除部分波形後：

刪除整個波形後：

ARB 保護

保護任意波形的某個區域不被改變。

面板操作

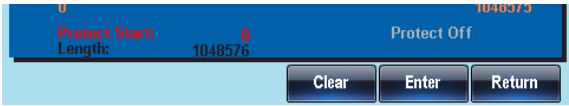
1. 按 ARB 鍵

2. 按 F2 (Edit)

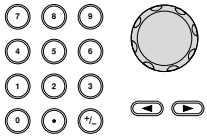
3. 按 F5 (Protect)

4. 按 F2 (Start)

5. Protect Start 呈現亮紅色



6. 使用方向鍵和可調旋鈕或數位鍵盤輸入 Protect Start 位址



7. 按 F5 (Enter)保存設置

8. 按 F6 (Return)返回上級選單

9. 重複 4~8 步完成 Length (F3) 設置

10. 按 F5 (Done)確認保護區域

11. 按 F6 (Return)返回上級選單

12. 按 F4 (Done)保護所選區域或波形

保護整個波形

13. 按 F1 (ALL)保護整個波形

14. 按 F6 (Done)確認

15. 按 F6 (Return)返回上級選單

解除保護

16. 按 F5 (Unprotect)解除保護波形

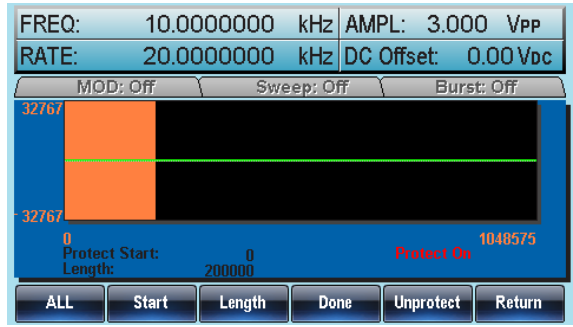
17. 按 F6 (Done)確認

18. 按 F6 (Return)返回上級選單

19. 波形背景變回黑色。“Unprotected”呈灰色

波形保護區域以橘色背景顯示，如下圖：

Start:0, Length: 200000



輸出任意波形

訊號產生器能夠輸出高達 1 M(0~1048575)的任意波形，迴圈數可以指定也可以無限次迴圈。

輸出任意波形

面板操作

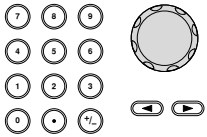
1. 按 ARB 鍵

2. 按 F6 (Output)

3. 按 F1 (Start)

4. Start 參數呈現亮紅色

5. 使用方向鍵和可調旋鈕或數位鍵盤輸入起始位址



6. 按 F5 (Enter)確認起始點

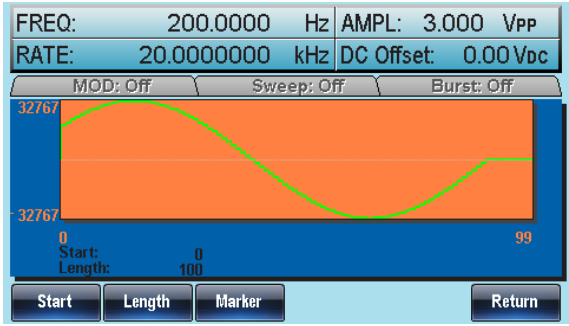
7. 按 F6 (Return)返回上級選單

8. 重複 4~7 步完成 Length (F2) 設置

9. 按 F6 (Return)返回上級選單

前面板端子輸出如下波形：

position 0，length 100



輸出 N 次迴圈的任意波形

背景	以指定迴圈次數重複輸出任意波形。N Cycle 功能使用軟體觸發輸出。
範圍	1~1048575 次迴圈

面板操作

1. 按 ARB 鍵

2. 按 F6 (Output)

3. 定義任意波形輸出的 Start 和 Length

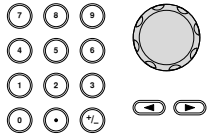
注意: 改變長度將改變脈衝波的占空比/頻率。

4. 按 F4 (N Cycle)

5. 按 F1 (Cycles)

6. Cycles 參數呈現亮紅色

7. 使用方向鍵和可調旋鈕或數位鍵盤輸入迴圈數



8. 按 F5 (Enter)確認迴圈數

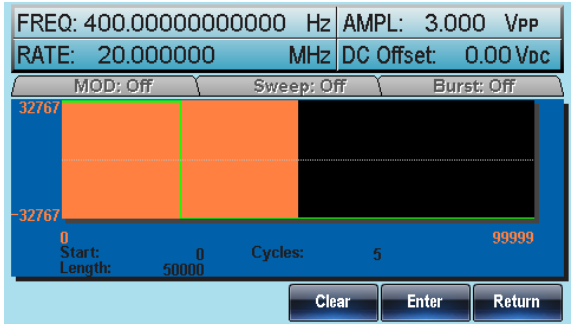
9. 按 F6 (Return)返回上級選單

10. 按 Trigger (F5)內部觸發輸出(1 次)

注意: 按 F5 (Trigger)之前，請確保已經按下輸出鍵並點亮 OUTPUT 指示燈。

11. 按 F6 (Return)返回上級選單

前面板端子輸出 5 次迴圈的脈衝波，如下圖所示：



輸出任意波形 – 無限迴圈

背景　無限次重複輸出任意波形，建立一個迴圈波。

面板操作

1. 按 ARB 鍵

2. 按 F6 (Output)

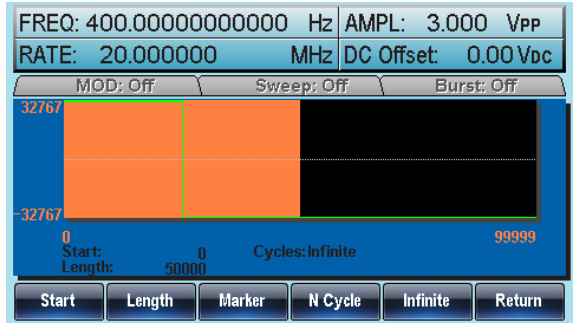
3. 定義任意波輸出的 Start 和 Length

注意: 改變長度將改變脈衝波的占空比/頻率

4. 按 F5 (Infinite)無限次輸出任意波形

5. 按 F6 (Return)返回上級選單

從前面板端子輸出無限次脈衝波，如下圖所示：



輸出標記

面板操作

1. 按 ARB 鍵

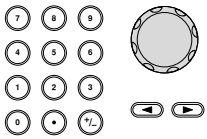
2. 按 F6 (Output)

3. 按 F3 (Marker)

4. 按 F1 (Start)

5. Start 參數呈現亮紅色

6. 使用方向鍵和可調旋鈕或數位鍵盤輸入起始位址



7. 按 F5 (Enter)確認起始點

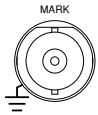
8. 按 F6 (Return)返回上級選單

9. 重複 4~8 步完成 Length (F2) 設置

10. 按 F6 (Return)返回上級選單

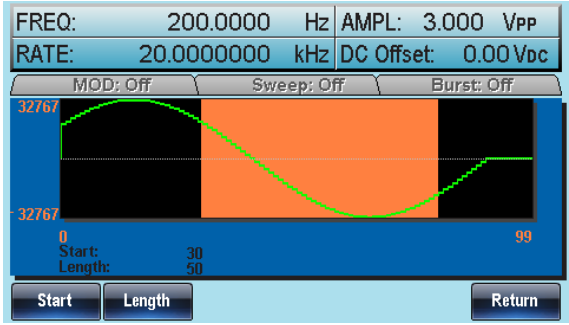
標記輸出

使用後面板的 MARK 輸出端子



點 30~80 間的標記輸出如下圖所示：

(Start 30, Length 50)



存儲/調取任意波形

AFG-3000 系列訊號產生器可以建立一些常見波形，包括正弦波、方波、斜波、sinc、指數上升、指數下降和 DC 波形。

將波形保存至內部記憶體

面板操作

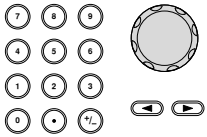
1. 按 ARB 鍵

2. 按 F4 (Save)

3. 按 F1 (Start)

4. Start 參數呈現亮紅色

5. 使用方向鍵和可調旋鈕或數位鍵盤輸入起始位址



6. 按 F5 (Enter)確認起始點

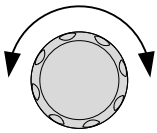
7. 按 F6 (Return)返回上級選單

8. 重複 4~8 步完成 Length (F2) 設置

9. 按 F3 (Memory)

10. 使用可調旋鈕選擇記憶體檔

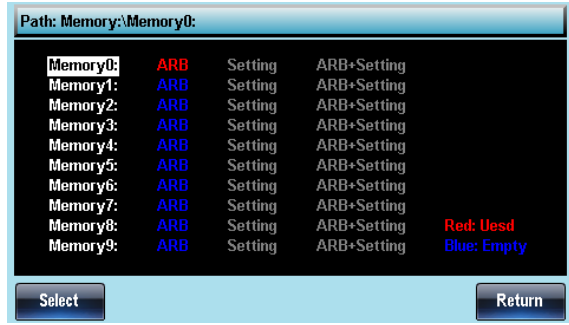
ARB0~ARB9



11. 按 F1 (Select)將波形保存至所選檔

12. 按 F6 (Return)返回上級選單

使用可調旋鈕選擇 ARB1 檔，如下圖所示：



將檔保存至 USB 記憶體

面板操作

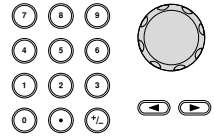
1. 按 ARB 鍵

2. 按 F4 (Save)

3. 按 F1 (Start)

4. Start 參數呈現亮紅色

5. 使用方向鍵和可調旋鈕或數位鍵盤輸入起始位址



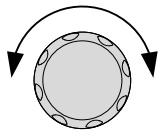
6. 按 F5 (Enter)確認起始點

7. 按 F6 (Return)返回上級選單

8. 重複 4~8 步完成 Length (F2) 設置

1. 按 F4 (USB)

2. 使用可調旋鈕查找檔案系統

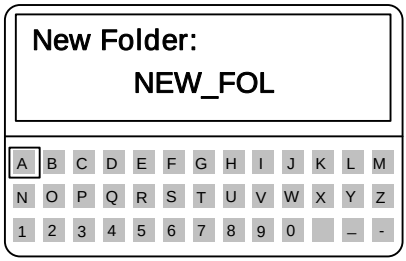


3. 按 Select 選擇目錄或檔案名

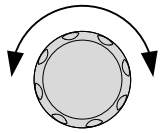
建立資料夾

4. 按 F2 (New Folder)

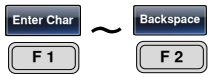
5. 顯示預設資料夾名稱“NEW_FOL”



6. 使用可調旋鈕移動游標



7. 使用 F1 (Enter Char)或 F2 (Backspace)建立資料夾名稱

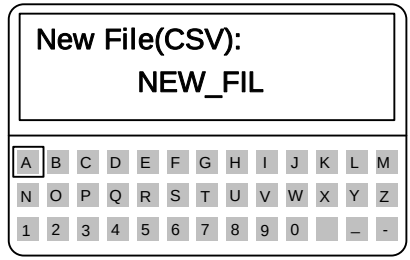


8. 按 F5 (Save)保存

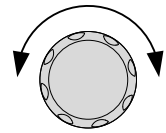
建立新文件

9. 按 F3 (New File)

10. 顯示預設檔案名“NEW_FIL”



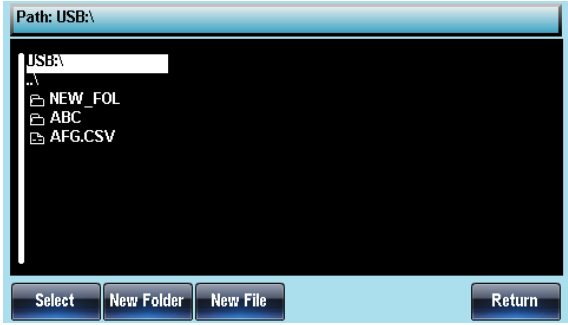
11. 使用可調旋鈕移動游標



12. 使用 F1 (Enter Char)或 F2 (Backspace)建立檔案名

13. 按 F5 (Save)保存

在根目錄下建立 ABC 資料夾和 AFG.CSV 文件，如圖所示：



從內部記憶體調取波形

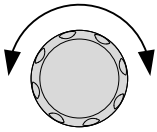
面板操作

1. 按 ARB 鍵

2. 按 F5 (Load)

3. 按 F1 (Memory)

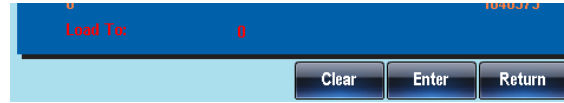
4. 使用可調旋鈕查找檔案系統



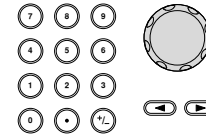
5. 按 Select 選擇目錄或檔案名

6. 按 F3 (To)選擇已調取波形的起始點

7. “Load To”呈現亮紅色



8. 使用方向鍵和可調旋鈕或數位鍵盤輸入起始點



9. 按 F5 (Enter)確認起始點

10. 按 F6 (Return)返回上級選單

11. 按 F5 (Done)

使用可調旋鈕選擇 ARB1 檔，調取波形的起始點為 0，如下圖所示：

從 USB 調取波形

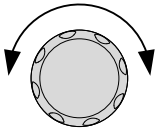
面板操作

1. 按 ARB 鍵

2. 按 F5 (Load)

3. 按 F2 (USB)

4. 使用可調旋鈕選擇檔案名

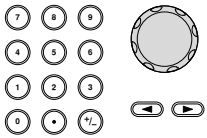


5. 按 F1 (Select)選擇檔

6. 按 F3 (To)選擇已調取波形的起始點

7. “Load To”呈現亮紅色

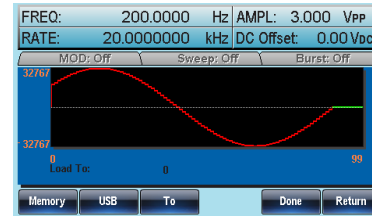
8. 使用方向鍵和可調旋鈕或數位鍵盤輸入起始點



9. 按 F5 (Enter)確認起始點

10. 按 F5 (Done)

使用可調旋鈕選擇 AFG.CSV 文件，調取波形的起始點為 0，如下圖所示：



遠端介面

確立遠端連接

The AFG-3000 supports USB, RS232 and GPIB remote connections.

Configure USB interface

USB configuration	PC side connector	Type A, host
	AFG-3000 side connector	Type B, slave
	Speed	1.1/2.0 (full speed)

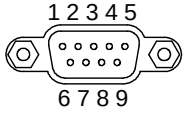
Panel Operation

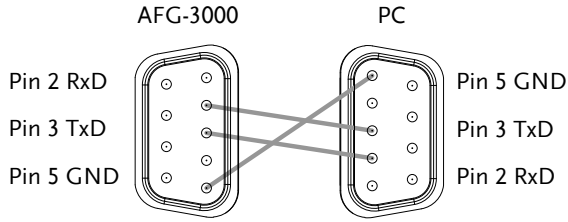
1. Press the Utility key followed by Interface (F2) and USB (F3).

2. Connect the USB cable to the rear panel USB B (slave) port.

3. When the PC asks for the USB driver, select XXXXXXX.inf included in the software package or download the driver from the GW website, www.gwinstek.com.

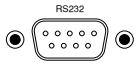
Configure RS232 interface

RS-232C configuration	Connector	DB-9, Male
	Baud rate	9600, 19200, 38400, 57600, 115200
	Parity	None/8Bits, Odd/7Bits, Even/7Bits
	Stop bits	1 (fixed)
Pin assignment		2: RxD (Receive data) 3: TxD (Transmit data) 5: GND 4, 6 ~ 9: No connection
PC connection	Use the Null Modem connection as in the below diagram.	



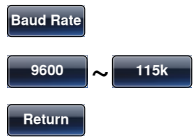
Panel Operation

1. Connect the RS-232 cable to the rear panel RS-232 port.



2. Press the Utility key followed by Interface (F2) and RS-232 (F2).

3. Press Baud Rate (F1) and choose a baud rate (F1)~(F5). Press return



4. Press Parity/Bits (F2) and choose a parity (F1)~(F3). Press return.

Configure GPIB interface

GPIB configuration

Connector	24 pin Female
GPIB address	1-30

GPIB constraints

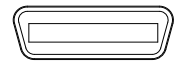
- Maximum 15 devices altogether, 20m cable length, 2m between each device
- Unique address assigned to each device
- At least 2/3 of the devices turned On
- No loop or parallel connection

Pin assignment

Pin1	Data line 1	Pin13	Data line 5
Pin2	Data line 2	Pin14	Data line 6
Pin3	Data line 3	Pin15	Data line 7
Pin4	Data line 4	Pin16	Data line 8
Pin5	EOI	Pin17	REN
Pin6	DAV	Pin18	Ground
Pin7	NRFD	Pin19	Ground
Pin8	NDAC	Pin20	Ground
Pin9	IFC	Pin21	Ground
Pin10	SRQ	Pin22	Ground
Pin11	ATN	Pin23	Ground
Pin12	Shield (screen)	Pin24	Signal ground

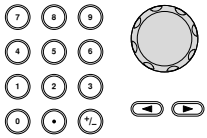
Panel Operation

1. Connect the GPIB cable to the rear panel GPIB port.



2. Press the Utility key followed by Interface and GPIB. Press Address (F1).

3. Use the scroll wheel or number pad to choose an address.



4. Press Done (F5) to confirm.

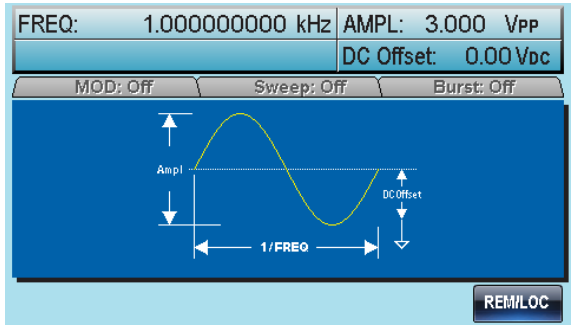
Remote control terminal connection

Terminal application	Invoke the terminal application such as MTTTY (Multi-Threaded TTY). For RS-232C, set the COM port, baud rate, stop bit, data bit, and parity accordingly. To check the COM port No, see the Device Manager in the PC. For WinXP, Control panel → System → Hardware tab.
Functionality check	Run this query command via the terminal. *idn? This should return the Manufacturer, Model number, Serial number, and Firmware version in the following format. GW INSTEK, AFG-3081, SN:XXXXXXXX,Vm.mm Note: ^j or ^m can be used as the terminal character when using a terminal program.
PC Software	The proprietary PC software, downloadable from GWInstek website, can be used for remote control.

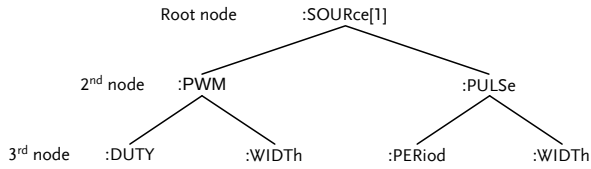
Display

When a remote connection is established all panel keys are locked bar F6.

1. Press REM/LOCK (F6) to return the function generator to local mode.



指令語法

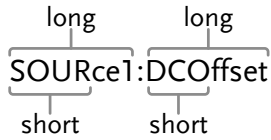
Compatible standard	• IEEE488.2, 1992 (fully compatible) • SCPI, 1994 (partially compatible)
Command Tree	The SCPI standard is an ASCII based standard that defines the command syntax and structure for programmable instruments. Commands are based on a hierarchical tree structure. Each command keyword is a node on the command tree with the first keyword as the root node. Each sub node is separated with a colon. Shown below is a section of the SOURce[1] root node and the :PWM and :PULSe sub nodes. 
Command types	Commands can be separated in to three distinc types, simple commands, compound commands and queries.

Simple	A single command with/without a parameter
Example	*OPC
Compound	Two or more commands separated by a colon (:) with/without a parameter
Example	SOURce:PULSe:WIDTh

	Query	A query is a simple or compound command followed by a question mark (?). A parameter (data) is returned. The maximum or minimum value for a parameter can also be queried where applicable.
	Example	SOURce1:FREQuency? SOURce1:FREQuency? MIN

Command forms

Commands and queries have two different forms, long and short. The command syntax is written with the short form of the command in capitals and the remainder (long form) in lower case.



The commands can be written in capitals or lower-case, just so long as the short or long forms are complete. An incomplete command will not be recognized.

Below are examples of correctly written commands:

LONG	SOURce1:DCOffset
	SOURCE1:DCOFFSET
	source1:dcoffset
SHORT	SOUR1:DCO
	sour1:dco

Command Format	 1: command header 2: single space 3: parameter 4: message terminator
Square Brackets []	Commands that contain squares brackets indicate that the contents are optional. The function of the command is the same with or without the square bracketed items. Brackets are not sent with the command. For example, the frequency query below can use any of the following 3 forms: SOURce1:FREQuency? [MINimum|MAXimum] SOURce1:FREQuency? MAXimum SOURce1:FREQuency? MINimum SOURce1:FREQuency?
Braces {}	Commands that contain braces indicate one item within the braces must be chosen. Braces are not sent with the command.
Angled Brackets <>	Angle brackets are used to indicate that a value must be specified for the parameter. See the parameter description below for details. Angled brackets are not sent with the command.
Bars |	Bars are used to separate multiple parameter choices in the command format.

Parameters

Type	Description	Example
<Boolean>	Boolean logic	0, 1/ON,OFF
<NR1>	integers	0, 1, 2, 3
<NR2>	decimal numbers	0.1, 3.14, 8.5
<NR3>	floating point	4.5e-1, 8.25e+1
<NRf>	any of NR1, 2, 3	1, 1.5, 4.5e-1

	<NRf+> <Numeric>	NRf type with a suffix including MINimum, MAXimum or DEFault parameters.	1, 1.5, 4.5e-1 MAX, MIN,
	<aard>	Arbitrary ASCII characters.	
	<discrete>	Discrete ASCII character parameters	IMM, EXT, MAN
	<frequency> <peak deviation in Hz> <rate in Hz>	NRf+ type including frequency unit suffixes.	1 KHZ, 1.0 HZ, MHZ
	<amplitude>	NRf+ type including voltage peak to peak.	VPP
	<offset>	NRf+ type including volt unit suffixes.	V
	<seconds>	NRf+ type including time unit suffixes.	NS, S MS US
	<percent> <depth in percent>	NRf type	N/A
Message terminators	LF CR	line feed code (new line) and carriage return.	
	LF	line feed code (new line)	
	EOI	IEEE-488 *EOI* (End-Or-Identify)	
Note	∧j or ∧m should be used when using a terminal program.		

Command Separators	Space	A space is used to separate a parameter from a keyword/command header.
	Colon (:)	A colon is used to separate keywords on each node.
	Semicolon (;)	A semi colon is used to separate subcommands that have the same node level. For example: SOURce[1]:DCOffset? SOURce[1]:OUTPut? →SOURce1:DCOffset?;OUTPut?
	Colon + Semicolon (:;)	A colon and semicolon can be used to combine commands from different node levels. For example: SOURce1:PWM:SOURce? SOURce:PULSe:WIDTh? →SOURce1:PWM:SOURce?:;SOURce:PULSe:WIDTh?
	Comma (,)	When a command uses multiple parameters, a comma is used to separate the parameters. For example: SOURce:APPLy:SQUare 10KHZ, 2.0 VPP, -1V

指令清單

系統指令

SYSTem:ERRor? System Query

Description	Reads an error from the error queue.	
Query Syntax	**SYSTem:ERRor?**	
Return parameter	<string>	Returns an error string, <256 ASCII characters.
Example	**SYSTem:ERRor?** **-138 Suffix not allowed** Returns an error string.	

*IDN? System Query

Description	Returns the function generator manufacturer, model number, serial number and firmware version number in the following format: GW INSTEK,AFG-3081,SN:XXXXXXXX,Vm.mm
Query Syntax	**IDN?**
Return parameter	<string>
Example	***IDN?** GW INSTEK,AFG-3081,SN:XXXXXXXX,Vm.mm Returns the identification of the function generator.

*RST System Command

Description	Reset the function generator to its factory default state.
Note	Note the *RST command will not delete instrument save states in memory.
Syntax	***RST**

*TST? System Query

Description	Performs a system self-test and returns a pass or fail judgment. An error message will be generated if the self test fails.	
Note	The error message can be read with the SYST:ERR? query.	
Query Syntax	***TST?**	
Return parameter	+0	Pass judgment
	+1	Fail judgment
Example	***TST?** +0 The function generator passed the self-test.	

SYSTem:VERSion? System Query

Description	Performs a system version query. Returns a string with the instrument, firmware version, FPGA revision and bootloader.
Query Syntax	**SYSTem:VERSion?**
Return parameter	<string>
Example	**SYST:VERS?** AFG-3000 VX.XXX_XXXX FPGA:XXXX BootLoad:XXXX

Returns the year (2010) and version for that year (1).

*OPC — System Command

Description	This command sets the Operation Complete Bit (bit 0) of the Standard Event Status Register after the function generator has completed all pending operations. For the AFG-3000, the *OPC command is used to indicate when a sweep or burst has completed.
Note	Before the OPC bit is set, other commands may be executed.
Syntax	***OPC**

*OPC? — System Query

Description	Returns the OPC bit to the output buffer when all pending operations have completed. I.e. when the OPC bit is set.
Note	Commands cannot be executed until the *OPC? query has completed.
Query Syntax	***OPC?**
Return parameter	1
Example	***OPC?** **1** Returns a "1" when all pending operations are complete.

*WAI — System Command

Description	This command waits until all pending operations have completed before executing additional commands. I.e. when the OPC bit is set.

Note	This command is only used for triggered sweep and burst modes.
Syntax	***WAI**

SYSTem:LANGuage System Command

Description	Sets or queries the display language. Select the language shown on the function generator front-panel display. Only one language can be enabled at a time. SYSTem:LANGuage? query returns "Chinese" or "English".	
Note	Only one language can be set.	
Syntax	**SYSTem:LANGuage {CHINese|ENGlish}**	
Example	**SYST:LANG ENG** Sets the display language to English.	
Query Syntax	**SYSTem:LANGuage?**	
Return Parameter	CHIN	Chinese
	ENG	English
Query Example	**SYST:LANG?** **ENG** The current language is English.	

狀態寄存器指令

*CLS

System Command

Description	The *CLS command clears all the event registers, the error queue and cancels an *OPC command.
Syntax	***CLS**

*ESE

System Command

Description	The Standard Event Status Enable command determines which events in the Standard Event Status Event register can set the Event Summary Bit (ESB) of the Status Byte register. Any bit positions set to 1 enable the corresponding event. Any enabled events set bit 5 (ESB) of the Status Byte register.
Note	The *CLS command clears the event register, but not the enable register.
Syntax	***ESE <enable value>**
Parameter	<enable value> 0~255
Example	***ESE 20** Sets a bit weight of 20 (bits 2 and 4).
Query Syntax	***ESE?**

Return Parameter

Bit	Register	Bit	Register
0	Not used	4	Message Available
1	Not used	5	Standard Event
2	Error Queue	6	Master Summary
3	Questionable Data	7	Not used

Example

***ESE?**

4

Bit 2 is set.

*ESR? System Command

Description	Reads and clears the Standard Event Status Register. The bit weight of the standard event status register is returned.
Note	The *CLS will also clear the standard event status register.
Query Syntax	***ESR?**

Return Parameter

Bit	Register	Bit	Register
0	Operation Complete	4	Execution Error
1	Not Used	5	Command Error
2	Query Error	6	Not Used
3	Device Error	7	Power On

Query Example

***ESR?**

5

Returns the bit weight of the standard event status register (bit 0 and 2).

*STB? System Command

Description	Reads the Status byte condition register.
Note	Bit 6, the master summary bit, is not cleared.
Syntax	***STB?**

*SRE System Command

Description	The Service Request Enable Command determines which events in the Status Byte Register are allowed to set the MSS (Master summary bit). Any bit that is set to "1" can cause the MSS bit to be set.

Note	The *CLS command clears the status byte event register, but not the enable register.			
Syntax	***SRE <enable value>**			
Parameter	<enable value>	0~255		
Example	***SRE 12** Sets a bit weight of 12 (bits 2 and 3) for the service request enable register.			
Query Syntax	***SRE?**			
Return Parameter	Bit	Register	Bit	Register
	0	Not used	4	Message Available
	1	Not used	5	Standard Event
	2	Error Queue	6	Master Summary
	3	Questionable Data	7	Not used
Query Example	***SRE?** **12** Returns the bit weight of the status byte enable register.			

介面設置指令

SYSTem:INTerface System Command

Description	Selects the remote interface. RS-232 is the factory default.
Note	There is no interface query.
Syntax	**SYSTem:INTerface {GPIB|RS232|USB}**
Example	**SYST:INT USB** Sets the interface to USB.

SYSTem:LOCal System Command

Description	Sets the function generator to local mode. In local mode, all front panel keys are operational.
Syntax	**SYSTem:LOCal**
Example	**SYST:LOC**

SYSTem:REMote System Command

Description	Disables the front panel keys and puts the function generator into remote mode (RS-232).
Syntax	**SYSTem:REMote**
Example	**SYST:REM**

應用指令

The APPLy command has 8 different types of outputs (Sine, Square, Ramp, Pulse, Noise, Triangle, DC, User). The command is the quickest, easiest way to output waveforms remotely. Frequency, amplitude and offset can be specified for each function.

As only basic parameters can be set with the Apply command, other parameters use the instrument default values.

The Apply command will set the trigger source to immediate and disable burst, modulation and sweep modes. Turns on the output command SOURce[1]:OUTP ON. The termination setting will not be changed.

As the frequency, amplitude and offset parameters are in nested square brackets, amplitude can only be specified if the frequency has been specified and offset can only be specified if amplitude has been set. For the example:

SOURce[1]:APPLy:SINusoid [<frequency> [,<amplitude> [,<offset>]]]

Output Frequency For the output frequency, MINimum, MAXimum and DEFault can be used. The default frequency for all functions is set to 1 kHz. The maximum and minimum frequency depends on the function used. If a frequency output that is out of range is specified, the max/min frequency will be used instead. A "Data out range error will be generated" from the remote terminal.

Output Amplitude

When setting the amplitude, MINimum, MAXimum and DEFault can be used. The range depends on the function being used and the output termination (50Ω or high impedance). The default amplitude for all functions is 100 mVpp (50Ω).

If the amplitude has been set and the output termination is changed from 50Ω to high impedance, the amplitude will double. Changing the output termination from high impedance to 50Ω will half the amplitude.

Vrms, dBm or Vpp units can be used to specify the output unit to use with the current command. The VOLT:UNIT command can be used to set the units when no unit is specified with the Apply command. If the output termination is set to high impedance, dBm units cannot be used. The units will default to Vpp.

The output amplitude can be affected by the function and unit chosen. Vpp and Vrms or dBm values may have different maximum values due to differences such as crest factor. For example, a 5Vrms square wave must be adjusted to 3.536 Vrms for a sine wave.

DC Offset voltage

The offset parameter can be set to MINimum, MAXimum or DEFault. The default offset is 0 volts. The offset is limited by the output amplitude as shown below.

$|V_{offset}| < V_{max} - Vpp/2$

If the output specified is out of range, the maximum offset will be set.

The offset is also determined by the output termination (50Ω or high impedance). If the offset has been set and the output termination has changed from 50Ω to high impedance, the offset will double. Changing the output termination from high impedance to 50Ω will half the offset.

SOURce[1]:APPLy:SINusoid

Source Specific Command

Description	Outputs a sine wave from the selected channel when the command has executed. Frequency, amplitude and offset can also be set.	
Syntax	SOURce[1]:APPLy:SINusoid [<frequency> [,<amplitude> [,<offset>]]]	
Parameter	<frequency>	1μHz~80MHz(3081)/ 50MHz(3051)
	<*amplitude*>	10mV~10V (50Ω) (3.536 Vrms)
	<offset>	0~4.99V (50Ω)
Example	**SOUR1:APPL:SIN 2KHZ,MAX,MAX** Sets frequency to 2kHz and sets the amplitude and offset to the maximum.	

SOURce[1]:APPLy:SQUare

Source Specific Command

Description	Outputs a square wave from the selected channel when the command has executed. Frequency, amplitude and offset can also be set. The duty cycle is set to 50%.	
Syntax	SOURce[1]:APPLy:SQUare [<frequency> [,<amplitude> [,<offset>]]]	
Parameter	<frequency>	1μHz~80MHz(3081)/ 50MHz(3051)

	<*amplitude*>	10mV~10V (50Ω)
	<offset>	0~4.99V (50Ω)
Example	**SOUR1:APPL:SQU 2KHZ,MAX,MAX** Sets frequency to 2kHz and sets the amplitude and offset to the maximum.	

SOURce[1]:APPLy:RAMP

Source Specific Command

Description	Outputs a ramp wave from the selected channel when the command has executed. Frequency, amplitude and offset can also be set. The symmetry is set to 100%.	
Syntax	**SOURce[1]:APPLy:RAMP [<frequency> [,<amplitude> [,<offset>]]]**	
Parameter	<frequency>	1μHz~1MHz
	<*amplitude*>	10mV~10V (50Ω)
	<offset>	0~4.99V (50Ω)
Example	**SOUR1:APPL:RAMP 2KHZ,MAX,MAX** Sets frequency to 2kHz and sets the amplitude and offset to the maximum.	

SOURce[1]:APPLy:PULSe

Source Specific Command

Description	Outputs a ramp wave from the selected channel when the command has executed. Frequency, amplitude and offset can also be set.

Note	The PW settings from the SOURce[1]:PULS: WIDT command are preserved. Edge and pulse width may be adjusted to supported levels. Repetition rates will be approximated from the frequency. For accurate repetition rates, the period should be adjusted using the SOURce[1]:PULS:PER command	
Syntax	**SOUR[1]:APPLy:PULSe [<frequency> [,<amplitude> [,<offset>]]]**	
Parameter	<frequency>	500µHz~50MHz
	<*amplitude*>	10mV~10V (50Ω)
	<offset>	0~4.99V (50Ω)
Example	**SOUR1:APPL:PULS 1KHZ,MIN,MAX** Sets frequency to 1kHz and sets the amplitude to minimum and the and offset to the maximum.	

SOURce[1]:APPLy:NOISe

Source Specific Command

Description	Outputs Gaussian noise with a 50 MHz bandwidth. Amplitude and offset can also be set.	
Note	Frequency cannot be used with the noise function; however a value (or DEFault) must be specified. The frequency is remembered for the next function used.	
Syntax	**SOURce[1]:APPLy:NOISe [<frequency|DEFault> [,<amplitude> [,<offset>]]]**	
Parameter	<frequency>	Not applicable
	<*amplitude*>	10mV~10V (50Ω)
	<offset>	0~4.99V (50Ω)
Example	**SOUR1:APPL:NOIS DEF, 3.0, 1.0**	

Sets the amplitude to 3 volts with an offset of 1 volt.

SOURce[1]:APPLy:TRIangle

Source Specific Command

Description	Outputs a triangle wave from the selected channel when the command has executed. Frequency, amplitude and offset can also be set.	
Syntax	**SOURce[1]:APPLy:TRIangle [<frequency> [,<amplitude> [,<offset>]]]**	
Parameter	<frequency>	1μHz~1MHz
	<*amplitude*>	10mV~10V (50Ω)
	<offset>	0~4.99V (50Ω)
Example	**SOUR1:APPL:TRI 2khz, 3.0, 1.0** Sets the frequency to 1 MHz with an amplitude of 3 volts and with an offset of 1 volt.	

SOURce[1]:APPLy:DC

Source Specific Command

Description	Outputs a triangle wave from the selected channel when the command has executed. Frequency, amplitude and offset can also be set.	
Note	Frequency and amplitude cannot be used with the DC function; however a value (or DEFault) must be specified. The values are remembered for the next function used.	
Syntax	**SOUR[1]:APPLy:DC [<frequency|DEFault> [,<amplitude>|DEFault> [,<offset>]]]**	
Parameter	<frequency>	Not applicable
	<*amplitude*>	Not applicable
	<offset>	±5V (50Ω), ±10V (open)
Example	**SOUR1:APPL:DC DEF, DEF, 1.0**	

Sets the DC offset to 1 volt.

SOURce[1]:APPLy:USER

Source Specific Command

Description	Outputs an arbitrary waveform from the selected channel. The output is that specified from the FUNC:USER command.	
Note	Frequency and amplitude cannot be used with the DC function; however a value (or DEFault) must be specified. The values are remembered for the next function used.	
Syntax	**SOURce[1]:APPLy:USER [<frequency> [,<amplitude> [,<offset>]]]**	
Parameter	<frequency>	1μHz~100MHz
	<amplitude>	0~10V (50Ω)
	<offset>	0~5V (50Ω)
Example	**SOUR1:APPL:USER**	

SOURce[1]:APPLy?

Source Specific Command

Description	Outputs a string with the current settings.	
Note	The string can be passed back appended to the Apply Command.	
Syntax	**SOURce[1]:APPLy?**	
Return Parameter	<string>	Function, frequency, amplitude, offset
Example	**SOUR1:APPL?** SIN +5.0000000000000E+03,+3.0000E+00,-2.50E+00 Returns a string with the current function and parameters, Sine, 5kHz, 3 Vpp, -2.5V offset.	

輸出指令

Unlike the Apply commands, the Output commands are low level commands to program the function generator.

This section describes the low-level commands used to program the function generator. 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.

SOURce[1]:FUNCtion

Source Specific Command

Description	The FUNCtion command selects and outputs the selected output. The User parameter outputs an arbitrary waveform previously set by the SOURce[1]:FUNC:USER command.
Note	If the function mode is changed and the current frequency setting is not supported by the new mode, the frequency setting will be altered to next highest value. Vpp and Vrms or dBm amplitude values may have different maximum values due to differences such as crest factor. For example, if a 5Vrms square wave is changed to a sinewave, then the Vrms is automatically adjusted to 3.536. The modulation, burst and sweep modes can only be used with some of the basic waveforms. If a mode is not supported, the conflicting mode will be disabled. See the table below.

	Sine	Squ	Tri	Ramp	Pulse	Noise	ARB
AM	✓	✓	✓	✓	✓	×	✓
FM	✓	✓	✓	✓	×	×	×
PWM	×	✓	×	×	×	×	×
FSK	✓	✓	✓	✓	✓	×	×
SWEEP	✓	✓	✓	✓	×	×	×
BRUST	✓	✓	✓	✓	×	×	×

Syntax	**SOURce[1]:FUNCtion {SINusoid|SQUare|RAMP| PULSe|NOISe|TRIAngle|DC| USER}**
Example	**SOUR1:FUNC SIN** Sets the output as a sine function.
Query Syntax	**SOURce[1]:FUNCtion?**
Return Parameter	SIN, SQU, RAMP, PULS, NOIS, DC, TRI, USER — Returns the current output type.
Example	**SOUR1:FUNC?** SIN Current output is sine.

SOURce[1]:FREQuency

Source Specific Command

Description	Sets the output frequency for the SOURce[1]:FUNCtion command. The query command returns the current frequency setting.
Note	The maximum and minimum frequency depends on the function mode.

Sine, Square	1μHz~80MHz(3081)/ 50MHz(3051)
Ramp, Triangle	1μHz~80MHz(3081)/ 50MHz(3051)
Pulse	50μHz~50MHz
Noise, DC	Not applicable

	User	1μHz~100MHz

If the function mode is changed and the current frequency setting is not supported by the new mode, the frequency setting will be altered to next highest value.

The duty cycle of square waveforms depends on the frequency settings.

20% to 80% (*frequency* < 25 MHz)

40% to 60% (25 MHz < *frequency* < 50 MHz)

50% (*frequency* > 50 MHz)

If the frequency is changed and the set duty cycle cannot support the new frequency, the highest duty cycle available at that frequency will be used. A "settings conflict" error will result from the above scenario.

Syntax	**SOURce[1]:FREQuency {<frequency>|MINimum|MAXimum}**
Example	**SOUR1:FREQ MAX** Sets the frequency to the maximum for the current mode.
Query Syntax	**SOURce[1]:FREQuency?**
Return Parameter	<NR3> Returns the frequency for the current mode.
Example	**SOUR1:FREQ? MAX** +1.0000000000000E+03 The maximum frequency that can be set for the current function is 1MHz.

SOURce[1]:AMPlitude

Source Specific Command

Description	Sets the output amplitude for the SOURce[1]:FUNCtion command. The query command returns the current amplitude settings.

Note	The maximum and minimum amplitude depends on the output termination. The default amplitude for all functions is 100 mVpp (50Ω). If the amplitude has been set and the output termination is changed from 50Ω to high impedance, the amplitude will double. Changing the output termination from high impedance to 50Ω will half the amplitude. The offset and amplitude are related by the following equation. |V*offset*| < V*max* – Vpp/2 If the output termination is set to high impedance, dBm units cannot be used. The units will default to Vpp. The output amplitude can be affected by the function and unit chosen. Vpp and Vrms or dBm values may have different maximum values due to differences such as crest factor. For example, a 5Vrms square wave must be adjusted to 3.536 Vrms for a sine wave. The amplitude units can be explicitly used each time the SOURce[1]:AMPlitude command is used. Alternatively, the VOLT:UNIT command can be used to set the amplitude units for all commands.	
Syntax	**SOURce[1]:AMPlitude {< amplitude> |MINimum|MAXimum}**	
Example	**SOUR1:AMP MAX** Sets the amplitude to the maximum for the current mode.	
Query Syntax	**SOURce[1]:AMPlitude? {MINimum|MAXimum}**	
Return Parameter	<NR3>	Returns the amplitude for the current mode.
Example	**SOUR1:AMP? MAX**	

+5.0000E+00

The maximum amplitude that can be set for the current function is 5 volts.

SOURce[1]:DCOffset

Source Specific Command

Description	Sets or queries the DC offset for the current mode.
Note	The offset parameter can be set to MINimum, MAXimum or DEFault. The default offset is 0 volts. The offset is limited by the output amplitude as shown below. $\|V_{offset}\| < V_{max} - Vpp/2$ If the output specified is out of range, the maximum offset will be set. The offset is also determined by the output termination (50Ω or high impedance). If the offset has been set and the output termination has changed from 50Ω to high impedance, the offset will double. Changing the output termination from high impedance to 50Ω will half the offset. When trying to set a DC voltage, the SOURce[1]:FUNC DC should be used prior to setting an offset.
Syntax	**SOURce[1]:DCOffset {< offset> |MINimum|MAXimum}**
Example	**SOUR1:DCO MAX** Sets the offset to the maximum for the current mode.
Query Syntax	**SOURce[1]:DCOffset? {MINimum|MAXimum}**
Return Parameter	<NR3> — Returns the offset for the current mode.
Example	**SOUR1:DCO?**

+3.0000E+00

The offset for the current mode is set to +3 volts.

SOURce[1]:SQUare:DCYCle

Source Specific Command

Description	Sets or queries the duty cycle for square waves only. The setting is remembered if the function mode is changed. The default duty cycle is 50%.	
Note	The duty cycle of square waveforms depend on the frequency settings. 20% to 80% (*frequency* < 25 MHz) 40% to 60% (25 MHz < *frequency* < 50 MHz) 50% (*frequency* > 50 MHz) If the frequency is changed and the set duty cycle cannot support the new frequency, the highest duty cycle available at that frequency will be used. A "settings conflict" error will result from the above scenario. For square waveforms, the Apply command and AM/FM modulation modes ignore the duty cycle settings.	
Syntax	**SOURce[1]:SQUare:DCYCle {< percent> |MINimum|MAXimum}**	
Example	**SOUR1:SQU:DCYC MAX** Sets the duty cycle to the highest possible for the current frequency.	
Query Syntax	**SOURce[1]:SQUare:DCYCle? {MINimum|MAXimum}**	
Return Parameter	<NR3>	Returns the duty cycle as a percentage.
Example	**SOUR1:SQU:DCYC?** +5.00E+01 The duty cycle is set 50%.	

SOURce[1]:RAMP:SYMMetry

Source Specific Command

Description	Sets or queries the symmetry for ramp waves only. The setting is remembered if the function mode is changed. The default symmetry is 50%.	
Note	For ramp waveforms, the Apply command and AM/FM modulation modes ignore the current symmetry settings.	
Syntax	**SOURce[1]:RAMP:SYMMetry {< percent> |MINimum|MAXimum}**	
Example	**SOUR[1]:RAMP:SYMM MAX** Sets the symmetry to the 100%.	
Query Syntax	**SOURce[1]:RAMP:SYMMetry? {MINimum|MAXimum}**	
Return Parameter	<NR3>	Returns the symmetry as a percentage.
Example	**SOUR1:RAMP:SYMMetry?** +1.0000E+02 The symmetry is set as 100%.	

OUTPut

Source Specific Command

Description	Enables/Disables or queries the front panel output. The default is set to off.
Note	If the output is overloaded by an external voltage, the output will turn off and an error message will be displayed. The overload must first be removed before the output can be turned on again with output command. Using the Apply command automatically sets the front panel output to on.
Syntax	**OUTPut {OFF|ON}**

Example	**OUTP ON**	
	Turns the output on.	
Query Syntax	**OUTPut?**	
Return Parameter	1	ON
	0	OFF
Example	**OUTP?**	
	1	
	The output is currently on.	

OUTPut:LOAD

Source Specific Command

Description	Sets or queries the output termination. Two impedance settings can be chosen, DEFault (50Ω) and INFinity (high impedance >10 kΩ).	
	The output termination is to be used as a reference only. If the output termination is set 50Ω but the actual load impedance is not 50Ω, then the amplitude and offset will not be correct.	
Note	If the amplitude has been set and the output termination is changed from 50Ω to high impedance, the amplitude will double. Changing the output termination from high impedance to 50Ω will half the amplitude.	
	If the output termination is set to high impedance, dBm units cannot be used. The units will default to Vpp.	
Syntax	**OUTPut:LOAD {DEFault|INFinity}**	
Example	**OUTP:LOAD DEF**	
	Sets the output termination to 50Ω.	
Query Syntax	**OUTPut:LOAD?**	
Return Parameter	DEF	Default
	INF	INFinity

Example	**OUTP:LOAD?** **DEF** The output is set to the default of 50Ω.

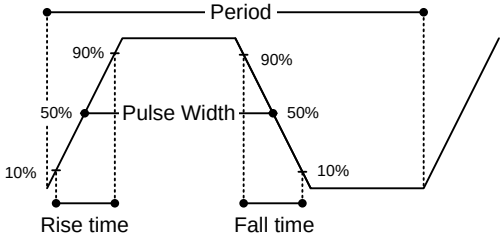
SOURce[1]:VOLTage:UNIT

Source Specific Command

Description	Sets or queries the output amplitude units. There are three types of units: VPP, VRMS and DBM.	
Note	The units set with the VOLTage:UNIT command will be used as the default unit for all amplitude units unless a different unit is specifically used for a command. If the output termination is set to high impedance, dBm units cannot be used. The Units will automatically default to Vpp.	
Syntax	**SOURce[1]:VOLTage:UNIT {VPP|VRMS|DBM}**	
Example	**SOUR1:VOLT:UNIT VPP** Sets the amplitude units to Vpp.	
Query Syntax	**SOURce[1]:VOLTage:UNIT?**	
Return Parameter	VPP	Vpp
	VRMS	Vrms
	DBM	dBm
Example	**SOUR1:VOLT:UNIT?** VPP The amplitude units are set to Vpp.	

脈衝設置指令

The pulse chapter is used to control and output pulse waveforms. Unlike the APPLy command, low level control is possible including setting the rise time, fall time, period and pulse width.



SOURce[1]:PULSe:PERiod

Source Specific Command

Description	Sets or queries the pulse period. The default period is 1 ms.
Note	The pulse period must be greater than the pulse width and edge time(1.6x) combined. Pulse Width + (1.6 * Edge Time) < Period If the edge time or pulse width are too great, they will automatically be reduced to fit the period by the function generator. The PULSe:PERiod function will change the period for all functions, not just for the pulse waveforms. If a different function is chosen and the current period is out of range, the period will be automatically adjusted to suit the new function.
Syntax	**SOURce[1]:PULSe:PERiod {<seconds>|MINimum|MAXimum}**
Example	**SOUR1:PULS:PER MIN** Sets the period to the minimum time allowed.
Query Syntax	**SOURce[1]:PULSe:PERiod? [MINimum|MAXimum]**

Return Parameter	<seconds>	20 ns ~ 2000 seconds
Example	SOUR1:PULS:PER? +1.0000E+01 The period is set to 10 seconds.	

SOURce[1]:PULSe:WIDTh

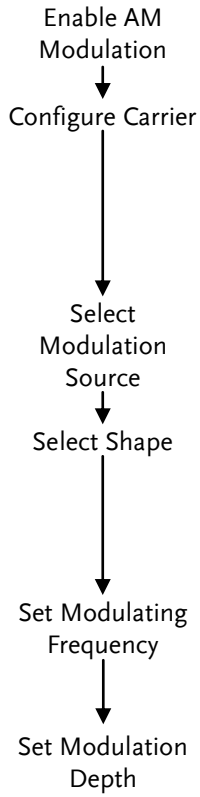
Source Specific Command

Description	Sets or queries the pulse width. The default pulse width is 100us. The minimum pulse width is affected by the period time. If the period is over 20 or 200 seconds, then the minimum pulse width is 1us and 10us, respectively. Pulse width is defined as the time from the rising to falling edges (at a threshold of 50%).
Note	The pulse width cannot be less than the edge time times 1.6. Pulse Width > 1.6 * Edge Time The pulse width must be less than the period minus the edge time (x1.6). Pulse Width < Period – (1.6 *Edge Time)
Syntax	**SOURce[1]:PULSe:WIDTh {<seconds>|MINimum|MAXimum}**
Example	**SOUR1:PULS:WIDT MAX** Sets the pulse width to the maximum allowed.
Query Syntax	**SOURce[1]:PULSe:WIDTh? [MINimum|MAXimum]**
Return Parameter	<seconds> 8 ns ~ 2000 seconds
Example	**SOUR1:PULS:WIDT? MIN** +8.0000E-09 The pulse width is set to 8 nanoseconds.

幅值調製(AM)指令

AM 介紹

To successfully create an AM waveform, the following commands must be executed in order.



1. Turn on AM modulation using the SOURce[1]: AM:STAT ON command
2. Use the APPLy command to select a carrier waveform. Alternatively the equivalent FUNC, FREQ, AMPl, and DCOffs commands can be used to create a carrier waveform with a designated frequency, amplitude and offset.
3. Select an internal or external modulation source using the SOURce[1]:AM:SOUR command.
4. Use the SOURce[1]:AM:INT:FUNC command to select a sine, square, upramp, dnramp or triangle modulating waveshape. For internal sources only.
5. Set the modulating frequency using the SOURce[1]: AM:INT:FREQ command. For internal sources only.
6. Set the modulation depth using the SOURce[1]: AM:DEPT command.

SOURce[1]:AM:STATe

Source Specific Command

Description	Sets or disables AM modulation. By default AM modulation is disabled. AM modulation must be enabled before setting other parameters.	
Note	Burst or sweep mode will be disabled if AM modulation is enabled. As only one modulation is allowed at any one time, other modulation modes will be disabled when AM modulation is enabled.	
Syntax	**SOURce[1]:AM:STATe {OFF|ON}**	
Example	**SOUR1:AM:STAT ON** Enables AM modulation.	
Query Syntax	**SOURce[1]:AM:STATe?**	
Return Parameter	0	Disabled (OFF)
	1	Enabled (ON)
Example	**SOUR1:AM:STAT?** **1** AM modulation mode is currently enabled.	

SOURce[1]:AM:SOURce

Source Specific Command

Description	Sets or queries the modulation source as internal or external. Internal is the default modulation source.
Note	If an external modulation source is selected, modulation depth is limited to ± 5V from the MOD INPUT terminal on the rear panel. For example, if modulation depth is set to 100%, then the maximum amplitude is +5V, and the minimum amplitude is -5V.
Syntax	**SOURce[1]:AM:SOURce {INTernal|EXTernal}**
Example	**SOUR1:AM:SOUR EXT**

	Sets the modulation source to external.	
Query Syntax	**SOURce[1]:AM:SOURce?**	
Return Parameter	INT	Internal
	EXT	External
Example	**SOUR1:AM:SOUR?**	
	INT	
	The modulation source is set to internal.	

SOURce[1]:AM:INTernal:FUNCtion

Source Specific Command

Description	Sets the shape of the modulating waveform from sine, square, triangle, upramp and dnramp. The default shape is sine.			
Note	Square and triangle waveforms have a 50% duty cycle. Upramp and dnramp have a symmetry of 100% and 0%, respectively.			
Syntax	**SOURce[1]:AM:INTernal:FUNCtion {SINusoid|SQUare|TRIangle|UPRamp|DNRamp}**			
Example	**SOUR1:AM:INT:FUNC SIN**			
	Sets the AM modulating wave shape to sine.			
Query Syntax	**SOURce[1]:AM:INTernal:FUNCtion?**			
Return Parameter	SIN	Sine	UPRAMP	Upramp
	SQU	Square	DNRAMP	Dnramp
	TRI	Triangle		
Example	**SOUR1:AM:INT:FUNC?**			
	SIN			
	The shape for the modulating waveform is Sine.			

SOURce[1]:AM:INTernal:FREQuency

Source Specific Command

Description	Sets the frequency of the internal modulating waveform only. The default frequency is 100Hz.

Syntax	**SOURce[1]:AM:INTernal:FREQuency {<frequency>|MINimum|MAXimum}**	
Parameter	<frequency>	2 mHz~ 20 kHz
Example	**SOUR1:AM:INT:FREQ +1.0000E+02** Sets the modulating frequency to 100Hz.	
Query Syntax	**SOURce[1]:AM:INTernal:FREQuency? [MINimum|MAXimum]**	
Return Parameter	<NR3>	Returns the frequency in Hz.
Example	**SOUR1:AM:INT:FREQ? MIN** **+1.0000E+02** Returns the minimum frequency allowed.	

SOURce[1]:AM:DEPTh

Source Specific Command

Description	Sets or queries the modulation depth for internal sources only. The default is 100%.	
Note	The function generator will not output more than ±5V, regardless of the modulation depth. The modulation depth of an external source is controlled using the ±5V MOD INPUT terminal on the rear panel, and not the SOURce[1]:AM:DEPTh command.	
Syntax	**SOURce[1]:AM:DEPTh {<depth in percent>|MINimum|MAXimum}**	
Parameter	<depth in percent>	0~120%
Example	**SOUR1:AM:DEPT 50** Sets the modulation depth to 50%.	
Query Syntax	**SOURce[1]:AM:DEPTh? [MINimum|MAXimum]**	
Return Parameter	<NR3>	Return the modulation depth as a percentage.

Example **SOUR1:AM:DEPT?**

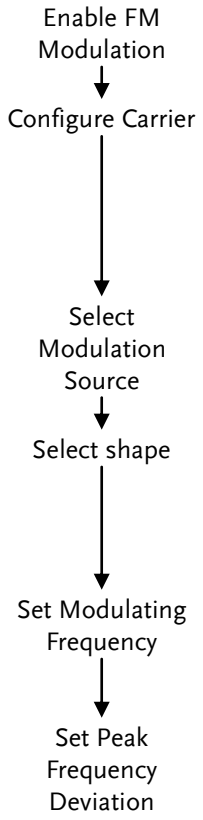
+1.0000E+02

The modulation depth is 100%.

頻率調製(FM)指令

FM 介紹

The following is an overview of the steps required to generate an FM waveform.



1. Turn on FM modulation using the SOURce[1]: FM:STAT ON command.
2. Use the APPLy command to select a carrier waveform. Alternatively, the FUNC, FREQ, AMPl, and DCOffs commands can be used to create a carrier waveform with a designated frequency, amplitude and offset.
3. Select an internal or external modulation source using the SOURce[1]:FM:SOUR command.
4. Use the SOURce[1]:FM:INT:FUNC command to select a sine, square, upramp, dnramp or triangle modulating waveshape. For internal sources only.
5. Set the modulating frequency using the SOURce[1]: FM:INT:FREQ command. For internal sources only.
6. Use the SOURce[1]:FM:DEV command to set the frequency deviation.

SOURce[1]:FM:STATe

Source Specific Command

Description	Sets or disables FM modulation. By default FM modulation is disabled. FM modulation must be enabled before setting other parameters.	
Note	Burst or sweep mode will be disabled if FM modulation is enabled. As only one modulation is allowed at any one time, other modulation modes will be disabled when FM modulation is enabled.	
Syntax	**SOUR[1]:FM:STATe {OFF|ON}**	
Example	**SOUR1:FM:STAT ON** Enables FM modulation.	
Query Syntax	**SOURce[1]:FM:STATe?**	
Return Parameter	0	Disabled (OFF)
	1	Enabled (ON)
Example	**SOUR1:FM:STAT?** **1** FM modulation mode is currently enabled.	

SOURce[1]:FM:SOURce

Source Specific Command

Description	Sets or queries the modulation source as internal or external. Internal is the default modulation source.
Note	If an external modulation source is selected, modulation depth is limited to ± 5V from the MOD INPUT terminal on the rear panel. For example, if modulation depth is set to 100%, then the maximum amplitude is +5V, and the minimum amplitude is -5V.
Syntax	**SOURce[1]:FM:SOURce {INTernal|EXTernal}**

Example	**SOUR1:FM:SOUR EXT**	
	Sets the modulation source to external.	
Query Syntax	**SOURce[1]:FM:SOURce?**	
Return Parameter	INT	Internal
	EXT	External
Example	**SOUR1:FM:SOUR?**	
	INT	
	The modulation source is set to internal.	

SOURce[1]:FM:INTernal:FUNCtion

Source Specific Command

Description	Sets the shape of the modulating waveform from sine, square, triangle, upramp and dnramp. The default shape is sine.			
Note	Square and triangle waveforms have a 50% duty cycle. Upramp and dnramp have a symmetry of 100% and 0%, respectively.			
Syntax	**SOURce[1]:FM:INTernal:FUNCtion {SINusoid|SQUare|TRIangle|UPRamp|DNRamp}**			
Example	**SOUR1:FM:INT:FUNC SIN**			
	Sets the FM modulating wave shape to sine.			
Query Syntax	**SOURce[1]:FM:INTernal:FUNCtion?**			
Return Parameter	SIN	Sine	UPRAMP	Upramp
	SQU	Square	DNRAMP	Dnramp
	TRI	Triangle		
Example	**SOUR1:FM:INT:FUNC?**			
	SIN			
	The shape for the modulating waveform is Sine.			

SOURce[1]:FM:INTernal:FREQuency

Source Specific Command

Description	Sets the frequency of the internal modulating waveform only. The default frequency is 10Hz.	
Syntax	**SOURce[1]:FM:INTernal:FREQuency {<frequency>|MINimum|MAXimum}**	
Parameter	<frequency>	2 mHz~ 20 kHz
Example	**SOUR1:FM:INT:FREQ +1.0000E+02** Sets the modulating frequency to 100Hz.	
Query Syntax	**SOURce[1]:FM:INTernal:FREQuency? [MINimum|MAXimum]**	
Return Parameter	<NR3>	Returns the frequency in Hz.
Example	**SOUR1:FM:INT:FREQ? MAX** **+2.0000E+04** Returns the maximum frequency allowed.	

SOURce[1]:FM:DEViation

Source Specific Command

Description	Sets or queries the peak frequency deviation of the modulating waveform from the carrier waveform. The default peak deviation is 100Hz. The frequency deviation of external sources is controlled using the ±5V MOD INPUT terminal on the rear panel. A positive signal (>0~+5V) will increase the deviation (up to the set frequency deviation), whilst a negative voltage will reduce the deviation.
Note	The relationship of peak deviation to modulating frequency and carrier frequency is shown below. Peak deviation = modulating frequency – carrier frequency. The carrier frequency must be greater than or

equal to the peak deviation frequency. The sum of the deviation and carrier frequency must not exceed the maximum frequency for a specific carrier shape. If an out of range deviation is set for any of the above conditions, the deviation will be automatically adjusted to the maximum value allowed and an "out of range" error will be generated.

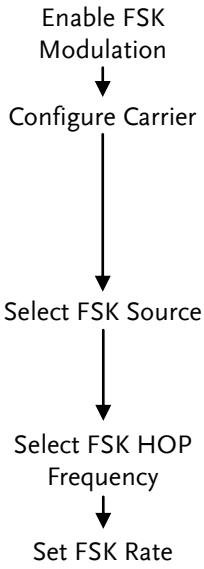
For square wave carrier waveforms, the deviation may cause the duty cycle frequency boundary to be exceeded. In these conditions the duty cycle will be adjusted to the maximum allowed and a "settings conflict" error will be generated.

Syntax	**SOURce[1]:FM:DEViation {<peak deviation in Hz>|MINimum|MAXimum}**	
Parameter	<peak deviation in Hz>	DC~80MHz(3081)/ 50MHz(3051) DC~1MHz (Ramp)
Example	**SOUR1:FM:DEV MAX** Sets the frequency deviation to the maximum value allowed.	
Query Syntax	**SOURce[1]:FM:DEViation? [MINimum|MAXimum]**	
Return Parameter	<NR3>	Returns the frequency deviation in Hz.
Example	**SOURce[1]:FM:DEViation? MAX** **+8.0000E+04** The maximum frequency deviation for the current function is 80MHz.	

頻移鍵控(FSK)指令

FSK 介紹

The following is an overview of the steps required to generate an FSK modulated waveform.



1. Turn on FSK modulation using the SOURce[1]: FSK:STAT ON command.
2. Use the APPLy command to select a carrier waveform. Alternatively, the FUNC, FREQ, AMPl, and DCOffs commands can be used to create a carrier waveform with a designated frequency, amplitude and offset.
3. Select an internal or external modulation source using the SOURce[1]:FSK:SOUR command.
4. Set the hop frequency using the SOURce[1]:FSK:FREQ command.
5. Use the SOURce[1]: FSK:INT:RATE command to set the FSK rate. The FSK rate can only be set for internal sources.

SOURce[1]:FSKey:STATe

Source Specific Command

Description	Turns FSK Modulation on or off. By default FSK modulation is off.
Note	Burst or sweep mode will be disabled if FSK modulation is enabled. As only one modulation is allowed at any one time, other modulation modes will be disabled when FSK modulation is enabled.
Syntax	**SOURce[1]:FSKey:STATe {OFF|ON}**

Example	**SOUR1:FSK:STAT ON**	
	Enables FSK modulation	
Query Syntax	**SOURce[1]:FSKey:STATe?**	
Return Parameter	0	Disabled (OFF)
	1	Enabled (ON)
Example	**SOUR1:FSK:STAT?**	
	ON	
	FSK modulation is currently enabled.	

SOURce[1]:FSKey:SOURce

Source Specific Command

Description	Sets or queries the FSK source as internal or external. Internal is the default source.	
Note	If an external FSK source is selected, FSK rate is controlled by the Trigger INPUT terminal on the rear panel.	
Syntax	**SOURce[1]:FSKey:SOURce {INTernal|EXTernal}**	
Example	**SOUR1:FSK:SOUR EXT**	
	Sets the FSK source to external.	
Query Syntax	**SOURce[1]:FSKey:SOURce?**	
Return Parameter	INT	Internal
	EXT	External
Example	**SOUR1:FSK:SOUR?**	
	INT	
	The FSK source is set to internal.	

SOURce[1]:FSKey:FREQuency

Source Specific Command

Description	Sets the FSK hop frequency. The default hop frequency is set to 100Hz.

Note	For FSK, the modulating waveform is a square wave with a duty cycle of 50%.	
Syntax	**SOURce[1]:FSKey:FREQuency {<frequency>|MINimum|MAXimum}**	
Parameter	<frequency>	1 μHz~ 80 MHz(3081)/ 50MHz(3051)
Example	**SOUR1:FSK:FREQ +1.0000E+02** Sets the FSK hop frequency to to 100Hz.	
Query Syntax	**SOURce[1]:FSKey:FREQuency? [MINimum|MAXimum]**	
Return Parameter	<NR3>	Returns the frequency in Hz.
Example	**SOUR1:FSK:FREQ? MAX** **+8.0000E+07** Returns the maximum hop frequency allowed.	

SOURce[1]:FSKey:INTernal:RATE

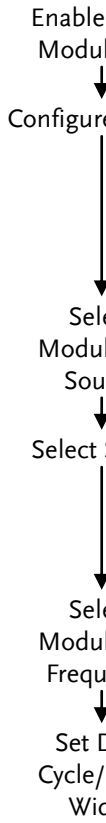
Source Specific Command

Description	Sets or queries the FSK rate for internal sources only.	
Note	External sources will ignore this command.	
Syntax	**SOURce[1]:FSKey:INTernal:RATE {<rate in Hz>|MINimum|MAXimum}**	
Parameter	<rate in Hz>	2 mHz~100 kHz
Example	**SOUR1:FSK:INT:RATE MAX** Sets the rate to the maximum (100kHz).	
Query Syntax	**SOURce[1]:FSKey:INTernal:RATE? [MINimum|MAXimum]**	
Return Parameter	<NR3>	Returns the FSK rate in Hz.
Example	**SOUR1:FSK:INT:RATE? MAX** **+1.0000E+05** Returns the maximum FSK rate allowed.	

脈寬調製(PWM)指令

PWM 介紹

The following is an overview of the steps required to generate a PWM modulated waveform.



1. Turn on PWM modulation using the SOURce[1]: PWM:STATe ON command.
2. Use the APPLy command to select a pulse waveform. Alternatively, the FUNC, FREQ, AMPl, and DCOffs commands can be used to create a pulse waveform with a designated frequency, amplitude and offset.
3. Select an internal or external modulation source using the SOURce[1]:PWM:SOUR command.
4. Use the SOURce[1]: PWM:INT:FUNC command to select a sine, square, upramp, dnramp or triangle modulating waveshape. For internal sources only.
5. Set the modulating frequency using the SOURce[1]:PWM:INT:FREQ command. For internal sources only.
6. Use the SOURce[1]:PWM:DUTY command to set the duty cycle or Pulse Width.

SOURce[1]:PWM:STATe

Source Specific Command

Description	Turns FSK Modulation on or off. By default FSK modulation is off.

Note	Burst or sweep mode will be disabled if PWM modulation is enabled. As only one modulation is allowed at any one time, other modulation modes will be disabled when FSK modulation is enabled.	
Syntax	**SOURce[1]:PWM:STATe {OFF|ON}**	
Example	**SOUR1:PWM:STAT ON** Enables PWM modulation	
Query Syntax	**SOURce[1]:PWM:STATe?**	
Return Parameter	0	Disabled (OFF)
	1	Enabled (ON)
Example	**SOUR1:PWM:STAT?** **ON** FSK modulation is currently enabled.	

SOURce[1]:PWM:SOURce

Source Specific Command

Description	Sets or queries the PWM source as internal or external. Internal is the default source.	
Note	If an external PWM source is selected, the duty cycle/pulse width is controlled by the MOD INPUT terminal on the rear panel.	
Syntax	**SOURce[1]:PWM:SOURce {INTernal|EXTernal}**	
Example	**SOUR1:PWM:SOUR EXT** Sets the PWM source to external.	
Query Syntax	**SOURce[1]:PWM:SOURce?**	
Return Parameter	INT	Internal
	EXT	External
Example	**SOUR1:PWM:SOUR?** **INT** The PWM source is set to internal.	

SOURce[1]:PWM:INTernal:FUNction

Source Specific Command

Description	Sets the shape of the modulating waveform from sine, square, triangle, upramp and dnramp. The default shape is sine.
Note	Square and triangle waveforms have a 50% duty cycle. Upramp and dnramp have a symmetry to 100% and 0%, respectively. Carrier must be a pulse or PWM waveform.
Syntax	**SOURce[1]:PWM:INTernal:FUNction {SINusoid|SQUare|TRIangle|UPRamp|DNRamp}**
Example	**SOUR1:PWM:INT:FUN SIN** Sets the PWM modulating wave shape to sine. .
Query Syntax	**SOURce[1]:PWM:INTernal:FUNction?**

Return Parameter				
	SIN	Sine	UPRAMP	Upramp
	SQU	Square	DNRAMP	Dnramp
	TRI	Triangle		

Example	**SOUR1:PWM:INT:FUNC?** **SIN** The shape for the modulating waveform is Sine.

SOURce[1]:PWM:INTernal:FREQuency

Source Specific Command

Description	Sets the modulating waveform frequency for internal sources. The default frequency is set to 10Hz.
Syntax	**SOURce[1]:PWM:INTernal:FREQuency {<frequency>|MINimum|MAXimum}**

Parameter		
	<frequency>	2 mHz~ 20 kHz

Example	**SOUR1:PWM:INT:FREQ MAX** Sets the frequency to the maximum value.

Query Syntax	**SOURce[1]:PWM:INTernal:FREQuency?**	
Return Parameter	<NR3>	Returns the frequency in Hz.
Example	**SOUR1:PWM:INT:FREQ? MAX** **+2.0000E+04** Returns the modulating frequency. (20kHz)	

SOURce[1]:PWM:DUTY

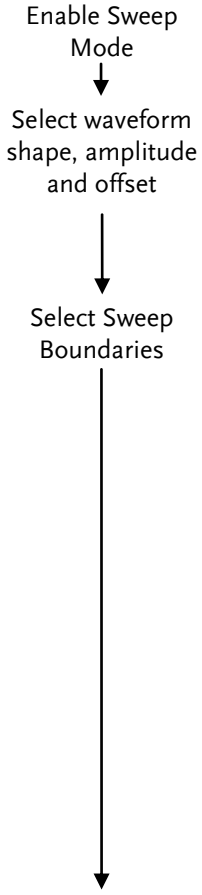
Source Specific Command

Description	Sets or queries the duty cycle deviation. The default duty cycle is 50%.	
Note	The duty cycle is limited by period, edge time and minimum pulse width. The duty cycle deviation of an external source is controlled using the ±5V MOD INPUT terminal on the rear panel. A positive signal (>0~+5V) will increase the deviation (up to the set duty cycle deviation), whilst a negative voltage will reduce the deviation.	
Syntax	**SOURce[1]:PWM:DUTY {< percent>|minimum |maximum}**	
Parameter	<percent>	0%~100% (limited, see above)
Example	**SOUR1:PWM:DUTY +3.0000E+01** Sets the duty cycle to 30%.	
Query Syntax	**SOURce[1]:PWM:DUTY?**	
Return Parameter	<NR3>	Returns the deviation in %.
Example	**SOUR1:PWM:DUTY?** **+3.0000E+01** The current duty cycle is 30%.	

頻率掃描指令

掃描介紹

Below shows the order in which commands must be executed to perform a sweep.



1. Turn on Sweep mode modulation using the SOURce[1]: SWE:STAT ON command.
2. Use the APPLy command to select the waveform shape. Alternatively, the FUNC, FREQ, AMPl, and DCOffs commands can be used to create a waveform with a designated frequency, amplitude and offset.
3. Set the frequency boundaries by setting start and stop frequencies or by setting a center frequency with a span.

   Start~Stop — Use the SOURce[1]:FREQ:STAR and SOURce[1]:FREQ:STOP to set the start and stop frequencies. To sweep up or down, set the stop frequency higher or lower than the start frequency.

   Span — Use the SOURce[1]:FREQ:CENT and SOURce[1]:FREQ:SPAN commands to set the center frequency and the frequency span. To sweep up or down, set the span as positive or negative.

4. Choose Linear or Logarithmic spacing using the SOURce[1]:SWE:SPAC command.

Select Sweep Time
↓
Select the sweep trigger source
↓
Select the marker frequency

5. Choose the sweep time using the SOURce[1]:SWE:TIME command.
6. Select an internal or external sweep trigger source using the SOURce[1]:SOUR command.
7. To output a marker frequency from the SYNC terminal, use The SOURce[1]:MARK:FREQ command. To enable marker frequency output, use the SOURce[1]:MARK ON command.

The marker frequency can be set to a value within the sweep span.

SOURce[1]:SWEep:STATe

Source Specific Command

Description	Sets or disables Sweep mode. By default Sweep is disabled. FM modulation must be enabled before setting other parameters.	
Note	Any modulation modes or Burst mode will be disabled if sweep mode is enabled.	
Syntax	**SOURce[1]:SWEep:STATe {OFF|ON}**	
Example	**SOUR1:SWE:STAT ON** Enables sweep mode.	
Query Syntax	**SOURce[1]:SWEep:STATe?**	
Return Parameter	0	Disabled (OFF)
	1	Enabled (ON)
Example	**SOUR1:SWE:STAT?** **1** Sweep mode is currently enabled.	

SOURce[1]:FREQuency:STARt

Source Specific Command

Description	Sets the start frequency of the sweep. 100Hz is the default start frequency.	
Note	To sweep up or down, set the stop frequency higher or lower than the start frequency.	
Syntax	**SOURce[1]:FREQuency:STARt {<frequency>|MINimum|MAXimum}**	
Parameter	<frequency>	100μHz~ 80MHz(3081)/ 50MHz(3051) 100μHz~ 1MHz (Ramp)
Example	**SOUR1:FREQ:STAR +2.0000E+03** Sets the start frequency to 2kHz.	
Query Syntax	**SOURce[1]:FREQuency:STARt? [MINimum|MAXimum]**	
Return Parameter	<NR3>	Returns the start frequency in Hz.
Example	**SOUR1:FREQ:STAR? MAX** **+8.0000E+07** Returns the maximum start frequency allowed.	

SOURce[1]:FREQuency:STOP

Source Specific Command

Description	Sets the stop frequency of the sweep. 1 kHz is the default start frequency.	
Note	To sweep up or down, set the stop frequency higher or lower than the start frequency.	
Syntax	**SOURce[1]:FREQuency:STOP {<frequency>|MINimum|MAXimum}**	
Parameter	<frequency>	100μHz~ 80MHz(3081)/ 50MHz(3051) 100μHz~ 1MHz (Ramp)

Example	**SOUR1:FREQ:STOP +2.0000E+03** Sets the stop frequency to 2kHz.	
Query Syntax	**SOURce[1]:FREQuency:STOP? [MINimum|MAXimum]**	
Return Parameter	<NR3>	Returns the stop frequency in Hz.
Example	**SOUR1:FREQ:STOP? MAX** **+8.0000E+07** Returns the maximum stop frequency allowed.	

SOURce[1]:FREQuency:CENTer

Source Specific Command

Description	Sets and queries the center frequency of the sweep. 550 Hz is the default center frequency.	
Note	The maximum center frequency depends on the sweep span and maximum frequency: max center freq = max freq – span/2	
Syntax	**SOURce[1]:FREQuency:CENTer {<frequency>|MINimum|MAXimum}**	
Parameter	<frequency>	100μHz~ 80MHz(3081)/ 50MHz(3051) 100μHz~ 1MHz (Ramp)
Example	**SOUR1:FREQ:CENT +2.0000E+03** Sets the center frequency to 2kHz.	
Query Syntax	**SOURce[1]:FREQuency:CENTer? [MINimum|MAXimum]**	
Return Parameter	<NR3>	Returns the stop frequency in Hz.
Example	**SOUR1:FREQ:CENT? MAX** **+8.0000E+06** Returns the maximum center frequency allowed, depending on the span.	

SOURce[1]:FREQuency:SPAN

Source Specific Command

Description	Sets and queries the frequency span of the sweep. 900 Hz is the default frequency span. The span frequency is equal to the stop-start frequencies.	
Note	To sweep up or down, set the span as positive or negative. The maximum span frequency has a relationship to the center frequency and maximum frequency: max freq span= 2(max freq – center freq)	
Syntax	**SOURce[1]:FREQuency:SPAN {<frequency>|MINimum|MAXimum}**	
Parameter	<frequency>	100μHz~ 80MHz(3081)/ 50MHz(3051)100μHz~ 1MHz (Ramp)
Example	**SOUR1:FREQ:SPAN +2.0000E+03** Sets the frequency span to 2kHz.	
Query Syntax	**SOURce[1]:FREQuency:SPAN? [MINimum| MAXimum]**	
Return Parameter	<NR3>	Returns the frequency span in Hz.
Example	**SOUR1:FREQ:SPAN?** **+2.0000E+03** Returns the frequency span for the current sweep.	

SOURce[1]:SWEep:SPACing

Source Specific Command

Description	Sets linear or logarithmic sweep spacing. The default spacing is linear.
Syntax	**SOURce[1]:SWEep:SPACing {LINear|LOGarithmic}**
Example	**SOUR1:SWE:SPAC LIN** Sets the spacing to linear.

Query Syntax	**SOURce[1]:SWEep:SPACing?**	
Return Parameter	LIN	Linear spacing
	LOG	Logarithmic spacing
Example	**SOUR1:SWE:SPAC?**	
	LOG	
	The spacing is currently set as linear.	

SOURce[1]:SWEep:TIME

Source Specific Command

Description	Sets or queries the sweep time. The default sweep time is 1 second.	
Note	The function generator automatically determines the number of frequency points that are used for the sweep based on the sweep time.	
Syntax	**SOURce[1]:SWEep:TIME {<seconds>|MINimum|MAXimum}**	
Parameter	<seconds>	1 ms ~ 500 s
Example	**SOUR1:SWE:TIME +1.0000E+00**	
	Sets the sweep time to 1 second.	
Query Syntax	**SOURce[1]:SWEep:TIME? {<seconds>| MINimum|MAXimum}**	
Return Parameter	<NR3>	Returns sweep time in seconds.
Example	**SOUR1:SWE:TIME?**	
	+2.0000E+01	
	Returns the sweep time (20 seconds).	

SOURce[1]:SWEep:SOURce

Source Specific Command

Description	Sets or queries the trigger source as immediate (internal), external or manual. Immediate (internal) is the default trigger source. IMMediate will constantly output a swept waveform. EXTernal will output a swept waveform after each external trigger pulse. Manual will ouput a swept waveform after the trigger softkey is pressed.
Note	If the APPLy command was used to create the waveform shape, the source is automatically set to IMMediate. The *OPC/*OPC? command/query can be used to signal the end of the sweep.
Syntax	**SOURce[1]: SWEep:SOURce {IMMediate|EXTernal|MANual}**
Example	**SOUR1: SWE:SOUR EXT** Sets the sweep source to external.
Query Syntax	**SOURce[1]: SWEep:SOURce?**

Return Parameter		
	IMM	Immediate
	EXT	External
	MANual	Manual

Example	**SOUR1:SWE:SOUR?** **IMM** The sweep source is set to immediate.

OUTPut[1]:TRIGger:SLOPe

Source Specific Command

Description	Configures the trigger output signal (TTL) as a positive or negative slope. A positive slope will output a pulse with a rising edge and a negative slope will output a pulse with a falling edge.

Note	The Trig out signal depends on the selected trigger source.	
	Trigger Source	Description
	Immediate	A square wave is output from the Trig out terminal with a 50% duty cycle at the start of every sweep.
	External	Trigger Output is disconnected.
	Manual	A pulse (>1 us) is output from the Trig out terminal at the start of each sweep.
Syntax	**OUTPut[1]:TRIGger:SLOPe {POSitive|NEGative}**	
Example	**OUTP1:TRIG:SLOP NEG** Sets the Trig out signal as negative edge.	
Query Syntax	**OUTPut[1]:TRIGger:SLOPe?**	
Return Parameter	POS	Positive edge
	NEG	Negative edge
Example	**OUTP1:TRIG:SLOP?** **NEG** The Trig out signal is set to negative edge.	

OUTPut[1]:TRIGger

Source Specific Command

Description	Turns the trigger out signal on or off from the Trig out terminal on the rear panel. When set to on, a trigger signal (TTL) is output at the start of each pulse. The default is setting is off.	
Syntax	**OUTPut[1]:TRIGger {OFF|ON}**	
Example	**OUT OUTP1:TRIG ON** Enables the Trig out signal.	
Query Syntax	**OUTPut[1]:TRIGger?**	
Return Parameter	0	Disabled
	1	Enable

Example	**OUTP1:TRIG?** **1** The Trig out signal is enabled.

SOURce[1]:MARKer:FREQuency

Source Specific Command

Description	Sets or queries the marker frequency. The default marker frequency is 500 Hz. The marker frequency is used to output a SYNC signal from the SYNC terminal on the front panel. The SYNC signal goes logically high at the start of each sweep and goes low at the marker frequency.	
Note	The marker frequency must be between the start and stop frequencies. If the marker frequency is set to a value that is out of the range, the marker frequency will be set to the center frequency and a "settings conflict" error will be generated.	
Syntax	**SOURce[1]:MARKer:FREQuency {<frequency>|MINimum|MAXimum}**	
Parameter	<frequency>	100 µHz ~ 80 MHz(3081)/ 50MHz(3051)100 µHz ~ 1 MHz (Ramp)
Example	**SOUR1:MARK:FREQ +1.0000E+03** Sets the marker frequency to 1 kHz.	
Query Syntax	**SOURce[1]:MARKer:FREQuency? [MINimum| MAXimum]**	
Return Parameter	<NR3>	Returns the marker frequency in Hz.
Example	**SOUR1:MARK:FREQ? MAX** **+1.0000E+03** Returns the marker frequency (1 kHz).	

SOURce[1]:MARKer

Source Specific Command

Description	Turns the marker frequency on or off. The default is off.	
Note	MARKer ON	The SYNC signal goes logically high at the start of each sweep and goes low at the marker frequency.
	MARKer OFF	The SYNC terminal outputs a square wave with a 50% duty cycle at the start of each sweep.
Syntax	**SOURce[1]:MARKer {OFF|ON}**	
Example	**SOUR1:MARK ON** Enables the marker frequency.	
Query Syntax	**SOURce[1]:MARKer?**	
Return Parameter	0	Disabled
	1	Enabled
Example	**SOUR1:MARK?** **1** The marker frequency is enabled.	

脈衝串模式指令

脈衝串模式介紹

Burst mode can be configured to use an internal trigger (N Cycle mode) or an external trigger (Gate mode) using the Trigger INPUT terminal on the rear panel. Using N Cycle mode, each time the function generator receives a trigger, the function generator will output a specified number of waveform cycles (burst). After the burst, the function generator will wait for the next trigger before outputting another burst. N Cycle is the default Burst mode.

The alternative to using a specified number of cycles, Gate mode uses the external trigger to turn on or off the output. When the Trigger INPUT signal is high*, waveforms are continuously output (creating a burst). When the Trigger INPUT signal goes low*, the waveforms will stop being output after the last waveform completes its period. The voltage level of the output will remain equal to the starting phase of the burst waveforms, ready for the signal to go high* again.

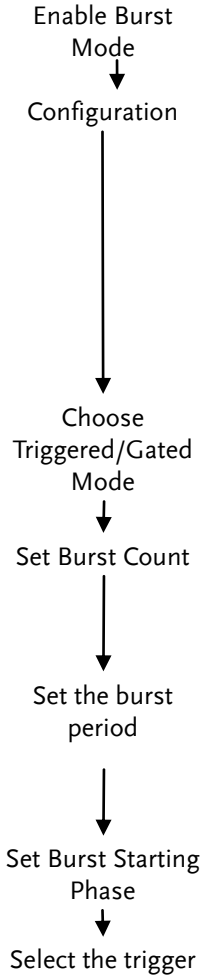
*assuming the Trigger polarity is not inverted.

Only one burst mode can be used at any one time. The burst mode depends on the source of the trigger (internal, external, manual) and the source of the burst.

	Function		
Burst Mode & Source	N Cycle*	Cycle	Phase
Triggered – IMMediate, BUS	Available	Available	Available
Triggered - EXTernal, MANual	Available	Unused	Available
Gated pulse - IMMediate	Unused	Unused	Available

*burst count

The following is an overview of the steps required to generate a burst waveform.



1. Turn on Burst mode using the SOURce[1]:BURS:STAT ON command.
2. Use the APPLy command to select a sine, square, ramp, pulse or triangle burst waveform*. Alternatively, the FUNC, FREQ, AMPl, and DCOffs commands can be used to create the burst waveform* with a designated frequency, amplitude and offset.

   *2 mHz minimum for internally triggered bursts.
3. Use the SOURce[1]: BURS:MODE command to select from triggered or gated burst modes.
4. Use the SOURce[1]:BURS:NCYC command to set the burst count. This command is only for triggered burst mode only.
5. Use the SOURce[1]:BURS:INT:PER command to set the burst period/cycle. This command is only applicable for triggered burst mode (internal trigger).
6. Use the SOURce[1]:BURS:PHAS command to set the burst starting phase.
7. Use the SOURce[1]:BURS:TRIG:SOUR command to select the trigger source for triggered burst mode only.

SOURce[1]:BURSt:STATe

Source Specific Command

Description	Turns burst mode on or off. By default burst mode is turned off.	
Note	When burst mode is turned on, sweep and any modulation modes are disabled.	
Syntax	**SOURce[1]:BURSt:STATe {OFF|ON}**	
Example	**SOUR1:BURS:STAT OFF** Turns burst mode on.	
Query Syntax	**SOURce[1]:BURSt:STATe?**	
Return Parameter	0	Disabled
	1	Enabled
Example	**SOUR1:BURS:STAT?** **OFF** Burst mode is off.	

SOURce[1]:BURSt:MODE

Source Specific Command

Description	Sets or queries the burst mode as gated or triggered. The default burst mode is triggered.	
Note	The burst count, period, trigger source and any manual trigger commands are ignored in gated burst mode.	
Syntax	**SOURce[1]:BURSt:MODE {TRIGgered|GATed}**	
Example	**SOUR1:BURS:MODE TRIG** Sets the burst mode to triggered.	
Query Syntax	**SOURce[1]:BURSt:MODE?**	
Return Parameter	TRIG	Triggered mode
	GAT	Gated mode

Example	**SOUR1:BURS:MODE?** **TRIG** The current burst mode is triggered.

SOURce[1]:BURSt:NCYCles

Source Specific Command

Description	Sets or queries the number of cycles (burst count) in triggered burst mode. The default number of cycles is 1. The burst count is ignored in gated mode.	
Note	If the trigger source is set to immediate, the product of the burst period and waveform frequency must be greater than the burst count: Burst Period X Waveform frequency > burst count If the burst count is too large, the burst period will automatically be increased and a "Settings conflict" error will be generated. Only sine and square waves are allowed infinite burst above 25 MHz.	
Syntax	**SOURce[1]:BURSt:NCYCles{< # cycles> |INFinity|MINimum |MAXimum}**	
Parameter	<# cycles>	1~1,000,000 cycles.
	INFinity	Sets the number to continuous.
	MINimum	Sets the number to minimum allowed.
	MAXimum	Sets the number to maximum allowed.
Example	**SOUR1:BURS:NCYCl INF** Sets the number of burst cycles to continuous (infinite).	
Query Syntax	**SOURce[1]:BURSt:NCYCles? [MINimum|MAXimum]**	
Return Parameter	<NR3>	Returns the number of cycles.
	INF	INF is returned if the number of cycles is continuous.

Example	**SOUR1:BURS:NCYC?** **+1.0000E+02** The burst cycles are set to 100.

SOURce[1]:BURSt:INTernal:PERiod

Source Specific Command

Description	Sets or queries the burst period. Burst period settings are only applicable when the trigger is set to immediate. The default burst period is 10 ms. During manual triggering, external triggering or Gate burst mode, the burst period settings are ignored.
Note	The burst period must be long enough to output the designated number of cycles for a selected frequency. Burst period > burst count/(waveform frequency + 200 ns) If the period is too short, it is automatically increased so that a burst can be continuously output. A "data out of range" error will also be generated.
Syntax	**SOURce[1]:BURSt:INTernal:PERiod {<seconds>|MINimum|MAXimum}**
Parameter	<seconds > 1 us ~ 500 seconds
Example	**SOUR1:BURS:INT:PER +1.0000E+01** Sets the period to 10 seconds.
Query Syntax	**SOURce[1]:BURSt:INTernal:PERiod? [MINimum|MAXimum]**
Return Parameter	<NR3> Returns the burst period in seconds.
Example	**SOUR1:BURS:INT:PER?** **+1.0000E+01** The burst period is 10 seconds.

SOURce[1]:BURSt:PHASe

Source Specific Command

Description	Sets or queries the starting phase for the burst. The default phase is 0 degrees. At 0 degrees, sine square and ramp waveforms are at 0 volts. In gated burst mode, waveforms are continuously output (burst) when the Trig signal is true. The voltage level at the starting phase is used to determine the voltage level of the signal in-between bursts.
Note	The phase command is not used with pulse waveforms.
Syntax	**SOURce[1]:BURSt:PHASe {<angle>|MINimum|MAXimum}**
Parameter	<angle> -360 ~ 360 degrees
Example	**SOUR1:BURS:PHAS MAX** Sets the phase to 360 degrees.
Query Syntax	**SOURce[1]:BURSt:PHASe? [MINimum|MAXimum]**
Return Parameter	<NR3> Returns the phase angle in degrees.
Example	**SOUR1:BURS:PHAS?** **+1.2000E+01** The burst phase is 120 degrees.

SOURce[1]:BURSt:TRIGger:SOURce

Source Specific Command

Description	Sets or queries the trigger source for triggered burst mode. In trigged burst mode, a waveform burst is output each time a trigger signal is received and the number of cycles is determined by the burst count. There are three trigger sources for triggered burst mode:

	Immediate	A burst is output at a set frequency determined by the burst period.
	External	EXTernal will output a burst waveform after each external trigger pulse. Any additional trigger pulse signals before the end of the burst are ignored.
	Manual	Manual triggering will output a burst waveform after the trigger softkey is pressed.
Note	If the APPLy command was used, the source is automatically set to IMMediate. The *OPC/*OPC? command/query can be used to signal the end of the burst.	
Syntax	**SOURce[1]:BURSt:TRIGger:SOURce {IMMediate|EXTernal|MANual}**	
Example	**SOUR1:BURS:TRIG:SOUR EXT** Sets the burst trigger source to external.	
Query Syntax	**SOURce[1]:BURSt:TRIGger:SOURce?**	
Return Parameter	IMM	Immediate
	EXT	External
	MANual	Manual
Example	**SOUR1:BURS:TRIG:SOUR?** **IMM** The burst trigger source is set to immediate.	

SOURce[1]:BURSt:TRIGger:DELay

Source Specific Command

Description	The DELay command is used to insert a delay (in seconds) before a burst is output. The delay starts after a trigger is received. The default delay is 0 seconds.

Syntax	**SOURce[1]: BURSt:TRIGger:DELay {<seconds>|MINimum|MAXimum}**	
Parameter	<seconds>	0~85 seconds
Example	**SOUR1:BURS:TRIG:DEL +1.0000E+01** Sets the trigger delay to 10 seconds.	
Query Syntax	**SOURce[1]:BURSt:TRIGger:DELay? [MINimum|MAXimum]**	
Return Parameter	<NRf>	Delay in seconds
Example	**SOUR1:BURS:TRIG:DEL +1.0000E+01** The trigger delay is 10 seconds.	

SOURce[1]:BURSt:TRIGger:SLOPe

Source Specific Command

Description	Sets or queries the trigger edge for externally triggered bursts from the Trigger INPUT terminal on the rear panel. By default the trigger is rising edge (Positive).	
Syntax	**SOURce[1]:BURSt:TRIGger:SLOPe {POSitive|NEGative}**	
Parameter	POSitive	rising edge
	NEGative	falling edge
Example	**SOUR1:BURS:TRIG:SLOP NEG** Sets the trigger slope to negative.	
Query Syntax	**SOURce[1]:BURSt:TRIGger:SLOPe?**	
Return Parameter	POS	rising edge
	NEG	falling edge
Example	**SOUR1:BURS:TRIG:SLOP NEG** The trigger slope is negative.	

SOURce[1]:BURSt:GATE:POLarity

Source Specific Command

Description	In gated mode, the function generator will output a waveform continuously while the external trigger receives logically true signal from the Trigger INPUT terminal. Normally a signal is logically true when it is high. The logical level can be inverted so that a low signal is considered true.	
Syntax	**SOURce[1]:BURSt:GATE:POLarity{NORMal|INVertes}**	
Parameter	NORMal	Logically high
	INVertes	Logically low
Example	**SOUR1:BURS:GATE:POL INV** Sets the state to logically low (inverted).	
Query Syntax	**SOURce[1]:BURSt:GATE:POLarity?**	
Return Parameter	NORM	Normal(High) logical level
	INV	Inverted (low) logical level
Example	**SOUR1:BURS:GATE:POL?** **INV** The true state is inverted(logically low).	

SOURce[1]:BURSt:OUTPut:TRIGger:SLOPe

Source Specific Command

Description	Sets or queries the trigger edge of the trigger output signal. The signal is output from the trigger out terminal on the rear panel. The default trigger output slope is positive.
Note	The trigger output signal on the rear panel depends on the burst trigger source or mode:

	Immediate	50% duty cycle square wave is output at the start of each burst.
	External	Trigger output disabled.
	Gated mode	Trigger output disabled.
	Manual	A >1 ms pulse is output at the start of each burst.

Syntax	**SOURce[1]:BURSt:OUTPut:TRIGger:SLOPe {POSitive|NEGative}**	
Parameter	POSitive	Rising edge.
	NEGative	Falling edge.
Example	**SOUR1:BURS:OUTP:TRIG:SLOP POS** Sets the trigger output signal slope to positive (rising edge).	
Query Syntax	**SOURce[1]:BURSt:OUTPut:TRIGger:SLOPe?**	
Return Parameter	POS	Rising edge.
	NEG	Falling edge.
Example	**SOUR1:BURS:OUTP:TRIG:SLOP?** **POS** The trigger output signal slope to positive.	

OUTPut:TRIGger

Source Specific Command

Description	Sets or queries the trigger output signal on or off. By default the signal is disabled. When enabled, a TTL compatible square wave is output. This function applies to sweep as well as burst mode.	
Syntax	**OUTPut[1]:TRIGger {OFF|ON}**	
Parameter	OFF	Turns the output off.
	ON	Turns the output on.
Example	**OUTP1:TRIG ON** Turns the output on.	

Query Syntax	**OUTPut[1]:TRIGger?**	
Return Parameter	0	Disabled
	1	Enabled

Query Example **OUTP1:TRIG?**

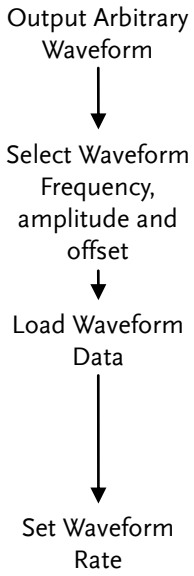
1

The trigger output is enabled.

任意波形指令

任意波形介紹

Use the steps below to output an arbitrary waveform over the remote interface.



1. Use the SOURce[1]:FUNCtion USER command to output the arbitrary waveform currently selected in memory.
2. Use the APPLy command to select frequency, amplitude and DC offset. Alternatively, the FUNC, FREQ, AMPl, and DCOffs commands can be used.
3. Waveform data (1 to 1,048,576 points per waveform) can be downloaded into volatile memory using the DATA:DAC command. Binary integer or decimal integer values in the range of ± 32767 can be used.
4. The waveform rate is the product of the number of points in the waveform and the waveform frequency.

Rate = Hz × # points

Range:	Rate:	10 μHz ~ 200MHz
	Frequency:	10 μHz ~ 100MHz
	# points:	1~1,048,576

SOURce[1]:FUNCtion USER

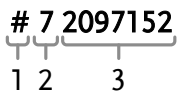
Source Specific Command

Description	Use the SOURce[1]:FUNCtion USER command to output the arbitrary waveform currently selected in memory. The waveform is output with the current frequency, amplitude and offset settings.
Syntax	**SOURce[1]:FUNCtion USER**
Example	**SOUR1:FUNC USER** Selects and outputs the current waveform in memory.

DATA:DAC

Source Specific Command

Description	The DATA:DAC command is used to download binary or decimal integer values into memory using the IEEE-488.2 binary block format or as an ordered list of values.
Note	The integer values (±32767) correspond to the maximum and minimum peak amplitudes of the waveform. For instance, for a waveform with an amplitude of 5Vpp (0 offset), the value 32767is the equivalent of 2.5 Volts. If the integer values do not span the full output range, the peak amplitude will be limited. The IEEE-488.2 binary block format is comprised of three parts:



7. Initialization character (#)
8. Digit length (in ASCII) of the number of bytes
9. Number of bytes

IEEE 488.2 uses two bytes to represent waveform data (16 bit integer). Therefore the number of bytes is always twice the number of data points.

Syntax	**DATA:DAC VOLATILE, <start>, {<binary block>|<value>, <value>, . . . }**	
Parameter	<start>	Start address of the arbitrary waveform
	<binary block>	
	<value>	Decimal or integer values ±32767
Example	**DATA:DAC VOLATILE, #216 Binary Data** The command above downloads 5 data values (stored in 16 bytes) using the binary block format. **DATA:DAC VOLATILE, 1000, 32767, 2048, 0, -2048, -32767** Downloads the data values (32767, 2048, 0, -2048, -32767) to address 1000.	

SOURce[1]:ARB:EDIT:COPY

Source Specific Command

Description	Copies a segment of a waveform to a specific starting address.	
Syntax	**SOURce[1]:ARB:EDIT:COPY [<start>[,<length>[,<paste>]]]**	
Parameter	<start>	Start address: 0~1048,576
	<length>	0 ~ 1048,576
	<paste>	Paste address: 0~1048,576
Example	**SOUR1:ARB:EDIT:COPY 1000, 256, 1257** Copies 256 data values starting at address 1000 and copies them to address 1257.	

SOURce[1]:ARB:EDIT:DELete

Source Specific Command

Description	Deletes a segment of a waveform from memory. The segment is defined by a starting address and length.

Note	A waveform/waveform segment cannot be deleted when output.	
Syntax	**SOURce[1]:ARB:EDIT:DELete [<STARt>[,<LENGth>]]**	
Parameter	<STARt>	Start address: 0~1048,576
	<LENGth>	0 ~ 1048,576
Example	**SOURce1:ARB:EDIT:DEL 1000, 256** Deletes a section of 256 data points from the waveform starting at address 1000.	

SOURce[1]:ARB:EDIT:DELete:ALL

Source Specific Command

Description	Deletes all user-defined waveforms from non-volatile memory and the current waveform in volatile memory.
Note	A waveform cannot be deleted when output.
Syntax	**SOURce[1]:ARB:EDIT:DELete:ALL**
Example	**SOUR1:ARB:EDIT:DEL:ALL** Deletes all user waveforms from memory.

SOURce[1]:ARB:EDIT:POINt

Source Specific Command

Description	Edit a point on the arbitrary waveform.	
Note	A waveform/waveform segment cannot be deleted when output.	
Syntax	**SOURce[1]:ARB:EDIT:POINt [<address> [, <data>]]**	
Parameter	<address>	Address of data point: 0~1,048,576
	<data>	Value data: ± 32,767
Example	**SOUR1:ARB:EDIT:POIN 1000, 32767** Creates a point on the arbitrary waveform at address 1000 with the highest amplitude.	

SOURce[1]:ARB:EDIT:LINE

Source Specific Command

Description	Edit a line on the arbitrary waveform. The line is created with a starting address and data point and a finishing address and data point.	
Note	A waveform/waveform segment cannot be deleted when output.	
Syntax	**SOURce[1]:ARB:EDIT:LINE [<address1>[,<data>[,<address2>[,<data2>]]]]**	
Parameter	<addrress1>	Address of data point1: 0~1,048,576
	<data1>	Value data2: ± 32,767
	<address2>	Address of data point2: 0~1,048,576
	<data2>	Value data2: ± 32,767
Example	**SOUR1:ARB:EDIT:LINE 40, 50, 100, 50**	
	Creates a line on the arbitrary waveform at 40,50 to 100,50.	

SOURce[1]:ARB:EDIT:PROTect

Source Specific Command

Description	Protects a segment of the arbitrary waveform from deletion or editing.	
Syntax	**SOURce[1]:ARB:EDIT:PROTect [<STARt>[,<LENGth>]]**	
Parameter	<STARt>	Start address: 0~1048,576
	<LENGth>	0 ~ 1048,576
Example	**SOUR1:ARB:EDIT:PROT 40, 50**	
	Protects a segment of the waveform from address 40 for 50 data points.	

SOURce[1]:ARB:EDIT:PROTect:ALL

Source Specific Command

Description	Protects the arbitrary waveform currently in non-volatile memory/ currently being output.
Syntax	**SOURce[1]:ARB:EDIT:PROTect:ALL**
Example	**SOUR1:ARB:EDIT:PROT:ALL**

SOURce[1]:ARB:EDIT:UNProtect

Source Specific Command

Description	Uprotects the arbitrary waveform currently in non-volatile memory/currently being output.
Syntax	**SOURce[1]:ARB:EDIT:UNProtect**
Example	**SOUR1:ARB:EDIT:UNP**

SOURce[1]:ARB:BUILt:SINusoid

Source Specific Command

Description	Creates a sinusoid with a specified start address, length and scale.	
Syntax	**SOURce[1]:ARB:BUILt:SINusoid [<STARt>[,<LENGth>[,<SCALe>]]]**	
Parameter	<STARt>	Start address*: 0~1048,576
	<LENGth>	Length*: 0 ~ 1048,576
	<SCALe>	Scale: ±32767
	* Start + Length ⩽ 1,048,576	
Example	**SOUR1:ARB:BUIL:SIN 1000, 1000, 100**	
	Creates a sin wave 1000 points in length with a scale of 100 and a start address of 1000.	

SOURce[1]:ARB:BUILt:SQUare

Source Specific Command

Description	Creates a square wave with a specified start address, length and scale.

Syntax	**SOURce[1]:ARB:BUILt:SQUare [<STARt>[,<LENGth>[,<SCALe>]]]**	
Parameter	<STARt>	Start address*: 0~1048,576
	<LENGth>	Length*: 0 ~ 1048,576
	<SCALe>	Scale: ±32767
	* Start + Length ≤ 1,048,576	
Example	**SOUR1:ARB:BUIL:SQU 1000, 1000, 100**	
	Creates a square wave 1000 points in length with a scale of 100 and a start address of 1000.	

SOURce[1]:ARB:BUILt:PULSe

Source Specific Command

Description	Creates a pulse wave with a specified frequency and duty.		
Syntax	**SOURce[1]:ARB:BUILt:PULSe [<FREQuency>[,<DUTY>]]**		
Parameter	<FREQuency>	1pHz~500kHz*	
	<DUTY>	0.0001%~99.9999%	
	*Frequency	Resolution	Duty Resolution
	1pHz~5Hz	1pHz	0.0001%
	>5Hz~50Hz	1uHz	0.0001%
	>50Hz~500Hz	10uHz	0.001%
	>500Hz~5kHz	100uHz	0.01%
	>5kHz~50kHz	1mHz	0.1%
	>50kHz~500kHz	10mHz	1%
Example	**SOUR1:ARB:BUIL:PULSe +1.00000002E+03, +1.002E+01**		
	Creates a 1000.0002Hz pulse wave with a 10.02% duty cycle.		

SOURce[1]:ARB:BUILt:RAMP

Source Specific Command

Description	Creates a ramp wave with a specified start address, length and scale.	
Syntax	**SOURce[1]:ARB:BUILt:RAMP[<STARt>[,<LENGth>[,<SCALe>]]]**	
Parameter	<STARt>	Start address*: 0~1048,576
	<LENGth>	Length*: 0 ~ 1048,576
	<SCALe>	Scale: ±32767
	* Start + Length ≤ 1,048,576	
Example	**SOUR1:ARB:BUIL:RAMP 1000, 1000, 100**	
	Creates a ramp wave 1000 points in length with a scale of 100 and a start address of 1000.	

SOURce[1]:ARB:BUILt:SINC

Source Specific Command

Description	Creates a sinc wave with a specified start address, length and scale.	
Syntax	**SOURce[1]:ARB:BUILt:SINC [<STARt>[,<LENGth>[,<SCALe>]]]**	
Parameter	<STARt>	Start address*: 0~1048,576
	<LENGth>	Length*: 0 ~ 1048,576
	<SCALe>	Scale: ±32767
	* Start + Length ≤ 1,048,576	
Example	**SOUR1:ARB:BUIL:SINC 1000, 1000, 100**	
	Creates a sinc wave 1000 points in length with a scale of 100 and a start address of 1000.	

SOURce[1]:ARB:BUILt:EXPRise

Source Specific Command

Description	Creates an exponential rise wave with a specified start address, length and scale.	
Syntax	**SOURce[1]:ARB:BUILt:EXPRise [<STARt>[,<LENGth>[,<SCALe>]]]**	
Parameter	<STARt>	Start address*: 0~1048,576
	<LENGth>	Length*: 0 ~ 1048,576
	<SCALe>	Scale: ±32767
	* Start + Length ≤ 1,048,576	
Example	**SOUR1:ARB:BUIL:EXPR 1000, 1000, 100**	
	Creates a exponential rise wave 1000 points in length with a scale of 100 and a start address of 1000.	

SOURce[1]:ARB:BUILt:EXPFail

Source Specific Command

Description	Creates a DC waveform with a specified start address, length and scale.	
Syntax	**SOURce[1]:ARB:BUILt:EXPFail [<STARt>[,<LENGth>[,<SCALe>]]]**	
Parameter	<STARt>	Start address*: 0~1048,576
	<LENGth>	Length*: 0 ~ 1048,576
	<SCALe>	Scale: ±32767
	* Start + Length ≤ 1,048,576	
Example	**SOUR1:ARB:BUIL:EXPF 1000, 1000, 100**	
	Creates an exponential fall wave 1000 points in length with a scale of 100 and a start address of 1000.	

SOURce[1]:ARB:BUILt:DC

Source Specific Command

Description	Creates an exponential fall wave with a specified start address, length and scale.	
Syntax	**SOURce[1]:ARB:BUILt:DC [<STARt>[,<LENGth>[,<SCALe>]]]**	
Parameter	<STARt>	Start address*: 0~1048,576
	<LENGth>	Length*: 0 ~ 1048,576
	<SCALe>	Scale: ±32767
	* Start + Length ≤ 1,048,576	
Example	**SOUR1:ARB:BUIL:DC 1000, 1000, 100**	
	Creates an exponential fall wave 1000 points in length with a scale of 100 and a start address of 1000.	

SOURce[1]:ARB:NCYCles

Source Specific Command

Description	The arbitrary waveform output can be repeated for a designated number of cycles.	
Syntax	**SOURce[1]:ARB:NCYCles {< #cycles> |INFinity|MINimum |MAXimum}**	
Parameter	<# cycles>	1~1,048,575 cycles
	INFinity	Sets the number of cycles to continuous.
	MINimum	Sets the number of cycles to the minimum allowed.
	MAXimum	Sets the number of cycles to the maximum allowed.
Example	**SOUR1:ARB:NCYCl INF**	
	Sets the number of ARB waveform output cycles to continuous (infinite).	
Query Syntax	**SOURce[1]:ARB:NCYCles? [MINimum|MAXimum]**	

Return Parameter	<NR3>	Returns the number of cycles.
	INF	INF is returned if the number of cycles is continuous.
Example	SOUR1:ARB:NCYC?	
	+1.0000E+02	
	The number of ARB waveform output cycles is returned (100).	

SOURce[1]:ARB:OUTPut:MARKer

Source Specific Command

Description	Define a section of the arbitrary waveform for marker output. The marker is output from the SYNC terminal on the front panel.	
Syntax	SOURce[1]:ARB:OUTPut:MARKer [<STARt>[,<LENGth>]]	
Parameter	<STARt>	Start address*: 0~1048,576
	<LENGth>	Length*: 0 ~ 1048,576
	* Start + Length ≤ currently output arbitrary waveform	
Example	SOUR1:ARB:OUTP:MARK 1000, 1000	
	The marker output is for a start address of 1000 with a length of 1000.	

SOURce[1]:ARB:OUTPut

Source Specific Command

Description	Output the current arbitrary waveform in volatile memory. A specified start and length can also be designated.	
Syntax	SOURce[1]:ARB:OUTPut [<STARt>[,<LENGth>]]	
Parameter	<STARt>	Start address*: 0~1048,576
	<LENGth>	Length*: 0 ~ 1048,576
	* Start + Length ≤ currently output arbitrary waveform	

Example **SOUR1:ARB:OUTP 20 200**

Outputs the current arbitrary waveform in memory.

存儲和調取指令

Up to 10 different instrument states can be stored to non-volatile memory (memory locations 0~9).

*SAV	Instrument Command
Description	Saves the current instrument state to a specified save slot. When a state is saved, all the current instrument settings, functions and waveforms are also saved.
Note	The *SAV command doesn't save waveforms in non-volatile memory, only the instrument state. The *RST command will not delete saved instrument states from memory.
Syntax	***SAV {0|1|2|3|4|5|6|7|8|9}**
Example	***SAV 0** Save the instrument state to memory location 0.

*RCL	Instrument Command
Description	Recall previously saved instrument states from memory locations 0~9.
Syntax	***RCL {0|1|2|3|4|5|6|7|8|9}**
Example	***RCL 0** Recall instrument state from memory location 0.

MEMory:STATe:DELete	Instrument Command
Description	Delete memory from a specified memory location.
Syntax	**MEMory:STATe:DELete {0|1|2|3|4|5|6|7|8|9}**
Example	**MEM:STAT:DEL 0**

Delete instrument state from memory location 0.

MEMory:STATe:DELete ALL	Instrument Command
Description	Delete memory from all memory locations, 0~9.
Syntax	**MEMory:STATe:DELete ALL**
Example	**MEM:STAT:DEL ALL** Deletes all the instrument states from memory locations 0~9.

錯誤資訊

The AFG-3000 has a number of specific error codes. Use the SYSTem:ERRor command to recall the error codes.

Command Error Codes

-101 Invalid character

An invalid character was used in the command string. Example: #, $, %.

SOURce1:AM:DEPTh MIN%

-102 Syntax error

Invalid syntax was used in the command string. Example: An unexpected character may have been encountered, like an unexpected space.

SOURce1:APPL:SQUare , 1

-103 Invalid separator

An invalid separator was used in the command string. Example: a space, comma or colon was incorrectly used.

APPL:SIN 1 1000 OR SOURce1:APPL:SQUare

-108 Parameter not allowed

The command received more parameters than were expected. Example: An extra (not needed) parameter was added to a command

SOURce1:APPL? 10

-109 Missing parameter

The command received less parameters than expected. Example: A required parameter was omitted.

SOURce1:APPL:SQUare

-112 Program mnemonic too long

A command header contains more than 12 characters:

OUTP:SYNCHRONIZATION ON

-113 Undefined header

An undefined header was encountered. The header is syntactically correct. Example: the header contains a character mistake.

SOUR1:AMM:DEPT MIN

-123 Exponent too large

Numeric exponent exceeds 32,000. Example:

SOURce[1]:BURSt:NCYCles 1E34000

-124 Too many digits

The mantissa (excluding leading 0's) contains more than 255 digits.

-128 Numeric data not allowed

An unexpected numeric character was received in the command. Example: a numeric parameter is used instead of a character string.

SOURce1:BURSt:MODE 123

-131 Invalid suffix

An invalid suffix was used. Example: An unknown or incorrect suffix may have been used with a parameter.

SOURce1:SWEep:TIME 0.5 SECS

-138 Suffix not allowed

A suffix was used where none were expected. Example: Using a suffix when not allowed.

SOURce1:BURSt: NCYCles 12 CYC

-148 Character data not allowed

A parameter was used in the command where not allowed. Example: A discrete parameter was used where a numeric parameter was expected.

SOUR1:MARK:FREQ ON

-158 String data not allowed

An unexpected character string was used where none were expected. Example: A character string is used instead of a valid parameter.

SOURce1:SWEep:SPACing 'TEN'

-161 Invalid block data

Invalid block data was received. Example: The number of bytes sent with the DATA:DAC command doesn't correlate to the number of bytes specified in the block header.

-168 Block data not allowed

Block data was received where block data is not allowed. Example:

SOURce1:BURSt: NCYCles #10

-170~178 expression errors

Example: The mathematical expression used was not valid.

Execution Errors

-211 Trigger ignored

A trigger was received but ignored. Example: Triggers will be ignored until the function that can use a trigger is enabled (burst, sweep, etc.).

-223 Too much data

Data was received that contained too much data. Example: An arbitrary waveform with over 1,048,576 points cannot be used.

-221 Settings conflict; turned off infinite burst to allow immediate trigger source

Example: Infinite burst is disabled when an immediate trigger source is selected. Burst count set to 1,000,000 cycles.

-221 Settings conflict; infinite burst changed trigger source to MANual

Example: The trigger source is changed to immediate from manual when infinite burst mode is selected.

-221 Settings conflict; burst period increased to fit entire burst

Example: The function generator automatically increases the burst period to allow for the burst count or frequency.

-221 Settings conflict; burst count reduced

Example: The burst count is reduced to allow for the waveform frequency if the burst period is at it's maximum.

-221 Settings conflict; trigger delay reduced to fit entire burst

Example: The trigger delay is reduced to allow the current period and burst count.

-221 Settings conflict;triggered burst not available for noise

Example: Triggered burst cannot be used with noise.

-221 Settings conflict;amplitude units changed to Vpp due to high-Z load

Example: If a high impedance load is used, dBm units cannot be used. The units are automatically set to Vpp.

-221 Settings conflict;trigger output disabled by trigger external

Example: The trigger output terminal is disabled when an external trigger source is selected.

-221 Settings conflict;trigger output connector used by FSK

Example: The trigger output terminal cannot be used in FSK mode.

-221 Settings conflict;trigger output connector used by burst gate

Example: The trigger output terminal cannot be used in gated burst mode.

-221 Settings conflict;trigger output connector used by trigger external

Example: The trigger output connector is disabled when the trigger source is set to external.

-221 Settings conflict;frequency reduced for pulse function

Example: When the function is changed to pulse, the output frequency is automatically reduced if over range.

-221 Settings conflict;frequency reduced for ramp function

Example: When the function is changed to ramp, the output frequency is automatically reduced if over range.

-221 Settings conflict;frequency made compatible with burst mode

Example: When the function is changed to burst, the output frequency is automatically adjusted if over range.

-221 Settings conflict;frequency made compatible with FM

Example: When the function is changed to FM, the frequency is automatically adjusted to suit the FM settings.

-221 Settings conflict;burst turned off by selection of other mode or modulation

Example: Burst mode is disabled when sweep or a modulation mode is enabled.

-221 Settings conflict;FSK turned off by selection of other mode or modulation

Example: FSK mode is disabled when burst, sweep or a modulation mode is enabled.

-221 Settings conflict;FM turned off by selection of other mode or modulation

Example: FM mode is disabled when burst, sweep or a modulation mode is enabled.

-221 Settings conflict;AM turned off by selection of other mode or modulation

Example: AM mode is disabled when burst, sweep or a modulation mode is enabled.

-221 Settings conflict; sweep turned off by selection of other mode or modulation

Example: Sweep mode is disabled when burst or a modulation mode is enabled.

-221 Settings conflict;not able to modulate this function

Example: A modulated waveform cannot be generated with dc voltage, noise or pulse waveforms.

-221 Settings conflict;not able to sweep this function

Example: A swept waveform cannot be generated with dc voltage, noise or pulse waveforms.

-221 Settings conflict;not able to burst this function

Example: A burst waveform cannot be generated with the dc voltage function.

-221 Settings conflict;not able to modulate noise, modulation turned off

Example: A waveform cannot be modulated using the noise function.

-221 Settings conflict;not able to sweep pulse, sweep turned off

Example: A waveform cannot be swept using the pulse function.

-221 Settings conflict;not able to modulate dc, modulation turned off

Example: A waveform cannot be modulated using the dc voltage function.

-221 Settings conflict;not able to sweep dc, modulation turned off

Example: A waveform cannot be swept using the dc voltage function.

-221 Settings conflict;not able to burst dc, burst turned off

Example: The burst function cannot be used with the dc voltage function.

-221 Settings conflict;not able to sweep noise, sweep turned off

Example: A waveform cannot be swept using the noise function.

-221 Settings conflict;pulse width decreased due to period

Example: The pulse width has been adjusted to suit the period settings.

-221 Settings conflict;amplitude changed due to function

Example: The amplitude (VRM / dBm) has been adjusted to suit the selected function. For the AFG-3000, a typical square wave has a much higher amplitude (5V Vrms) compared to a sine wave (~3.54) due to crest factor.

-221 Settings conflict;offset changed on exit from dc function

Example: The offset level is adjusted on exit from a DC function.

-221 Settings conflict;FM deviation cannot exceed carrier

Example: The deviation cannot be set higher than the carrier frequency

-221 Settings conflict;FM deviation exceeds max frequency

Example: If the FM deviation and carrier frequency combined exceeds the maximum frequency plus 100 kHz, the deviation is automatically adjusted.

-221 Settings conflict;frequency forced duty cycle change

Example: If the frequency is changed and the current duty cannot be supported at the new frequency, the duty will be automatically adjusted.

-221 Settings conflict;offset changed due to amplitude

Example: The offset is not a valid offset value, it is automatically adjusted, considering the amplitude.

|offset| ≤ max amplitude – Vpp/2

-221 Settings conflict;amplitude changed due to offset

Example: The amplitude is not a valid value, it is automatically adjusted, considering the offset.

Vpp ≤ 2X (max amplitude -|offset|)

-221 Settings conflict;low level changed due to high level

Example: The low level value was set too high. The low level is set 1 mV less than the high level.

-221 Settings conflict;high level changed due to low level

Example: The high level value was set too low. The high level is set 1 mV greater than the low level.

-222 Data out of range;value clipped to upper limit

Example: The parameter was set out of range. The parameter is automatically set to the maximum value allowed.

SOURce[1]:FREQuency 80.1MHz.

-222 Data out of range;value clipped to lower limit

Example: The parameter was set out of range. The parameter is automatically set to the minimum value allowed.

SOURce[1]:FREQuency 0.1μHz.

-222 Data out of range;period; value clipped to ...

Example: If the period was set to a value out of range, it is automatically set to an upper or lower limit.

-222 Data out of range;frequency; value clipped to ...

Example: If the frequency was set to a value out of range, it is automatically set to an upper or lower limit.

-222 Data out of range;user frequency; value clipped to upper limit

Example: If the frequency is set to a value out of range for an arbitrary waveform using, SOURce[1]: APPL: USER or SOURce[1]: FUNC:USER, it is automatically set to the upper limit.

-222 Data out of range;ramp frequency; value clipped to upper limit

Example: If the frequency is set to a value out of range for a ramp waveform using, SOURce[1]: APPL: RAMP or SOURce[1]:FUNC:RAMP, it is automatically set to the upper limit.

-222 Data out of range;pulse frequency; value clipped to upper limit

Example: If the frequency is set to a value out of range for a pulse waveform using, SOURce[1]: APPL:PULS or SOURce[1]:FUNC:PULS, it is automatically set to the upper limit.

-222 Data out of range;burst period; value clipped to ...

Example: If the burst period was set to a value out of range, it is automatically set to an upper or lower limit.

222 Data out of range;burst count; value clipped to ...

Example: If the burst count was set to a value out of range, it is automatically set to an upper or lower limit.

-222 Data out of range; burst period limited by length of burst; value clipped to upper limit

Example: The burst period must be greater than burst count divided by the frequency + 200 ns. The burst period is adjusted to satisfy these conditions.

burst period > 200 ns + (burst count/burst frequency).

-222 Data out of range; burst count limited by length of burst; value clipped to lower limit

Example: The burst count must be less than burst period * the waveform frequency when the the trigger source is set to immediate (SOURce[1]: TRIG:SOUR IMM). The burst count is automatically set to the lower limit.

-222 Data out of range;amplitude; value clipped to ...

Example: If the amplitude was set to a value out of range, it is automatically set to an upper or lower limit.

-222 Data out of range;offset; value clipped to ...

Example: If the offset was set to a value out of range, it is automatically set to an upper or lower limit.

-222 Data out of range;frequency in burst mode; value clipped to ...

Example: If the frequency was set to a value out of range in burst mode. The burst frequency is automatically set to an upper or lower limit, taking the burst period into account.

-222 Data out of range;frequency in FM; value clipped to ...

Example: The carrier frequency is limited by the frequency deviation (SOURce[1]: FM:DEV). The carrier frequency is automatically adjusted to be less than or equal to the frequency deviation.

-222 Data out of range;marker confined to sweep span; value clipped to ...

Example: The marker frequency is set to a value outside the start or stop frequencies. The marker frequency is automatically adjusted to either the start or stop frequency (whichever is closer to the set value).

-222 Data out of range;FM deviation; value clipped to ...

Example: The frequency deviation is outside of range. The deviation is automatically adjusted to an upper or lower limit, depending on the frequency.

-222 Data out of range;trigger delay; value clipped to upper limit

Example: The trigger delay was set to a value out of range. The trigger delay has been adjusted to the maximum (85 seconds).

-222 Data out of range; trigger delay limited by length of burst; value clipped to upper limit

Example: The trigger delay and the burst cycle time combined must be less than the burst period.

-222 Data out of range;duty cycle; value clipped to ...

Example: The duty cycle is limited depending on the frequency.

Duty Cycle	Frequency
50%	> 50MHz
40%~60%	25 MHz ~ 50MHz
20%~80%	< 25 MHz

-222 Data out of range; duty cycle limited by frequency; value clipped to upper limit

Example: The duty cycle is limited depending on the frequency. When the frequency is greater than 50 MHz, the duty cycle is automatically limited to 50%.

-313 Calibration memory lost;memory corruption detected

Indicates that a fault (check sum error) has occurred with the non-volatile memory that stores the calibration data.

-314 Save/recall memory lost;memory corruption detected

Indicates that a fault (check sum error) has occurred with the non-volatile memory that stores the save/recall files.

-315 Configuration memory lost;memory corruption detected

Indicates that a fault (check sum error) has occurred with the non-volatile memory that stores the configuration settings.

-350 Queue overflow

Indicates that the error queue is full (over 20 messages generated, and not yet read). No more messages will be stored until the queue is empty. The queue can be cleared by reading each message, using the *CLS command or restarting the function generator.

-361 Parity error in program message

Indicates that there is a RS232 parity setting mismatch between the host PC and the function generator.

-362 Framing error in program message

Indicates that there is a RS232 stop bit setting mismatch between the host PC and the function generator.

-363 Input buffer overrun

Indicates that too many characters have been sent to the function generator via RS232. Ensure handshaking is used.

Query Errors

-410 Query INTERRUPTED

Indicates that a command was received but the data in the output buffer from a previous command was lost.

-420 Query UNTERMINATED

The function generator is ready to return data, however there was no data in the output buffer. For example: Using the APPLy command.

-430 Query DEADLOCKED

Indicates that a command generates more data than the output buffer can receive and the input buffer is full. The command will finish execution, though all the data won't be kept.

Arbitrary Waveform Errors

-770 Nonvolatile arb waveform memory corruption detected

Indicates that a fault (check sum error) has occurred with the non-volatile memory that stores the arbitrary waveform data.

-781 Not enough memory to store new arb waveform; bad sectors

Indicates that a fault (bad sectors) has occurred with the non-volatile memory that stores the arbitrary waveform data. Resulting in not enough memory to store arbitrary data.

-787 Not able to delete the currently selected active arb waveform

Example: The currently selected waveform is being output and cannot be deleted.

800 Block length must be even

Example: As block data (DATA:DAC VOLATILE) uses two bytes to store each data point, there must be an even number or bytes for a data block.

SCPI 狀態寄存器

The status registers are used to record and determine the status of the function generator.

The function generator has a number of register groups:

Questionable Status Registers

Standard Event Status Registers

Status Byte Register

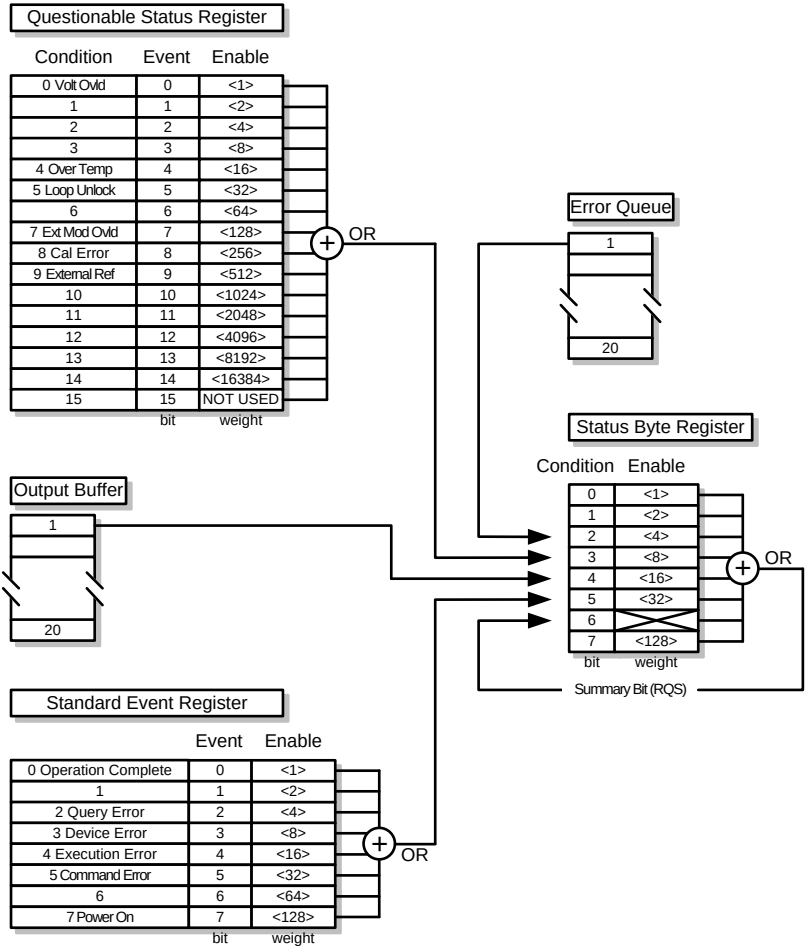
As well as the output and error queues.

Each register group is divided into three types of registers: condition registers, event registers and enable registers.

Register types

Condition Register	The condition registers indicate the state of the function generator in real time. The condition registers are not triggered. I.e., the bits in the condition register change in real time with the instrument status. Reading a condition register will not clear it. The condition registers cannot be cleared or set.
Event Register	The Event Registers indicate if an event has been triggered in the condition registers. The event registers are latched and will remain set unless the *CLS command is used. Reading an event register will not clear it.
Enable Register	The Enable register determines which status event(s) are enabled. Any status events that are not enabled are ignored. Enabled events are used to summarize the status of that register group.

AFG-3000 Status System



Questionable Status Register

Description: The Questionable Status Registers will show if any faults or errors have occurred.

Bit Summary:

Register	Bit	Bit Weight
Voltage overload	0	1
Over temperature	4	16
Loop unlock	5	32
Ext Mod Overload	7	128
Cal Error	8	256
External Reference	9	512

Standard Event Status Registers

Description: The Standard Event Status Registers indicate when the *OPC command has been executed or whether any programming errors have occurred.

Notes: The Standard Event Status Enable register is cleared when the *ESE 0 command is used.

The Standard Event Status Event register is cleared when the *CLS command or the *ESR? command is used.

Bit Summary	Register	Bit	Bit Weight
	Operation complete bit	0	1
	Query Error	2	4
	Device Error	3	8
	Execution Error	4	16
	Command Error	5	32
	Power On	7	128

Error Bits		
	Operation complete	The operation complete bit is set when all selected pending operations are complete. This bit is set in response to the *OPC command.
	Query Error	The Query Error bit is set when there is an error reading the Output Queue. This can be caused by trying to read the Output Queue when there is no data present.
	Device Error	The Device Dependent Error indicates a failure of the self-test, calibration, memory or other device dependent error.
	Execution Error	The Execution bit indicates an execution error has occurred.
	Command Error	The Command Error bit is set when a syntax error has occurred.
	Power On	Power has been reset.

The Status Byte Register

Description	The Status Byte register consolidates the status events of all the status registers. The Status Byte register can be read with the *STB? query or a serial poll and can be cleared with the *CLS command. Clearing the events in any of the status registers will clear the corresponding bit in the Status Byte register.		
Notes	The Status byte enable register is cleared when the *SRE 0 command is used. The Status Byte Condition register is cleared when the *CLS command is used.		
Bit Summary	Register	Bit	Bit Weight
	Error Queue	2	4
	Questionable Data	3	8
	Message Available	4	16
	Standard Event	5	32
	Master Summary / Request Service	6	64
Status Bits	Error Queue	There are error message(s) waiting in the error queue.	
	Questionable data	The Questionable bit is set when an "enabled" questionable event has occurred.	
	Message Available	The Message Available bit is set when there is outstanding data in the Output Queue. Reading all messages in the output queue will clear the message available bit.	

Standard Event	The Event Status bit is set if an "enabled" event in the Standard Event Status Event Register has occurred.
Master Summary/ Service Request bit	The Master Summary Status is used with the *STB? query. When the *STB? query is read the MSS bit is not cleared. The Request Service bit is cleared when it is polled during a serial poll.

Output Queue

Description	The Output queue stores output messages in a FIFO buffer until read. If the Output Queue has data, the MAV bit in the Status Byte Register is set.

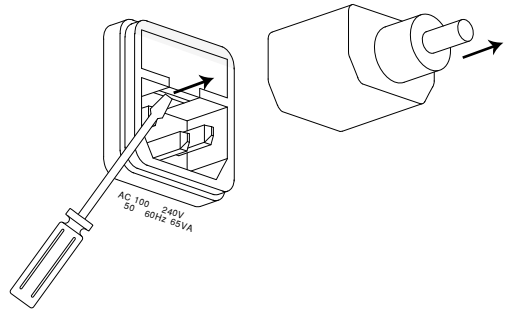
Error Queue

Description	The error queue is queried using the SYSTem:ERRor? command. The Error queue will set the "Error Queue" bit in the status byte register if there are any error messages in the error queue. If the error queue is full the last message will generate a "Queue overflow" error and additional errors will not be stored. If the error queue is empty, "No error" will be returned. Error messages are stored in the error queue in a first-in-first-out order. The errors messages are character strings that can contain up to 255 characters.

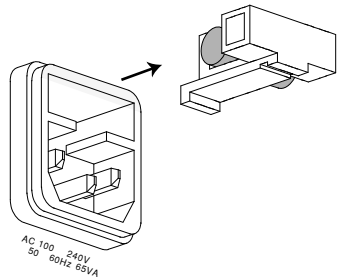
附錄

保險絲更換

步驟 1. 拔去電源線並使用螺絲刀取出保險絲座



2. 更換保險絲



額定值 T0.63A, 250V

AFG-3000 系列規格

此規格適用條件：+20℃~+30℃，開機 30 分鐘以上。

波形		AFG-3051 AFG-3081
		正弦波, 方波, 斜波, 脈衝波, 雜訊波, DC, Sin(x)/x, 指數上升, 指數下降, 負斜波
任意波形		
	ARB 功能	內置
	取樣速率	200 MSa/s
	重建率	100MHz
	波形長度	1M 點
	幅度解析度	16 位
	非易失性記憶體	10 組 1M 波形(1)
	使用者定義輸出部分	從 2~1M 點任選
	使用者定義標記輸出	從 2~1M 點任選
	輸出模式	1~1048575 次迴圈或無限模式

頻率特性			
範圍	正弦波	50MHz	80MHz
	方波	50MHz	80MHz
	三角波, 斜波	1MHz	
解析度		1μHz	
精確度	穩定度	±1 ppm 0~50˚C ±0.3 ppm 18~28˚C	
	老化率	±1 ppm, 每年	
	容差	≤1 μHz	
輸出特性(2)			
幅值	範圍	10 mVpp~10 Vpp(接 50Ω) 20 mVpp~20 Vpp(開路)	
	精確度	± 1%設置值 ±1 mVpp (1 kHz,>10 mVpp)	
	解析度	0.1 mV 或 4 位	
	平坦度	± 1% (0.1dB) <10 MHz ± 2% (0.2 dB) 10 MHz~50 MHz ± 10% (0.9 dB) 50 MHz~70 MHz ± 20% (1.9 dB) 70 MHz~80 MHz (正弦波 1 kHz)	

	單位	Vpp, Vrms, dBm,
偏移	範圍	±5 Vpk ac +dc (接 50Ω) ±10Vpk ac +dc (開路)
	精確度	1%設置值 + 2 mV + 0.5%幅值
波形輸出	阻抗	50Ω 典型值(固定) > 10MΩ (輸出關閉)
	保護	短路保護 超載繼電器自動禁用主輸出
同步輸出	範圍	TTL-compatible into>1kΩ
	阻抗	50Ω 正常值
正弦波特性		
	諧波失真(5)	–60 dBc DC～1 MHz, Ampl＜3 Vpp –55 dBc DC～1 MHz, Ampl＞3 Vpp –45 dBc 1MHz～5 MHz, Ampl＞3 Vpp –30 dBc 5MHz～80 MHz, Ampl＞3 Vpp
	總諧波失真	< 0.2%+0.1mVrms DC~20 kHz
	偽波(非諧波)(5)	–60 dBc DC～1 MHz –50 dBc 1MHz～20MHz –50 dBc+ 6 dBc/octave 1MHz～80MHz
	相位雜訊	＜-65dBc 典型值 10MHz, 30 kHz band ＜-47dBc 典型值 80MHz, 30 kHz band
方波特性		
	上升/下降時間	<8 ns(3)
	過激訊號	<5%
	不對稱性	1%週期 +1 ns
	可變占空比	20.0% to 80.0% ≤ 25 MHz 40.0% to 60.0% 25～50MHz 50.0%(固定) 50～80MHz
	抖動	0.01%+525ps ＜ 2 MHz 0.1%+75ps ＞ 2 MHz
斜波特性		
	線性度	＜ 0.1%峰值輸出
	可變對稱性	0%~100%
脈衝波特性		
	週期	20ns～ 2000s

	脈衝寬度	8ns～ 1999.9s 最小脈衝寬度: FREQ≦50MHz：8nS FREQ≦6.5MHz：5%週期值 解析度: FREQ≦50MHz：1nS FREQ≦6.5MHz：1%週期值
	過激訊號	<5%
	抖動	100 ppm +50 ps
AM 調製		
	載波波形	正弦波, 方波, 三角波, 斜波, 脈衝波, 任意波
	調製波形	正弦波, 方波, 三角波, 正/負斜波
	調製頻率	2 mHz~20 kHz
	深度	0%~120.0%
	源	內部/外部
FM 調製		
	載波波形	正弦波, 方波, 三角波, 斜波
	調製波形	正弦波, 方波, 三角波, 正/負斜波
	調製頻率	2 mHz~20 kHz
	峰值偏移	DC~50 MHz DC~80 MHz
	源	內部/外部
PWM		
	載波波形	方波
	調製波形	正弦波, 方波, 三角波, 正/負斜波
	調製頻率	2 mHz~20 kHz
	偏移	0% ～ 100.0%脈衝寬度
	源	內部/外部
FSK		
	載波波形	正弦波, 方波, 三角波, 斜波, 脈衝波
	調製波形	占空比為 50%的方波
	內部頻率	2 mHz~100 kHz
	頻率範圍	DC~50 MHz DC~80 MHz
	源	內部/外部
掃描		
	波形	正弦波, 方波, 三角波, 斜波
	類型	線性或對數
	方向	向上或向下
	起始/停止頻率	100 μHz~50 MHz 100 μHz~80 MHz
	掃描時間	1 ms~500 s
	觸發	單次, 外部, 內部

	標記	標記訊號的下降沿 (可程式設計)
	源	內部/外部
脈衝串		
	波形	正弦波, 方波, 三角波, 斜波
	頻率	1 μHz~50 MHz(4)　1 μHz~80 MHz(4)
	脈衝串計數	1~1000000 次迴圈或無限
	起始/停止相位	-360.0°~+360.0°
	內部週期	1 ms~500 s
	門電路源	外部觸發
	觸發源	單次, 外部或內部
觸發延遲	N 次迴圈, 無限	0s~85 s
外部調製輸入		
	類型	AM, FM, 掃描, PWM
	電壓範圍	± 5V 滿刻度
	輸入阻抗	10kΩ
	頻率	DC~20kHz
外部觸發輸入		
	類型	FSK, 脈衝串, 掃描
	輸入準位	TTL 相容
	斜率	上升或下降(可相容)
	脈衝寬度	>100ns
	輸入阻抗	10kΩ, DC 耦合
等待時間	掃描	<10us (典型值)
	脈衝串	<100ns (典型值)
抖動	掃描	2.5 us
	脈衝串	1ns; 脈衝除外, 300 ps
調製輸出		
	類型	AM, FM, 掃描, PWM
幅值	範圍	≥1Vpp
	阻抗	> 10kΩ 典型值(固定)
觸發輸出		
	類型	脈衝串, 掃描
	準位	TTL Compatible into 50Ω
	脈衝寬度	>450 ns
	最大頻率值	1 MHz
	扇出	≥4 TTL load
	阻抗	50Ω 典型值
標記輸出		
	類型	ARB, 掃描

	準位	TTL Compatible into 50Ω
	扇出	≥4 TTL load
	阻抗	50Ω 典型值
存儲/調取		10 組設置存儲
介面		GPIB, RS232, USB
顯示		4.3" TFT LCD 480 × 3 (RGB) × 272

系統特性				
	配置時間 (典型值)	函數改變: 標準---->102ms 脈衝-------->660ms 內置任意波形->240ms 頻率改變: 24ms 幅值改變: 50ms 偏移改變: 50ms 選擇用戶定義的任意波形: < 2s，對於 1M 點 調製改變: < 200ms		
	任意波形下載時間(典型值)	二進位碼		ASCII 碼
		GPIB/RS232 (115 Kbps)	USB Device	USB Host
	1M points	189 sec	34 sec	70 sec
	512K points	95 sec	18sec	35 sec
	256K points	49 sec	9 sec	18 sec
	64K points	16 sec	3 sec	6 sec
	16K points	7 sec	830 ms	1340 ms
	8K points	6 sec	490 ms	780 ms
	4K points	6 sec	365 ms	520 ms
	2K points	5 sec	300 ms	390 ms

通用規格		
	電源	AC100~240V, 50~60Hz
	功耗	65 VA

	操作環境	適合溫度: 18 ~ 28˚C 操作溫度: 0 ~ 40˚C 相對濕度: ≤ 80%, 0 ~ 40˚C ≤ 70%, 35 ~ 40˚C 安裝等級：CAT Ⅱ
	海拔	2000m
	污染程度	IEC 61010 2 級, 室內使用
	存儲溫度	-10~70˚C, 濕度: ≤70%
尺寸(WxHxD)	臺式	265 (W) x 107 (H) x 374 (D)
	重量	約 4kg
	安全性設計	EN61010-1
	EMC 測試	EN 55011, IEC-61326
	附件	測試線(GTL-110× 1), 使用手冊 × 1, 光碟 × 1, 快速入門指導 × 1, 電源線 × 1

(1). 可存儲 10 組波形(每組波形 1M 點)；
(2). 對於 0℃~28℃範圍內的操作環境，每改變 1℃，輸出幅值和偏移規格增加 1/10(1 年)；
(3). 高頻時的邊沿時間減小；
(4). 僅 25MHz 以上的正弦波和方波允許使用無限次脈衝串計數；
(5). -70dBm 層限制低幅值的諧波失真和偽雜訊；

EC 符合性聲明書

我們

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聲明如下涉及的產品

AFG-3081, AFG-3051

符合理事會設立的關於成員國電磁相容性(2004/108/EEC)和低電壓指令(2006/95/EEC)的法律法規要求。對於評估有關電磁相容性和低電壓指令，適用下列標準：

◎ **EMC**

EN 61326-1 : **EN 61326-2-1:**	用於測量、控制和實驗室使用的電子設備 — EMC 要求(2006)
傳導&輻射排放 EN 55011: 2007+A2: 2007	靜電釋放 EN 61000-4-2: 2009
電流諧波 EN 61000-3-2: 2006+A1: 2009+A2: 2009	抗輻射度 EN 61000-4-3: 2006+A1: 2008
電壓波動 EN 61000-3-3: 2008	電學快速瞬變模式 IEC 61000-4-4: 2004+Corr.1 : 2006+Corr.2 : 2007
----------	浪湧抗擾度 EN 61000-4-5: 2006
----------	傳導敏感度 EN 61000-4-6: 2009
----------	工頻磁場分佈 EN 61000-4-8: 1993+A1: 2001
----------	電壓下降/中斷 EN 61000-4-11: 2004

◎ **安全**

低壓設備規章 2006/95/EC
安全要求 **IEC/EN 61010-1: 2001**

索引