多通道函數信號發生器

MFG-2000 系列

使用手冊

固緯料號 NO.82MF32K000EG1

ISO-9001 認證企業

GW INSTEK

2015.07

本手冊所含資料在印製之前已經過校正，但因固緯電子實業股份有限公司不斷改善產品，所以保留未來修改產品規格、特性以及保養維修程式的權利，不必事前通知。

固緯電子實業股份有限公司
236 新北市土城區中興路 7-1 號

目錄

安全說明

本章節包含操作和存儲信號發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 MFG-2000 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 61010-1:2010(第三版）規定了如下測量等級，MFG-2000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 或 100 ~ 120V AC, 220 ~ 240V AC,50 ~ 60Hz（功率輸出型號） 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: T0.5A/250V 或 T1A/250V（功率輸出型號）. 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 61010-1:2010（第三版）規定了如下污染程度。MFG-2000 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

英制电源线

在英國使用信號發生器時，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: 0.75mm² 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

本章節介紹了信號發生器的主要特點、外觀、設置過程和開機。

主要特点

型號

MFG-2000seriesspecific functions						
	CH1 Function With 200MSa/sARB	CH2 Function With 200MSa/sARB	25MHz Pulse Generator	RF Generator (function with ARB)	Power Amplifier	Modulation /Sweep/Burst/ Frequency.Counter
MFG-2110	●10MHZ		●			
MFG-2120	●20MHZ		●			
MFG-2120MA	●20MHZ		●		●	●
MFG-2130M	●30MHZ		●			●
MFG-2160MF	●60MHZ		●	●160MHZ		●
MFG-2160MR	●60MHZ		●	●320MHZ		●
MFG-2230M	●30MHZ	●30MHZ	●			●
MFG-2260M	●60MHZ	●60MHZ	●			●
MFG-2260MFA	●60MHZ	●60MHZ	●	●160MHZ	●	●
MFG-2260MRA	●60MHZ	●60MHZ	●	●320MHZ	●	●

性能

DDS 信号发生器系列

全頻段 1μHz 高頻解析度

20ppm 频率稳定度

任意波形能力

200 MSa/s 采样率

100 MSa/s 重复率

16k 点波形长度

10 組 16k 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

無需 PC 就可編輯波形

-60dBc 低失真正弦波

特點

正弦波, 方波, 斜波, 脈衝波, 雜訊波

內部和外部 LIN/LOG 掃描，帶標記輸出

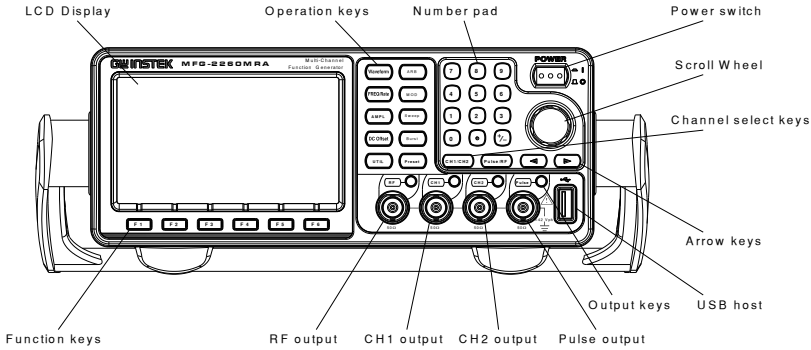
內部/外部 AM, FM, PM, FSK,SUM,PWM 調製

內部和外部觸發的脈衝串信號

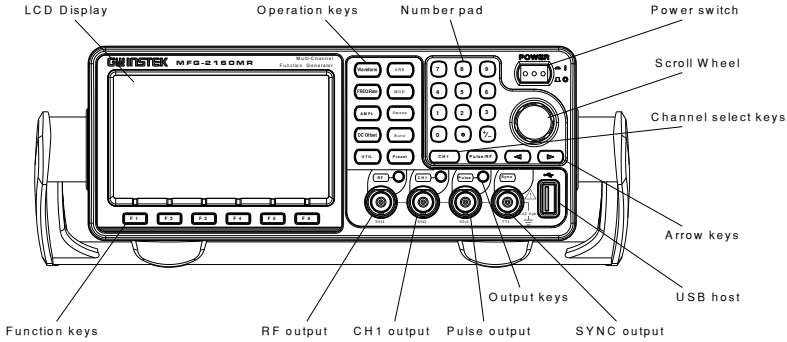
	最大允許隔離電壓是 42Vpk
	可調整脈衝上升/下降沿時間
	存儲/調取 10 組設置記憶體
	輸出超載保護
介面	USB 標準介面,LAN 標準介面(僅 MFG-22XX)
	4.3’’彩色 TFT LCD (480× 272)使用者介面
	AWES (任意波形編輯軟體) PC 軟體

面板介绍

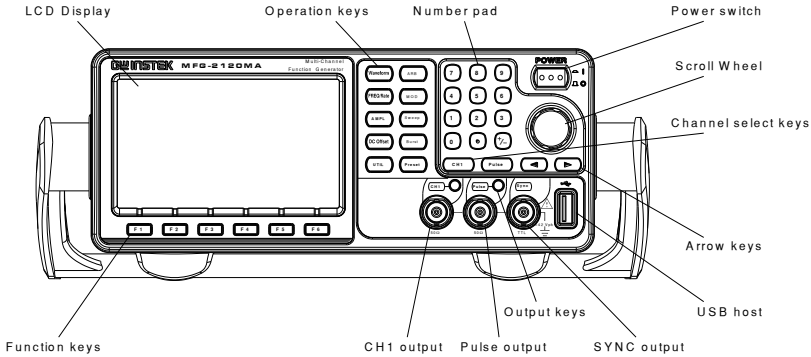
MFG-2260MRA/MFG-2260MFA 前面板



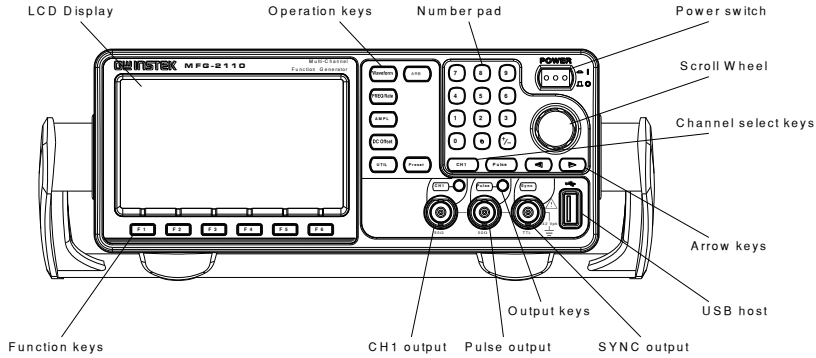
MFG-2160MR/MFG-2160MF 前面板



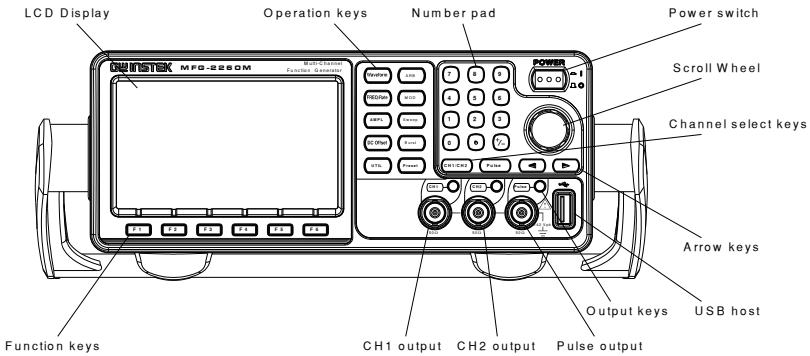
MFG- 2120MA/MFG-2130M 前面板



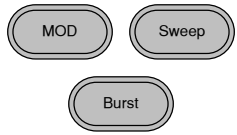
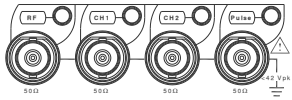
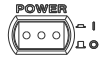
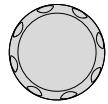
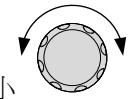
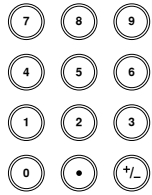
MFG-2110/MFG-2120 前面板



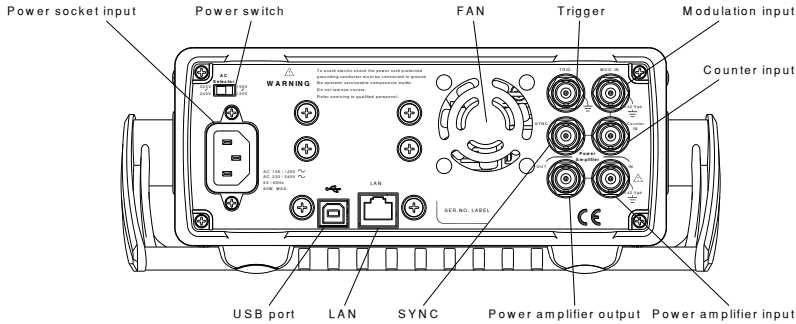
MFG-2260M/MFG-2230M 前面板



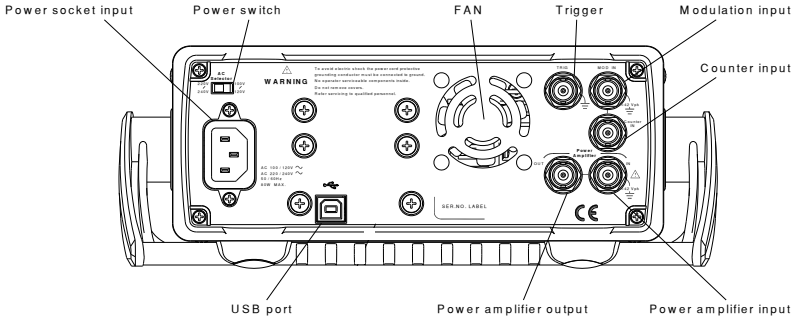
LCD 顯示	TFT 彩色 LCD 顯示, 480 x 272 解析度	
功能鍵: F1~F6	F 1	位於 LCD 屏下側，用於功能啟動
操作鍵	Waveform	用於選擇波形類型
	FREQ/Rate	用於設置頻率或取樣速率
	AMPL	用於設置波形幅值
	DC Offset	設置直流偏置
	UTIL	用於進入存儲和調取選項、更新和查閱固件版本、進入校正選項、系統設置、雙通道功能、計頻計。
	ARB	用於設置任意波形參數

		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
通道切換		用於切換通道
輸出埠		RF 為 RF 通道輸出埠 CH1 為通道一輸出埠 CH2 為通道二輸出埠 Pulse 為 Pulse 通道輸出埠
開機按鈕		用於開關機
USB Host		USB Host 介面
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

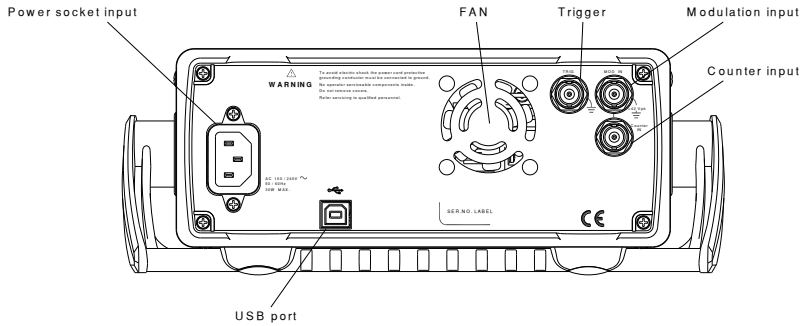
MFG-2260MRA/MFG-2260MFA 后面板



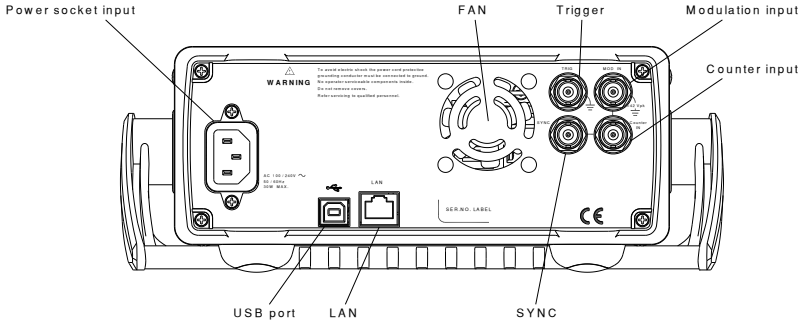
MFG- 2120MA 後面板



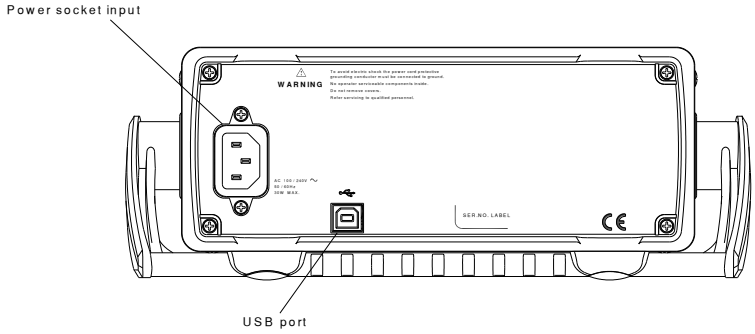
MFG-2160MR/MFG-2160MF/MFG-2130M 後面板

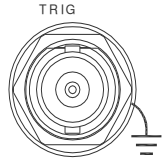
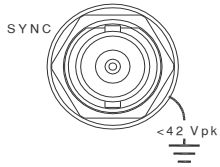
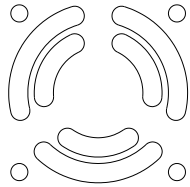


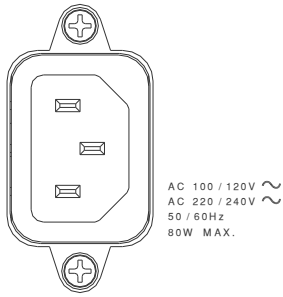
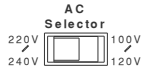
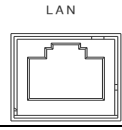
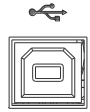
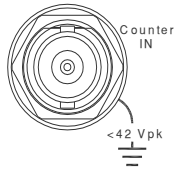
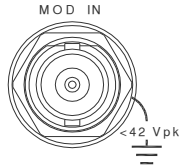
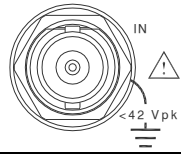
MFG-2260M/MFG-2230M 後面板

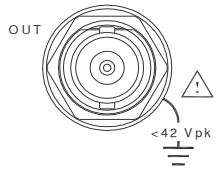


MFG-2110/MFG-2120 後面板



觸發		詳見 P23 表格
Sync 輸出		詳見 P23 表格
風扇		風扇

電源插座		電源輸入: 100~240V AC 50~60Hz. 或 100~120V AC 220~240V AC 50~60Hz.
電源選擇		AC 電壓選擇：100V~120V 或 220V~240V.此功能僅使用在有 Power Amplifier 的機器裡：MFG-2120MA, MFG-2260MFA, MFG-2260MRA
LAN 介面		LAN 介面用於遠端控制（僅 MFG-22XX)
USB 介面		Mini-B 類 USB 介面用於連接 PC 機和遠端控制
Counter in		計頻計輸入端子
MOD 輸入		詳見 P23 表格
Power Amplifier in		功率放大輸入端

Power Amplifier out		功率放大輸出端

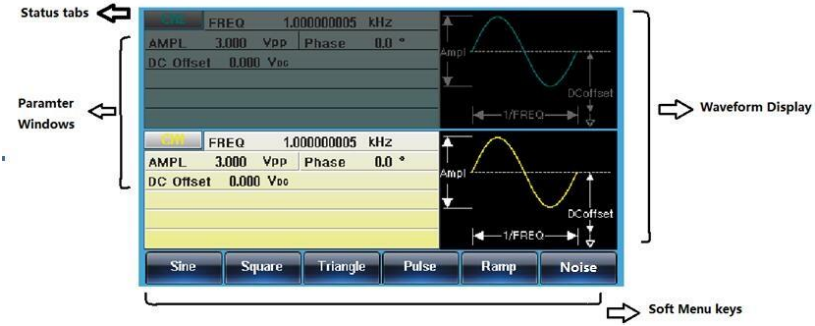
21XX:

端子	功能	所屬模式
Trigger	Trigger in(EXT)	CH1:FSK,SWEEP,BURST RF:ASK,FSK,PSK,BURST
	Trigger out	CH1:BURST
	Marker	CH1:SWEEP,ARB
MOD IN	EXT	CH1:AM,FM,PM,SUM,PWM
SYNC	Sync signal output	CH1

22XX:

端子	功能	所屬模式
Trigger	Trigger in(EXT)	CH1/CH2:FSK,SWEEP,BURST RF:ASK,FSK,PSK,SWEEP,BURST
MOD IN	EXT	CH1/CH2:AM,FM,PM,SUM,BURST
SYNC	Trigger out	CH1/CH2:SWEEP.BURST
	Marker	CH1/CH2:SWEEP.ARB
	Sync signal output	CH1,CH2

显示



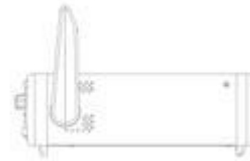
參數窗口	參數顯示和編輯視窗
狀態功能表	顯示當前通道的設置狀態
波形顯示	用於顯示波形
軟菜單鍵	功能鍵(F1~F6)與左側的軟菜單鍵對應

设置信号发生器

背景 本章節介紹了如何調整信號發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



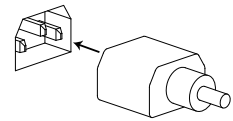
水準放置 MFG

或傾斜放置

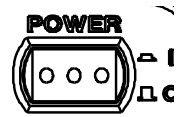
手把垂直放置以方便手提

開機

1. 將電源線接入後面板插座



2. 打開位於前面板的電源開關



3. 當按下電源開關後，螢幕顯示載入狀態

此時，信號發生器已經可以使用。

快速操作

本章節介紹了 MFG-2000 的快捷方式、內置説明和默認出廠設置，方便用戶快速入門。有關參數、設置和限制的詳細內容，參見 MFG-2000 使用者手冊。

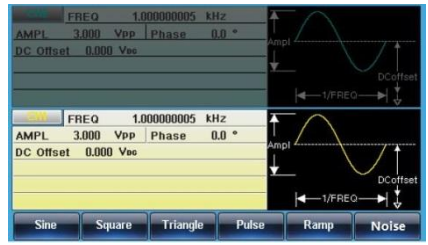
如何使用数字输入

背景

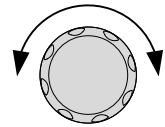
MFG-2000 有三類主要的數位輸入: 數位鍵盤, 方向鍵和可調旋鈕。下面將為您介紹如何使用數字輸入編輯參數。

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

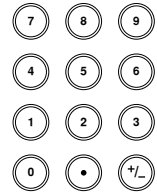
2. 使用方向鍵將游標移至需要編輯的數位



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



如何使用帮助菜单

背景

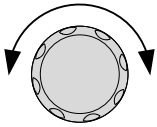
說明功能表詳細描述了每個鍵的含義和它的功能.(以 MFG-22xx 系列機器為例)

1. 按 UTIL

2. 按 System (F4)

3. 按 Help (F3)

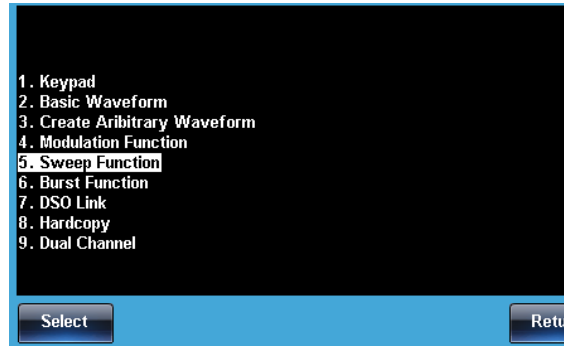
4. 可調旋鈕用於導航說明功能表。按 Select 選擇該項



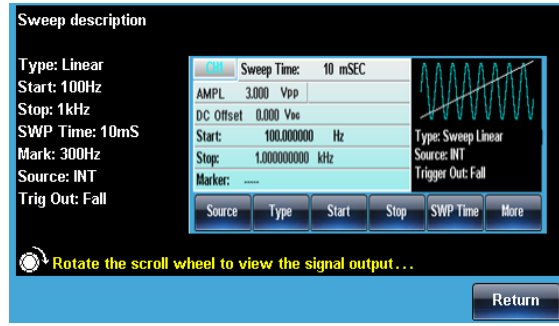
Keypad	用於解釋任一前面板鍵
Create Arbitrary Waveform	解釋如何創建任意波形
Modulation Function	解釋如何創建調製波形
Sweep Function	解釋掃描功能

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

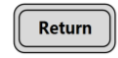
5. 例如，選擇專案 5 可以查看掃描功能



6. 可調旋鈕用於導航說明頁面



7. 按 Return 返回上級菜單



顯示區域的分配

輸出通道

MFG 系列機器分為 21xx 及 22xx 兩個系列共 10 個機型，主要是 CH1/CH2/Pulse/RF 4 個輸出通道的不同搭配， CH1/Pulse 為標配，CH2/ RF 為選配. CH1 的顯示位置固定，Pulse 的顯示位置會隨著 CH2 的存在與否而變化.

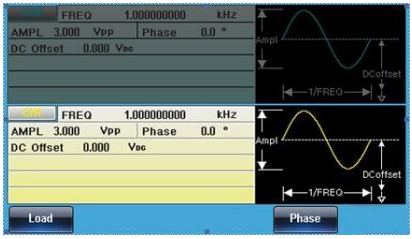
為有效區別各個通道，分別給他們賦予了不同的顏色.

CH1	黃色	
CH2	藍色	
Pulse	粉紅色	
RF	橙色	

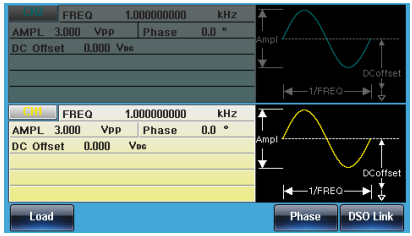
DSO Link

此功能只有 22xx 系列機型所有，切換通道操作後：

21xx



22xx

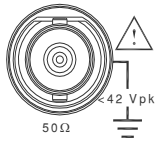


选择波形

方波

例子: 方波, 3Vpp, 75%占空比, 1 kHz

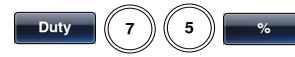
輸出



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)

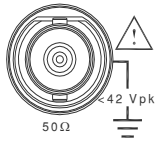
4. 分別按 AMPL, 3 + VPP (F6)

5. 按 Output 鍵

三角波

例子: 斜波, 5Vpp,10kHz，50%對稱度

輸出



輸入: N/A

1. 按 Waveform 鍵, 選擇 Ramp (F5)

2. 分別按(F1), 5 + 0 + %(F5)

3. 分別按 Freq/Rate 鍵, 1 + 0 + kHz (F5)

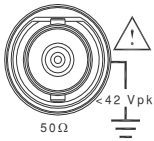
4. 分別按 AMPL 鍵, 5 +VPP (F6)

5. 按 Output 鍵

正弦波

例子: 正弦波, 10Vpp,100kHz

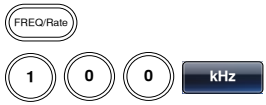
輸出



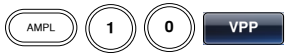
輸入: N/A

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)



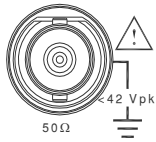
4. 按 Output 鍵

调制

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)

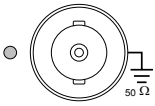
9. 按 MOD, AM (F1), Source (F1), INT (F1)

10. 按 Output 鍵 

ASK

例子: ASK 調製，50%調製占空比, 1kHz 載波, 正弦波, 10 Hz 頻率, 內部源

輸出



輸入: N/A

1. 按 MOD 鍵, 選擇 ASK(F2) 

2. 按 Waveform, 選擇 Sine (F1) 

3. 分別按 Freq/Rate 鍵, 1 + kHz (F5) 

4. 按 MOD 鍵, 選擇 ASK(F2),ASK Rate(F3) 

5. 按 1+ 0 + Hz (F2) 

6. 按 MOD 鍵, 選擇 ASK(F2),ASK Ampl(F2) 

7. 按 5+0+%(F3) 

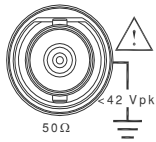
8. 按 MOD, ASK(F2), Source (F1), INT (F1) 

9. 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)

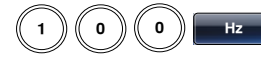
4. 按 MOD 鍵, 選擇 FM (F2), Shape (F4), Square (F2)

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)



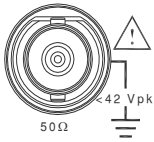
9. 按 MOD, FM (F2), Source (F1), INT (F1)

10. 按 Output 鍵

FSK

例子: FSK 調製, 100Hz 跳躍頻率, 1kHz 載波, 正弦波, 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 Sine (F1)

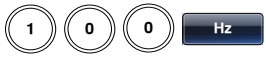
3. 分別按 Freq/Rate 鍵, 1 + kHz (F5)

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)



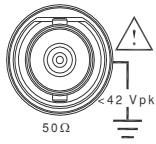
8. 按 MOD, FSK (F3), Source (F1), INT (F1)

9. 按 Output 鍵

PM

例子: PM 調製,800Hz 正弦載波, 1 5kHz 調製正弦波, 180˚相位頻偏, 內部源

輸出

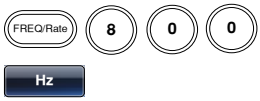


輸入: N/A

1. 按 Waveform, 選擇 Sine (F1)

2. 按 MOD 鍵, 選擇 PM (F4)

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



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

5. 按 MOD 鍵, PM (F4), PM Freq (F3)

6. 按 1 + 5 + kHz (F3)

7. 按 MOD, PM (F4), PM Dev (F2)

8. 按 5 + 0 + ° (F1)

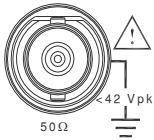
9. 按 MOD, PM (F4), Source (F1), INT (F1)

10. 按 Output 鍵 

PSK

例子: PSK 調製，50%相位偏移，1kHz 載波, 正弦波, 10 Hz 頻率, 內部源

輸出



1. 按 MOD 鍵, 選擇 PSK(F6) 

2. 按 Waveform, 選擇 Sine (F1) 

輸入: N/A

3. 分別按 Freq/Rate 鍵, 1 + kHz (F5) 

4. 按 MOD 鍵, 選擇 PSK(F6), PSK Rate(F3) 

5. 按 1 + 0 + Hz (F2) 

6. 按 MOD 鍵, 選擇 PSK(F6),PSK Phase(F2) 

7. 按 5+ 0 + %(F3) 

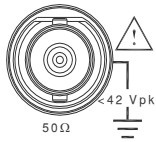
8. 按 MOD, PSK(F6), Source (F1), INT (F1) 

9. 按 Output 鍵 

PWM

例子: PWM 調製, 800Hz 載波, 15 kHz 調製正弦波, 50%占空比, 內部源（僅 1，2 通道有此功能）

輸出

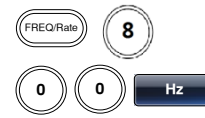


輸入: N/A

1. 按 Waveform, 選擇 Square (F2)

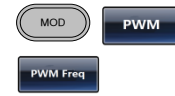
2. 按 MOD 鍵, 選擇 PWM(F6)

3. 分別按 Freq/Rate 鍵, 8+0+0+Hz(F4)



4. 按 MOD 鍵, 選擇 PWM(F6),Shape(F4),Sine(F1)

5. 按 MOD 鍵, 選擇 PWM(F6),PWM Freq(F3)

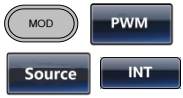


6. 按 1 + 5+ kHz(F3)

7. 按 MOD 鍵, 選擇 PWM(F6),Duty(F2)

8. 按 5 + 0 + % (F1)

9. 按 MOD, PWM(F6), Source(F1),INT(F1)

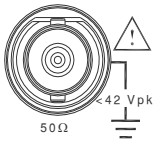


10. 按 Output 鍵

SUM

例子: SUM 調製. 100Hz 調製方波, 1kHz 正弦載波, 50%振幅深度, 內部源

輸出



1. 按 MOD 鍵, 選擇 SUM (F5)

2. 按 Waveform, 選擇 Sine (F1)

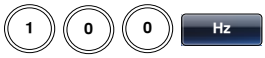
輸入: N/A

3. 分別按 Freq/Rate 鍵, 1 + kHz (F5)

4. 按 MOD 鍵, 選擇 SUM (F5), Shape (F4), Square (F2)

5. 按 MOD 鍵, 選擇 SUM (F5), SUM Freq (F3)

6. 按 1 + 0 + 0 + Hz (F2)



7. 按 MOD 鍵, 選擇 SUM (F5), SUMAmpl (F2)

8. 按 5 + 0 + ° (F1)

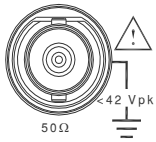
9. 按 MOD, SUM (F5), Source (F1), INT (F1)

10. 按 Output 鍵

扫描

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) 

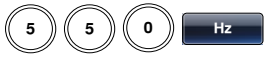
4. 按 1 + MHz (F5) 

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) 

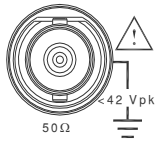
10. 按 Output 鍵 

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

脉冲串

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 Set (F5), INT (F1)

9. 按 Burst, N Cycle (F1), TRIG Set (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)

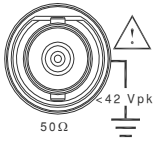
12. 按 Output 鍵

ARB

ARB–增加內置波形

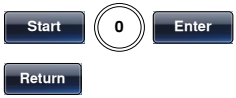
例子: ARB 模式, 上升指數函數. Start 0, Length 100, Scale 327

輸出



1. 按 ARB, Built in (F3), Wave (F4),Math(F2),選擇 Select (F5)

2. 按 Start (F1), 0 + Enter (F2), Return



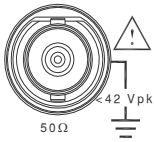
3. 按 Length (F2), 100, Enter (F2), Return

4. 按 Scale (F3), 327, Enter (F2), Return , Done (F5)

ARB–增加點

例子: ARB 模式, 增加點, 位址 40, 資料 300

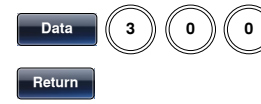
輸出



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

6. 按 4 + 0 + Enter (F5), Return

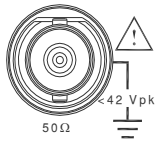
7. 按 Data (F2), 3+0+0, Enter (F5)



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

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

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

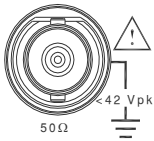
5. 按 Stop Data (F4), 1 + 0 + 0, Enter (F5), Return, Done (F5)

ARB–輸出部分

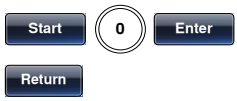
例子: ARB 模式, 輸出 ARB 波形, Start 0, Length 1000

輸出

1. 按 ARB, Output (F6)



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

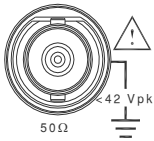


3. 按 Length (F2), 1 + 0 + 0, Enter (F5), Return

ARB–輸出 N 次迴圈

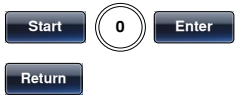
例子: ARB 模式, 輸出 N 次迴圈, Start 0, Length 1000, N 次, 10

輸出

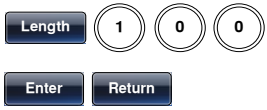


1. 按 ARB,Output(F6)

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)

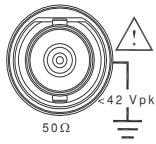
5. 按 Cycle(F1),1+0

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)

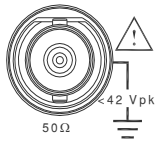
3. 按 Length (F2), 1+0+0+0, Enter (F5), Return (F6)

4. 按 infinite(F5), Return(F6)

ARB–輸出標記

例子: ARB 模式, 輸出標記, Start 30, Length 80

輸出



1. 按 ARB, Output (F6), Marker (F3)

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

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

工具栏

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. 使用可調旋鈕選擇檔，按 Done (F5)

菜单树

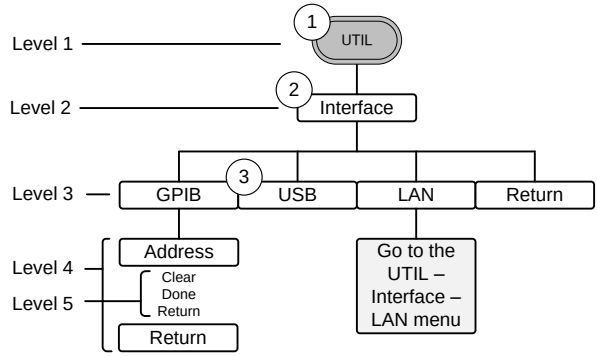
常規

使用者可以將功能表樹用作對信號發生器的功能和特性的簡易參考。MFG-2000 功能表系統逐層排列，每層都有操作或軟體導航。返回軟鍵用於返回上級菜單。例如：設置介面 USB

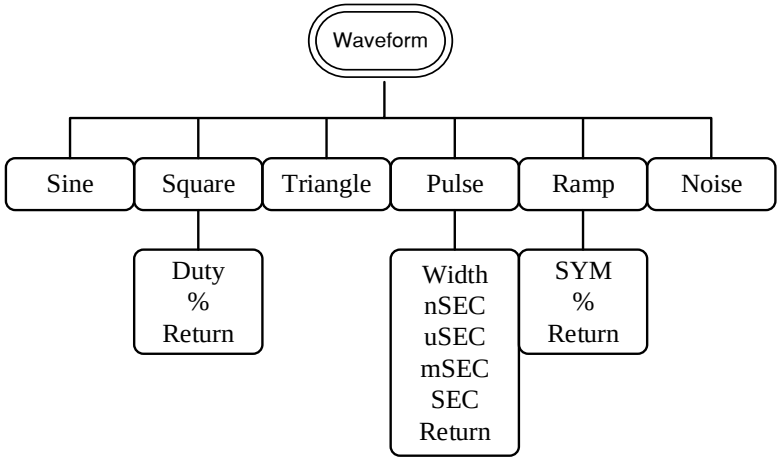
(1)按 UTIL 鍵.

(2)interface 軟鍵.

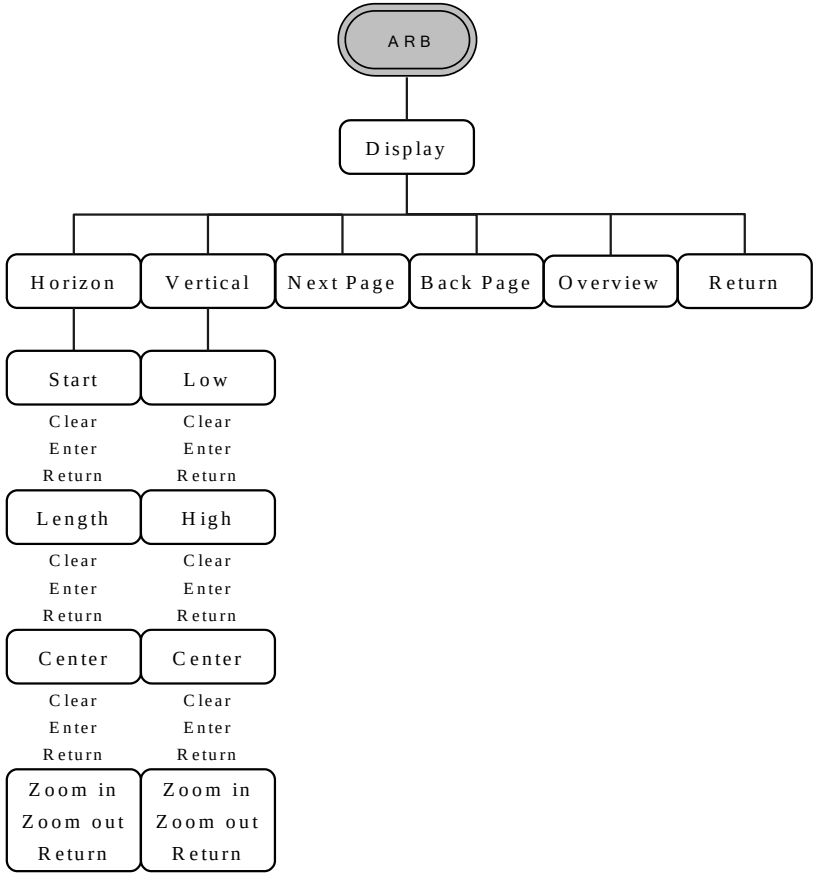
(3) USB.



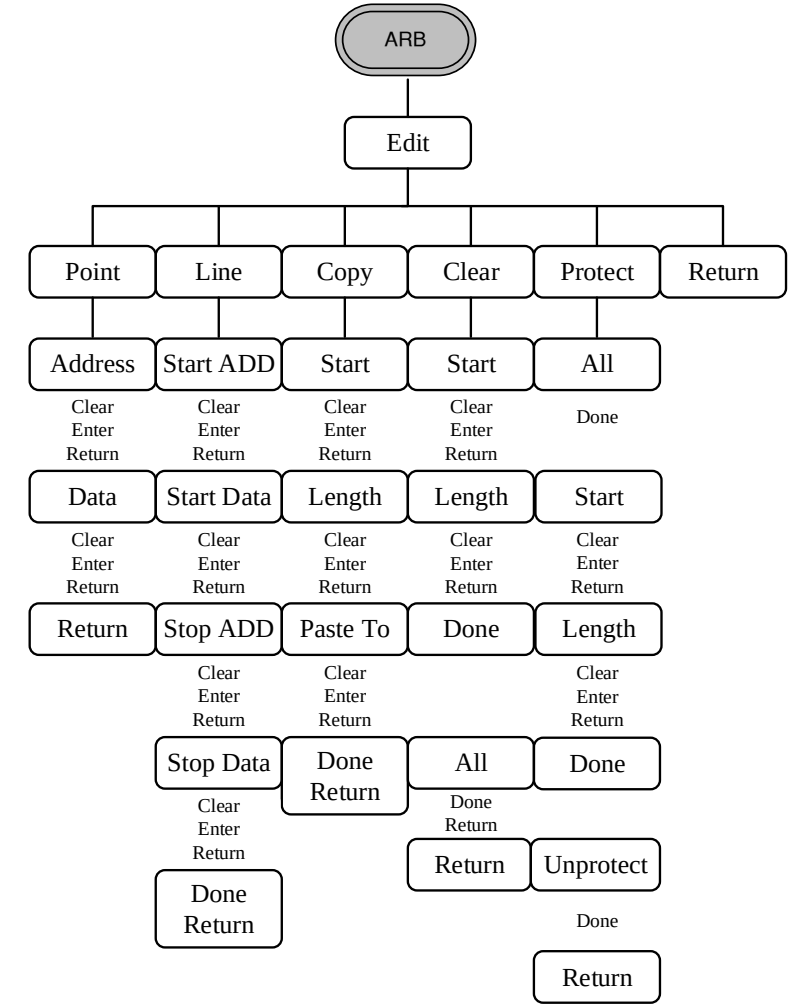
波形


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

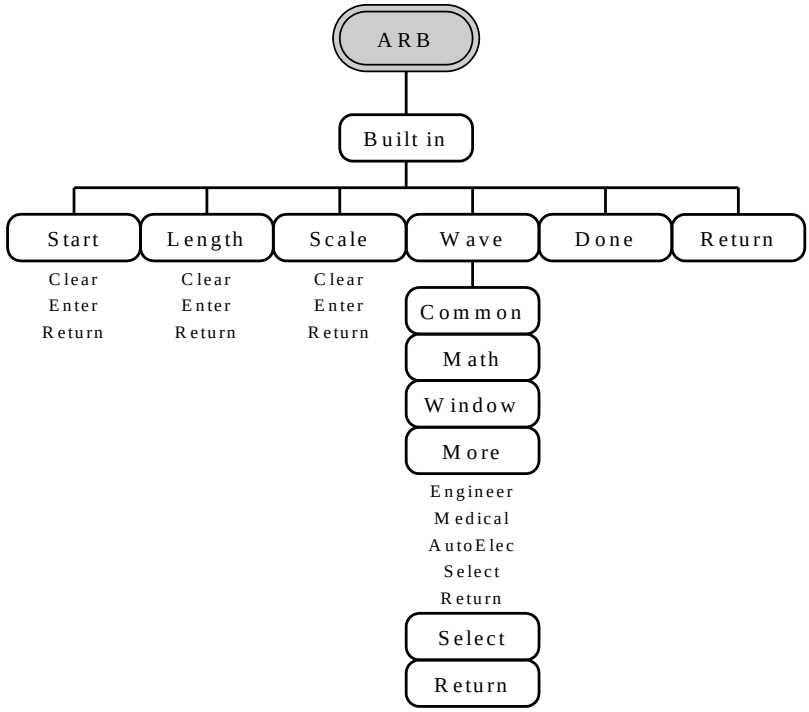
ARB–顯示


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

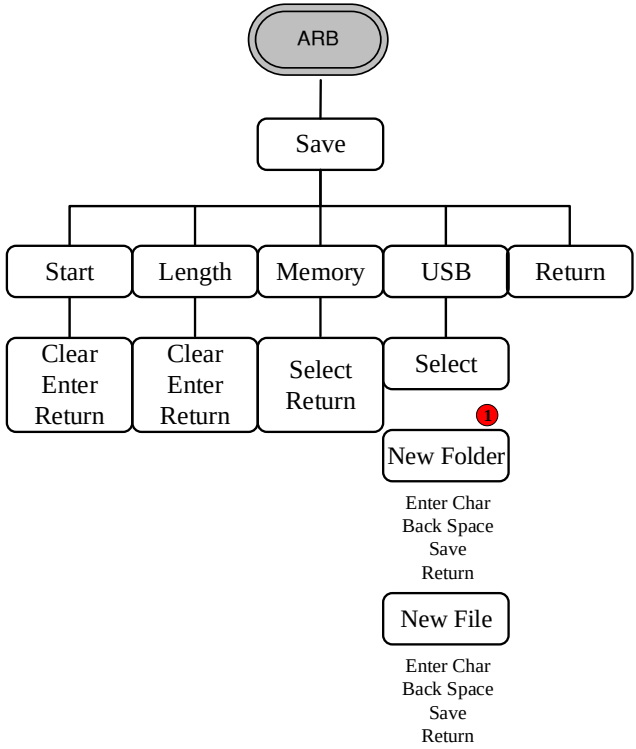
ARB–編輯


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

ARB–内置

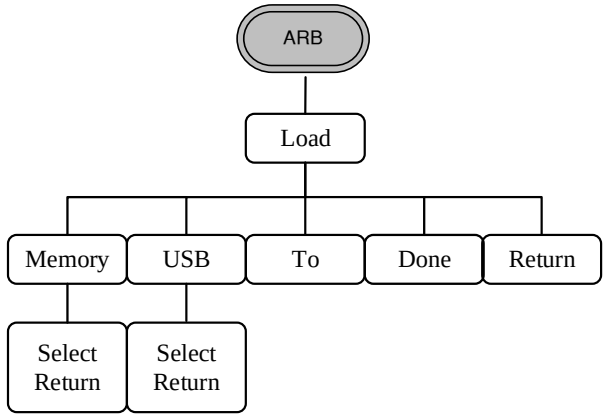

ARB
Built in
Start
Length
Scale
Wave
Done
Return
Clear
Enter
Return
Clear
Enter
Return
Clear
Enter
Return
Common
Math
Window
More
Engineer
Medical
AutoElec
Select
Return
Select
Return

ARB–存储

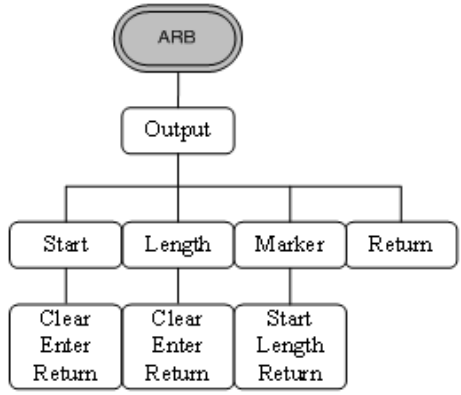


注：标记①部分 New Folder 只在 MFG-22XX 系列機器里才有.

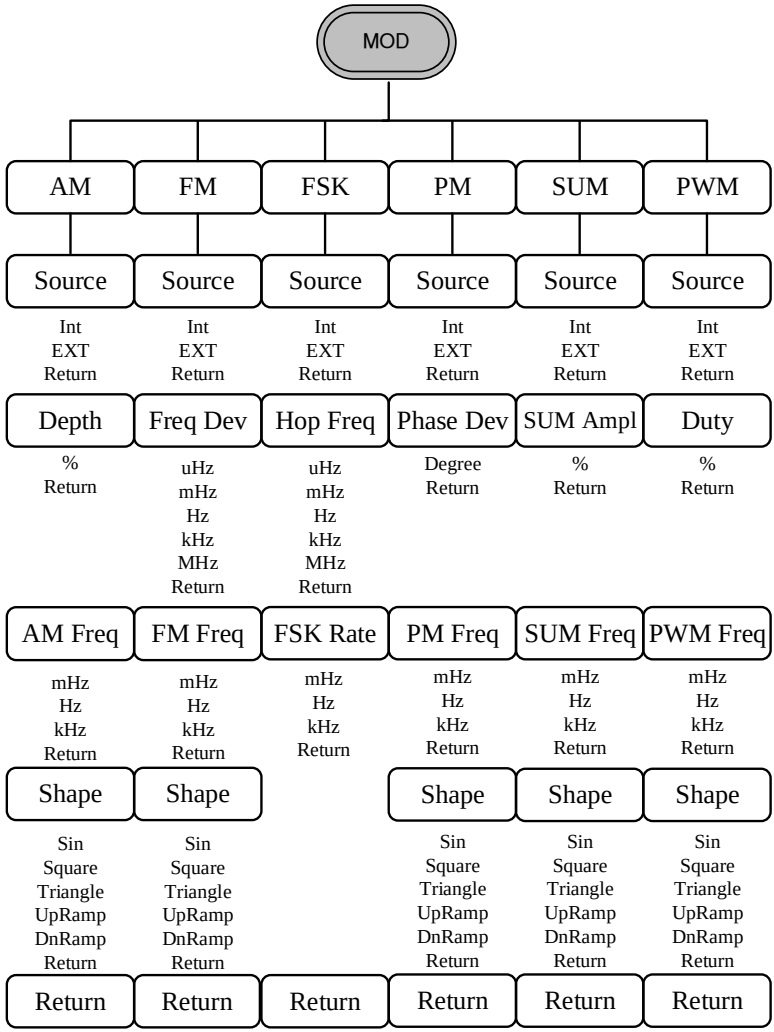
ARB–調取


ARB
Load
Memory
USB
To
Done
Return
Select
Return
Select
Return

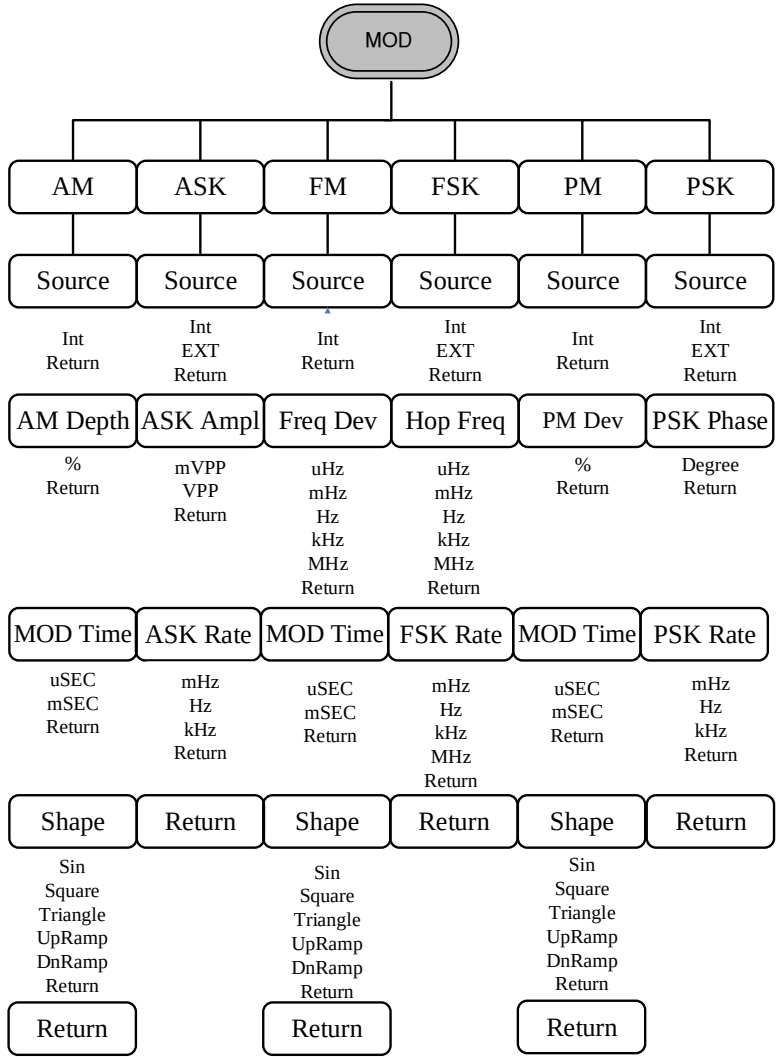
ARB–輸出


ARB
Output
Start
Length
Marker
Return
Clear
Enter
Return
Clear
Enter
Return
Start
Length
Return

调制_(CH1/CH2)

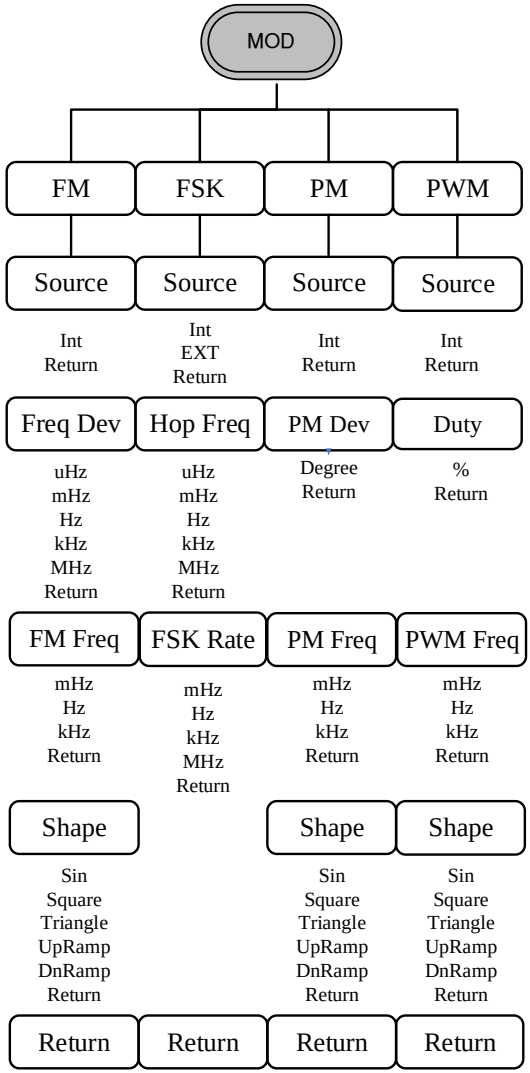

MOD
AM
FM
FSK
PM
SUM
PWM
Source
Source
Source
Source
Source
Source
Int
EXT
Return
Int
EXT
Return
Int
EXT
Return
Int
EXT
Return
Int
EXT
Return
Int
EXT
Return
Depth
Freq Dev
Hop Freq
Phase Dev
SUM Ampl
Duty
%
Return
uHz
mHz
Hz
kHz
MHz
Return
uHz
mHz
Hz
kHz
MHz
Return
Degree
Return
%
Return
%
Return
AM Freq
FM Freq
FSK Rate
PM Freq
SUM Freq
PWM Freq
mHz
Hz
kHz
Return
mHz
Hz
kHz
Return
mHz
Hz
kHz
Return
mHz
Hz
kHz
Return
mHz
Hz
kHz
Return
mHz
Hz
kHz
Return
Shape
Shape
Shape
Shape
Shape
Sin
Square
Triangle
UpRamp
DnRamp
Return
Sin
Square
Triangle
UpRamp
DnRamp
Return
Sin
Square
Triangle
UpRamp
DnRamp
Return
Sin
Square
Triangle
UpRamp
DnRamp
Return
Sin
Square
Triangle
UpRamp
DnRamp
Return
Return
Return
Return
Return
Return
Return

调制_(Sine-DDS)



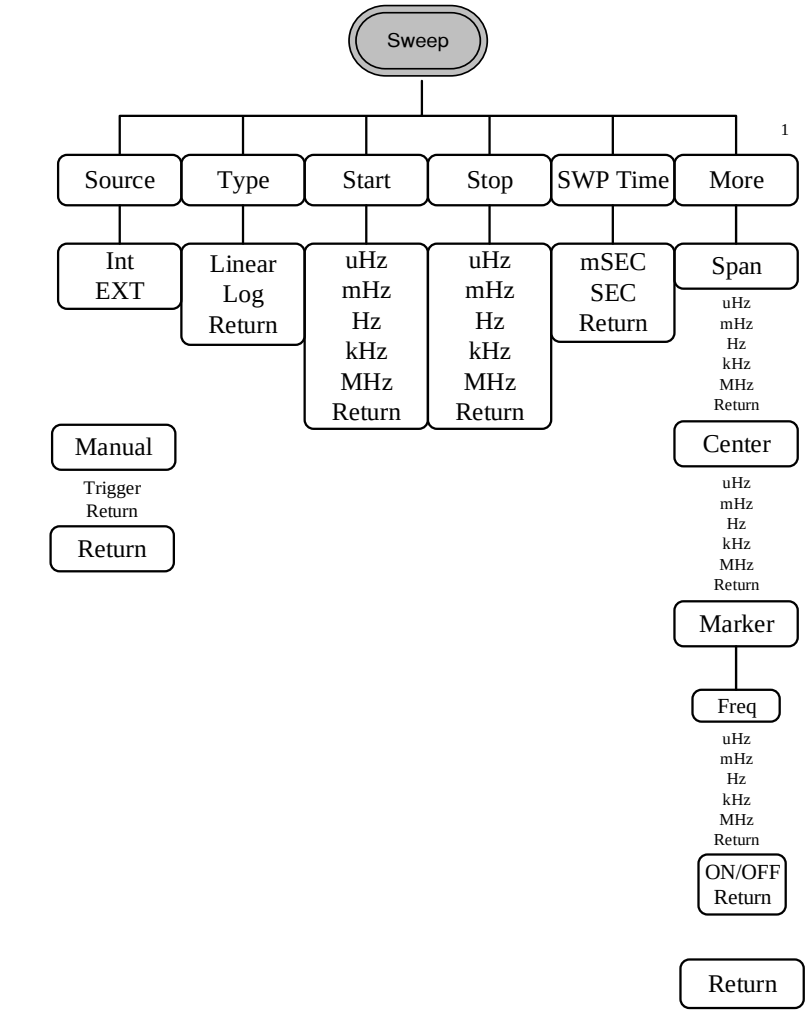
注：此功能為在 RF 波形時選擇 Sine-DDS 的調製功能.

调制_(Sine-ARB)

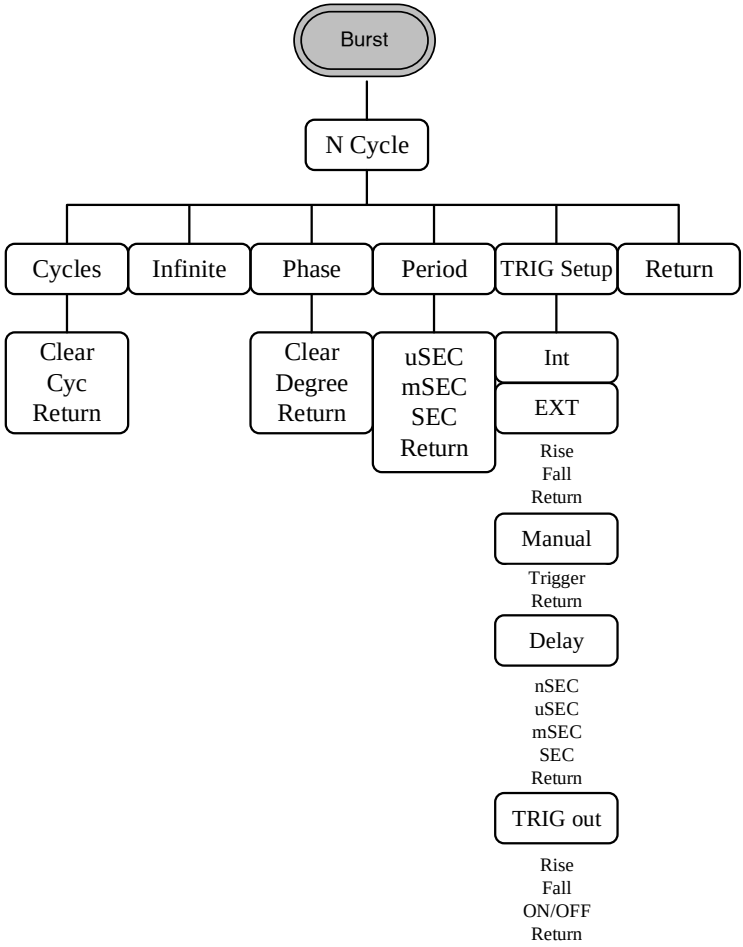


注：此功能為在 RF 波形時選擇 Sine-ARB 的調製功能.

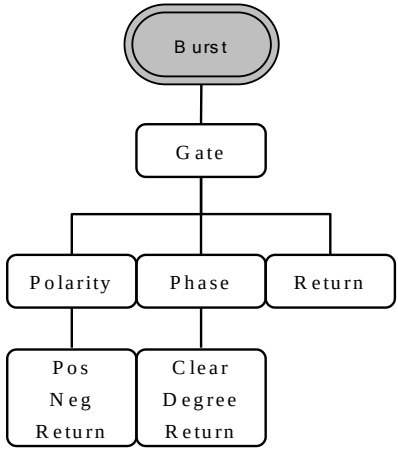
掃描


Sweep
1
Source
Type
Start
Stop
SWP Time
More
Int
EXT
Linear
Log
Return
uHz
mHz
Hz
kHz
MHz
Return
uHz
mHz
Hz
kHz
MHz
Return
mSEC
SEC
Return
Span
uHz
mHz
Hz
kHz
MHz
Return
Manual
Trigger
Return
Return
Center
uHz
mHz
Hz
kHz
MHz
Return
Marker
Freq
uHz
mHz
Hz
kHz
MHz
Return
ON/OFF
Return
Return

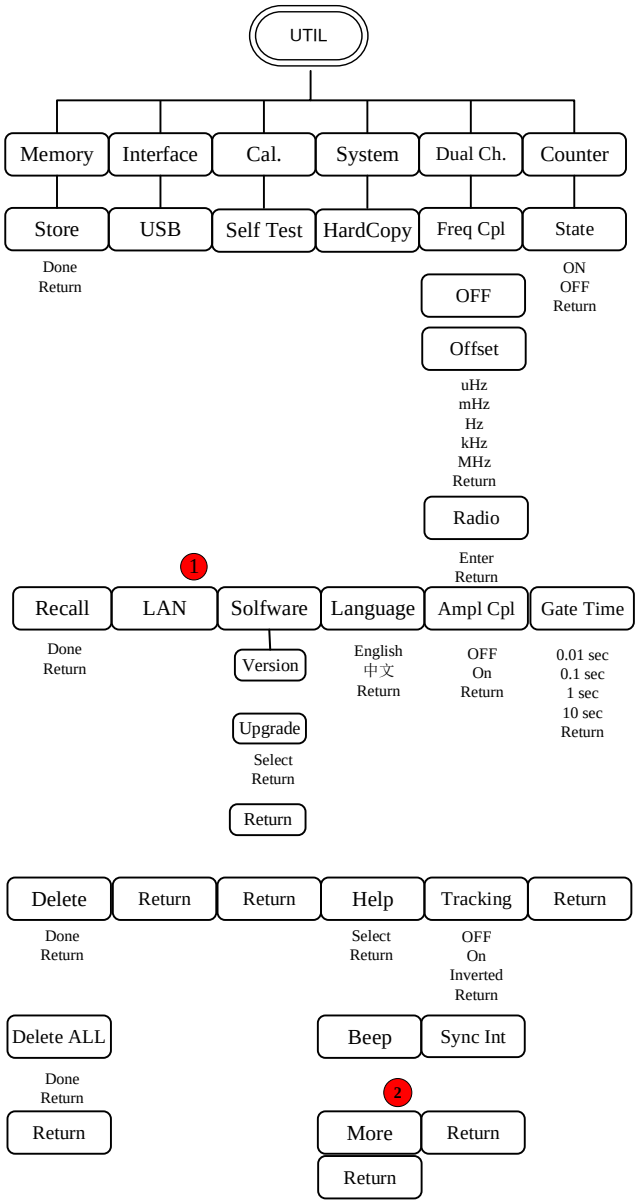
脈衝串–N 次迴圈

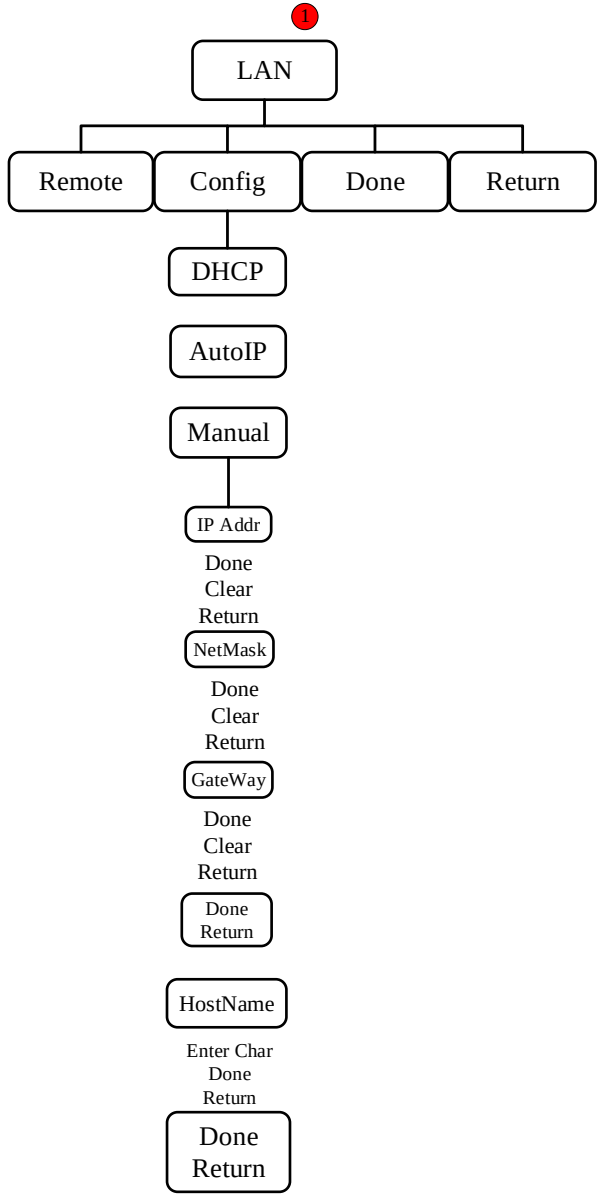

Burst
N Cycle
Cycles
Infinite
Phase
Period
TRIG Setup
Return
Clear
Cyc
Return
Clear
Degree
Return
uSEC
mSEC
SEC
Return
Int
EXT
Rise
Fall
Return
Manual
Trigger
Return
Delay
nSEC
uSEC
mSEC
SEC
Return
TRIG out
Rise
Fall
ON/OFF
Return

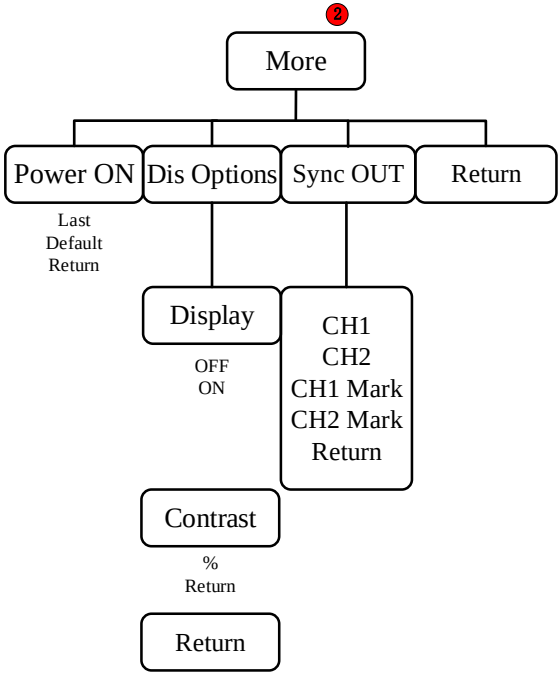
脈衝串–門控


Burst
Gate
Polarity
Phase
Return
Pos
Neg
Return
Clear
Degree
Return

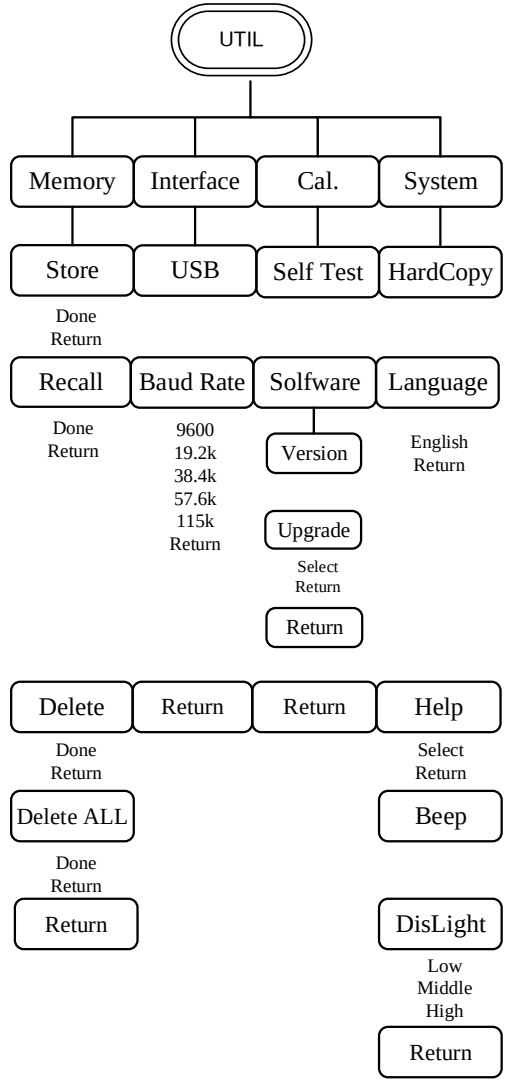
UTIL_(22XX)


UTIL
Memory
Interface
Cal.
System
Dual Ch.
Counter
Store
USB
Self Test
HardCopy
Freq Cpl
State
Done
Return
ON
OFF
Return
OFF
Offset
uHz
mHz
Hz
kHz
MHz
Return
Radio
Enter
Return
1
Recall
LAN
Solfware
Language
Ampl Cpl
Gate Time
Done
Return
Version
Upgrade
Select
Return
Return
English
中文
Return
OFF
On
Return
0.01 sec
0.1 sec
1 sec
10 sec
Return
Delete
Return
Return
Help
Tracking
Return
Done
Return
Select
Return
OFF
On
Inverted
Return
Delete ALL
Done
Return
Return
Beep
Sync Int
2
More
Return
Return

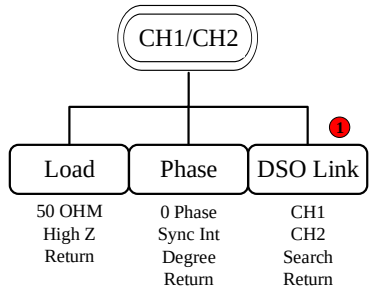

1
LAN
Remote
Config
Done
Return
DHCP
AutoIP
Manual
IP Addr
Done
Clear
Return
NetMask
Done
Clear
Return
GateWay
Done
Clear
Return
Done
Return
HostName
Enter Char
Done
Return
Done
Return


2
More
Power ON
Dis Options
Sync OUT
Return
Last
Default
Return
Display
OFF
ON
CH1
CH2
CH1 Mark
CH2 Mark
Return
Contrast
%
Return
Return

UTIL_(21XX)

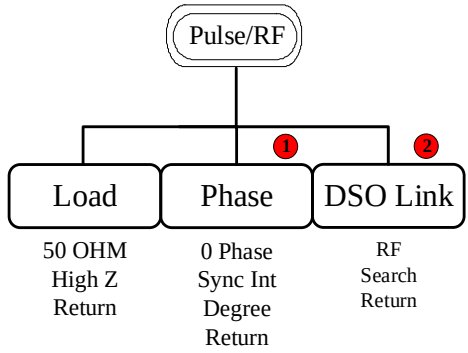

UTIL
Memory
Interface
Cal.
System
Store
USB
Self Test
HardCopy
Done
Return
Recall
Baud Rate
Solfware
Language
Done
Return
9600
19.2k
38.4k
57.6k
115k
Return
Version
Upgrade
Select
Return
Return
English
Return
Delete
Return
Return
Help
Done
Return
Delete ALL
Done
Return
Return
Select
Return
Beep
DisLight
Low
Middle
High
Return

CH1/CH2



注：標記①處只有 MFG-22XX 系列機器有 DSO-Link.

Pulse/RF



注：標記①處在 RF 通道無 Phase 功能. 標記②處在 Pulse 通道無 DSO-Link 功能, RF 通道只有 MFG-22XX 系列機器才有 DSO-Link.

默认设置

復位鍵用於恢復默認面板設置。

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/ASK/FM/FSK/PM/PSK/SUM)	載波	1kHz 正弦波
	調製波形	100Hz 正弦波
	AM 深度	100%
	ASK 幅度	50%
	ASK 頻率	10Hz
	FM 偏移	100Hz
	FSK 跳躍頻率	100Hz
	FSK 頻率	10Hz
	PM 相位偏移	180°
	PSK 相位	180°
	PSK 頻率	10Hz
	SUM 振幅	50%
	數據機狀態	Off

PWM 調製	載波	1kHz 方波
	調製波形	20kHz 正弦波
	PWM 占空比	50%
	數據機狀態	Off
掃描	起始/停止頻率	100Hz/1kHz
	掃描時間	1ms
	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)
校正	校正菜單	加密

操作

本章节介绍了如何输出基本波形。有关调制、扫描、脉冲串和任意波形的部分，详见调制和任意波章节，請看 114 頁和 209 頁。

CH1/CH2 通道

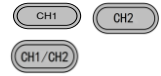
MFG-2000 系列多通道函數信號發生器在输出之前必须先对通道進行操作和選擇。

选择通道

Panel Operation

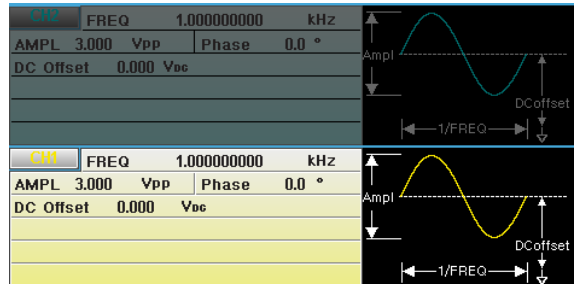
1. 按 CH1 或 CH2 或 CH1/CH2 鍵.

21xx
22xx



2. 被選擇的通道可以很清楚的看到，而未被選擇的會變淡。

如下方圖所示，CH1 已被選擇



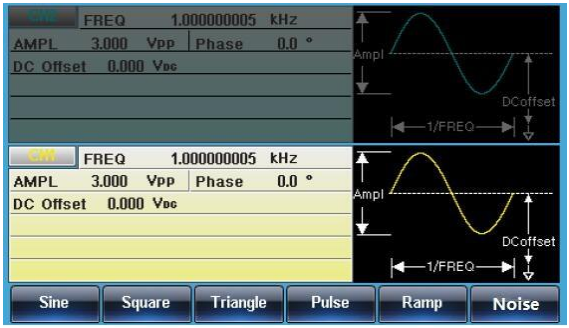
选择波形

MFG-2000 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。

设置正弦波

面板操作

1. 按 Waveform 鍵



2. 按 F1 (Sine)

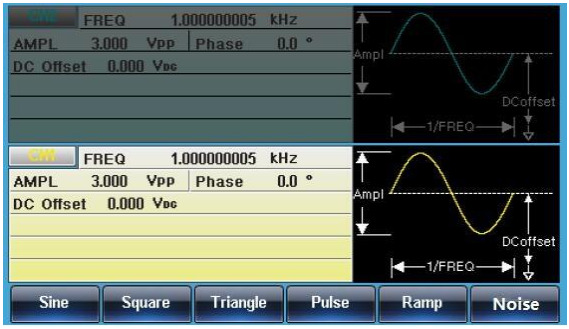
參數设置

3. 要設定 the Load/Frequency/Amplitude/DC Offset/ Phase 參數,請看 83 -88 頁.

设置方波

面板操作

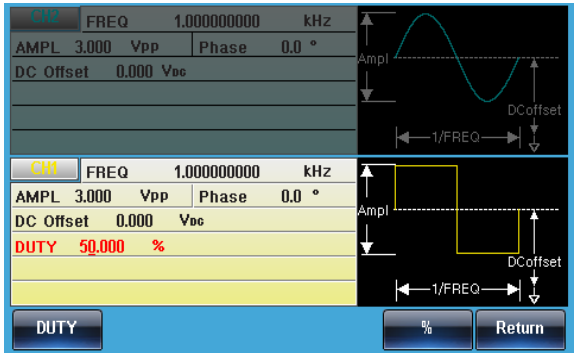
1. 按 Waveform 鍵



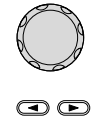
參数设置

2. 按 F2 (Square)創建一個方波

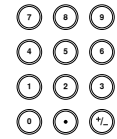
3. 按 F1 (Duty)將使位於參數窗口處的占空比參數變亮



4. 兩種方式可設置其大小：a,使用方向鍵或可調旋鈕。



b,使用數位鍵。



按 F2~F5 選擇單位範圍.

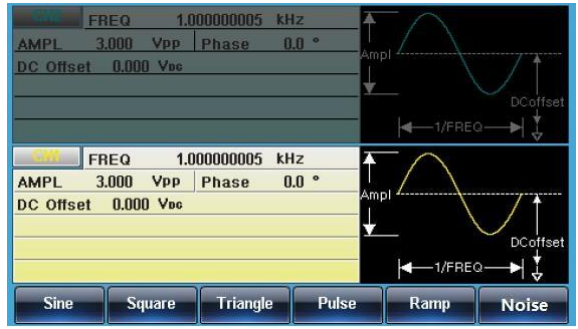
占空比範圍	0.01%~99.99%(受限於當前頻率的設定)

5. 要設定 theLoad/Frequency/Amplitude/DC Offset/ Phase 參數, 請看 83 -88 頁.

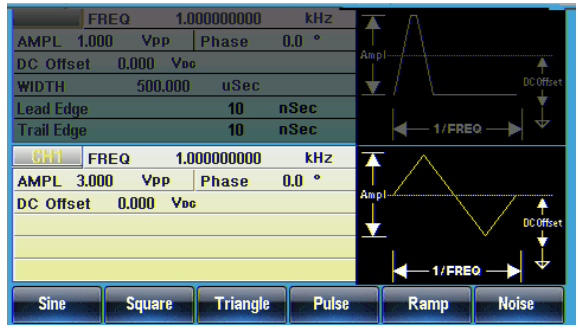
设置三角波

面板操作

1. 按 Waveform 鍵



2. 按 F3(Triangle)創建一個脈衝波



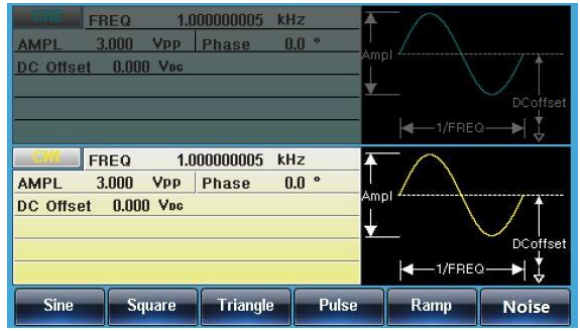
参数设置

3. 要設定 the Load/Frequency/Amplitude/DC Offset/ Phase 參數,請看 83 -88 頁.

设置脉冲波

面板操作

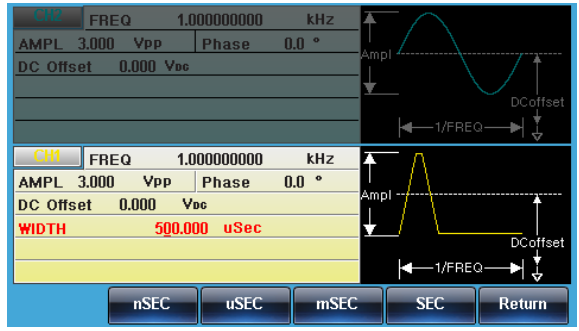
1. 按 Waveform 鍵



2. 按 F4(Pulse)創建一個脈衝波

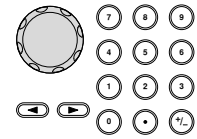
参数设置

3. 按 F1 (Width)將使位於參數窗口處的脈寬參數變亮



4. 兩種方式可設置其大小：
a,使用方向鍵或可調旋鈕

b,使用數位鍵.



通過 F2~F5 選擇相應單位.

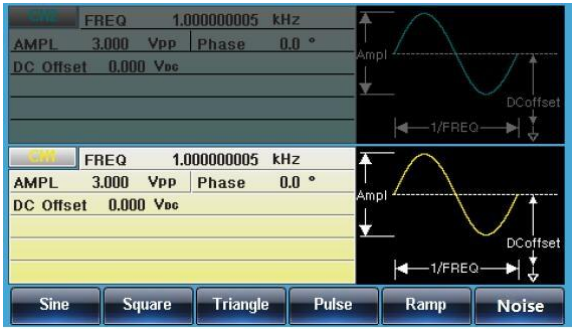
⚠ 脈衝寬度範圍 ≧20ns(受限於當前頻率的設定)

5. 要設定 the Load/Frequency/Amplitude/DC Offset/ Phase 參數,請看 83 -88 頁.

设置斜波

面板操作

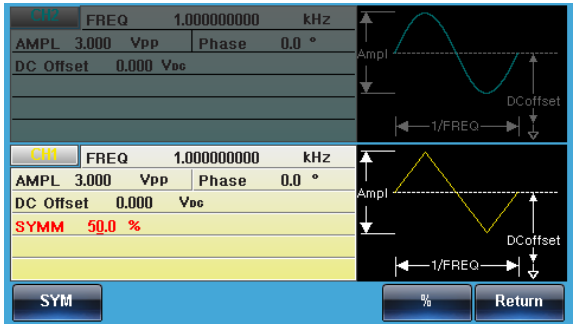
1. 按 Waveform 鍵



2. 按 F5 (Ramp)創建一個斜波

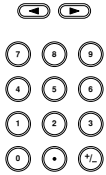
參数设置

3. 按 F1 (SYM)將使位於參數窗口處的 SYMM 參數變亮



4. 兩種方式可設置其大小：
   a,使用方向鍵或可調旋鈕。

   b,使用數位鍵.



   按 F5 (%) 選擇% 單位.

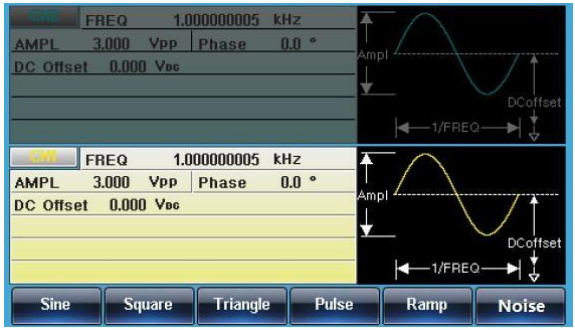
   對稱度範圍 0%~100%

5. 要設定 the Load/Frequency/Amplitude/DC Offset/ Phase 參數,請看 83 -88 頁.

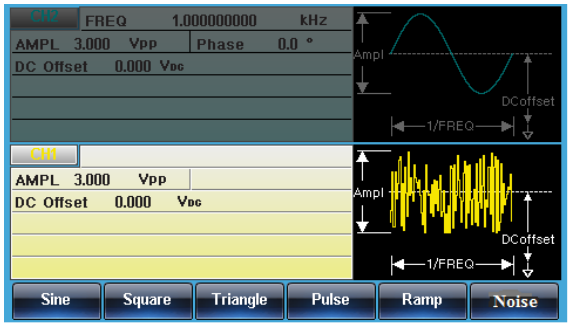
设置噪声波

面板操作

1. 按 Waveform 鍵



2. 按 F6 (Noise)



參數設置

要設定 the Load/Amplitude/DC Offset 參數,請看 83 - 86 頁.

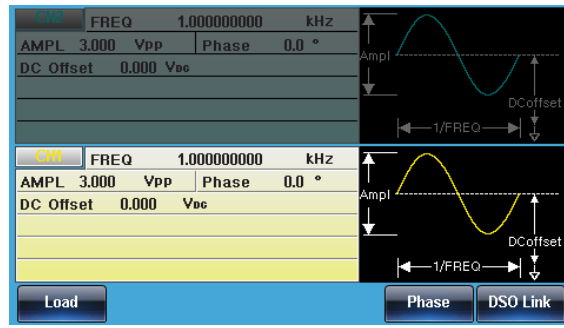
设置负载

面板操作

1. 按 CH1 或 CH2 或 CH1/CH2 鍵.

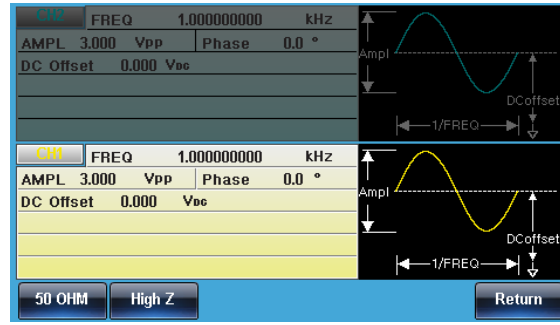
21XX 

22XX 

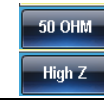


參數設置

2. 負載的設定. 選擇相應的通道後, 按 F1(Load) ，進入以下介面.



3. 按 F1(50OHM)或 F2(High Z)去設定 Load 的大小.



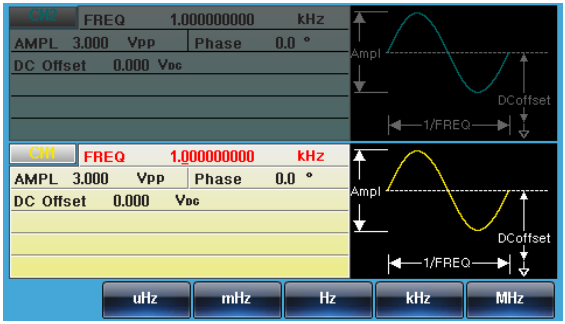
高阻時幅度是 50 歐姆的 2 倍.
可在 UTIL 裡可看到各個通道的 Load 設置狀態.

设置频率

面板操作

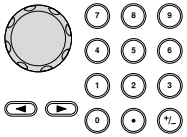
1. 按 FREQ/Rate 鍵

2. 位於參數窗口處的 FREQ 參數將變亮



參數設置

3. 兩種方式可設置其大小：
   a,使用方向鍵或可調旋鈕。



   b,使用數位鍵.

   通過 F2 ~F6 選擇相應單位.

範圍

Sine wave 1μHz~320MHz(max)

Square wave 1μHz~25MHz(max)

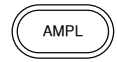
Pulse wave 1μHz~25MHz(max)

Ramp wave 1μHz~1MHz

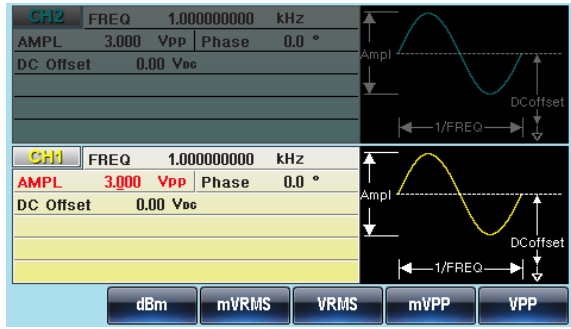
设置幅值

面板操作

1. 按 AMPL 鍵

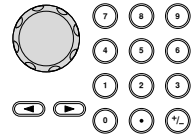


2. 位於參數窗口處的 AMPL 參數將變亮



參數設置

3. 兩種方式可設置其大小：
a,使用方向鍵或可調旋鈕



b,使用數位鍵.

通過 F2~F6 選擇相應單位.

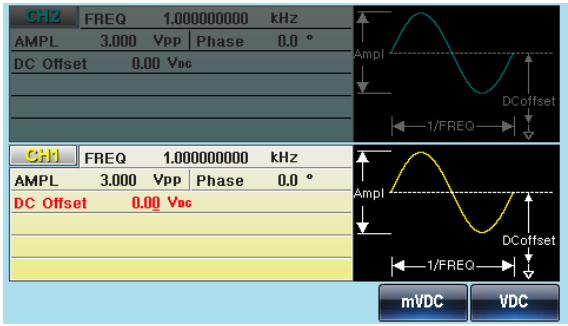
	50Ω load	High Z
範圍	1mVpp~10Vpp	2mVpp~20Vpp
單位	Vpp, Vrms, dBm	

设置直流偏置

面板操作

1. 按 DC 偏置鍵

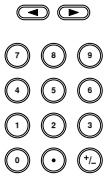
2. 位於參數窗口處的 DC 偏置參數將變亮



參數設置

3. 兩種方式可設置其大小：
a,使用方向鍵或可調旋鈕。

b,使用數位鍵.



按 F5 (mVDC) 或 F6 (VDC) 來選擇電壓範圍.

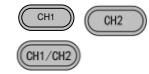
	50Ω load	High Z
範圍	±5Vpk	±10Vpk

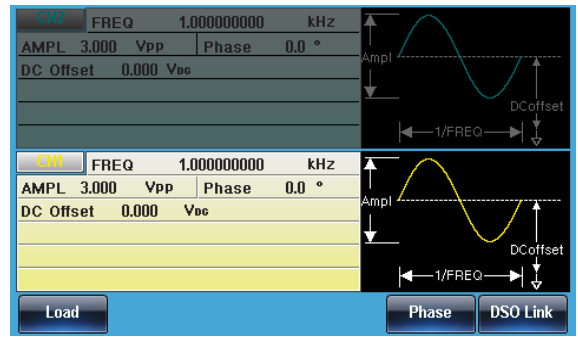
设置相位

面板操作

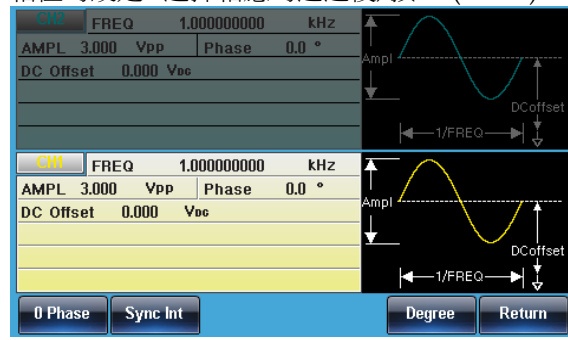
1. 按 CH1 或 CH2 或 CH1/CH2 鍵.

21XX
22XX





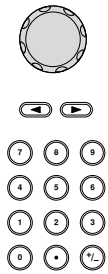
2. 相位的設定. 選擇相應的通道後, 按 F5(Phase) .



參數設置

3. 兩種方式可設置其大小：
a,使用方向鍵或可調旋鈕

b,使用數位鍵.



按 F5 (Degree) 選擇相應單位.

進入相位設定介面有兩個快捷的操作：

當前通道相位設為零

CH1/CH2 相位同時設為零

RF 通道

MFG-2000 系列機器有多個通道輸出，只有選擇了此通道才能對其進行設定操作等. RF 波形中有 Sine-DDS 和 Sine-ARB，兩者的取樣速率不同，對應調製類型也不同。Sine-DDS 支援最高 320MHz 正弦波頻率輸出。

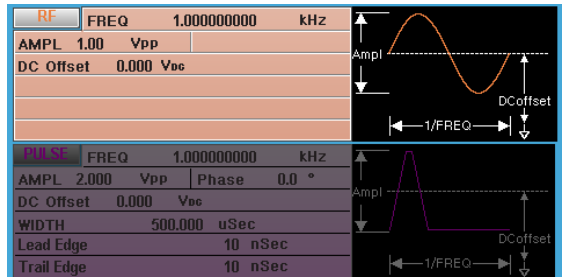
选择 RF 波形

面板操作

1. 按 Pulse/RF 鍵選擇 RF.

2. 被選擇的通道可以很清楚的看到，而未被選擇的會變淡.

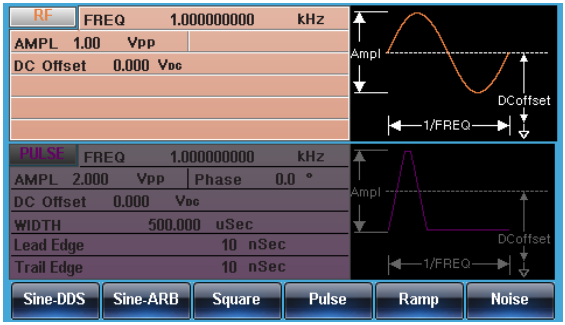
   在下圖螢幕顯示中, RF 被選擇.



设置正弦波

面板操作

1. 按 Waveform 鍵.



2. 按 F1 (Sine-DDS)創建 Sine-DDS 波或按 F2(Sine-ARB)創建 Sine-ARB 波.

參數設置

3. 設定 the Load/Frequency/Amplitude/DC Offset 的值, 請看 95 -99 頁.

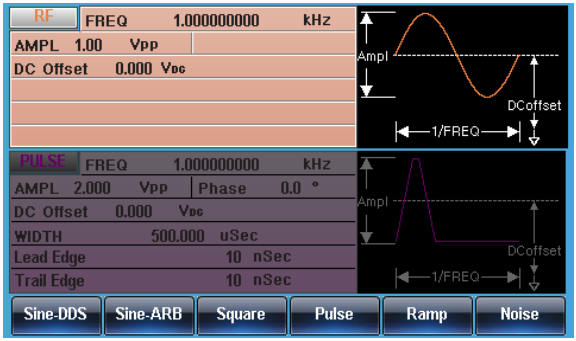
Sine-DDS, RF 調製功能有 AM,ASK,FM,FSK,PM,PSK. 頻率上限 160MHz (MFG-2XXXMF) / 320MHz (MFG-2XXXMR).

Sine-ARB,RF 調製功能有 FM,FSK,PM,PWM.頻率上限依型號請參照規格表之 CH1 相同.

设置方波

面板操作

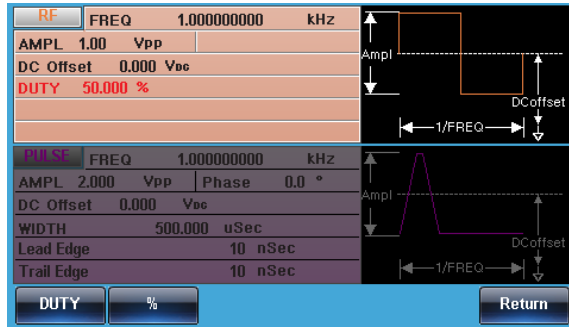
1. 按 Waveform 鍵.



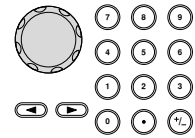
2. 按 F3 (Square) 創建方波.

參數設置

3. 按 F1 (Duty). 位於參數窗口處的占空比參數變亮.



4. 兩種方式可設置其大小：
a,使用方向鍵或可調旋鈕。



b,使用數位鍵.

按 F2 (%) 選擇% 單位.

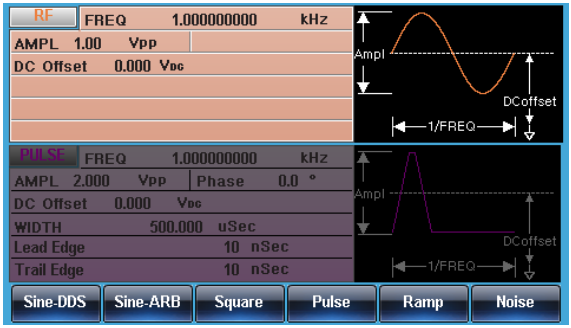
占空比範圍　　0.01%~99.99%(受限於當前頻率的設定)

5. 設定 the Load/Frequency/Amplitude/DC Offset 的值, 請看 95 -99 頁.

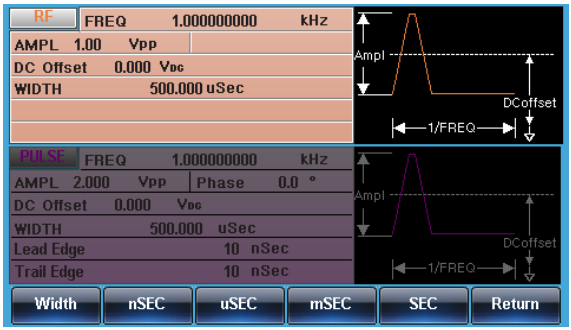
设置脉冲波

面板操作

1. 按 Waveform 鍵.

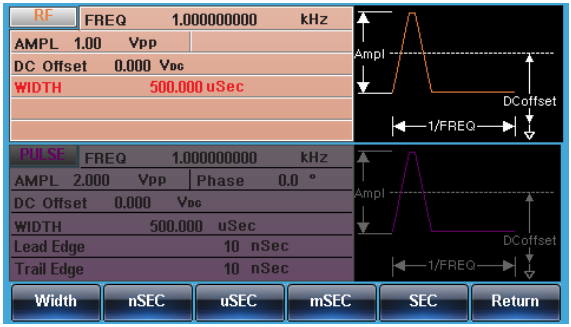


2. 按 F4 (Pulse)創建脈衝波. Pulse F 4



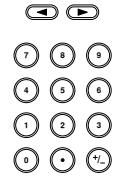
參數設置

3. 按 F1 (Width). 位於參數窗口處的脈衝寬度參數變亮. Width F 1



4. 兩種方式可設置其大小：
   a,使用方向鍵或可調旋鈕

   b,使用數位鍵.



   按 F2~F5 選擇相應單位.

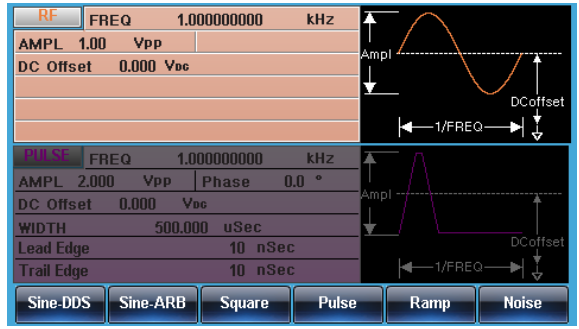
⚠ 脈衝波寬度範圍 ≧20ns(受限於當前頻率的設定)

5. 設定 the Load/Frequency/Amplitude/DC Offset 的值, 請看 95 -99 頁.

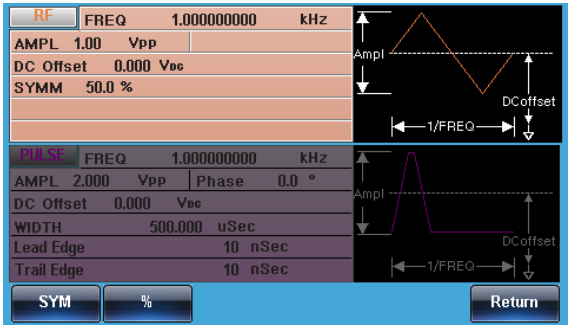
设置斜波

面板操作

1. 按 Waveform 鍵.



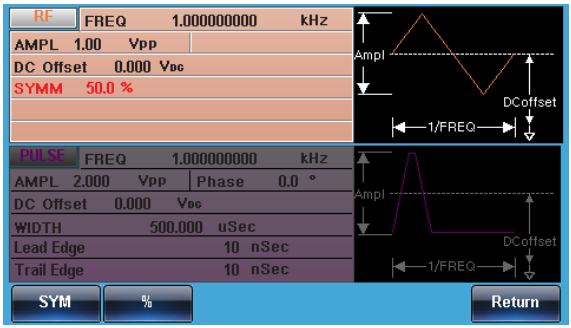
2. 按 F5 (Ramp)創建斜波.



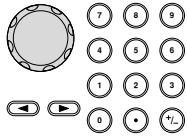
參數設置

3. 按 F1 (SYM). 位於參數窗口處的對稱度參數變亮.

SYM F 5



4. 兩種方式可設置其大小：
a,使用方向鍵或可調旋鈕



b,使用數位鍵.

按 F2 (%) 選擇% 單位.

% F 2

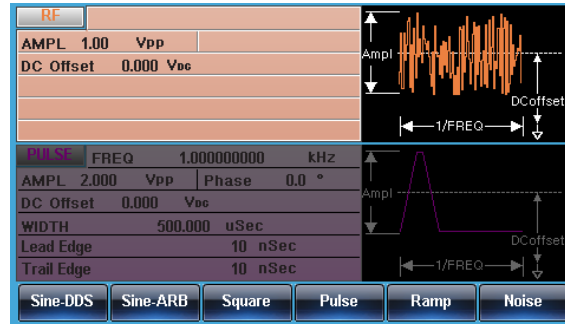
對稱度範圍 0%~100%

5. 設定 the Load/Frequency/Amplitude/DC Offset 的值, 請看 95 -99 頁.

设置噪声波

面板操作

1. 按 Waveform 鍵.



2. 按 F6 (Noise)創建雜訊波.

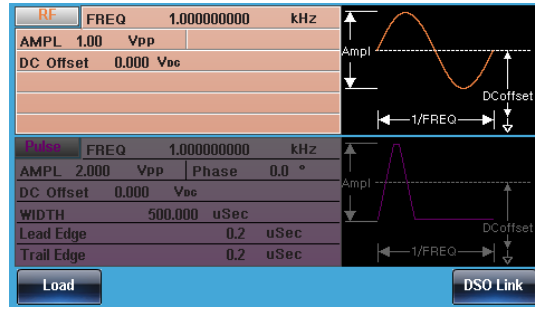
參數設置

3. 設定 the Load/Amplitude/DC Offset 的值, 請看 95 -99 頁.

设置负载

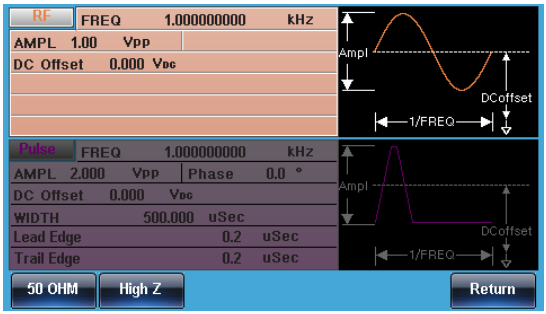
面板操作

1. 按 Pulse/RF 鍵.



參數設置

2. 負載的設定. 選擇相應的通道後, 按 F1(Load) .



3. 按 F1(50OHM)或 F2(High Z)去設定 Load 的大小.

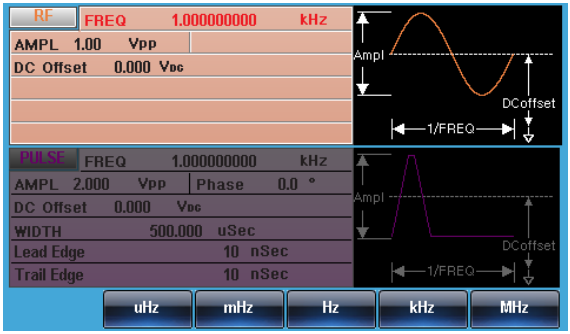
高阻時幅度是 50 歐姆的 2 倍. 可在 UTIL 裡可看到各個通道的 Load 設置狀態.

设置频率

面板操作

1. 按 FREQ/Rate 鍵.

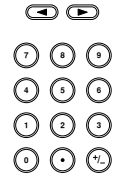
2. 位於參數視窗處的頻率參數變亮.



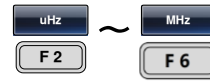
參數設置

3. 兩種方式可設置其大小：
   a,使用方向鍵或可調旋鈕。

   b,使用數位鍵.



   通過 F2~F6 選擇相應單位.



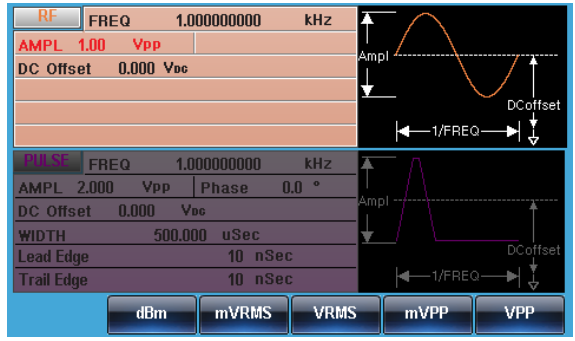
範圍	Sine wave	1μHz~320MHz(max)
	Square wave	1μHz~25MHz(max)
	Pulse wave	1μHz~25MHz(max)
	Ramp wave	1μHz~1MHz

设置幅度

面板操作

1. 按 AMPL 鍵.

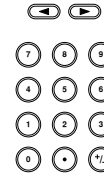
2. 位於參數視窗處的幅度參數變亮.



參數設置

3. 兩種方式可設置其大小：
   a,使用方向鍵或可調旋鈕

   b,使用數位鍵.



   通過 F2~F6 選擇相應單位.

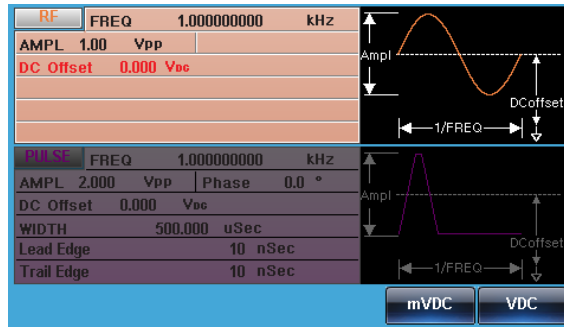
⚠		50Ω load	High Z
	範圍	1mVpp~10Vpp	2mVpp~20Vpp
	單位	Vpp, Vrms, dBm	

设置直流偏置

面板操作

1. 按 DC Offset 鍵.

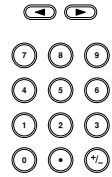
2. 位於參數窗口處的偏移參數變亮.



參數設置

3. 兩種方式可設置其大小：
   a,使用方向鍵或可調旋鈕

   b,使用數位鍵.



   按 F5 (mVDC)或 F6 (VDC) 選擇電壓範圍.

	50Ω load	High Z
範圍	±5Vpk	±10Vpk

Pulse 通道

MFG-2000 系列機器有多個通道輸出，只有選擇了此通道才能對其進行設定操作等.

选择脉冲波

面板操作

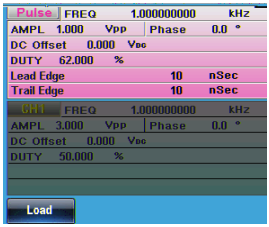
1. 按 Pulse 或 Pulse/RF 鍵選擇 Pulse.

21xx 

22xx 

2. 被選擇的通道可以很清楚的看到，而未被選擇的會變淡.
   在下方螢幕顯示中, 選擇 Pulse.

21xx 系列機型



22xx 系列機型

Pulse 通道的顯示位置在 21xx 和 22xx 系列機器有所不同，後續將以 22xx 圖示為例.

設置脈衝波占空比

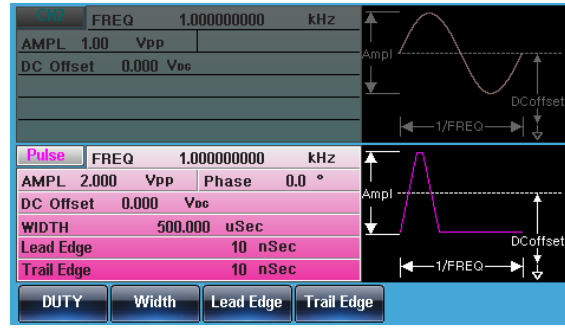
Instead of setting the pulse width of the pulse, the duty of the pulse can be set. The settable duty times depend on the leading&trailing edge time settings, as defined below:

Pulse Duty Cycle ≥ 100×最小脈寬 ÷ Pulse 週期

Pulse Duty Cycle < 100×(1-最小脈寬÷Pulse週期)

面板操作

1. 按 Waveform 鍵

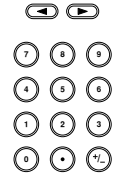


參數設置

2. 按 F1 (DUTY)位於參數窗口處的 DUTY 參數變亮

3. 兩種方式可設置其大小：
a,使用方向鍵或可調旋鈕

b,使用數位鍵.



按 F5 選擇 % 單位.

4. 設定 the Load/Frequency/Amplitude/DC Offset/Phase 的值,請看 106 -110 頁.

⚠	占空比範圍	0.01%~99.99%(受限於當前頻率的設定)

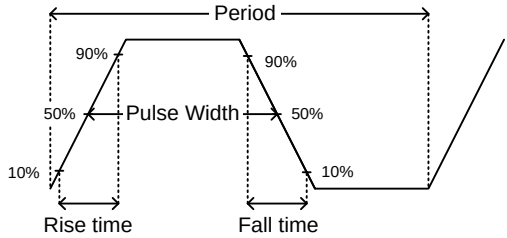
設置脈衝波寬度

脉冲宽度设置取决于上升/下降时间设置或边缘时间和周期设置，如下所定义:

脉冲宽度≥最小允許脉冲宽度

脉冲宽度<脈衝週期 -最小允許脉冲宽度

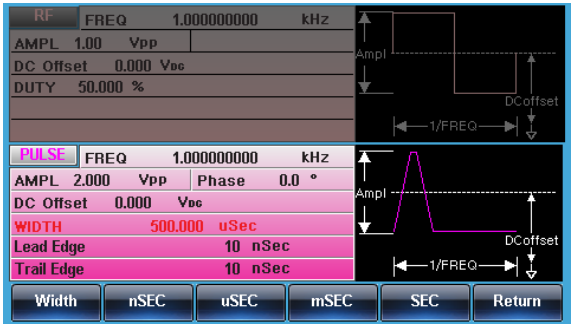
脉冲宽度被定义为从 50%上升沿阈值到一个完整周期的 50%下降沿阈值的时间，如圖所示.



面板操作

1. 按 Waveform 鍵.

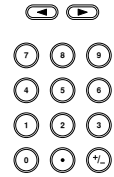
2. 按 F2 (Width). 位於參數窗口處的脈衝寬度參數變亮..



參數設置

3. 兩種方式可設置其大小：
   a,使用方向鍵或可調旋鈕

   b,使用數位鍵.



   通過 F2~F5 來選擇相應單位.

4. 設定 the Load/Frequency/Amplitude/DC Offset/Phase 的值, 請看 106 -110 頁.

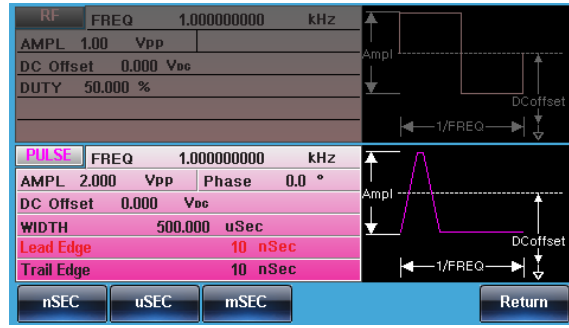
⚠	脈衝寬度範圍	≧20ns(受限於當前頻率的設定)

設置脈衝波前沿時間

面板操作

1. 按 Waveform 鍵.

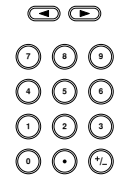
2. 按 F3 (Lead Edge).位於參數窗口處的前沿參數變亮.



3. 兩種方式可設置其大小：
   a,使用方向鍵或可調旋鈕

   b,使用數位鍵.

4. 通過 F1~F3 來選擇相應單位.

5. 對相反時間重複以上步驟.

6. 設定 the Load/Frequency/Amplitude/DC Offset/Phase 的值, 請看 106 -110 頁.

最小後沿時間　≧10nS(受限於當前頻率和脈寬的設定)

邊沿時間　≤ 0.625 × 脈衝寬度

設置脈衝波後沿時間

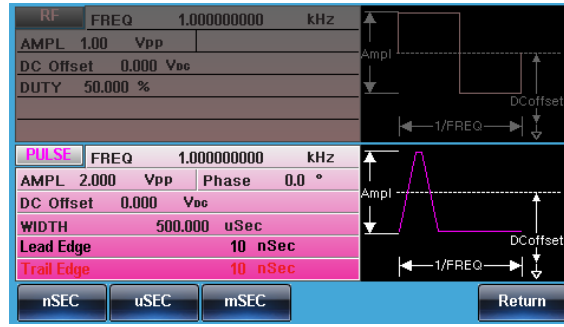
面板操作

1. 按 Waveform 鍵

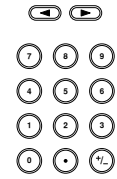
2. 按 F4 (Trail Edge). 位於參數窗口處的上升沿參數變亮



3. 兩種方式可設置其大小：
   a,使用方向鍵或可調旋鈕

   b,使用數位鍵.



   通過 F1~F3 來選擇相應單位.

4. 對相反時間重複以上步驟.

5. 設定 the Load/Frequency/Amplitude/DC Offset/Phase 的值,請看 106 -110 頁.

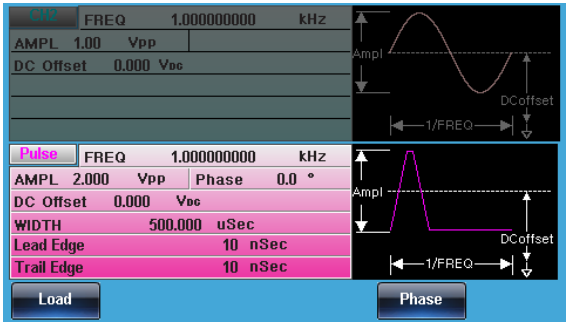
最小後沿時間　≧10nS(受限於當前頻率和脈寬的設定)

邊沿時間　≤ 0.625 × 脈衝寬度

設置負載

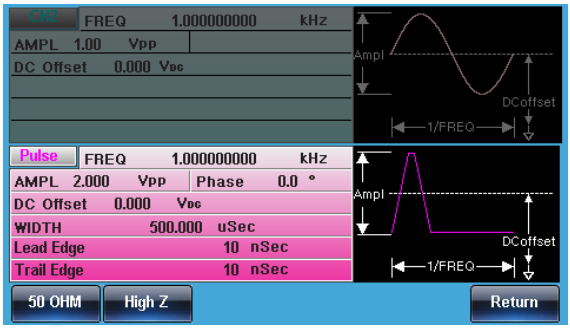
面板操作

1. 按 Pulse 或 RF/Pulse 鍵. 21XX 22XX



參數設置

2. 負載的設定.選擇相應的通道後, 按 F1(Load) .



3. 按 F1(50OHM)或 F2(High Z)去設定 Load 的大小.

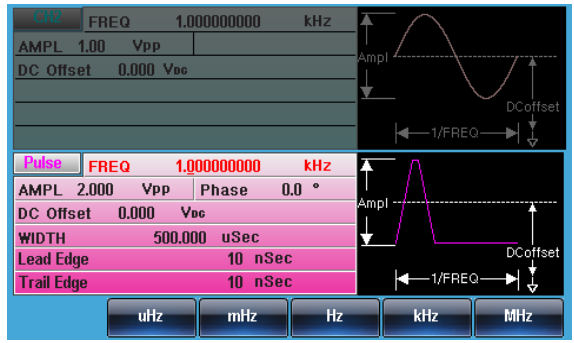
高阻時幅度是 50 OHM 的 2 倍.
可在 UTIL 裡可看到各個通道的 Load 設置狀態.

设置频率

面板操作

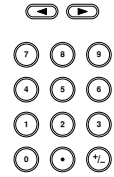
1. 按 FREQ/Rate 鍵.

2. 位於參數視窗處的頻率參數變亮..

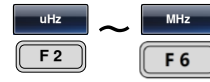


3. 兩種方式可設置其大小：
a,使用方向鍵或可調旋鈕

b,使用數位鍵.



通過 F2~F6 選擇相應單位.



範圍

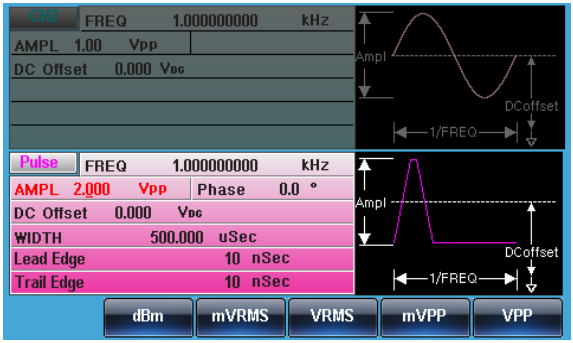
Sine wave	1μHz~320MHz(max)
Square wave	1μHz~25MHz(max)
Pulse wave	1μHz~25MHz(max)
Ramp wave	1μHz~1MHz

设置幅度

面板操作

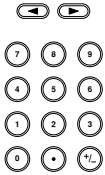
1. 按 AMPL 鍵.

2. 位於參數視窗處的幅度參數變亮.

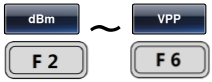


3. 兩種方式可設置其大小：
a,使用方向鍵或可調旋鈕

b,使用數位按鍵.



通過 F2~F6 選擇相應單位.



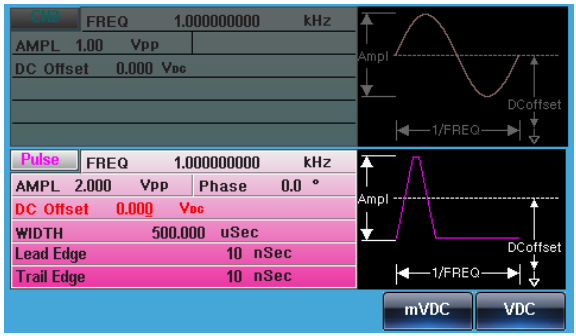
	50Ω load	High Z
範圍	1mVpp~10Vpp	2mVpp~20Vpp
單位	Vpp, Vrms, dBm	

设置直流偏置

面板操作

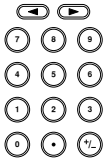
1. 按 DC Offset 鍵.

2. 位於參數窗口處的偏移參數變亮.



3. 兩種方式可設置其大小：
a,使用方向鍵或可調旋鈕

b,使用數位鍵.



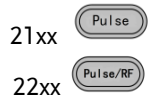
按 F5 (mVDC) 或 F6 (VDC) 選擇電壓範圍.

	50Ω load	High Z
範圍	±5Vpk	±10Vpk

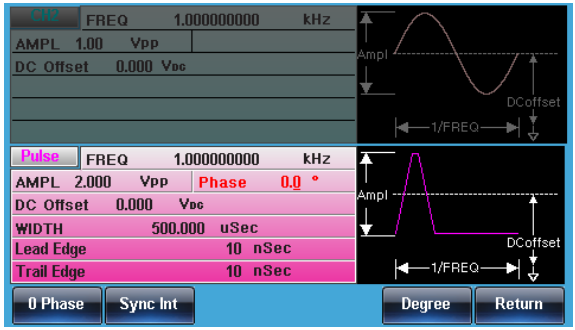
设置相位

面板操作

1. 按 Pulse 或 Pulse/RF 鍵.

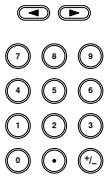


2. 相位的設定.選擇相應的通道後, 按 F5(Phase) .



3. 兩種方式可設置其大小：
a,使用方向鍵或可調旋鈕。

b,使用數位鍵.



按 F5 (Degree) 選擇相應單位.

進入相位設定介面有兩個快捷的操作：

當前通道相位設為零
CH1/CH2 相位同時設為零

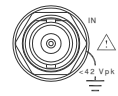
功率放大器

是指在给定失真率条件下，能产生最大功率输出以驱动某一负载（例如扬声器）的放大器。此处失真度<0.1%（Ampl>1Vpp）,适用于MFG-2120MA,MFG-2260MFA,2260MRA.

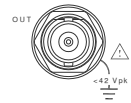
操作

面板操作

1. 從後面板 Power Amplifier BNC 埠輸入一外部信號。



2. 從後面板 Power Amplifier BNC 埠輸出,用相關測試儀器可直接測量其信號。



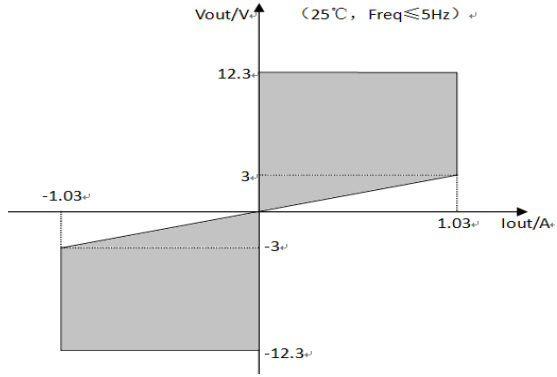
此放大器頻寬 DC-100KHz，最大灌入電壓 1.25Vpmax，最大帶載電流 1.6A，增益 20dB，最大輸出功率 20W。

Power Amplifier 的正常工作依賴於 AC 電源的正確輸入,請看 21 頁.

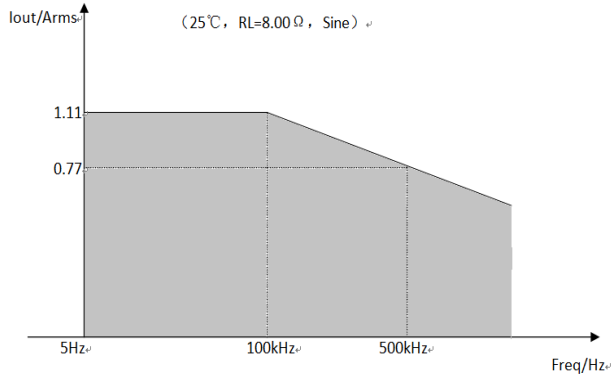
安全工作曲线

请用户仔细参考以下曲线，并确保在使用时使功率放大器工作于以下曲线内(阴影部分)，以防止功率放大器性能下降或者出现设备损坏。

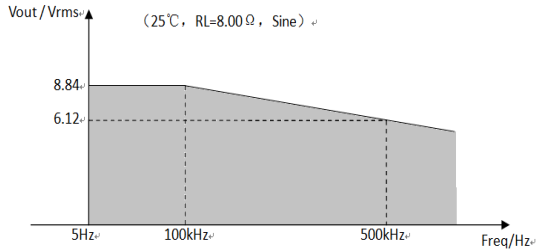
直流工作区域:



输出电流与工作频率的关系:



输出电压与工作频率的关系:



给放大器输入一个幅值很大的信号时，决定放大器性能的主要参数是频響及其散热条件。當输入大幅值信号的频率增加时，放大器即使在不带负载的时候其本身的工作电流、功耗也会随着输入信号的增加而

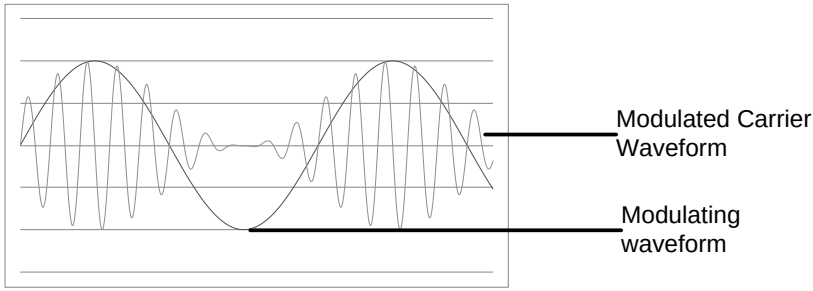
增加，且信号的失真也会随着频率的增加而增大，从而造成放大器发热，性能下降，所以对功率放大器的大幅值输入信号的频率和幅值的关系做了一些限制。

調製

MFG-2000 系列任意波形信号发生器能够产生 AM, FM, FSK,PM 和 SUM 调制波形。调制类型不同，调制参数的设置也有所不同。无论何时，只允许激活一种调制模式，且扫描或脉冲串模式不能与 AM/FM 同时启用。一旦激活一种调制模式，就意味着关闭前一个调制模式。

幅值调制(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。MFG-2000 信號發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。

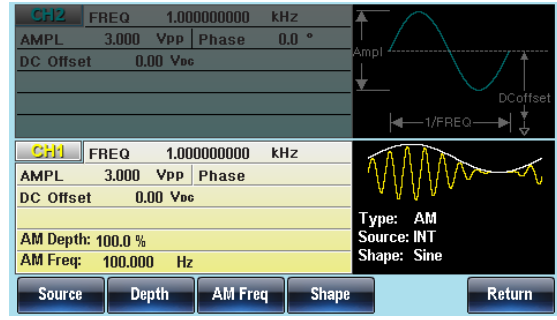


選擇 AM 調製

面板操作

1. 按 MOD 鍵

2. 按 F1 (AM)



AM 載波波形

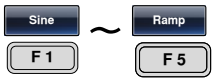
背景

AM 載波波形：正弦波、方波、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，參見**错误！未定义书签。**或**错误！未定义书签。**頁

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

範圍	AM 載波波形	正弦波, 方波, 脈衝波, 上斜波, 下斜波, 任意波

載波頻率

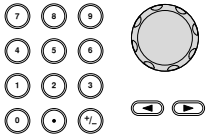
最大載波頻率與載波波形的選擇有關。預設載波頻率為 1kHz。

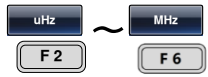
面板操作

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~ 320MHz
	方波	1μHz~25MHz
	三角波	1μHz~1MHz
	斜波	1μHz~1MHz
	預設頻率	1 kHz

調製波形

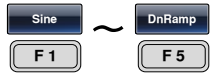
信號發生器可以接收內部和外部源。MFG-2000 的調製波形包括正弦波, 方波, 三角波, 上斜波, 下斜波。默認波形為正弦波。

面板操作

1. 選擇 MOD 鍵 

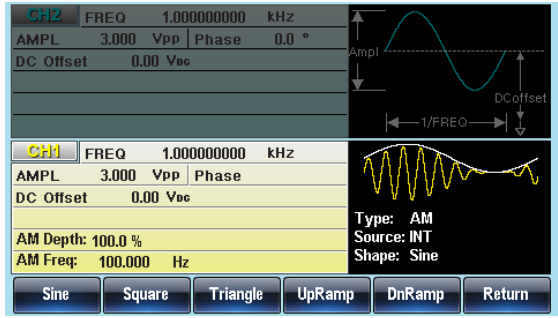
2. 按 F1 (AM) 

3. 按 F4 (Shape) 

4. 按 F1~F5 選擇波形 

5. 按 F6 (Return)返回菜單 

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。

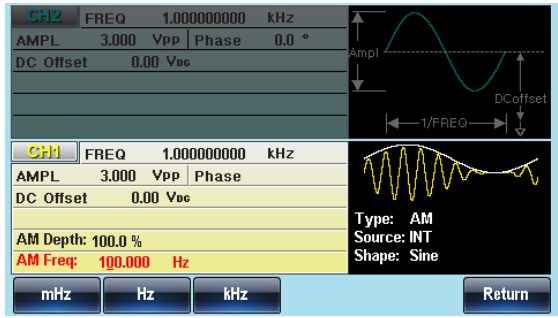
面板操作

1. 按 MOD 鍵

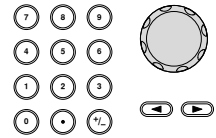
2. 按 F1 (AM)

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。

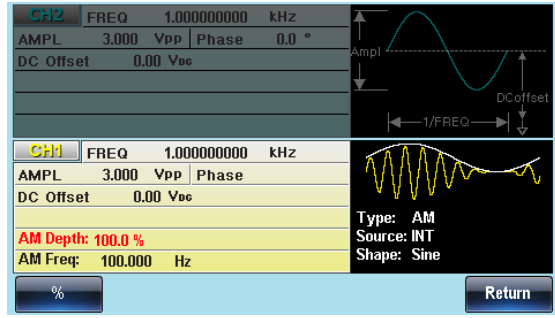
面板操作

1. 按 MOD 鍵

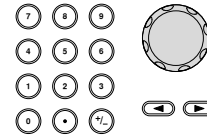
2. 按 F1 (AM)

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%
	默認深度	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 信號電壓控制。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

信號發生器將接受用於 AM 調製的內部或外部源。默認為內部源。

面板操作

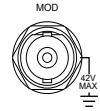
1. 按 MOD 鍵

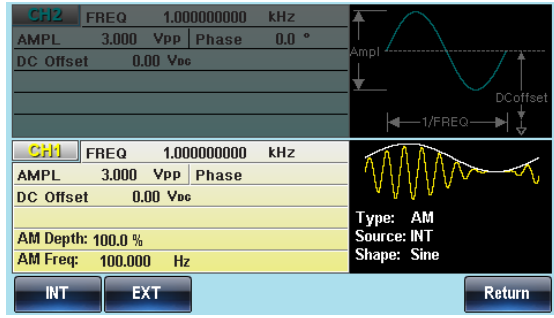
2. 按 F1 (AM)

3. 按 F1 (Source)

4. 按 F1(INT)或 F2(EXT)選擇調製源

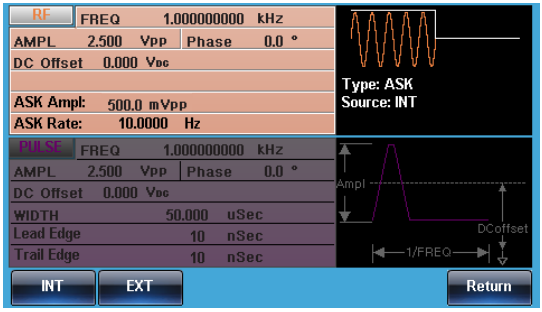
5. 按 Return 返回菜單

外部源	從後面板的 MOD 輸入端子接收外部調製信號 
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 信號電壓控制。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



幅移键控(ASK)

ASK 調製用於在兩個預設幅度(載波幅度和調製幅度)間移動其輸出幅度。函數發生器一次只允許啟用一種調製模式。當開啟 ASK 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 ASK 調製。在啟用 ASK 時，將關閉掃描或脈衝串模式。只有 RF 通道有 ASK 調製。



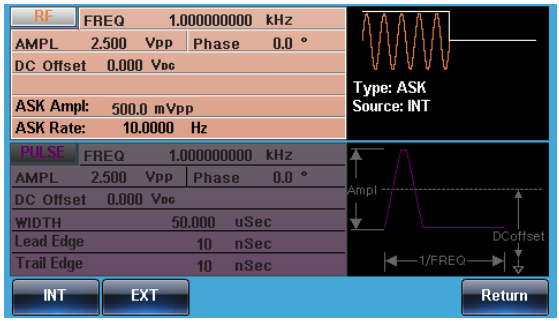
選擇 ASK 調製

當使用 ASK 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 F2 (ASK)



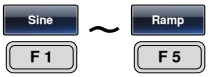
ASK 載波波形

背景　　默認波形為正弦波。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



範圍	載波波形	正弦波

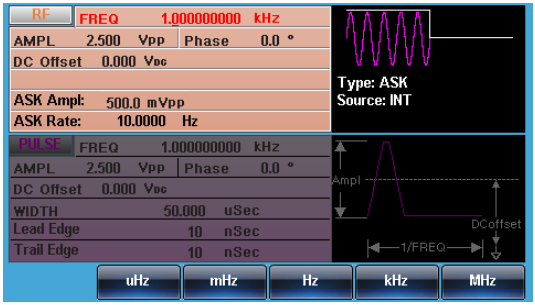
ASK 載波頻率

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，TriggerINPUT 信號的信號電平控制輸出頻率。當信號為邏輯低電平時，輸出載波頻率；當信號為邏輯高電平時，輸出跳躍頻率。

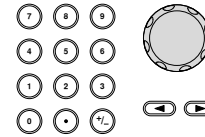
面板操作

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 ASK 頻率單位

範圍	載波波形	載波頻率
	正弦波	1μHz~320MHz
	預設頻率	1kHz

ASK 調製幅度

預設調製幅度均為 0.5Vpp。內部調製波是占空比為 50%的方波。選擇外部源時，TriggerINPUT 信號的信號電平控制輸出頻率。當信號為邏輯低電平時，輸出載波頻率；當信號為邏輯高電平時，輸出調製幅度。

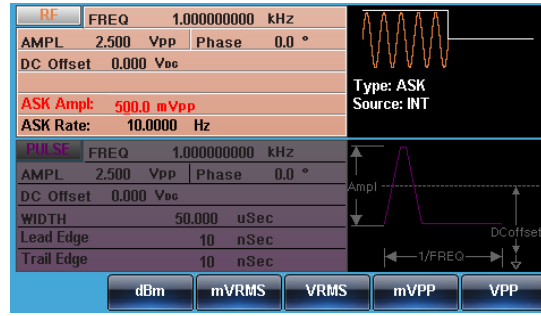
面板操作

1. 按 MOD 鍵

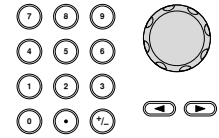
2. 按 F2 (ASK)

3. 按 F2 (ASK Ampl)

4. 位於波形顯示區域處的 ASK Ampl 參數將變亮



5. 使用方向鍵和可調旋鈕或數位鍵盤輸入調製幅度



6. 按 F2~F6 選擇單位類型

範圍	ASK 調製幅度	0V~最大值
	默認	0.5V

ASK 頻率

ASK 頻率是決定輸出載波幅度或調製幅度的頻率值。

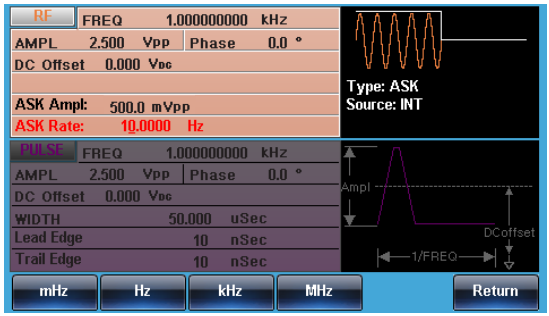
面板操作

1. 選擇 MOD

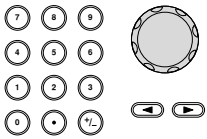
2. 按 F2 (ASK)

3. 按 F3 (ASK Rate)

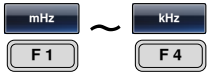
4. 位於波形顯示區域處的 ASK Rate 參數將變亮



5. 使用方向鍵和可調旋鈕或數位鍵盤輸入 ASK 頻率



6. 按 F1~F4 選擇頻率單位



範圍	ASK 頻率	2mHz~1MHz
	默認	100Hz
注意	如果選擇外部源, 忽視 ASK 頻率設置	

ASK 源

MFG-2000 接受內部和外部 ASK 源，默認為內部 ASK 源。當選擇內部 ASK 源時，使用 ASK Rate 功能設置 ASK 頻率。當選擇外部源時，ASK 頻率與後面板 TriggerINPUT 信號的頻率一致。

面板操作

1. 按 MOD 鍵

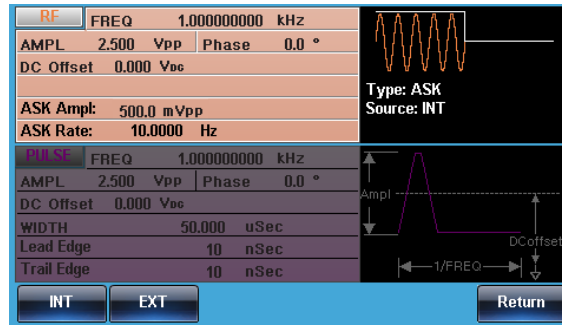
2. 按 F2 (ASK)

3. 按 F1 (Source)

4. 按 F1 (Internal)或 F2 (External)選擇 ASK 源

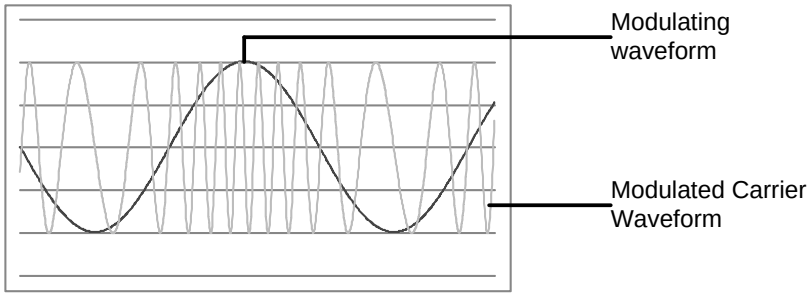
5. 按 Return 返回菜單

注意 Trigger INPUT 端子不能設置邊沿極性



频率调制(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 MFG-2000 時，無論何時只允許啟用一種調製模式。



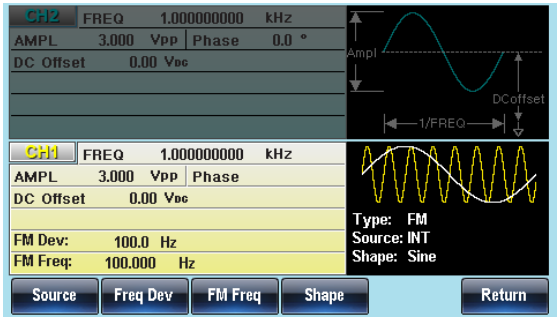
選擇頻率調製 (FM)

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)



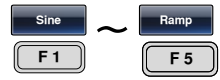
FM 載波波形

背景　FM 載波默認為正弦波。雜訊波不能用作載波

面板操作

1. 按 Waveform 鍵

2. 按 F1~F5 選擇載波形



範圍	載波波形	正弦波, 方波, 脈衝波, 斜波

FM 載波頻率

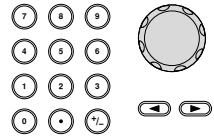
使用 MFG-2000 時，載波頻率必須大於或等於頻率偏移。如果頻率偏移大於載波頻率，函數發生器會自動將偏移調整到當前載波頻率所允許的最大值。載波最大頻率與所選波形有關。

面板操作

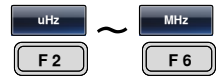
1. 按 FREQ/Rate 鍵選擇載波頻率

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~320MHz
	方波	1μHz~25MHz

	脈衝波	1μHz~25MHz
	三角波	1μHz~1MHz
	預設頻率	1 kHz

FM 波形

信號發生器能接受內部和外部源。MFG-2000 的內部調製波形包括正弦波、方波、脈衝波、正和負斜波(UpRamp, DnRamp)。預設情況為正弦波。

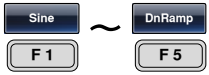
面板操作

1. 選擇 MOD

2. 按 F2 (FM)

3. 按 F4 (Shape)

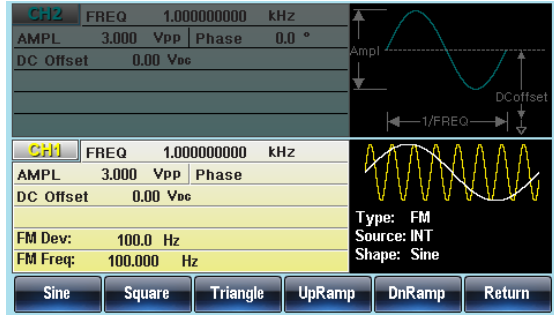
4. 按 F1~F5 選擇波形



5. 按 Return 返回菜單

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


CH2
FREQ 1.000000000 kHz
AMPL 3.000 Vpp
Phase 0.0 °
DC Offset 0.00 Vdc
Ampl
DCoffset
1/FREQ
CH1
FREQ 1.000000000 kHz
AMPL 3.000 Vpp
Phase
DC Offset 0.00 Vdc
FM Dev: 100.0 Hz
FM Freq: 100.000 Hz
Type: FM
Source: INT
Shape: Sine
Sine
Square
Triangle
UpRamp
DnRamp
Return

頻率調製波形

信號發生器將接受用於 FM 的內部或外部調製源。

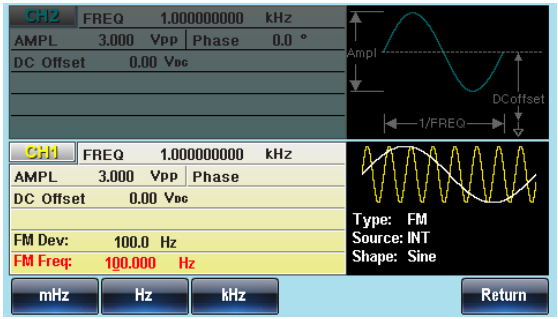
面板操作

1. 按 MOD 鍵

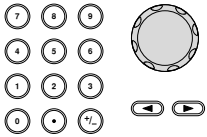
2. 按 F2 (FM)

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。

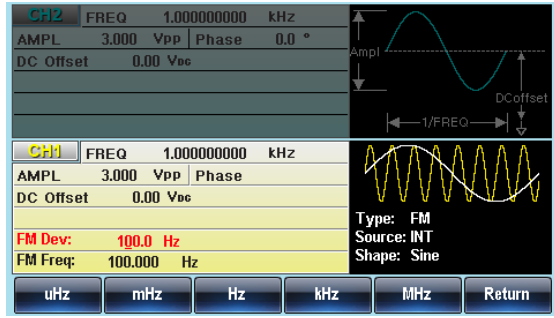
面板操作

1. 按 MOD 鍵

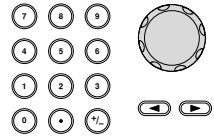
2. 按 F2 (FM)

3. 按 F2 (Freq Dev)

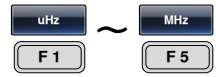
4. 位於波形顯示區域處的 Freq Dev 參數將變亮



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~Max Frequency
	默認深度	100Hz

選擇(FM)調製源

信號發生器將接受用於 FM 調製的內部或外部源。默認為內部源。

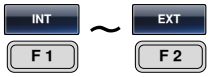
面板操作

1. 按 MOD 鍵

2. 按 F2 (FM)

3. 按 F1 (Source)

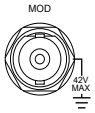
4. 按 F1 (INT)或 F2 (EXT)選擇調製源



5. 按 Return 返回菜單

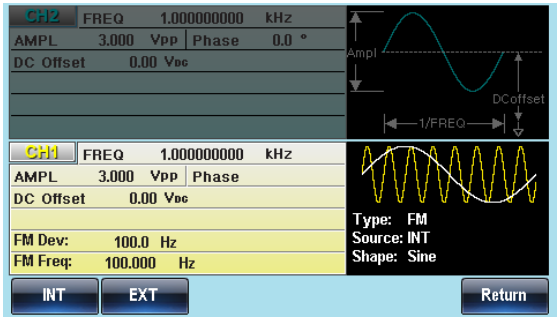
外部源

從後面板的 MOD 輸入端子接收外部調製信號



注意

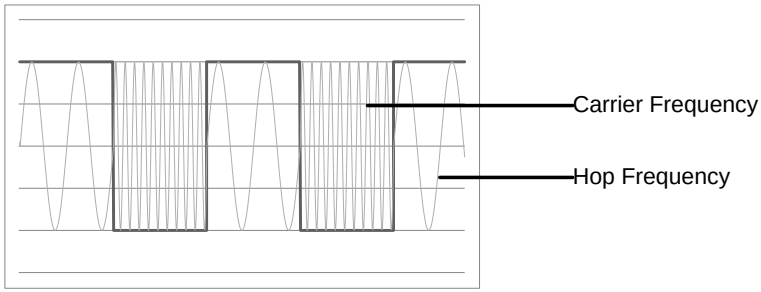
如果選擇外部調製源, 那麼頻偏將由後面板 MOD INPUT 上的± 5V 信號電壓控制。頻偏與調製信號電平成比例。例如，如果調製電壓為+5V, 那麼頻偏將等於設置的頻偏。外部信號電平越低，偏移就越小；而負信號電平將會使頻偏頻率降至載波頻率之下。



频移键控(FSK)

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。內部頻率發生器或後面板 Trigger INPUT 上的信號電平決定交替頻率。

函數發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。



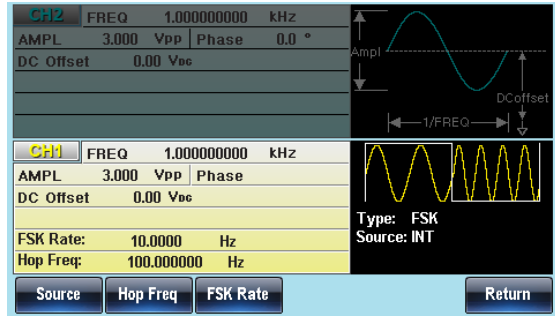
選擇 FSK 調製

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)



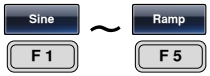
FSK 載波波形

背景　　默認波形為正弦波。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



範圍	載波波形	正弦波, 方波, 斜波, 脈衝波

FSK 載波頻率

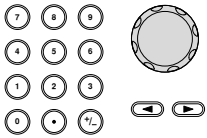
最大載波頻率與載波波形有關。預設載波頻率均為 1kHz。選擇外部源時，TriggerINPUT 信號的信號電平控制輸出頻率。當信號為邏輯低電平時，輸出載波頻率；當信號為邏輯高電平時，輸出跳躍頻率。

面板操作

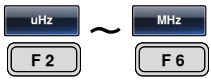
1. 按 FREQ/Rate 鍵選擇載波頻率

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~320MHz
	方波	1μHz~25MHz

斜波	1μHz~1MHz
脈衝波	1μHz~25MHz
預設頻率	1kHz

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，TriggerINPUT 信號的信號電平控制輸出頻率。當信號為邏輯低電平時，輸出載波頻率；當信號為邏輯高電平時，輸出跳躍頻率。

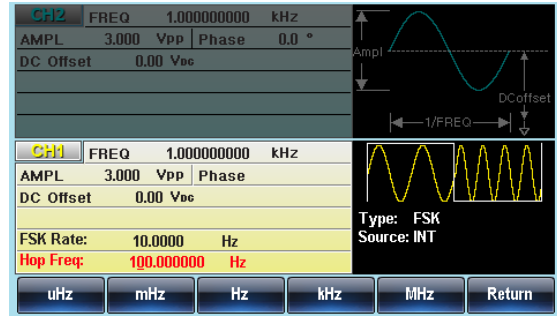
面板操作

1. 按 MOD 鍵

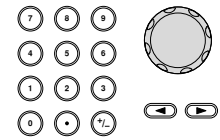
2. 按 F3 (FSK)

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~320MHz
	方波	1μHz~25MHz
	斜波	1μHz~1MHz
	脈衝波	1μHz~25MHz
	預設頻率	100Hz

FSK 頻率

FSK 頻率是決定輸出載波頻率或跳躍頻率的頻率值。

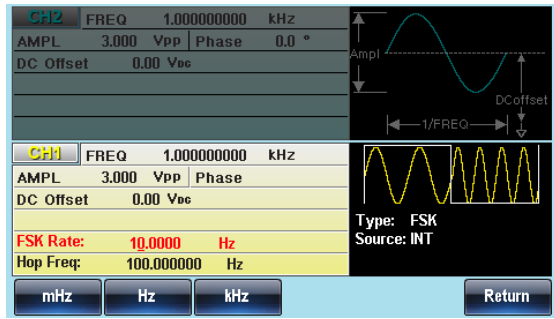
面板操作

1. 選擇 MOD

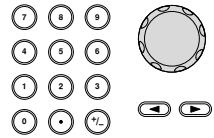
2. 按 F3 (FSK)

3. 按 F3 (FSK Rate)

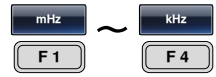
4. 位於波形顯示區域處的 FSK Rate 參數將變亮



5. 使用方向鍵和可調旋鈕或數位鍵盤輸入 FSK 頻率



6. 按 F1~F4 選擇頻率單位



範圍	FSK 頻率	2mHz~1MHz
	默認	10Hz
注意	如果選擇外部源, 忽視 FSK 頻率設置	

FSK 源

MFG-2000 接受內部和外部 FSK 源，默認為內部 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 TriggerINPUT 信號的頻率一致。

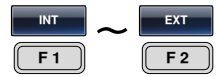
面板操作

1. 按 MOD 鍵

2. 按 F3 (FSK)

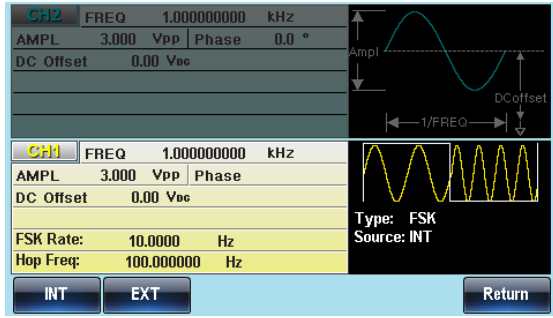
3. 按 F1 (Source)

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



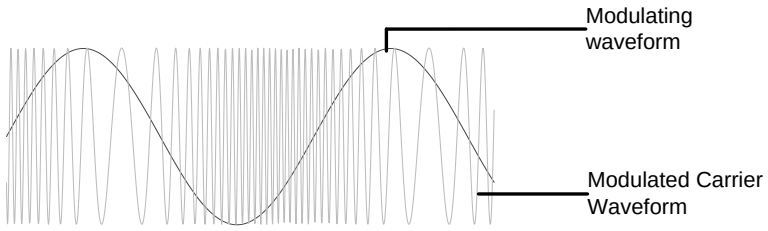
5. 按 Return 返回菜單

注意 Trigger INPUT 端子不能設置邊沿極性


CH2
FREQ 1.000000000 kHz
AMPL 3.000 Vpp
Phase 0.0 °
DC Offset 0.00 VDC
Ampl
DCoffset
1/FREQ
CH1
FREQ 1.000000000 kHz
AMPL 3.000 Vpp
Phase
DC Offset 0.00 VDC
FSK Rate: 10.0000 Hz
Hop Freq: 100.000000 Hz
Type: FSK
Source: INT
INT
EXT
Return

相位调制(PM)

對於相位調製，相位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 PM，將禁用其它調製模式。此外不允許掃描和脈衝串模式與 PM 同時使用。若使用 PM，將關閉掃描和脈衝串模式。



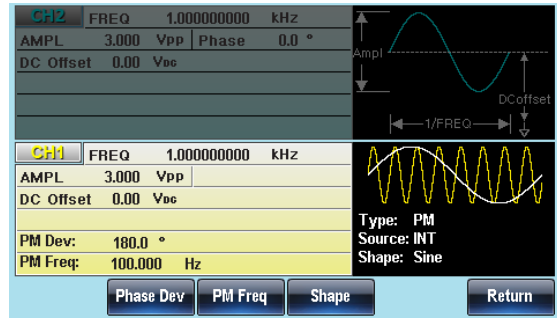
選擇相位調製 (PM)

選擇 PM 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 F4 (PM)



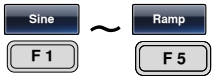
PM 載波波形

背景 PM 載波默認為正弦波。雜訊波不能用作載波

面板操作

1. 按 Waveform 鍵

2. 按 F1~F5 選擇載波形



範圍	載波波形	正弦波, 方波, 脈衝波, 斜波

PM 載波頻率

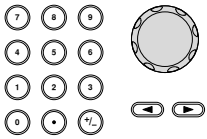
最大載波頻率與載波波形的選擇有關。預設載波頻率為 1kHz。

面板操作

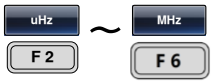
1. 按 FREQ/Rate 鍵選擇載波頻率

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~320MH
	方波	1μHz~25MHz

脈衝波	1μHz~25MHz
三角波	1μHz~1MHz
斜波	1μHz~1MHz
預設頻率	1 kHz

PM 波形

信號發生器能接受內部和外部源。MFG-2000 的內部調製波形包括正弦波、方波、脈衝波、正和負斜波(UpRamp, DnRamp)。預設情況為正弦波。

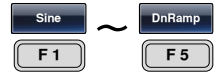
面板操作

1. 選擇 MOD

2. 按 F4 (PM)

3. 按 F4 (Shape)

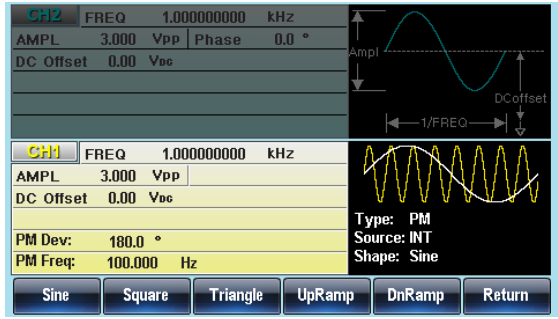
4. 按 F1~F5 選擇波形



5. 按 Return 返回菜單

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

信號發生器將接受用於 FM 的內部或外部調製源。

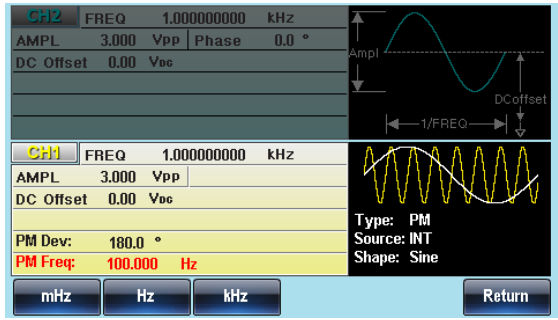
面板操作

1. 按 MOD 鍵

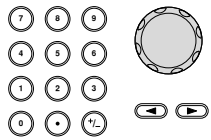
2. 按 F4 (PM)

3. 按 F3 (PM Freq)

4. 位於波形顯示區域處的 PM 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 PM 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。

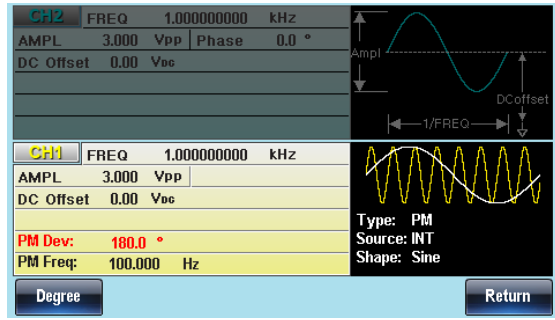
面板操作

1. 按 MOD 鍵

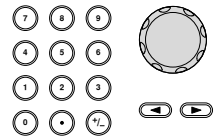
2. 按 F4 (PM)

3. 按 F2 (Phase Dev)

4. 位於波形顯示區域處的 Phase 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 選擇相位單位

範圍	相位偏移	0~360°
	默認相位	180°

選擇 (PM) 調製源

信號發生器將接受用於 FM 調製的內部或外部源。默認為內部源。

面板操作

1. 按 MOD 鍵

2. 按 F4 (PM)

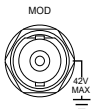
3. 按 F1 (Source)

4. 按 F1 (INT)或 F2 (EXT)選擇調製源

5. 按 Return 返回菜單

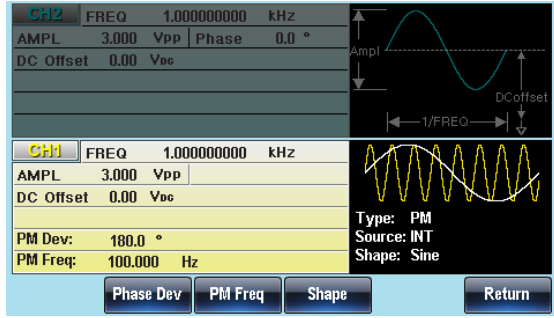
外部源

從後面板的 MOD 輸入端子接收外部調製信號



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 信號電壓控制。頻偏與調製信號電平成比例。例如，如果調製電壓為+5V, 那麼頻偏將等於設置的頻偏。外部信號電平越低，偏移就越小；而負信號電平將會使頻偏頻率降至載波頻率之下。


CH2
FREQ 1.000000000 kHz
AMPL 3.000 Vpp
Phase 0.0 °
DC Offset 0.00 Vdc
Ampl
DCoffset
1/FREQ
CH1
FREQ 1.000000000 kHz
AMPL 3.000 Vpp
DC Offset 0.00 Vdc
PM Dev: 180.0 °
PM Freq: 100.000 Hz
Type: PM
Source: INT
Shape: Sine
Phase Dev
PM Freq
Shape
Return

相移键控(PSK)

PSK 調製用於在兩個預設相位(載波相位和調製相位)間交替輸出相位。函數發生器一次只允許啟用一種調製模式。當開啟 PSK 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 PSK 調製。在啟用 PSK 時，將關閉掃描或脈衝串模式。只有 RF 通道有 PSK 調製。

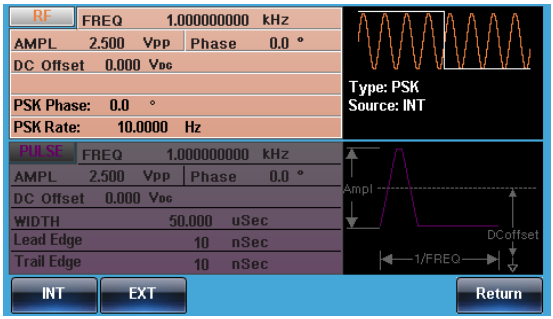
選擇 PSK 調製

當使用 PSK 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 F6 (PSK)



PSK 載波波形

背景　　默認波形為正弦波。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

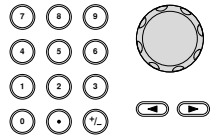
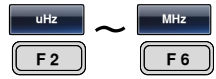
範圍	載波波形	正弦波

PSK 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。

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 PSK 頻率單位 

範圍	載波波形	載波頻率
	正弦波	1μHz~320MHz
	預設頻率	1kHz

PSK 調製相位

預設調製相位均為 180°。內部調製波是占空比為 50%的方波。

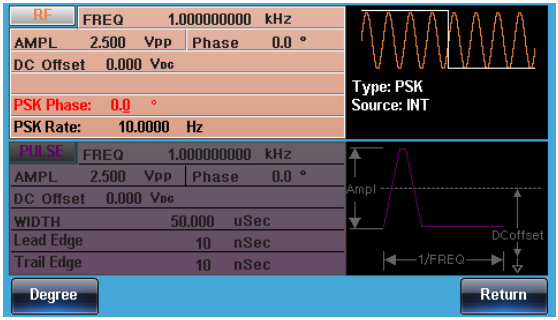
面板操作

1. 按 MOD 鍵 

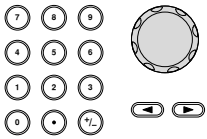
2. 按 F6 (PSK) 

3. 按 F2 (PSK Phase) 

4. 位於波形顯示區域處的 PSK Phase 參數將變亮



5. 使用方向鍵和可調旋鈕或數位鍵盤輸入調製相位



6. 按 F1 選擇°

範圍	PSK 調製相位	0~360°
	默認相位	180°

PSK 頻率

PSK 調製頻率設置載波相位和調製相位交替輸出的頻率。

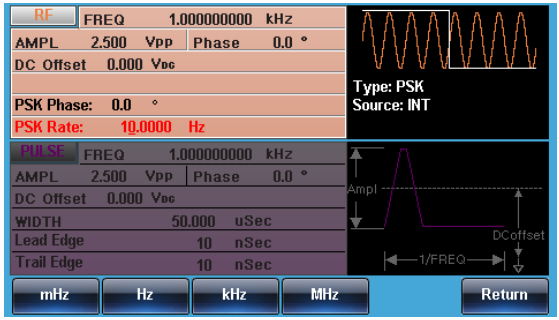
面板操作

1. 選擇 MOD

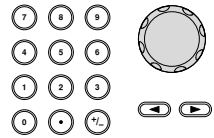
2. 按 F3 (PSK)

3. 按 F3 (PSK Rate)

4. 位於波形顯示區域處的 PSK Rate 參數將變亮



5. 使用方向鍵和可調旋鈕或數位鍵盤輸入 PSK 頻率



6. 按 F1~F4 選擇頻率單位

範圍	PSK 頻率	2mHz~1MHz
	默認	10Hz
注意	如果選擇外部源, 忽視 PSK 頻率設置	

PSK 源

MFG-2000 接受內部和外部 PSK 源，默認為內部 PSK 源。當選擇內部 PSK 源時，使用 PSK Rate 功能設置 PSK 頻率。當選擇外部源時，PSK 頻率與後面板 TriggerINPUT 信號的頻率一致。

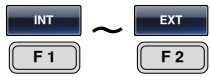
面板操作

1. 按 MOD 鍵

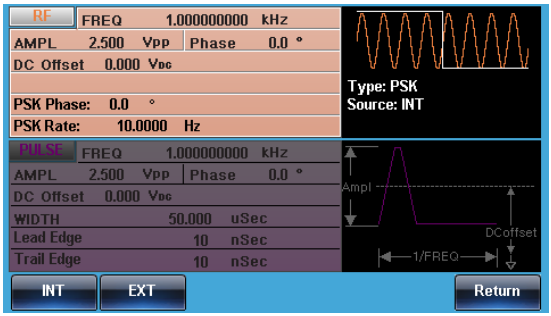
2. 按 F6 (PSK)

3. 按 F1 (Source)

4. 按 F1 (Internal)或 F2 (External)選擇 PSK 源

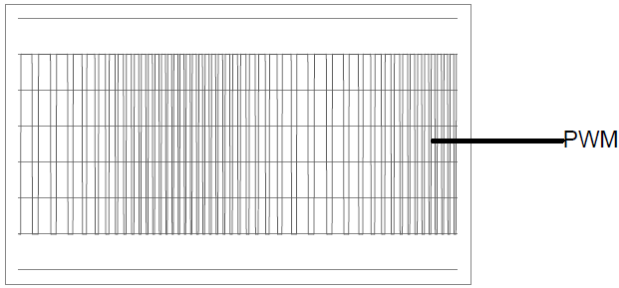


5. 按 Return 返回菜單



脉冲宽度调制(PWM)

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

选择 PWM, 需要考虑载波频率的当前设置、幅值调制频率、输出和偏移电压。

面板操作

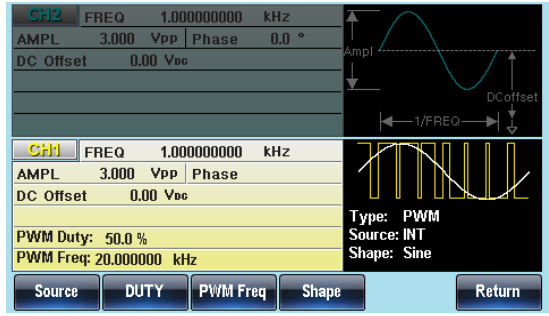
1. 按 MOD 鍵

2. 按 F6 (PWM)

3. 按 F1 (Source)

4. 按 F1 (INT)或 F2 (EXT)選擇調製源

5. 按 Return 返回菜單



PMW 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。

PMW 載波頻率

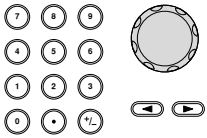
載波頻率與方波有關。預設載波頻率為1kHz。

面板操作

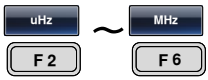
1. 按 FREQ/Rate 鍵選擇載波頻率

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 選擇頻率單位



PMW 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。默認波形為正弦波。

面板操作

1. 選擇 MOD

2. 按 F6 (PWM)

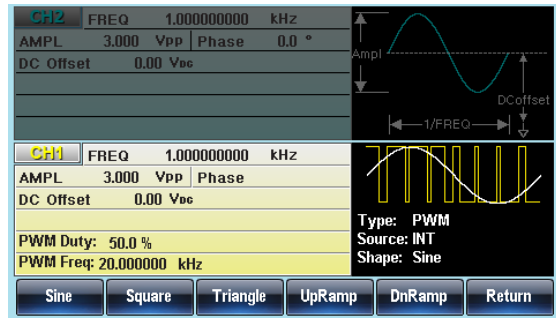
3. 按 F4 (Shape)

4. 按 F1~F5 選擇波形

5. 按 Return 返回菜單

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

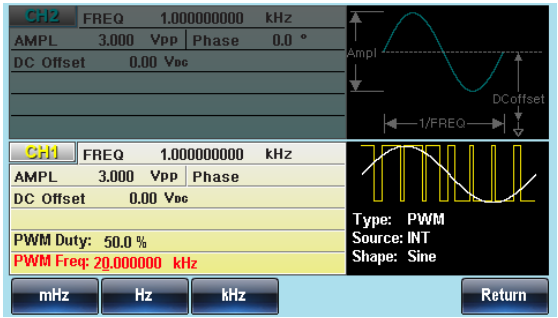
面板操作

1. 按 MOD 鍵

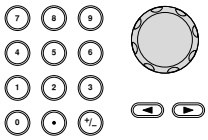
2. 按 F6 (PWM)

3. 按 F3 (PWM Freq)

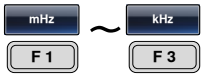
4. 位於波形顯示區域處的 PM 頻率參數將變亮



5. 使用方向鍵和可調旋鈕或數位鍵盤輸入 PWM 頻率



6. 按 F1~F3 選擇頻率單位



範圍		
	PWM 頻率	2mHz~20kHz
	默認	20kHz

調製占空比

用于设置占空比(%)

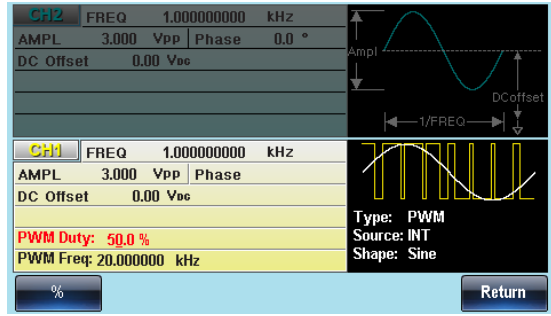
面板操作

1. 按 MOD 鍵

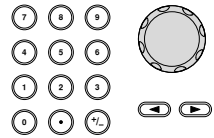
2. 按 F6 (PWM)

3. 按 F2 (Duty)

4. 位於波形顯示區域處的 PWM 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 PWM 頻率

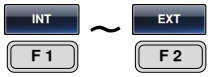
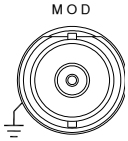


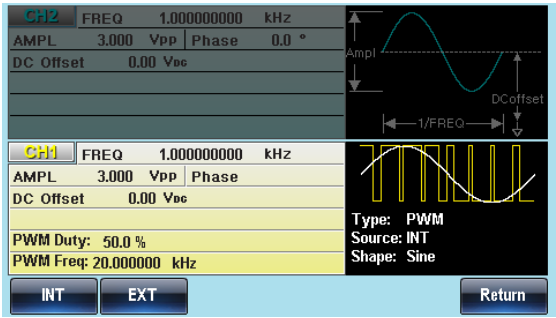
6. 按 F1(%)選擇百分號

範圍	占空比	0%~100%
	默認	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

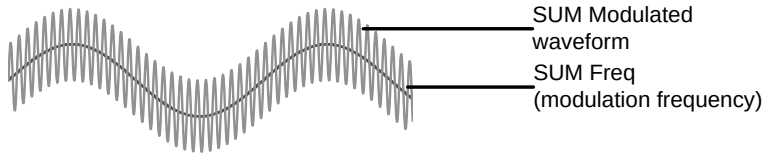
MFG-2000 接受內部和外部 PWM 調製源。預設為內部調製源。

面板操作	1. 選擇 MOD	
	2. 按 F6 (PWM)	
	3. 按 F1 (Source)	
	4. 按 F1 (INT)或 F2 (EXT)選擇調製源	
	5. 按 Return 返回菜單	
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%，則在調製信號為+5V時，輸出最大脈寬；在調製信號為-5V時，輸出最小脈寬。	



总和调制(SUM)

對於總和調製，深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 SUM，將禁用其它調製模式。此外不允許掃描和脈衝串模式與 SUM 同時使用。若使用 SUM，將關閉掃描和脈衝串模式。



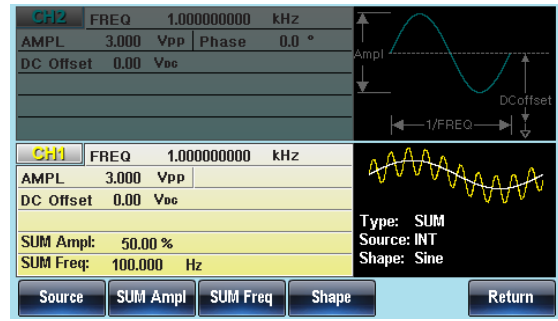
選擇總和調製 (SUM)

選擇 SUM 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 F5 (SUM)



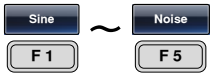
SUM 載波波形

背景　　SUM 載波默認為正弦波。

面板操作

1. 按 Waveform 鍵

2. 按 F1~F5 選擇載波形



範圍	載波波形	正弦波, 方波, 脈衝波,三角波,斜波,雜訊波

SUM 載波頻率

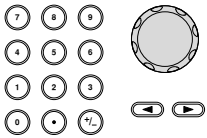
最大載波頻率與載波波形的選擇有關。預設載波頻率為 1kHz。

面板操作

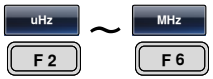
1. 按 FREQ/Rate 鍵選擇載波頻率

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~320MH
	方波	1μHz~25MHz

脈衝波	1μHz~25MHz
三角波	1μHz~1MHz
預設頻率	1 kHz

SUM 波形

信號發生器能接受內部和外部源。MFG-2000 的內部調製波形包括正弦波、方波、脈衝波、正和負斜波(UpRamp, DnRamp)。預設情況為正弦波。

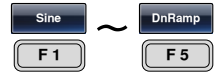
面板操作

1. 選擇 MOD

2. 按 F5 (SUM)

3. 按 F4 (Shape)

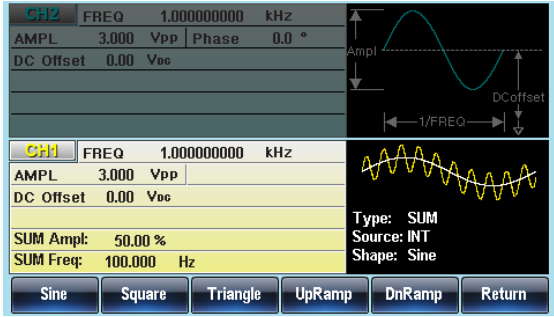
4. 按 F1~F5 選擇波形



5. 按 Return 返回菜單

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


CH2
FREQ 1.000000000 kHz
AMPL 3.000 Vpp
Phase 0.0 °
DC Offset 0.00 VDC
Ampl
DCoffset
1/FREQ
CH1
FREQ 1.000000000 kHz
AMPL 3.000 Vpp
DC Offset 0.00 VDC
SUM Ampl: 50.00 %
SUM Freq: 100.000 Hz
Type: SUM
Source: INT
Shape: Sine
Sine
Square
Triangle
UpRamp
DnRamp
Return

頻率調製波形

信號發生器將接受用於 FM 的內部或外部調製源。

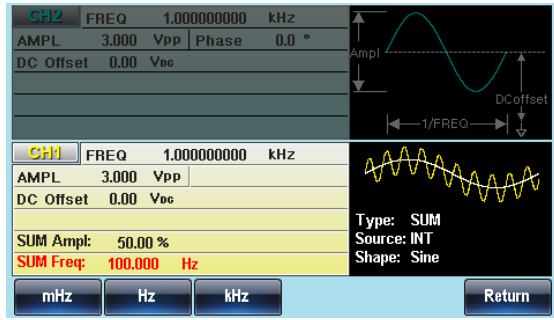
面板操作

1. 按 MOD 鍵

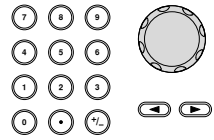
2. 按 F4 (PM)

3. 按 F3 (SUM Freq)

4. 位於波形顯示區域處的 PM 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 PM 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

總和偏移

總和偏移是載波與調製波的幅度最大偏差。

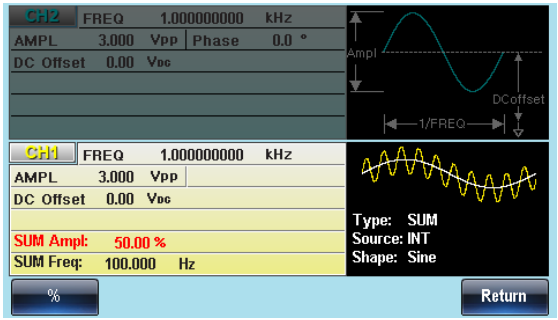
面板操作

1. 按 MOD 鍵

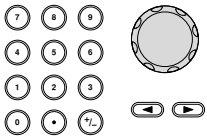
2. 按 F5 (SUM)

3. 按 F2 (SUM Ampl)

4. 位於波形顯示區域處的 SUM Ampl 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 選擇相位單位

範圍	相位偏移	0~100%
	默認相位	50%

選擇 (SUM) 調製源

信號發生器將接受用於 FM 調製的內部或外部源。默認為內部源。

面板操作

1. 按 MOD 鍵

2. 按 F5 (SUM)

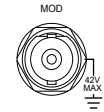
3. 按 F1 (Source)

4. 按 F1 (INT)或 F2 (EXT)選擇調製源

5. 按 Return 返回菜單

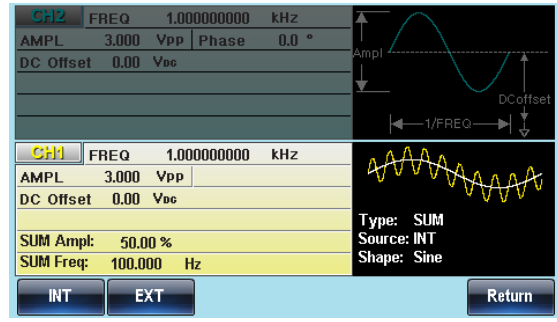
外部源

從後面板的 MOD 輸入端子接收外部調製信號



注意

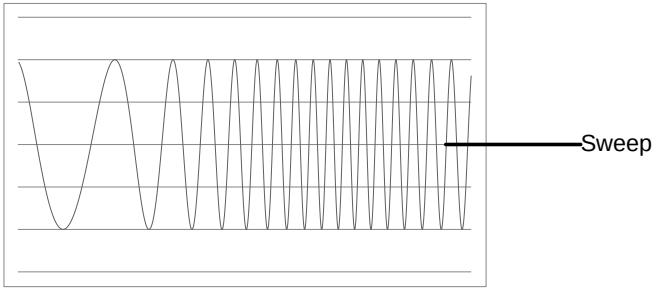
如果選擇外部調製源, 那麼頻偏將由後面板 MOD INPUT 上的± 5V 信號電壓控制。頻偏與調製信號電平成比例。例如，如果調製電壓為+5V, 那麼頻偏將等於設置的頻偏。外部信號電平越低，偏移就越小；而負信號電平將會使頻偏頻率降至載波頻率之下。



频率扫描

除雜訊波和脈衝波外，信號發生器可以對正弦波、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，信號發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。您也可以配置信號發生器，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。信號發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

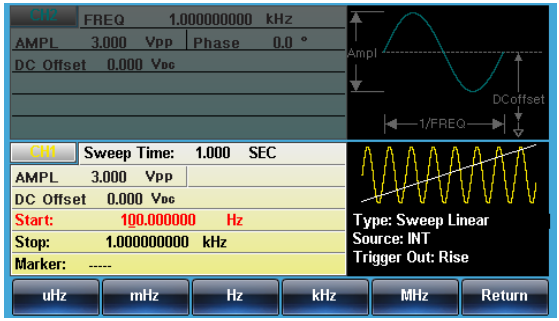
面板操作

1. 按 SWEEP 鍵

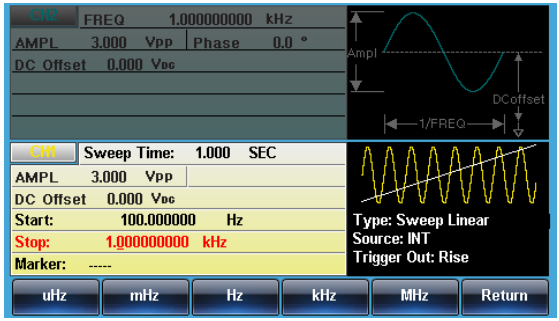
2. 按 F3 (Start)或 F4 (Stop)選擇起始或停止頻率

3. 位於波形顯示區域處的 Start 或 Stop 參數將變亮

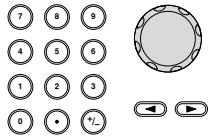
起始



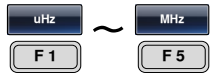
停止



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	
正弦波	1μHz~320MHz (max)
方波	1μHz~25MHz (max)
脈衝波	1μHz~25MHz (max)
三角波	1μHz~1MHz
起始	100Hz
終止	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，同步信號為 50%占空比的方波。在掃描開始時，同步信號處於 TTL 低電平，掃描中點上升到 TTL 高電平。同步信號頻率與指定掃描時間相等。打開標記，在掃描開始時同步信號處於 TTL 高電平，到達標識頻率處下降到 TTL 低電平。標記輸出端輸出同步信號。

中心頻率和跨距

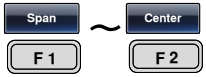
使用中心頻率和跨距來設置掃描上限和下限(起始/停止)。

面板操作

1. 按 SWEEP 鍵

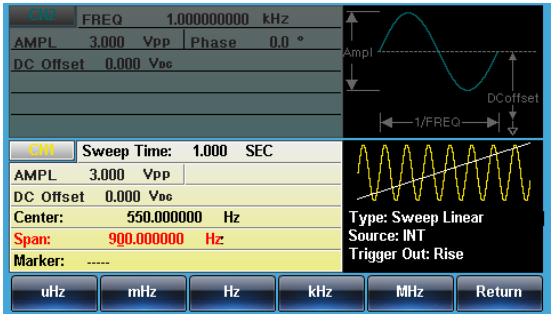
2. 按 F6 (More)

3. 按 F1 (Span)或 F2 (Center)選擇跨距或中心

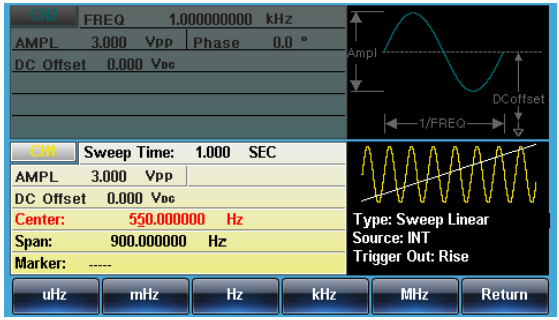


4. 位於波形顯示區域處的 Span 或 Center 參數將變亮

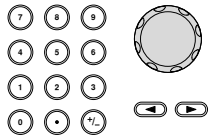
跨距



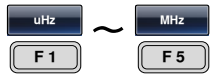
中心



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	
	正弦波	1μHz~320MHz (max)
	方波	1μHz~25MHz (max)
	脈衝波	1μHz~25MHz (max)
	三角波	1μHz~1MHz
	跨距頻率	
	正弦波	1μHz~320MHz (max)
	方波	1μHz~25MHz (max)
	脈衝波	1μHz~25MHz (max)
	三角波	1μHz~1MHz
	中心 – 默認	550Hz
	跨距 – 默認	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，同步信號為 50%占空比的方波。在掃描開始時，同步信號處於 TTL 低電平，掃描中點上升到 TTL 高電平。同步信號頻率與指定掃描時間相等。打開標記，在掃描開始時同步信號處於 TTL 高電平，到達標識頻率處下降到 TTL 低電平。標記輸出端輸出同步信號。

掃描模式

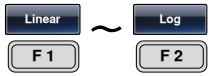
掃描模式用於選擇線性或對數掃描。預設線性掃描。

面板操作

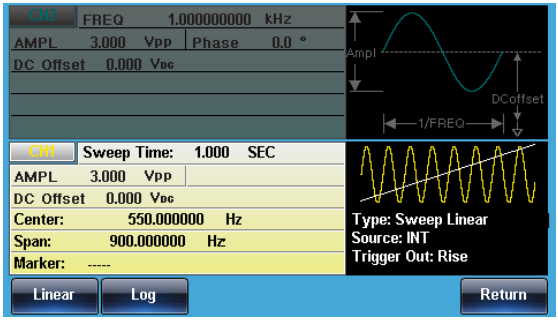
1. 按 SWEEP 鍵

2. 按 F2 (Type)

3. 按 F1 (Linear)或 F2 (Log)選擇線性或對數掃描



4. 按 Return 返回菜單



掃描時間

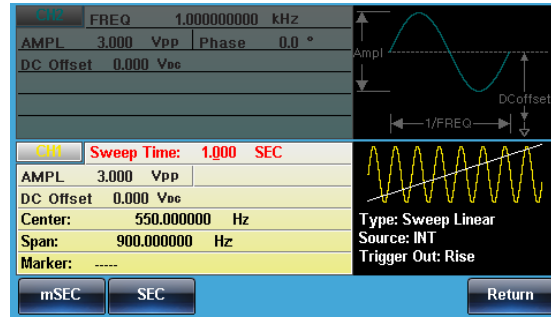
從起始頻率到截止頻率完成一次掃描所需的時間稱為掃描時間。信號發生器自動限定掃描的離散頻率點，該數目與掃描長度有關。

面板操作

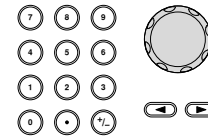
1. 按 SWEEP 鍵

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
	默認	1ms

標記頻率

標記信號變為低電平時的頻率稱為標記頻率(掃描開始時標記信號都處於高電平)。後面板 MARK 端子輸出標記信號。默認 550 Hz。

面板操作

1. 按 SWEEP 鍵

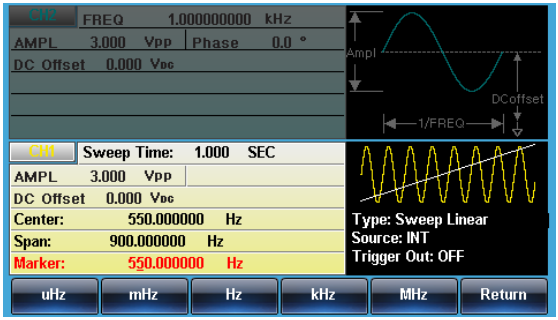
2. 按 F6 (More)

3. 按 F3 (Marker)

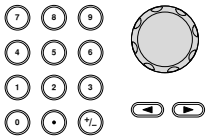
4. 按 F2 (ON/OFF)打開/關閉標記

5. 按 F1 (Freq)選擇標記頻率

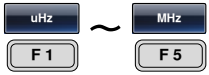
6. 位於波形顯示區域處的頻率參數將變亮



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	
	正弦波	1μHz~320MHz (max)
	方波	1μHz~25MHz (max)
	脈衝波	1μHz~25MHz (max)
	三角波	1μHz~1MHz
	默認	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

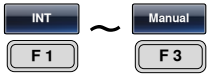
掃描模式下，信號發生器在收到觸發信號時輸出一個掃描。掃描輸出完成後，信號發生器輸出起始頻率，並等待下一次觸發。默認內部觸發源。

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 Return 返回菜單

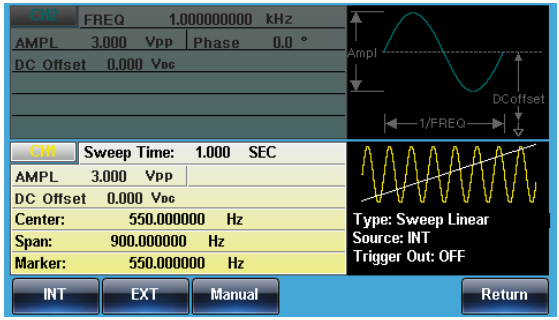
注意

選擇內部源時，信號發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，信號發生器就輸出一個掃描。

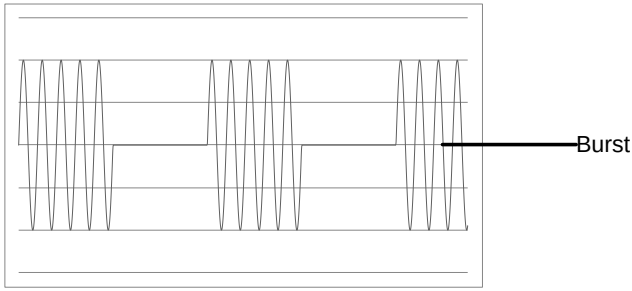
觸發週期必須大於或等於掃描時間+1ms。

5. 如果選擇手動觸發，按 F1 (Trigger)執行手動掃描



脉冲串模式

信號發生器能創建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，每次接收觸發時信號發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，信號發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。

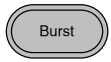
相比指定迴圈次數，門控模式使用外部觸發打開或關閉輸出。當觸發輸入信號為高電平時，波形持續輸出。當觸發輸入信號為低電平時，信號發生器在輸出最後一個完整波形後停止。輸出電壓電平仍與脈衝串波形的起始相位相同。

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

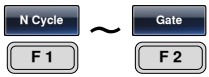
門控模式下，關閉脈衝串計數、脈衝串週期和觸發源。如果此時觸發，將不會有任何效果，也不會產生任何錯誤。

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

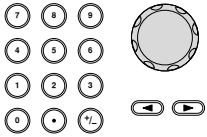
在 N 次迴圈和門控模式下，波形頻率定義了脈衝串波形的重複率。在 N 次迴圈模式下，以指定迴圈次數輸出波形。在門控模式下，當觸發信號為高電平時輸出波形頻率。脈衝串模式支援正弦波、方波、三角波或斜波。

面板操作

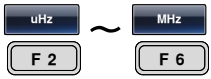
1. 按 FREQ/Rate 鍵

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-正弦波	1uHz~60MHz（最大）
	頻率 - 方波	1uHz~25MHz（最大）
	頻率 – Ramp 波	1uHz~1MHz
	默認	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)。默認 1 次迴圈。

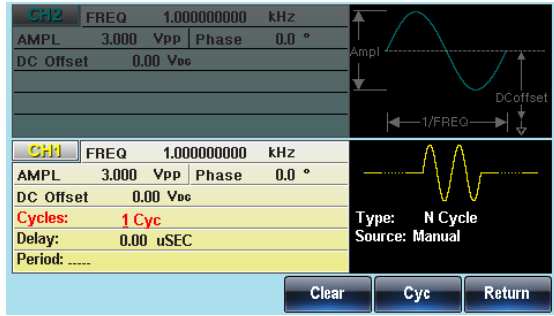
面板操作

1. 按 Burst 鍵

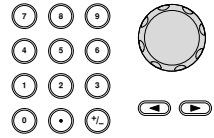
2. 按 F1 (N Cycle)

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 1~1000000

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，信號發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，信號發生器將記錄新計數，並在下次使用。

無限脈衝串計數

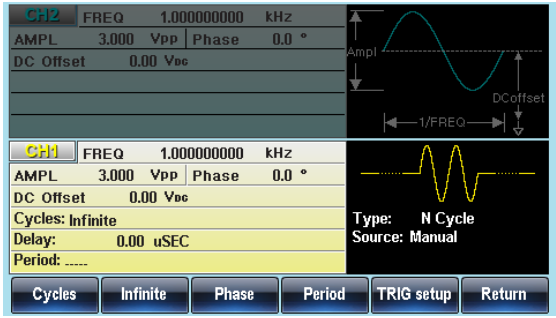
面板操作

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



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。

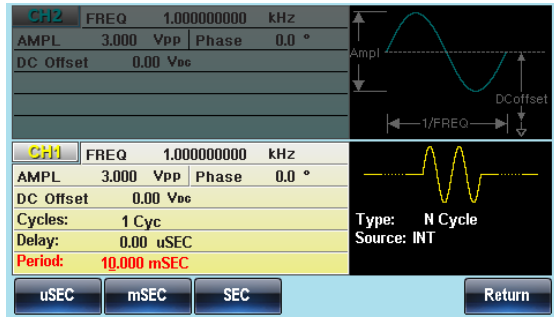
面板操作

1. 按 Burst 鍵

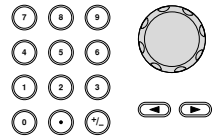
2. 按 F1 (N Cycle)

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
	默認	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。

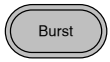
脈衝串週期一定要夠長，且滿足如下條件:
脈衝串週期>脈衝串計數/波形頻率 + 200ns

脈衝串相位

脈衝串波形的起始相位稱為脈衝串相位，默認 0˚。

面板操作

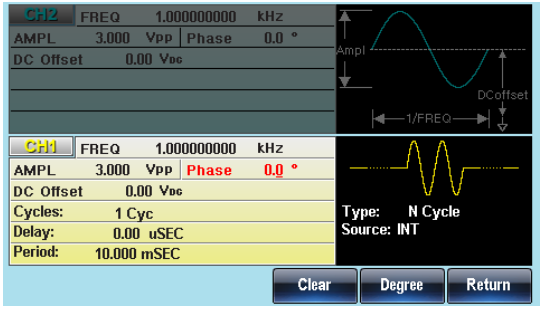
1. 按 Burst 鍵



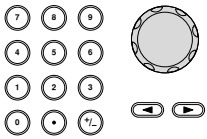
2. 按 F1 (N Cycle)

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˚
	默認	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 信號下降到低電平時，信號發生器完成當前波形後停止輸出。電壓輸出電平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，信號發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，信號發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。

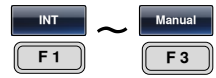
面板操作

1. 按 Burst 鍵

2. 按 F1 (N Cycle)

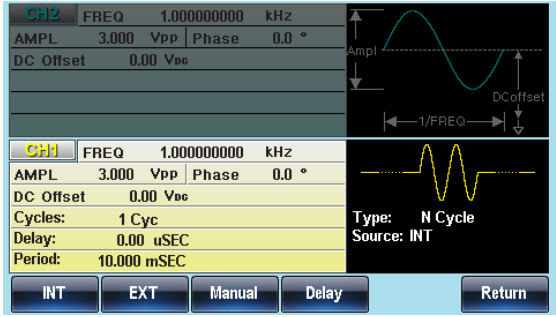
3. 按 F5 (TRIG setup)

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，信號發生器接收後面板觸發輸入端的觸發信號(TTL)。每收到一個觸發信號，信號發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信號將被忽略。

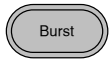
若使用手動或外部觸發，僅可用脈衝串相位和脈衝串迴圈/計數，脈衝串週期不可用。

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

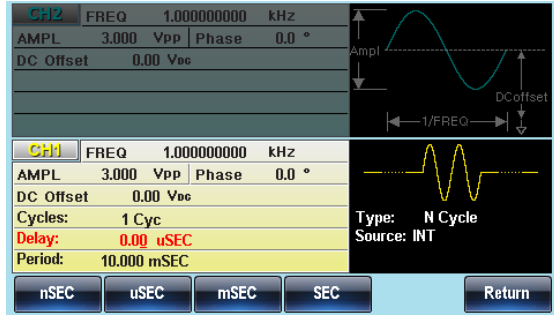


2. 按 F1 (N Cycle)

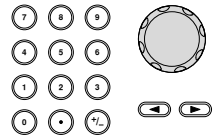
3. 按 F5 (TRIG setup)

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	0ns~100s
	默認	0s

脈衝串觸發輸出

觸發輸出端在後面板可用於脈衝或掃描模式輸出一個上升沿觸發信號，TTL 相容。預設情況下觸發信號上升沿。觸發信號是每一個脈衝串開始輸出。

面板操作

1. 按 Burst 鍵.

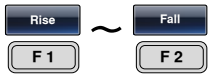
2. 按 F1 (N Cycle).

3. 按 F5 (TRIG setup).

4. 按 F5 (TRIG out).

5. 按 F3 (ON/OFF) 來切換觸發開關.

6. 選 F1 (Rise) 或 F2 (Fall) 邊沿觸發



注意

當選擇內部或外部觸發，觸發輸出信號將在一個 TTL 低/高水準，將在切換時指定的波形週期內完成。

當選擇手動觸發時，按下觸發軟按鍵觸發輸出。

當手動觸發時，函數發生器自動禁用觸發器輸出。使用手動觸發時，函數發生器從觸發輸出端輸出一個脈衝波（大於 1）。

輔助系統功能設置

辅助系统功能设置包括存储和调取设置、RS232/USB/GPIB 设置、查看软件版本、更新固件、自我校准、输出阻抗设置、改变语言和 DSO 连接设置。

存储和调取

MFG-2000 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	顯示垂直位置
	頻率	輸出開始
	長度	輸出長度
	顯示水準位置	
	設置	
	功能	AM
	波形	調製源
	頻率	波形
	脈衝寬度	深度
	方波占空比	AM 頻率
	斜波對稱性	ASK
	幅值	調製源
	幅值單位	波形
	偏移	速率
	調製類型	幅度
	蜂鳴器設置	FM
	阻抗	調製源
	主輸出	波形
	掃描	偏移
	源	FM 頻率
	類型	FSK
	觸發	調製源
	標記	波形

- 時間
- 起始頻率
- 停止頻率
- 中心頻率
- 跨距頻率
- 標記頻率

SUM
- 調製源
- 波形
- 速率
- 相位
- 速率
- 跳躍頻率

PM
- 調製源
- 波形
- 占空比
- 頻率

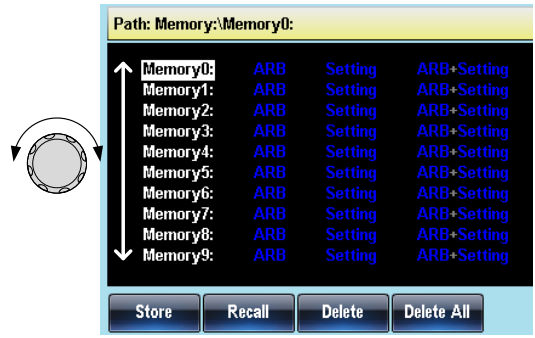
PSK
- 調製源
- 波形
- 速率
- 相位

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

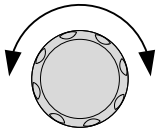
2. 按 F1 (Memory)



3. 選擇檔操作:

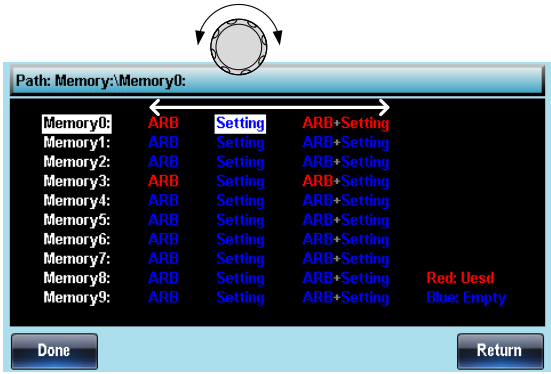
   F1 存儲檔, F2 調取檔, F3 刪除檔

4. 使用可調旋鈕選擇一個記憶體檔



5. 使用可調旋鈕選擇資料類型

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

选择远程接

MFG-2000 具有遠端控制局域網和 USB 介面,只有一個遠端介面可以在同一時間使用. LAN 介面只存在於 MFG-22xx 系列機器裡.

LAN 介面

背景

采用 LAN 接口时，必须指定一个 IP 地址（DHCP 的 IP，自动或手动配置）。

面板操作

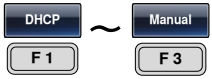
1. 按 UTIL 鍵.

2. 按 F2 (Interface).

3. 按 F3 (LAN).

4. 按 F2 (Config).

5. 選擇如何配置網路位址。按 F1（DHCP）、F2（自動 IP）、F3（手動）。

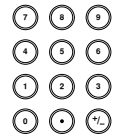


範圍		
	DHCP	使用 DHCP 自动配置一个 DHCP 服务器作為网络单元的 IP 地址。
	自動 IP	通过以太网电缆直接连接到主机时，使用自动配置单元的地址。
	手動	手动配置地址。

6. 如果選擇手動設置（IP 位址），F1，F2 和 F3（子網路遮罩）（閘道）反過來。

7. 把參數視窗中的位址、網路遮罩或閘道設置為高亮顯示.

8. 使用數位鍵盤輸入位址、網路遮罩或閘道。使用小數點作為欄位分隔符號。



9. 按 F5（做）確認設置。

10. 最後，按 F5（完成）以確認所有的 IP 配置設置。

局域網內的主機名稱

背景

下面介紹了如何在局域網介面中使用該單元的主機名稱。

面板操作

1. 按 UTIL 鍵.

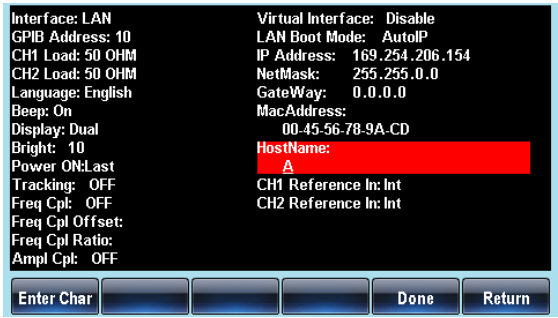
2. 按 F2 (Interface).

3. 按 F3 (LAN).

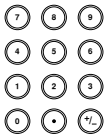
4. 按 F2 (Config).

5. 按 F4（主機名稱）設置為單位的主機名稱。

6. 把參數視窗中的主機名稱設置高亮顯示。



7. 使用滾動輪滾動每個字元。



8. 按 F1（輸入字元）來選擇一個角色，繼續下一個字元

9. 按 F5（做）來確認主機名稱。

USB 接口

背景 下面显示了如何通过 USB 接口配置远程控制仪表。

面板操作

1. 按 UTIL 鍵.

2. 按 F2 (Interface).

3. 按 F2 (USB).

系统和设置

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 

2. 按 F3(Cal.) 

3. 按 F2 (Software) 

查看版本

4. 按 F1(Version)查看固件版本 

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 

6. 按 F1（Select）選擇 CPU 文檔 

注意 FPGA 檔需放在 USB 根目錄下，升級選 CPU 檔即可，不可選 FPGA 檔。

語言選擇

背景 MFG-2000 提供英語(默認)和簡體中文兩種語言操作環境。

面板操作

1. 按 UTIL 鍵 

2. 按 F4 (System)

3. 按 F2 (Language)

22XX 還有 F1 中文選擇

4. Language 參數將變亮

5. F2 (English)選擇語（21XX）

22XX 還有中文（按 F1）

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 F4 (System)

3. 按 F4 (Beep)打開或關閉蜂鳴器

4. Beep 參數將變亮

顯示亮度

背景　顯示的亮度可從實用程式系統功能表中設置。

面板操作

1. 按 UTIL 鍵.

2. 按 F4 (System).

3. Press F5 (DisLight)(21XX)

22XX 是按 F5(More)後再按 F2(DisLight)

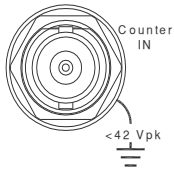
4. 按 F1~F3 選擇相應亮度。

頻率計數

Example: Turn on the frequency counter. Gate time: 1 second.

Output: N/A

Input:



1. Press UTIL, F6 (Counter).

2 . Press F2 (Gate Time), and press F3 (1 Sec) to choose a gate time of 1 second.

3 . Connect the signal of interest to the Frequency counter input on the rear panel.

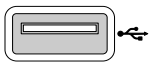
4. Input a 1kHz square wave signal into the Counter input on the rear panel. Set the gate time to 1S.

螢幕截圖

背景 信號發生器能截取螢幕圖像並將它們保存在 U 盤中

連接

1. 將 USBkey 插入後面板的 USB 端子



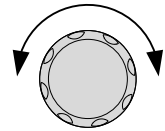
面板操作

2. 按 UTIL 鍵

3. 按 F4 (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, PM), 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

通道功能設置

通道功能設置包括輸出阻抗設置、輸出幅度檔位元設置、輸出波形極性、輸出相位設置、DSO 連接設置。

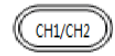
設置輸出阻抗

背景

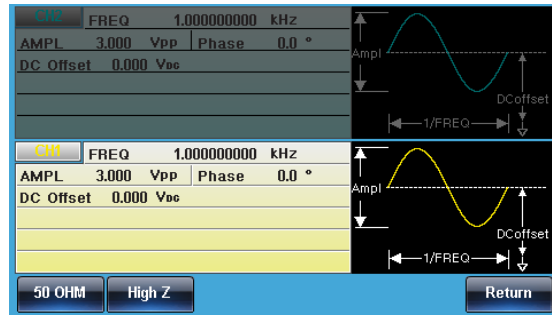
MFG-2000 提供可選輸出阻抗: 50Ω(默認)或 High-Z。輸出阻抗僅供參考，如果與實際負載阻抗不同，那麼實際幅值和偏移也將相應改變。

面板操作

1. 按 CH1/CH2 鍵



2. 按 F1 (Load)

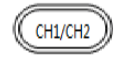


3. 按 F1 (50 OHM)或 F2 (High Z)選擇輸出阻抗

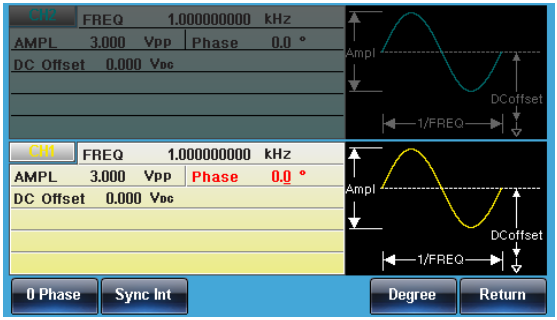
設置輸出波形相位

面板操作

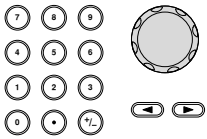
1. 按 CH1/CH2 鍵



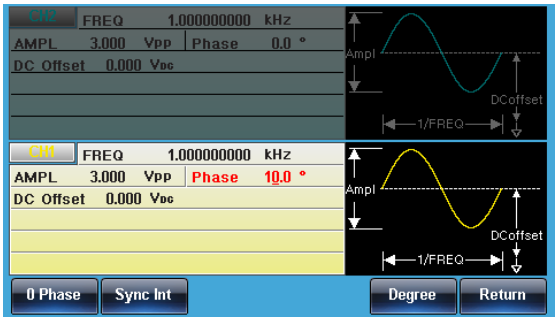
2. 按 F5(Phase)位於參數窗口處的 Phase 偏置參數將變亮



3. 使用方向鍵和可調旋鈕或數位鍵盤輸入 DC 偏置



4. 按 F5(Degree)選擇角度



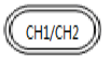
設置雙通道同相位

背景

MFG-2000 提供雙通道同相位功能。

面板操作

1. 按 CH1/CH2 鍵



2. 按 F5 (Phase)

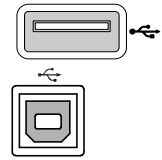
3. 按 F2 (S_Phase)同步雙通道相位

DSO 連接(只有 MFG-22XX 有)

背景

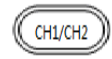
DSO 連接使 MFG-2000 和 GDS-1000/2000/3000 系列數位存儲示波器之間進行無損資料傳輸。(支援最大記錄長度 1M 點）

1. 將 MFG-2000 USB host 介面與 GDS-1000/2000/3000 的 USB B device 介面相連



面板操作

2. 按 CH1/CH2 鍵



3. 按 F6 (DSOLink)

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

雙通道操作

双通道部分，详细论述了如何在双通道模式下运行(MFG-2000 系列)和如何设置任一通道。

頻率耦合(只有 22XX 有)

背景

頻率耦合即選擇的通道的頻率偏移與為所選通道的頻率的頻率比。

面板操作

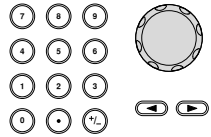
1. 按 UTIL 鍵.

2. 按 F5 (Dual Ch).

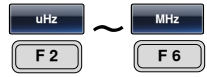
3. 按 F1 (Freq Cpl).

4. 設置選定通道的頻率，按 F2（偏移）。

使用選擇鍵，數位鍵或滾動輪輸入頻率偏移。

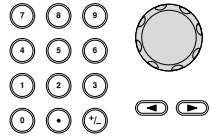


按 F2 ~ F6 選擇偏移頻率單位。



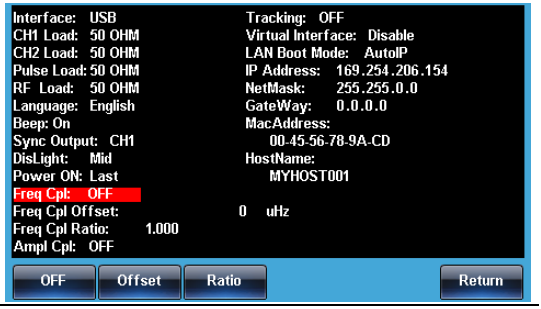
5. 按 F3 設置選中的通道頻率作為選擇的通道的頻率比

使用選擇鍵和滾動輪或數位鍵進入該比例。



按 F5 鍵（回車）確認

6. 另外，按 F1（關）禁用頻率耦合。



範圍	直流偏移範圍	-60MHz ~ 60MHz (最大)
	頻移解析度	1uHz. 未选择的通道的频率=选择通道的频率+偏移。选定通道的频率是固定的
	係數範圍	1000.000 ~ 0.001
	係數解析度	0.001. 係數=选择通道的频率选择通道的频率。选定通道的频率是固定的。

振幅耦合(只有 22XX 有)

背景

振幅耦合即傳遞的一個通道到另一個通道的幅度。當一個通道的振幅設置改變時，這些相同的設置會自動地反映在另一個通道中。

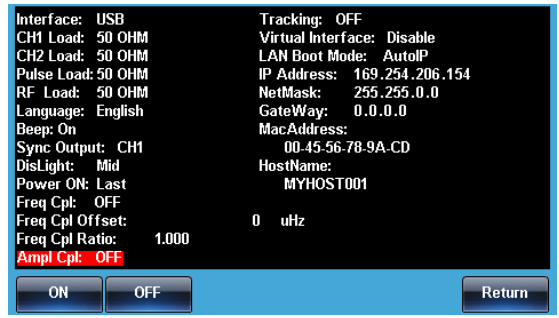
面板操作

1. 按 UTIL 鍵。

2. 按 F5 (Dual Ch)。

3. 按 F2 (Ampl Cpl)。

4. 按 F1 或 F2 關閉或打開振幅耦合。



通道跟蹤(只有 22XX 有)

背景

通道跟蹤將設置一個通道的波形輸出與其他通道相同。當一個通道的設置改變時，這些變化跟蹤到另一個通道上。此功能還具有執行反向跟蹤的能力，其中一個通道的輸出與另一個通道的關係是反向的。

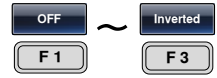
面板操作

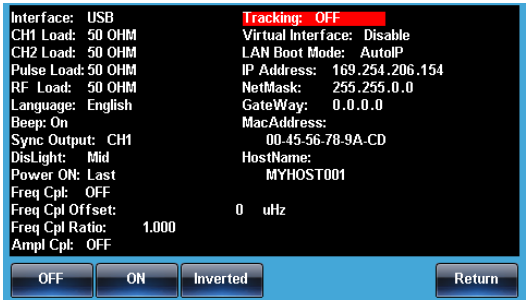
1. 按 UTIL 鍵。

2. 按 F5 (Dual Ch)。

3. 按 F3 (Tracking)。

4. 選擇跟蹤功能，按 F1，F2（下）(上)、F3（回車）。





相位同步(只有 22XX 有)

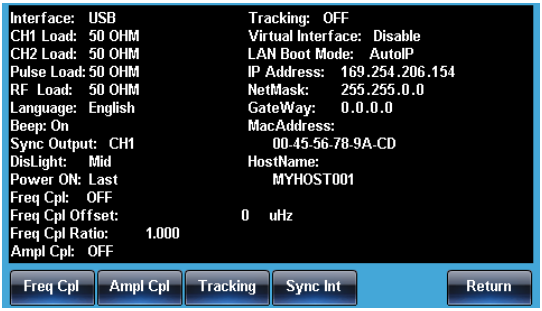
背景　　同時把兩個通道的相位置為 0º。

面板操作

1. 按 UTIL 鍵。

2. 按 F5 (Dual Ch)。

3. 按 F4 (Sync Int)。



任意波形

MFG-2000 系列信號發生器能夠創建自訂的任意波形，取樣速率 200MHz。每個波形 16k 資料點，垂直範圍在±8192(16384)以內。

插入內置波形

MFG-2000 系列信號發生器可以創建一些常見波形，包括公用，數學，窗函數和工程函數 66 種波形。

創建公用波

面板操作

1. 按 ARB 鍵

2. 按 F3(Built in)

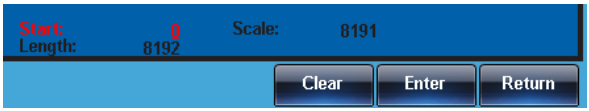
3. 按 F4 (Wave)

4. 按 F5（Select）

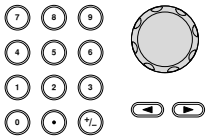
5. 按 F6（Return）

6. 按 F1 (Start)

7. Start 將變亮

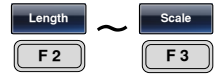


8. 使用方向鍵和可調旋鈕或數位鍵盤輸入起始位址



9. 按 F2 (Enter)確認 Start 點

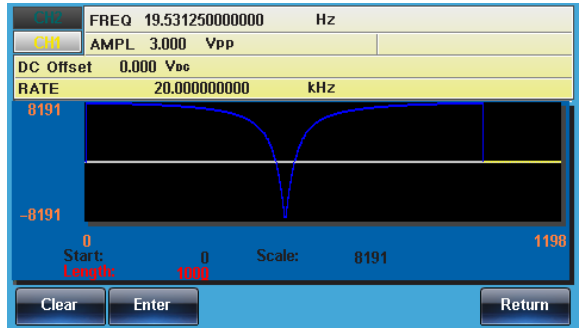
10. 按 Return 返回上級菜單 

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

12. 按 F5 (Done)完成操作 

13. 按 Return 返回上級菜單 

如下創建一個波，start:0, Length: 1000, Scale: 8191



显示任意波形

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

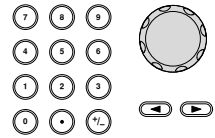
3. 按 F1 (Horizon)進入水準菜單

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

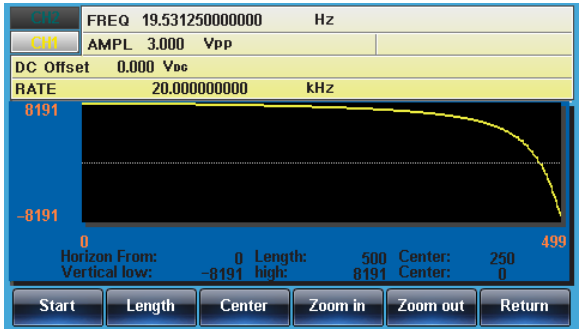


7. 按 Clear (F4)取消

8. 按 F5 (Enter)保存設置

9. 按 Return 返回上級菜單

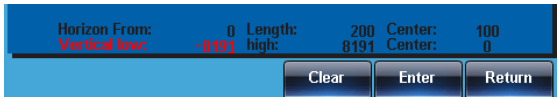
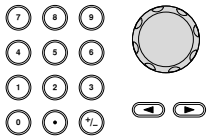
設置長度	10. 重複 4~9 步完成 Length (F2) 設置	Length F2
使用中心點	11. 重複 4~9 步完成 Center (F3) 設置	Center F3
Zoom in	12. 按 F4 (Zoom In)放大波形。長度每次減小一半。允許的最小長度為 3	Zoom in F4
Zoom out	13. 按 F5 (Zoom out)沿波形中點縮小。長度每次增加一倍。允許的最大長度為 16384 如下任意正弦波：start0、length 500、center 250	Zoom out F5



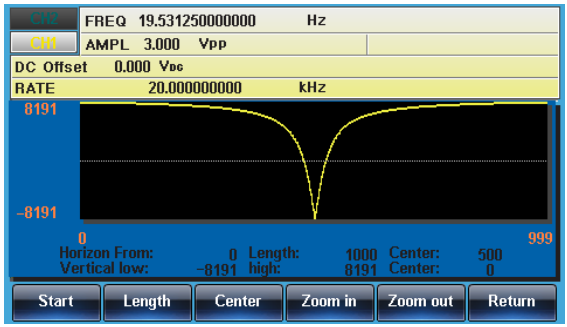
設置垂直顯示範圍

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	ARB
	2. 按 F1 (Display)	Display F1

	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 Return 返回上級菜單	
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- 8192，最大垂直高點為+8192	

如下正弦波：垂直最低點-8191、垂直最高點 8191、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

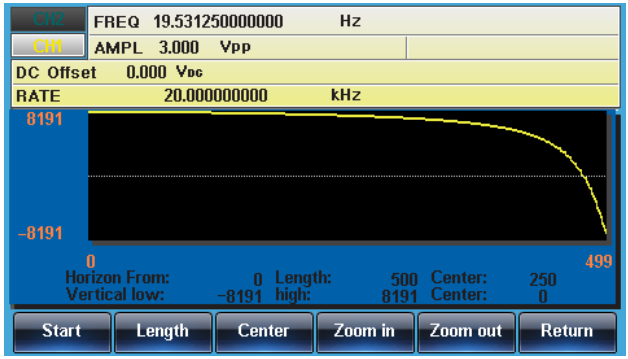
2. 按 F1 (Display)

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: 200→ 0
Length: 500
Center:450→250



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

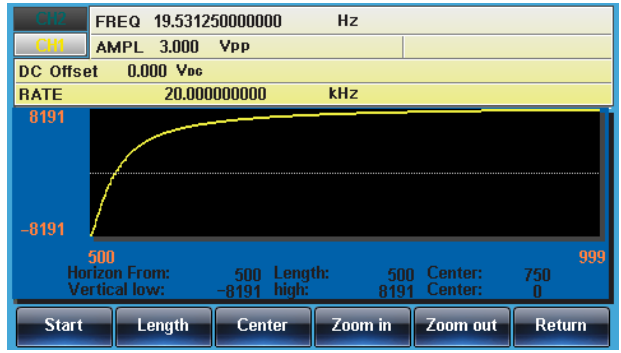
2. 按 F1 (Display)

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≤16384

選擇 Next Page 後，螢幕顯示如下：

Horizon From: 0 →500
Length: 500
Center:250→750



顯示

面板操作

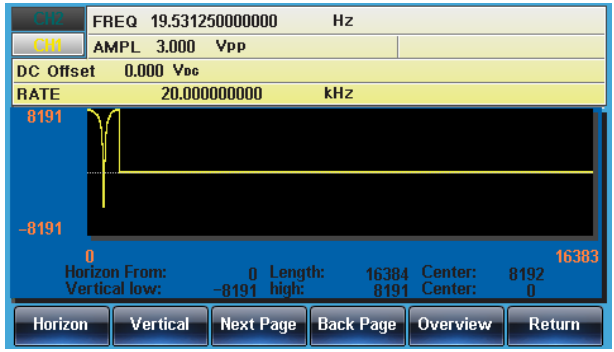
1. 按 ARB 鍵

2. 按 F1 (Display)

3. 按 F5 (Overview)顯示整個波形

水準: 0~1000,
垂直: -8192~ 8192

選擇 Overview 後，螢幕顯示如下：
Horizon From: 200→ 0
Length: 1199→16384
Center:799→8192
Vertical low/high: ±8192


CH2
FREQ 19.531250000000 Hz
CH1
AMPL 3.000 Vpp
DC Offset 0.000 VDC
RATE 20.000000000 kHz
8191
-8191
0
16383
Horizon From: 0 Length: 16384 Center: 8192
Vertical low: -8191 high: 8191 Center: 0
Horizon
Vertical
Next Page
Back Page
Overview
Return

编辑任意波形

增加一個點

背景 MFG-2000 提供強大的編輯功能，用戶可以在波形的任何位置創建點或線

面板操作

1. 按 ARB 鍵

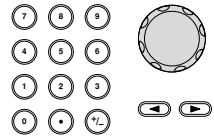
2. 按 F2 (Edit)

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



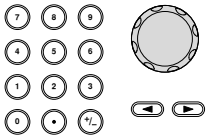
7. 按 F5 (Enter)保存設置

8. 按 Return 返回上級菜單

9. 按 F2 (Data)

10. Value 參數呈現紅色

11. 使用方向鍵和可調旋鈕或數位鍵盤輸入 Data 值



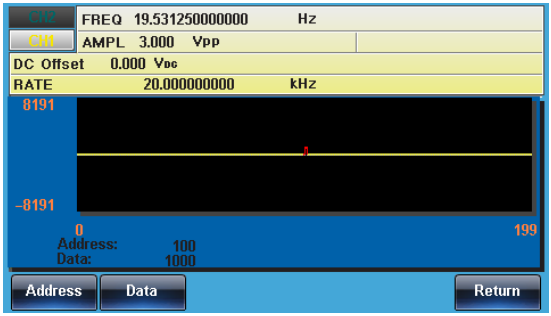
12. 按 F5 (Enter)保存設置

13. 按 Return 返回上級菜單

14. 再按 F6 (Return)返回 ARB 菜單

如下圖顯示：

Address 100，Data 1000



增加一條線

背景

MFG-2000 提供強大的編輯功能，用戶可以在波形的任何位置創建點或線

面板操作

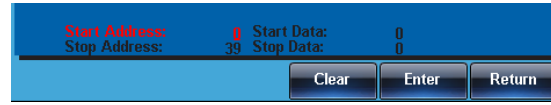
1. 按 ARB 鍵

2. 按 F2 (Edit)

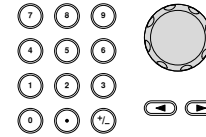
3. 按 F2 (Line)

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 Return 返回上級菜單

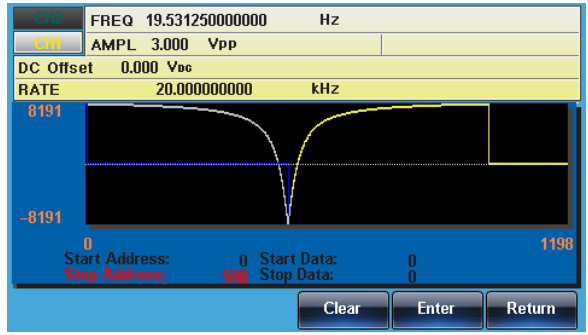
9. 重複 4~8 步，完成 Start Data (F2), Stop Address (F3)和 Stop Data (F4)設置

10. 按 F5 (Done)確認編輯

11. 按 Return 返回上級菜單

創建一條紅線，參數如下:

Start Address: 0, Start Data: 0
Stop Address: 500, Stop Data: 0



複製波形

面板操作

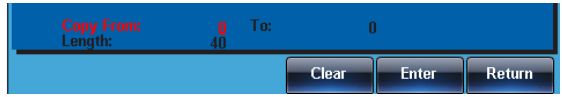
1. 按 ARB 鍵

2. 按 F2 (Edit)

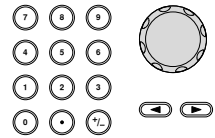
3. 按 F3 (Copy)

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 Return 返回上級菜單 

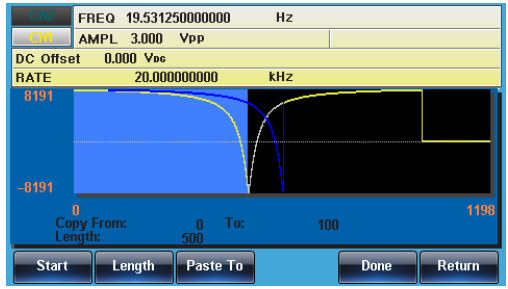
9. 重複 4~8 步完成 Length (F2)和 Paste To (F3)

10. 按 F5 (Done)確定選擇 

11. 按 Return 返回上級菜單 

將點 150~250 內的波形複製到點 300~400:

Copy From: 0
Length: 500
To: 100



清除波形

面板操作

1. 按 ARB 鍵 

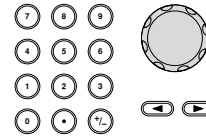
2. 按 F2 (Edit) 

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 — Enter / F5

8. 按 Return 返回上級菜單 — Return

9. 重複 4~8 步完成 Length (F2) 設置 — Length / F2

10. 按 F3 (Done)清除部分任意波形 — Done / F3

11. 按 Return 返回上級菜單 — Return

刪除所有

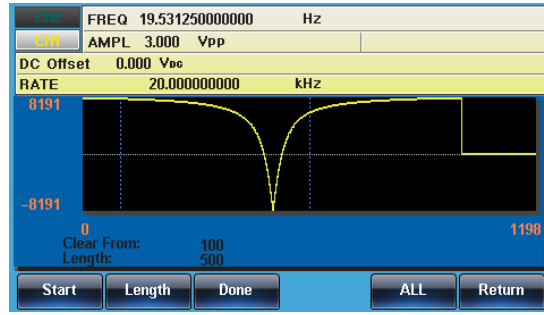
12. 按 F5 (ALL)刪除整個波形 — ALL / F5

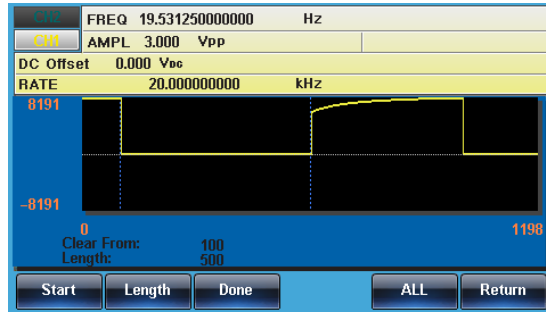
13. 再按 F5 (Done)確認刪除 — Done / F5

14. 按 Return 返回上級菜單 — Return

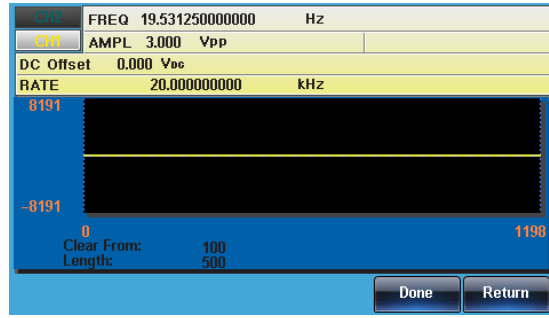
Start: 100, Length: 500.

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

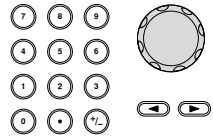
2. 按 F2 (Edit)

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 Return 返回上級菜單

9. 重複 4~8 步完成 Length (F3) 設置

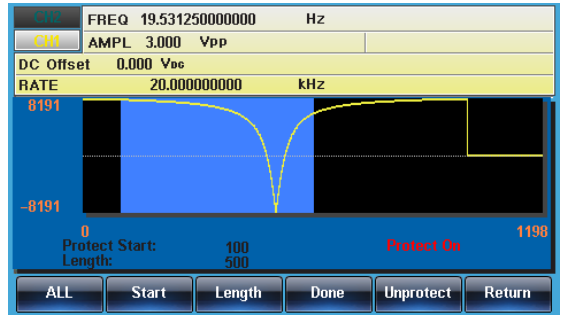
10. 按 F4 (Done)確認保護區域

11. 按 Return 返回上級菜單

	12. 按 F4 (Done)保護所選區域或波形	Done F4
保護整個波形	13. 按 F1 (ALL)保護整個波形	ALL F1
	14. 按 F6 (Done)確認	Done F6
	15. 按 Return 返回上級菜單	Return
解除保護	16. 按 F5 (Unprotect)解除保護波形	Unprotect F5
	17. 按 F6 (Done)確認	Done F6
	18. 按 Return 返回上級菜單	Return
	19. 波形背景變回黑色。“Unprotected”呈灰色	

波形保護區域以藍色背景顯示，如下圖：

Start:100, Length: 500



輸出任意波形

信號發生器能夠輸出高達 16k(2~16384)的任意波形。

輸出任意波形

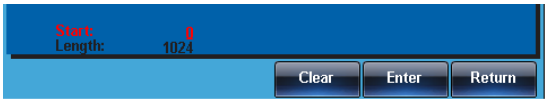
面板操作

1. 按 ARB 鍵

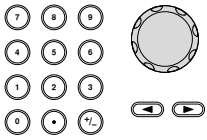
2. 按 F6 (Output)

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

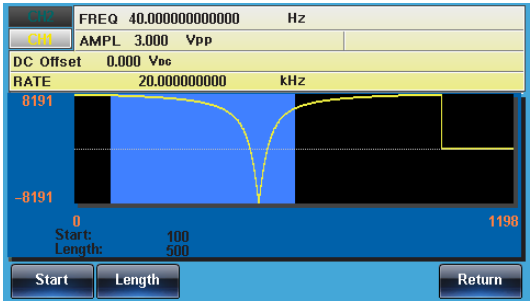
7. 按 Return 返回上級菜單

8. 重複 4~7 步完成 Length (F2) 設置

9. 按 Return 返回上級菜單

前面板端子輸出如下波形：

Start100，length 500


CH2
FREQ 40.000000000000 Hz
CH1
AMPL 3.000 Vpp
DC Offset 0.000 VDC
RATE 20.000000000 kHz
8191
-8191
0
1198
Start: 100
Length: 500
Start
Length
Return

存储/调取任意波形

MFG-2000 系列信號發生器可以創建一些常見波形，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

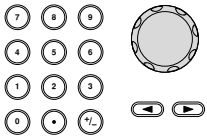
1. 按 ARB 鍵

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

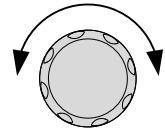
7. 按 F6 (Return)返回上級菜單

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

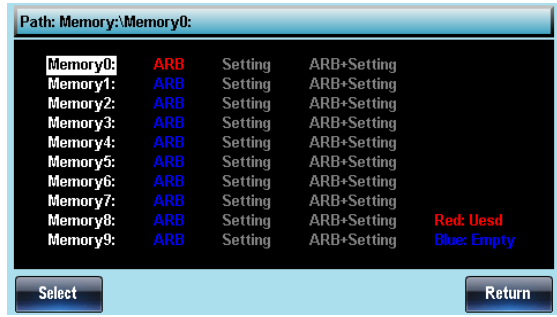
    ARB0~ARB9



11. 按 F1 (Select)將波形保存至所選檔

12. 按 Return 返回上級菜單

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

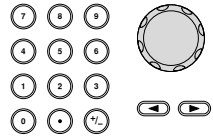
1. 按 ARB 鍵

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



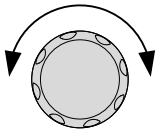
6. 按 F5 (Enter)確認起始點

7. 按 F6 (Return)返回上級菜單

8. 重複 4~8 步完成 Length (F2) 設置

9. 按 F4 (USB)

10. 使用可調旋鈕查找檔案系統

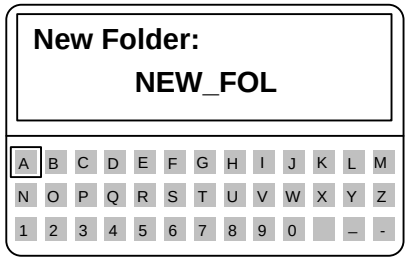


11. 按 Select 選擇目錄或檔案名

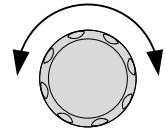
創建資料夾

12. 按 F2 (New Folder)

13. 顯示預設資料夾名稱“NEW_FOL”



14. 使用可調旋鈕移動游標



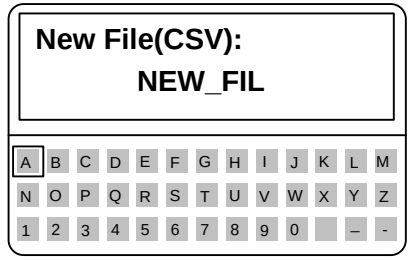
15. 使用 F1 (Enter Char)或 F2 (Backspace)創建資料夾名稱

16. 按 F5 (Save)保存

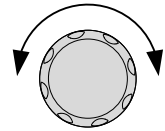
創建新文件

17. 按 F3 (New File)

18. 顯示預設檔案名“NEW_FIL”



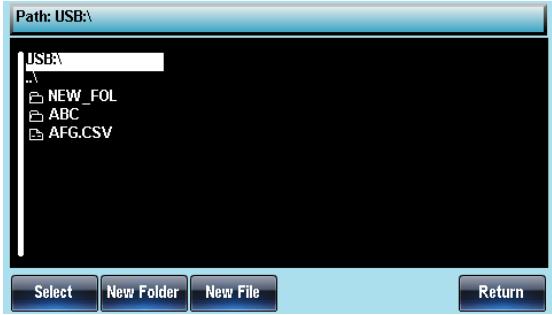
19. 使用可調旋鈕移動游標



20. 使用 F1 (Enter Char)或 F2 (Backspace)創建檔案名

21. 按 F5 (Save)保存

在根目錄下創建 ABC 資料夾和 MFG.CSV 文件，如圖所示：


Path: USB:\
USB:\
..\
NEW_FOL
ABC
AFG.CSV
Select
New Folder
New File
Return

從內部記憶體調取波形

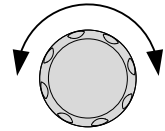
面板操作

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

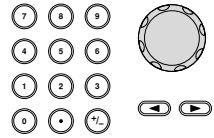


5. 按 Select 選擇目錄或檔案名

6. 按 F3 (To)選擇已調取波形的起始點

7. “Load To”呈現亮紅色

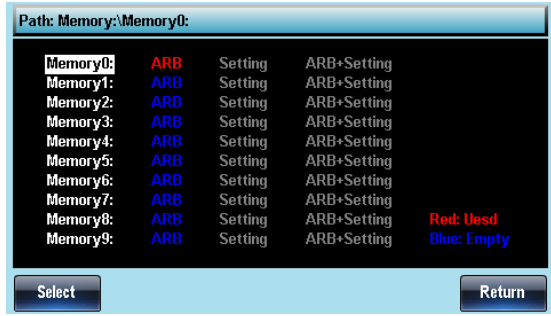
8. 使用方向鍵和可調旋鈕或數位鍵盤輸入起始點

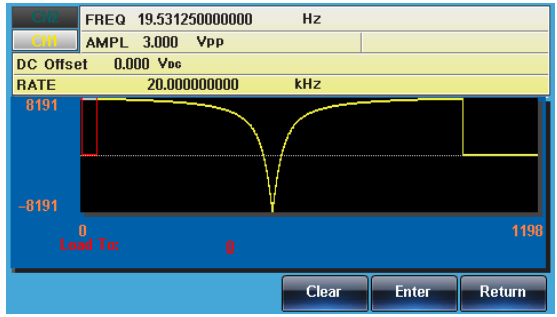


9. 按 F6 (Return)返回上級菜單

10. 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

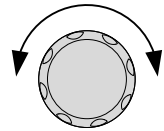
面板操作

1. 按 ARB 鍵

2. 按 F5 (Load)

3. 按 F2 (USB)

4. 使用可調旋鈕選擇檔案名

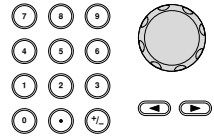


5. 按 F1 (Select)選擇檔

6. 按 F3 (To)選擇已調取波形的起始點

7. “Load To”呈現亮紅色

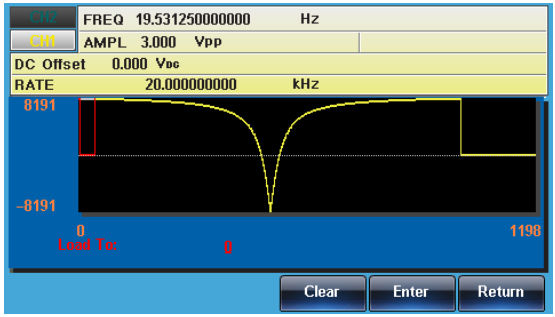
8. 使用方向鍵和可調旋鈕或數位鍵盤輸入起始點



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

确立远程连接

The MFG-2000 supports USBremote connections.

Configure USB interface

USB configuration	PC side connector	Type A, host
	MFG-2000 side connector	Type B, slave
	Speed	1.1/2.0 (full speed)

Panel Operation

1. Download and install the USB driver from the GW Instek website, www.gwinstek.com. Go to the Product > Signal Sources > Arbitrary Function Generators > AFG-30XX product page to find the USB driver setup file.

   Double click the driver file and follow the instructions in the setup wizard to install the driver.

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

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

Configure LAN interface

LAN configuration	MAC Address	Domain Name
	Instrument Name	DNS IP Address
	User Password	Gateway IP Address

Instrument IP Address Subnet Mask

HTTP Port 80 (fixed)

Panel Operation	1. Connect the LAN cable to the rear panel LAN port.	
	2. Press the Utility key followed by Interface (F2) and LAN (F3).	
DHCP Connections	Use DHCP to automatically configure the IP address of the unit for networks with a DHCP server.	
	3. Press Config (F2) followed by DHCP (F1), Done(F5). Press Done(F5) again.	
Auto IP Connections	Use Auto IP to automatically configure the IP address of the unit when it is directly connected to a host PC via the Ethernet cable.	
	4. Press Config (F2) followed by Auto IP (F2), Done(F5). Press Done(F5) again.	
Manual IP Connections	Manually configure the IP address.	
	5. Press Config (F2) followed by Manual (F3).	
	6. Press IP Addr (F1) and set the IP address using the number pad. Press Done (F1) to complete setting the IP Address.	

7. Press NetMask (F2) and set the mask address using the number pad. Press Done (F1) to complete setting the net mask.

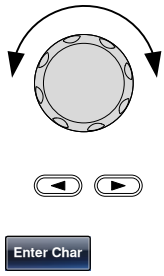
8. Press Gateway (F3) and set the gateway address using the number pad. Press Done (F1) to complete setting the gateway.

9. Press Done (F5) to complete setting the manual IP address and to return to LAN interface menu. Press Done(F5) again.

Setting the Host Name

10. Press Host Name (F4).

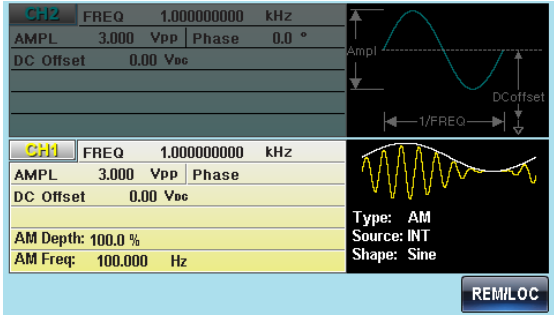
11. Enter the host name using the scroll wheel, arrow keys and soft-keys. Use the scroll wheel to highlight a character, and press Enter Char (F1) to select the highlighted character.



12. Press Done (F5) to finish setting the Host Name. Press Done(F5) again.

Remote control terminal connection

Terminal application	Invoke the terminal application such as MTTTY (Multi-Threaded TTY). ForUSB, 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, MFG-2000, 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 F5. 1. Press REM/LOCK (F6) to return the function generator to local mode. 


CH2
FREQ 1.000000000 kHz
AMPL 3.000 Vpp Phase 0.0 °
DC Offset 0.00 Vdc
Ampl
DCoffset
1/FREQ
CH1
FREQ 1.000000000 kHz
AMPL 3.000 Vpp Phase
DC Offset 0.00 Vdc
AM Depth: 100.0 %
AM Freq: 100.000 Hz
Type: AM
Source: INT
Shape: Sine
REM/LOC

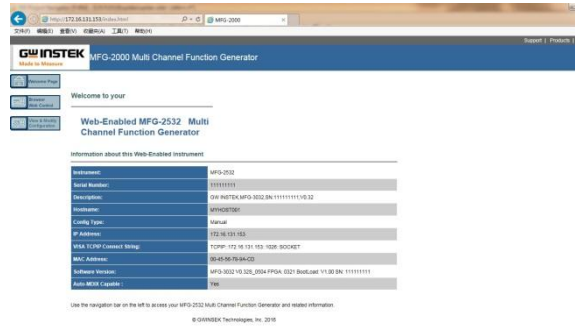
网络浏览器控制界面

The MFG--2000 also has a browser-based interface to remotely control the unit over a network.

Overview

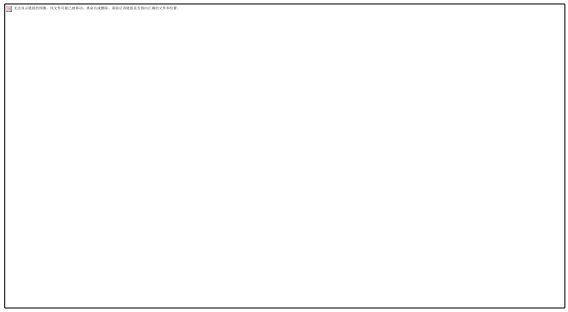
Welcome Page

The Welcome Page is the home page for the browser control interface. This page lists instrument information and the LAN configuration. It also has links to the Browser Web Control and the View & Modify Configuration pages.



Browser Web Control

The Browser Web Control allows you to remotely control and view the unit over a LAN. The unit can be controlled via a virtual control panel using a mouse, with SCPI controls via an SCPI input box or by running SCPI commands in a file.



View & Modify Configuration

The View & Modify Configuration page displays all the LAN configuration settings and allows you to edit the configuration.

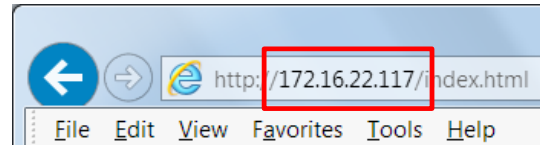
Operation

1. Configure the AFG-30XX interface to LAN and connect it to the LAN or directly to the PC (if the LAN interface is set to Auto IP).

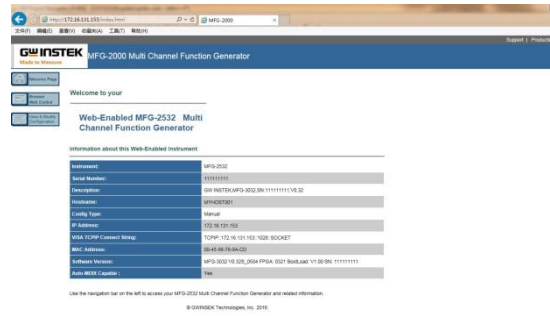
   See Page 错误！未定义书签。 for the LAN configuration details.

2. Next enable the virtual interface on the AFG-30XX. Press the Utility key followed by Interface (F2), LAN (F3) and Remote (F1) to enable/disable the Virtual interface.

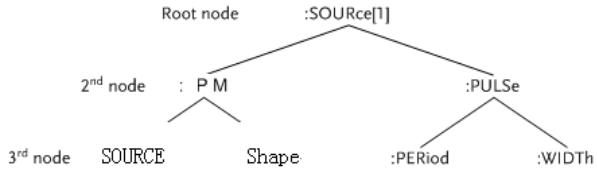
3. Enter the IP address of the unit into the address bar of your web browser as follows:



4. The Welcome page will appear in the browser.



指令語法

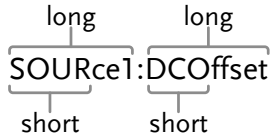
Compatible standard	IEEE488.2, 1992 (fully compatible) SCPI, 1994 (partially compatible)
Command Tree	The SCPI standard is an ASCII based standard that defines the command syntax and structure for programmable instruments. Commands are based on a hierarchical tree structure. Each command keyword is a 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|2|3|4] root node and the :PM 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	SOURce1: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

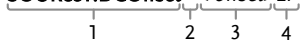
Commands and queries have two different forms, long and short. The command syntax is written with the short form of the command in capitals and the remainder (long form) in lower case.



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:dcoffst
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|2|3|4]:DCOffset? SOURce[1|2|3|4]:OUTPut? →SOURce1:DCOffset?;OUTPut?
	Colon + Semicolon (:;)	A colon and semicolon can be used to combine commands from different node levels. For example: SOURce1:PM:SOURce? SOURce:PULSe:WIDTh? →SOURce1:PM: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

指令列表

系统指令

SYSTem:ERRor? System Query

Description	Reads an error from the error queue. See page 错误！未定义书签。 for details regarding 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,MFG-2000,SN:XXXXXXXX,Vm.mm	
Query Syntax	***IDN?**	
Return parameter	<string>	
Example	***IDN?** GW INSTEK,MFG-2000,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?**
	MFG-2000 VX.XXX_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 MFG-2000, 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**

状态寄存器指令

*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.

接口设置指令

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
Syntax	**SYSTem:REMote**
Example	**SYST:REM**

应用指令

The APPLy command has 5 different types of outputs (Sine, Square, Ramp, Pulse, Noise,). 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 commandOUTPut[1|2|3|3RF|pulse] 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|2|3|3RF]: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|2|3|3RF]: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|2|3|3RF]:APPLy:SINusoid [<frequency> [,<amplitude> [,<offset>]]]	
Parameter	<frequency>	1μHz~320MHz
	<amplitude>	1mVpp~10Vpp (50 Ω)
	<offset>	-4.99V~4.99V (50 Ω)
Example	**SOUR1:APPL:SIN 2KHZ,MAX,MAX** Sets frequency to 2kHz and sets the amplitude and offset to the maximum.	

SOURce[1|2|3]: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|2|3]:APPLy:SQUare [<frequency> [,<amplitude> [,<offset>]]]	
Parameter	<frequency>	1μHz~25MHz
	<amplitude>	1mVpp~10Vpp (50Ω)
	<offset>	±5 Vpk ac +dc (50Ω)
Example	**SOUR1:APPL:SQU 2KHZ,MAX,MAX**	

Sets frequency to 2kHz and sets the amplitude and offset to the maximum.

SOURce[1|2|3]: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|2|3]:APPLy:RAMP [<frequency> [,<amplitude> [,<offset>]]]**	
Parameter	<frequency>	1μHz~1MHz
	<amplitude>	1mVpp~10Vpp (50Ω)
	<offset>	±5 Vpk ac +dc (50Ω)
Example	**SOUR1:APPL:RAMP 2KHZ,MAX,MAX**	
	Sets frequency to 2kHz and sets the amplitude and offset to the maximum.	

SOURce[1|2|3]:APPLy:PULSe

Source Specific Command

Description	Outputs a pulse waveform 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|2|3]: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|2|3]:PULS:PER command
Syntax	**SOUR[1|2|3|3RF|pulse]:APPLy:PULSe [<frequency> [,<amplitude> [,<offset>]]]**
Parameter	<frequency> 500μHz~25MHz <amplitude> 1mV~2.5 (50Ω) <offset> ±5 Vpk ac +dc (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|2|3]: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|2|3]:APPLy:NOISe [<frequency|DEFault> [,<amplitude> [,<offset>]]]**

Parameter	<frequency>	Not applicable
	<amplitude>	1mV~10V (50Ω)
	<offset>	±5 Vpk ac +dc (50Ω)
Example	**SOUR1:APPL:NOIS DEF, 3.0, 1.0** Sets the amplitude to 3 volts with an offset of 1 volt.	

SOURce[1|2|3]: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|2|3]:APPLy:USER [<frequency> [,<amplitude> [,<offset>]]]**

Parameter	<frequency>	1μHz~100MHz
	<amplitude>	0~10V (50Ω)
	<offset>	±5 Vpk ac +dc (50Ω)
Example	**SOUR1:APPL:USER 1KHZ,5.0,1.0**	

SOURce[1|2|3|3RF]: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|2|3|3RF|pulse]: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.

输出指令

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|2|3|3RF]: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|2|3|3RF]: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	Tria	Ramp	Pulse	Noise	ARB
AM	✓	✓	✓	✓	✓	×	✓
FM	✓	✓	✓	✓	×	×	×
PM	✓	✓	✓	✓	×	×	×
ASK	✓	×	×	×	×	×	×
FSK	✓	✓	✓	✓	✓	×	×
PSK	✓	×	×	×	×	×	×
SWEEP	✓	✓	✓	✓	×	×	×
BURST	✓	✓	✓	✓	×	×	×

Syntax	**SOURce[1|2|3|3RF]:FUNCtion {SINusoid|SQUare|RAMP| PULSe|NOISe| USER}**
Example	**SOUR1:FUNC SIN** Sets the output as a sine function.
Query Syntax	**SOURce[1|2|3|3RF]:FUNCtion?**
Return Parameter	SIN, SQU, RAMP, PULS, NOIS, USER — Returns the current output type.
Example	**SOUR1:FUNC?** ARB Current output is sine.

SOURce[1|2|3|3RF|pulse]:FREQuency

Source Specific Command

Description	Sets the output frequency for the theSOURce[1|2|3|3RF|pulse] :FUNCtion command. The query command returns the current frequency setting.
Note	The maximum and minimum frequency depends on the function mode.

	Sine, Square	1μHz~320MHz/25MHz
	Ramp	1μHz~1MHz
	Pulse	1μHz~25MHz
	Noise	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.

0.01% to 99.99%

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|2|3|3RF|pulse]:FREQuency {<frequency>|MINimum|MAXimum}**
Example	**SOUR1:FREQ MAX** Sets the frequency to the maximum for the current mode.
Query Syntax	**SOURce[1|2|3|3RF|pulse]:FREQuency?**
Return Parameter	<NR3> Returns the frequency for the current mode.
Example	**SOUR1:FREQ? MAX** +6.0000000000000E+07+1.0000000000000E+03 The maximum frequency that can be set for the current function is 60MHz.

SOURce[1|2|3|3RF|pulse]:AMPlitude

Source Specific Command

Description	The SOURce[1|2|3|3RF|pulse]:AMPLitude command sets the output amplitude for the selected channel. 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|2|3|3RF|pulse]:AMPlitude command is used. Alternatively, the VOLT:UNIT command can be used to set the amplitude units for all commands.
Syntax	**SOURce[1|2|3|3RF|pulse]:AMPlitude {< amplitude> |MINimum|MAXimum}**

Example	**SOUR1:AMP MAX** Sets the amplitude to the maximum for the current mode.	
Query Syntax	**SOURce[1|2|3|3RF|pulse]:AMPlitude? {MINimum|MAXimum}**	
Return Parameter	<NR3>	Returns the amplitude for the current mode.
Example	**SOUR1:AMP? MAX** +8.000E+00 The maximum amplitude that can be set for the current function is 8 volts.	

SOURce[1|2|3|3RF|pulse]: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.
Syntax	**SOURce[1|2|3|3RF|pulse]:DCOffset {< offset> |MINimum|MAXimum}**
Example	**SOUR1:DCO MAX**

	Sets the offset to the maximum for the current mode.	
Query Syntax	**SOURce[1|2|3|3RF|pulse]:DCOffset? {MINimum|MAXimum}**	
Return Parameter	<NR3>	Returns the offset for the current mode.
Example	**SOUR1:DCO?** +1.00E+00 The offset for the current mode is set to +1volts.	

SOURce[1|2|3]: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. 0.01% to 99.99% 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|2|3]: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|2|3]:SQUare:DCYCle? {MINimum|MAXimum}**

Return Parameter	<NR3>	Returns the duty cycle as a percentage.
Example	SOUR1:SQU:DCYC? +9.90E+01 The duty cycle is set 99%.	

SOURce[1|2|3]: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|2|3]:RAMP:SYMMetry {< percent> |MINimum|MAXimum}**
Example	**SOUR1:RAMP:SYMM +5.00E+01** Sets the symmetry to the 50%.
Query Syntax	**SOURce[1|2|3]:RAMP:SYMMetry? {MINimum|MAXimum}**

Return Parameter	<NR3>	Returns the symmetry as a percentage.
Example	SOUR1:RAMP:SYMMetry? +5.00E+01 Sets the symmetry to the 50%.	

SOURce[1|2|3|3RF]:PULSe:WIDTh

Source Specific Command

Description	Sets or queries the pulse width. The default pulse width is 50us. Pulse width is defined as the time from the rising to falling edges (at a threshold of 50%).
Note	The pulse width is restricted to the following limitations: Pulse Width ≥ Minimum Pulse Width Pulse Width < Pulse Period - Minimum Pulse Width
Syntax	**SOURCEPULSE:PULSe:WIDTh {<seconds>|MINimum|MAXimum}**
Example	**SOURCEPULSE:PULS:WIDT MAX** Sets the pulse width to the maximum allowed.
Query Syntax	**SOURCEPULSE:PULSe:WIDTh? [MINimum|MAXimum]**
Return Parameter	<seconds> ≧20 ns (limited by the current frequency setting)
Example	**SOURCEPULSE:PULS:WIDT?** +2.000000000000E-08 The pulse width is set to 20 nanoseconds.

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[1|2|3|3RF|pulse] {OFF|ON}**
Example	**OUTP1 ON** Turns the output on.
Query Syntax	**OUTPut[1|2|3|3RF|pulse]?**
Return Parameter	1 ON 0 OFF
Example	**OUTP1?** **1** The channel 1 output is currently on.

OUTPut[1|2|3|3RF|pulse]: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[1|2|3|3RF|pulse]:LOAD {DEFault|INFinity}**
Example	**OUTP1:LOAD DEF** Sets the output termination to 50Ω.

Query Syntax	**OUTPut[1|2|3|3RF|PULSe]:LOAD?**	
Return Parameter	DEF	Default
	INF	INFinity
Example	**OUTP1:LOAD?**	
	DEF	
	The output is set to the default of 50Ω.	

SOURCE[1|2|3|3RF|pulse]:VOLTage:UNIT

Source Specific Command

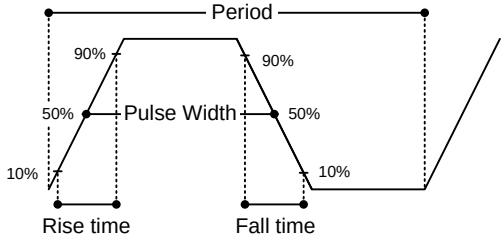
Description	Sets or queries the output amplitude units. There are three types of units: VPP, VRMS and DBM.
Note	The units set with the VOLTage:UNIT command will be used as the default unit for all amplitude units unless a different unit is specifically used for a command. If the output termination is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

Return Parameter	VPP	Vpp
	VRMS	Vrms
	DBM	dBm

Example	**SOURCEPULSE:VOLT:UNIT?**
	VPP
	The amplitude units are set to Vpp.

脉冲设置指令

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



SOURCEPULSE:PULSe:WIDTh

Source Specific Command

Description	Sets or queries the pulse width. The default pulse width is 50us. Pulse width is defined as the time from the rising to falling edges (at a threshold of 50%).	
Note	The pulse width is restricted to the following limitations: Pulse Width ≥ Minimum Pulse Width Pulse Width < Pulse Period - Minimum Pulse Width	
Syntax	**SOURCEPULSE:PULSe:WIDTh {<seconds>|MINimum|MAXimum}**	
Example	**SOURCEPULSE:PULS:WIDT MAX** Sets the pulse width to the maximum allowed.	
Query Syntax	**SOURCEPULSE:PULSe:WIDTh? [MINimum|MAXimum]**	
Return Parameter	<seconds>	≧20 ns (limited by the current frequency setting)

Example	**SOURCEPULSE:PULS:WIDT?** +2.000000000000E-08 The pulse width is set to 20 nanoseconds.

SOURCEPULSE:PULSe:DCYCle

Source Specific Command

Description	Sets or queries the pulse duty cycle.
Note	The duty cycle is restricted to the following limitations: Pulse Duty Cycle ⩾ 100×Minimum Pulse Width ÷ Pulse Period Pulse Duty Cycle < 100×(1-Minimum Pulse Width÷Pulse Period)
Syntax	**SOURCEPULSE:PULSe:DCYCle{<percent>|MINimum|MAXimum}**
Example	**SOURCEPULSE:PULS:DCYC MAX** Sets the duty to the maximum allowed.
Query Syntax	**SOURCEPULSE:PULSe:DCYCle? [MINimum|MAXimum]**
Return Parameter	<NR3> — 0.01%~99.99%(limited by the current frequency setting)
Example	**SOURCEPULSE:PULS:PULS:DCYC?** +1.0000E+01 The duty cycle is set to 10%

SOURCEPULSE:PULSe:TRANsition :LEADing

Source Specific Command

Description	Sets or queries the pulse leading edge time. The default rise time is 10ns. The leading and trailing edge time can be different.
Note	The leading edge time is limited by the pulse

	width as noted below: Leading/Trailing Edge Time ≤ 0.625 × Pulse Width	
Syntax	**SOURCEPULSE:PULSe:TRANsition:LEADing {<seconds>|MINimum|MAXimum}**	
Example	**SOURCEPULSE:PULS:TRANsition:LEADing MAX** Sets the pulse transition trailing to the maximum allowed.	
Query Syntax	**SOURCEPULSE:PULSe:TRANsition:LEADing? [MINimum|MAXimum]**	
Return Parameter	<seconds>	≧10ns (limited by the current frequency and pulse width settings)
Example	**SOURCEPULSE:PULS:TRANsition:LEADing?** +8.0000E-08 The pulse transition trailing is set to 80 nanoseconds.	

SOURCEPULSE:PULSe:TRANsition :TRAIling

Source Specific Command

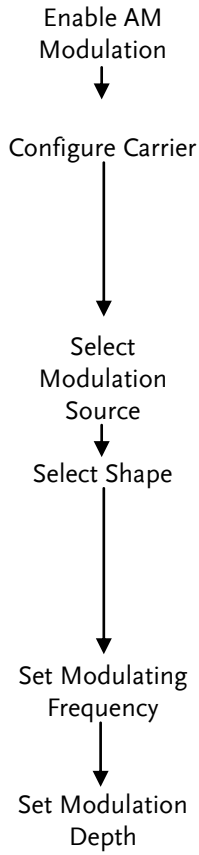
Description	Sets or queries the pulse trailing edge time. The default rise time is 10ns. The leading and trailing edge time can be different.
Note	The trailing edge time is limited by the pulse width as noted below: Leading/Trailing Edge Time ≤ 0.625 × Pulse Width
Syntax	**SOURCEPULSE:PULSe:TRANsition:TRAIling {<seconds>|MINimum|MAXimum}**
Example	**SOURCEPULSE:PULS:TRANsition:TRAIling MAX**

	Sets the pulse transition trailing to the maximum allowed.	
Query Syntax	**SOURCEPULSE:PULSe:TRANsition:TRAIling? [MINimum|MAXimum]**	
Return Parameter	<seconds>	≧10ns (limited by the current frequency and pulse width settings)
Example	**SOURCEPULSE:PULS:TRANsition:TRAIling?**	
	+8.0000E-08	
	The pulse transition trailing is set to 80 nanoseconds.	

幅值调制(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|2|3RF]: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|2|3RF]: AM:SOUR command.
4. Use the SOURce[1|2|3RF]: 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|2|3RF]: AM:INT:FREQ command. For internal sources only.
6. Set the modulation depth using the SOURce[1|2|3RF]: AM:DEPT command.

SOURce[1|2|3RF]: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|2|3RF]:AM:STATe {OFF|ON}**	
Example	**SOUR1:AM:STAT ON** Enables AM modulation.	
Query Syntax	**SOURce[1|2|3RF]:AM:STATe?**	
Return Parameter	0	Disabled (OFF)
	1	Enabled (ON)
Example	**SOUR1:AM:STAT?** **1** AM modulation mode is currently enabled.	

SOURce[1|2|3RF]: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. The RF channel supports only the internal modulation mode.

Syntax	**SOURce[1|2|3RF]:AM:SOURce {INTernal|EXTernal}**
Example	**SOUR1:AM:SOUR EXT** Sets the modulation source to external.
Query Syntax	**SOURce[1|2|3RF]:AM:SOURce?**

Return Parameter		
	INT	Internal
	EXT	External

Example	**SOUR1:AM:SOUR?** **INT** The modulation source is set to internal.

SOURce[1|2|3RF]: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|2|3RF]: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|2|3RF]: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|2|3RF]:AM:INTernal:FREQuency

Source Specific Command

Description	Sets the frequency of the internal modulating waveform only. The default frequency is 100Hz.	
Syntax	**SOURce[1|2|3RF]: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|2|3RF]:AM:INTernal:FREQuency? [MINimum|MAXimum]**	
Return Parameter	<NR3>	Returns the frequency in Hz.
Example	**SOUR1:AM:INT:FREQ?** **+1.0000000E+02** Returns the frequency to 100Hz.	

SOURce[1|2|3RF]:AM:DEPTh

Source Specific Command

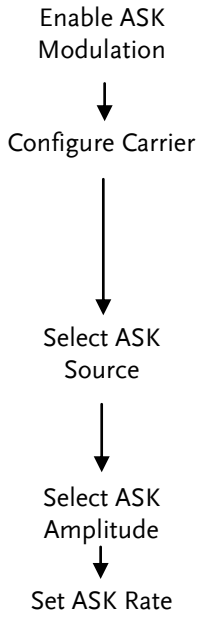
Description	Sets or queries the modulation depth for internal sources only. The default is 100%.	
Note	The function generator will not output more than ±5V, regardless of the modulation depth. The modulation depth of an external source is controlled using the ±5V MOD INPUT terminal on the rear panel, and not the SOURce[1|2|3RF]:AM:DEPTh command.	
Syntax	**SOURce[1|2|3RF]: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|2|3RF]:AM:DEPTh? [MINimum|MAXimum]**	
Return Parameter	<NR3>	Return the modulation depth as a percentage.
Example	**SOUR1:AM:DEPT?**	
	+5.0000E+01	
	The modulation depth is 50%.	

振幅键控(ASK)指令

ASK 介紹

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



1. Turn on ASK modulation using the SOURce[3RF]: ASK:STAT ON command.
2. Use the APPLy command to select a carrier waveform. Alternatively, the 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[3RF]:ASK:MOD:INT command.
4. Set the hop frequency using the SOURce[3RF]:ASK:FREQ command.
5. Use the SOURce[3RF]: ASK:INT:RATE command to set the ASK rate. The ASK rate can only be set for internal sources.

SOURce[3RF]:ASKey:STATe

Source Specific Command

Description	Turn on or off the ASK modulation function of the specified channel. Query the on/off status of the ASK modulation function of the specified channel.
Note	Burst or sweep mode will be disabled if ASK modulation is enabled. As only one modulation is allowed at any one time, other modulation modes will be disabled when ASK modulation is enabled.

Syntax	**SOUR[3RF]:ASK:STATe {OFF|ON}**	
Example	**SOURce3RF:ASK:STAT ON** Enables ASK modulation.	
Query Syntax	**SOURce[3RF]:ASK:STATe?**	
Return Parameter	0	Disabled (OFF)
	1	Enabled (ON)
Example	**SOURce3RF:ASK:STAT?** **1** ASK modulation mode is currently enabled.	

SOURce[3RF]:ASKey:SOURce

Source Specific Command

Description	Sets or queries the ASK source as internal or external. Internal is the default source.
Note	External ASK source can not be supported.
Syntax	**SOURce[3RF]:ASKey:SOURce {INTernal|EXTernal}**
Example	**SOURce3RF:ASK:SOUR EXT** Sets the ASK source to external.
Query Syntax	**SOURce[3RF]:ASKey:SOURce?**
Return Parameter	INT — Internal EXT — External
Example	**SOURce3RF:ASK:SOUR?** **EXT** The ASK source is set to external.

SOURce[3RF]:ASK:AMPlitude

Source Specific Command

Description	Sets the ASK amplitude. The default modultaion amplitude is set to 0.5V.
Note	For ASK, the modulating waveform is a square wave with a duty cycle of 50%.

Syntax	**SOURce[3RF]:ASKey:AMPlitude {<voltage>|MINimum|MAXimum}**	
Parameter	<amplitude>	0V～max
Example	**SOURce3RF:ASK:AMPlitude0.5V** Sets the ASK amplitude to 0.5V.	
Query Syntax	**SOURce[3RF]:ASKey: AMPlitude? [MINimum|MAXimum]**	
Return Parameter	<NR3>	Returns the depth.
Example	**SOURce3RF:ASK:AMPlitude 5.000E-01** Returns depthto 0.5V.	

SOURce[3RF]:ASKey:INTernal RATE

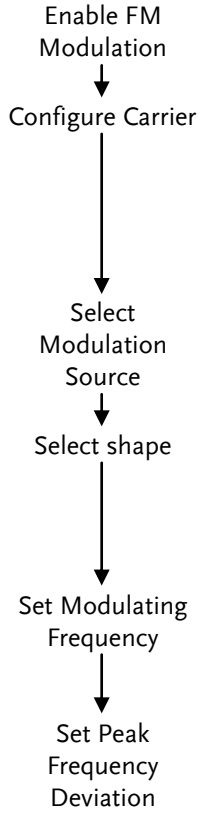
Source Specific Command

Description	Sets or queries the ASK rate for internal sources only.	
Note	External sources will ignore this command.	
Syntax	**SOURce[3RF]:ASKey:INTernal:RATE {<rate in Hz>|MINimum|MAXimum}**	
Parameter	<rate in Hz>	2 mHz~1MHz
Example	**SOURce3RF:ASK:INT:RATE MAX** Sets the rate to the maximum (1MHz).	
Query Syntax	SOURce[3RF]:ASKey:INTernal:RATE? [MINimum|MAXimum]	
Return Parameter	<NR3>	Returns the ASK rate in Hz.
Example	**SOURce3RF:ASK:INT:RATE?** **+1.0000E+06** Returns the maximum ASK rate allowed.	

频率调制(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|2|3|3RF]: 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|2|3|3RF]:FM:SOUR command.
4. Use the SOURce[1|2|3|3RF]: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|2|3|3RF]: FM:INT:FREQ command. For internal sources only.
6. Use the SOURce[1|2|3|3RF]:FM:DEV command to set the frequency deviation.

SOURce[1|2|3|3RF]: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|2|3|3RF]:FM:STATe {OFF|ON}**	
Example	**SOUR1:FM:STAT ON** Enables FM modulation.	
Query Syntax	**SOURce[1|2|3|3RF]:FM:STATe?**	
Return Parameter	0	Disabled (OFF)
	1	Enabled (ON)
Example	**SOUR1:FM:STAT?** **1** FM modulation mode is currently enabled.	

SOURce[1|2|3|3RF]: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. The RF channel supports only the internal modulation mode.

Syntax	**SOURce[1|2|3|3RF]:FM:SOURce {INTernal|EXTernal}**			
Example	**SOUR1:FM:SOUR EXT** Sets the modulation source to external.			
Query Syntax	**SOURce[1|2|3|3RF]:FM:SOURce?**			
Return Parameter	INT	Internal		
	EXT	External		
Example	**SOUR1:FM:SOUR?** **INT** The modulation source is set to internal.			

SOURce[1|2|3|3RF]: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|2|3|3RF]: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|2|3|3RF]: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|2|3|3RF]:FM:INTernal :FREQuency

Source Specific Command

Description	Sets the frequency of the internal modulating waveform only. The default frequency is 10Hz.	
Syntax	**SOURce[1|2|3|3RF]:FM:INTernal:FREQuency {<frequency>|MINimum|MAXimum}**	
Parameter	<frequency>	2 mHz~ 20 kHz
Example	**SOUR1:FM:INT:FREQ 100** Sets the modulating frequency to 100Hz.	
Query Syntax	**SOURce[1|2|3|3RF]:FM:INTernal:FREQuency? [MINimum|MAXimum]**	
Return Parameter	<NR3>	Returns the frequency in Hz.
Example	**SOUR1:FM:INT:FREQ?** **+1.0000E+02** Returns the frequency to 100Hz.	

SOURce[1|2|3|3RF]:FM:DEViation

Source Specific Command

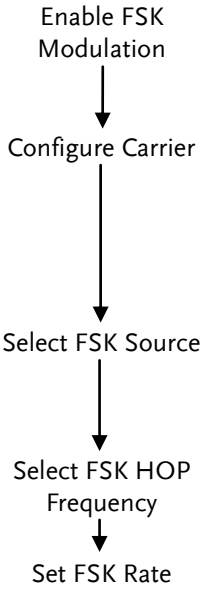
Description	Sets or queries the peak frequency deviation of the modulating waveform from the carrier waveform. The default peak deviation is 100Hz. The frequency deviation of external sources is controlled using the ±5V MOD INPUT terminal on the rear panel. A positive signal (>0~+5V) will increase the 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|2|3|3RF]:FM:DEViation {<peak deviation in Hz>|MINimum|MAXimum}**	
Parameter	<peak deviation in Hz>	DC to Max Frequency
Example	**SOUR1:FM:DEV MAX** Sets the frequency deviation to the maximum value allowed.	
Query Syntax	**SOURce[1|2|3|3RF]:FM:DEViation? [MINimum|MAXimum]**	
Return Parameter	<NR3>	Returns the frequency deviation in Hz.
Example	**SOURce[1|2|3|3RF]:FM:DEViation? MAX** **+1.0000E+01** Returns the maximum frequency deviation allowed.	

频移键控(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|2|3|3RF]: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|2|3|3RF]:FSK:SOUR command.
4. Set the hop frequency using the SOURce[1|2|3|3RF]:FSK:FREQ command.
5. Use the SOURce[1|2|3|3RF]: FSK:INT:RATE command to set the FSK rate. The FSK rate can only be set for internal sources.

SOURce[1|2|3|3RF]: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|2|3|3RF]:FSKey:STATe {OFF|ON}**

Example	**SOUR1:FSK:STAT ON** Enables FSK modulation	
Query Syntax	**SOURce[1|2|3|3RF]:FSKey:STATe?**	
Return Parameter	0	Disabled (OFF)
	1	Enabled (ON)
Example	**SOUR1:FSK:STAT?** **1** FSK modulation is currently enabled.	

SOURce[1|2|3|3RF]: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|2|3|3RF]:FSKey:SOURce {INTernal|EXTernal}**
Example	**SOUR1:FSK:SOUR INT** Sets the FSK source to internal.
Query Syntax	**SOURce[1|2|3|3RF]:FSKey:SOURce?**

Return Parameter		
	INT	Internal
	EXT	External

Example	**SOUR1:FSK:SOUR?** **INT** The FSK source is set to internal.

SOURce[1|2|3|3RF]: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|2|3|3RF]:FSKey:FREQuency {<frequency>|MINimum|MAXimum}**	
Parameter	<frequency>	1 μHz to Max Frequency
Example	**SOUR1:FSK:FREQ +1.0000E+02** Sets the FSK hop frequency to to 100Hz.	
Query Syntax	**SOURce[1|2|3|3RF]:FSKey:FREQuency? [MINimum|MAXimum]**	
Return Parameter	<NR3>	Returns the frequency in Hz.
Example	**SOUR1:FSK:FREQ? +1.0000000000000E+02** Returns the frequency to 100Hz.	

SOURce[1|2|3|3RF]:FSKey:INTernal:RATE

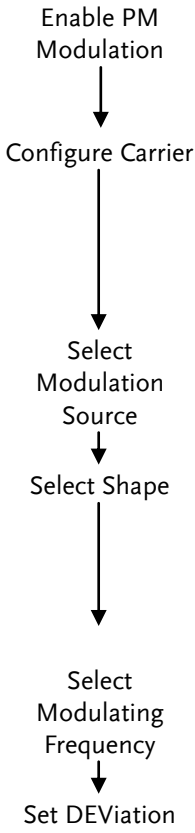
Source Specific Command

Description	Sets or queries the FSK rate for internal sources only.	
Note	External sources will ignore this command.	
Syntax	**SOURce[1|2|3|3RF]: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 (1MHz).	
Query Syntax	**SOURce[1|2|3|3RF]:FSKey:INTernal:RATE? [MINimum|MAXimum]**	
Return Parameter	<NR3>	Returns the FSK rate in Hz.
Example	**SOUR1:FSK:INT:RATE? MAX** **+1.000000000E+05** Returns the maximum FSK rate allowed.	

相位调制(PM)指令

PM 介紹

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



1. Turn on PM modulation using the SOURce[1|2|3|3RF]: PM:STATe 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|2|3|3RF]:PM:SOUR command.
4. Use the SOURce[1|2|3|3RF]: PM: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|2|3|3RF]:PM:INT:FREQ command. For internal sources only.
6. Use the SOURce[1|2|3|3RF]:PM:DEV command to set the phase DEViation.

SOURce[1|2|3|3RF]:PM:STATe

Source Specific Command

Description	Turns PM Modulation on or off. By default PM modulation is off.	
Note	Burst or sweep mode will be disabled if PM modulation is enabled. As only one modulation is allowed at any one time, other modulation modes will be disabled when PM modulation is enabled.	
Syntax	**SOURce[1|2|3|3RF]:PM:STATe {OFF|ON}**	
Example	**SOUR1:PM:STAT ON** Enables PM modulation	
Query Syntax	**SOURce[1|2|3|3RF]:PM:STATe?**	
Return Parameter	0	Disabled (OFF)
	1	Enabled (ON)
Example	**SOUR1:PM:STAT?** **1** PM modulation is currently enabled.	

SOURce[1|2|3|3RF]:PM:SOURce

Source Specific Command

Description	Sets or queries the PM source as internal or external. Internal is the default source.
Note	If an external PM source is selected, the phase modulation is controlled by the MOD INPUT terminal on the rear panel. The RF channel supports only the internal modulation mode.
Syntax	**SOURce[1|2|3|3RF]:PM:SOURce {INTernal|EXTernal}**
Example	**SOUR1:PM:SOUR INT** Sets the PM source to internal.
Query Syntax	**SOURce[1|2|3|3RF]:PM:SOURce?**

Return Parameter	INT	Internal
	EXT	External

Example **SOUR1:PM:SOUR?**

INT

The PM source is set to internal.

SOURce[1|2|3|3RF]:PM: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. .

Syntax **SOURce[1|2|3|3RF]:PM:INTernal:FUNction {SINusoid|SQUare|TRIangle|UPRamp|DNRamp}**

Example **SOUR1:PM:INT:FUN SIN**

Sets the PM modulating wave shape to sine. .

Query Syntax **SOURce[1|2|3|3RF]:PM:INTernal:FUNction?**

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

Example **SOUR1:PM:INT:FUNC?**

SIN

The shape for the modulating waveform is Sine.

SOURce[1|2|3|3RF]:PM:INTernal :FREQuency

Source Specific Command

Description Sets the modulating waveform frequency for internal sources. The default frequency is set to 20kHz.

Syntax	**SOURce[1|2|3|3RF]:PM:INTernal:FREQuency {<frequency>|MINimum|MAXimum}**	
Parameter	<frequency>	2 mHz~ 20 kHz
Example	**SOUR1:PM:INT:FREQ MAX** Sets the frequency to the maximum value.	
Query Syntax	**SOURce[1|2|3|3RF]:PM:INTernal:FREQuency?**	
Return Parameter	<NR3>	Returns the frequency in Hz.
Example	**SOUR1:PM:INT:FREQ?** **+2.0000000E+04** Returns the modulating frequency. (20kHz)	

SOURce[1|2|3|3RF]:PM:DEViation

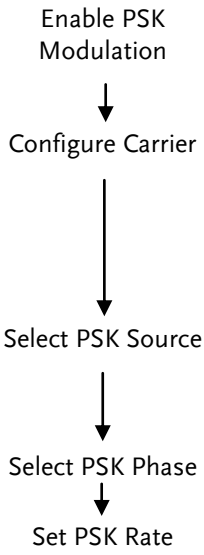
Source Specific Command

Description	Sets or queries the phase deviation of the modulating waveform from the carrier waveform. The default phase deviation is 180°.	
Note	For external sources, the phase deviation is controlled by the ±5V MOD Input terminal on the rear panel. If the phase deviation is set to 180 degrees, then +5V represents a deviation of 180 degrees. A lower input voltage will decrease the set phase deviation.	
Syntax	**SOURce[1|2|3|3RF]:PM:DEViation{<phase>|minimum|maximum}**	
Parameter	<percent>	0°~360°
Example	**SOUR1:PM:DEViation +3.0000E+01** Sets the deviation to 30°.	
Query Syntax	**SOURce[1|2|3|3RF]:PM:DEViation?**	
Return Parameter	<NR3>	Returns the deviation .
Example	**SOUR1:PM:DEViation?** **+3.0000E+01** The current deviation is 30°.	

相位键控(PSK)指令

PSK 介紹

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



1. Turn on FSK modulation using the SOURce[3RF]: PSK:STAT ON command.
2. Use the APPLy command to select a carrier waveform. Alternatively, the 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[3RF]:PSK:MOD:INT command.
4. Set the hop frequency using the SOURce[3RF]:PSK:PHASE command.
5. Use the SOURce[3RF]: PSK:INT:RATE command to set the PSK rate. The PSK rate can only be set for internal sources.

SOURce[3RF]:PSKey:STATe

Source Specific Command

Description	Turns PSK Modulation on or off. By default PSK modulation is off.
Note	Burst or sweep mode will be disabled if PSK modulation is enabled. As only one modulation is allowed at any one time, other modulation modes will be disabled when PSK modulation is enabled.
Syntax	**SOURce[3RF]:PSKey:STATe {OFF|ON}**

Example	**SOURce3RF:PSK:STAT ON**	
	Enables PSK modulation	
Query Syntax	**SOURce[3RF]:PSKey:STATe?**	
Return Parameter	0	Disabled (OFF)
	1	Enabled (ON)
Example	**SOURce3RF:PSK:STAT?**	
	ON	
	PSK modulation is currently enabled.	

SOURce[3RF]:PSKey:SOURce

Source Specific Command

Description	Sets or queries the PSK source as internal or external. Internal is the default source.	
Note	If an external PSK source is selected, PSK rate is controlled by the Trigger INPUT terminal on the rear panel.	
Syntax	**SOURce[3RF]:PSKey:SOURce {INTernal|EXTernal}**	
Example	**SOUR3RF:PSK:SOUR EXT**	
	Sets the PSK source to external.	
Query Syntax	**SOURce[3RF]:PSKey:SOURce?**	
Return Parameter	INT	Internal
	EXT	External
Example	**SOURce3RF:PSK:SOUR?**	
	INT	
	The PSK source is set to internal.	

SOURce[3RF]:PSKey:PHASE

Source Specific Command

Description	Sets the PSK hop frequency. The default hop frequency is set to 180°.

Note	For PSK, the modulating waveform is a square wave with a duty cycle of 50%.	
Syntax	SOURce[3RF]:PSKey:PHASE {<phase>|MINimum|MAXimum}	
Parameter	<phase>	0～360°.
Example	**SOUR3RF:PSK:DEV180** Sets the PSK hop deviation to to 180°.	
Query Syntax	**SOURce[3RF]:PSKey:DEViation? [MINimum|MAXimum]**	
Return Parameter	<percent>	0～360°.
Example	**SOUR1:PSK:DEV? MAX** **360°** Returns the maximum hop deviation allowed.	

SOURce[3RF]:PSKey:INTernal RATE

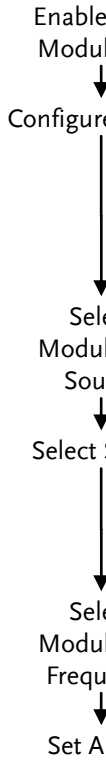
Source Specific Command

Description	Sets or queries the PSK rate for internal sources only.	
Note	External sources will ignore this command.	
Syntax	**SOURce[3RF]:PSKey:INTernal:RATE {<rate in Hz>|MINimum|MAXimum}**	
Parameter	<rate in Hz>	2 mHz~1MHz
Example	**SOURce3RF:PSK:INT:RATE MAX** Sets the rate to the maximum (1MHz).	
Query Syntax	**SOURce[3RF]:PSKey:INTernal:RATE? [MINimum|MAXimum]**	
Return Parameter	<NR3>	Returns the PSK rate in Hz.
Example	**SOURce3RF:PSK:INT:RATE? MAX** **+1.0000E+06** Returns the maximum PSK rate allowed.	

总和调制(SUM)指令

SUM 介紹

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



1. Turn on SUM modulation using the SOURce[1|2]: SUM:STATe 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|2]:SUM:SOUR command.
4. Use the SOURce[1|2]:SUM: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|2]:SUM:INT:FREQ command. For internal sources only.
6. Use the SOURce[1|2]:SUM:AMPL command to set the modulating AMPLitude.

SOURce[1|2]:SUM:STATe

Source Specific Command

Description	Turns SUM Modulation on or off. By default SUM modulation is off.	
Note	Burst or sweep mode will be disabled if SUM modulation is enabled. As only one modulation is allowed at any one time, other modulation modes will be disabled when SUM modulation is enabled.	
Syntax	**SOURce[1|2]:SUM:STATe {OFF|ON}**	
Example	**SOUR1:SUM:STAT ON** Enables SUM modulation	
Query Syntax	**SOURce[1|2]:SUM:STATe?**	
Return Parameter	0	Disabled (OFF)
	1	Enabled (ON)
Example	**SOUR1:SUM:STAT?** **1** SUM modulation is currently enabled.	

SOURce[1|2]:SUM:SOURce

Source Specific Command

Description	Sets or queries the SUM source as internal or external. Internal is the default source.	
Note	If an external SUM source is selected, the duty cycle/pulse width is controlled by the MOD INPUT terminal on the rear panel.	
Syntax	**SOURce[1|2]:SUM:SOURce {INTernal|EXTernal}**	
Example	**SOUR1:SUM:SOUR INT** Sets the SUM source to internal.	
Query Syntax	**SOURce[1|2]:SUM:SOURce?**	
Return Parameter	INT	Internal

	EXT	External

Example **SOUR1:SUM:SOUR?**

INT

The SUM source is set to internal.

SOURce[1|2]:SUM: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.

Syntax: **SOURce[1|2]:SUM:INTernal:FUNction {SINusoid|SQUare|TRIangle|UPRamp|DNRamp}**

Example: **SOUR1:SUM:INT:FUN SIN**

Sets the SUM modulating wave shape to sine. .

Query Syntax: **SOURce[1|2]:SUM:INTernal:FUNction?**

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

Example **SOUR1:SUM:INT:FUNC?**

SIN

The shape for the modulating waveform is Sine.

SOURce[1|2]:SUM:INTernal:FREQuency

Source Specific Command

Description: Sets the modulating waveform frequency for internal sources. The default frequency is set to 20KHz.

Syntax: **SOURce[1|2]:SUM:INTernal:FREQuency {<frequency>|MINimum|MAXimum}**

Parameter	<frequency>	2 mHz~ 20 kHz
Example	**SOUR1:SUM:INT:FREQ MAX**	
	Sets the frequency to the maximum value.	
Query Syntax	**SOURce[1|2]:SUM:INTernal:FREQuency?**	
Return Parameter	<NR3>	Returns the frequency in Hz.
Example	**SOUR1:SUM:INT:FREQ?**	
	+2.0000000E+04	
	Returns the modulating frequency. (20kHz)	

SOURce[1|2]:SUM:AMPL

Source Specific Command

Description	Sets or queries the amplitude of the modulating waveform from the carrier waveform. The default phase AMPLitude is 100%.	
Note	Ifanexternal SUM source is selected,the amplitude of the modulated waveform is controlled using the ±5V MOD INPUT terminal on the rear panel. A positive signal (>0~+5V) will increase the AMPLitude (up to the set duty cycle AMPLitude), whilst a negative voltage will reduce the AMPLitude.	
Syntax	**SOURce[1|2]:SUM:AMPL{<percent>|minimum |maximum}**	
Parameter	<percent>	0%~100%
Example	**SOUR1:SUM:AMPLitude +3.0000E+01**	
	Sets the amplitude to 30%.	
Query Syntax	**SOURce[1|2]:SUM:AMPLitude?**	
Return Parameter	<NR3>	Returns the amplitude .

Example **SOUR1:SUM:AMPLitude?**

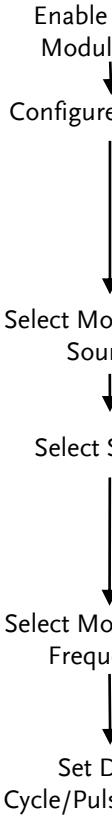
+3.000E+01

The current amplitude is 30%.

脉宽调制(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|2|3]: 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|2|3]:PWM:SOUR command.
4. Use the SOURce[1|2|3]: 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|2|3]:PWM:INT:FREQ command. For internal sources only.
6. Use the SOURce[1|2|3]:PWM:DUTY command to set the duty cycle or Pulse Width.

SOURce[1|2|3]:PWM:STATe

Source Specific Command

Description	Turns pulse width modulation on or off. By default

	PWM 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 PWM modulation is enabled.
Syntax	**SOURce[1|2|3]:PWM:STATe {OFF|ON}**
Example	**SOUR1:PWM:STAT ON** Enables PWM modulation
Query Syntax	**SOURce[1|2|3]:PWM:STATe?**
Return Parameter	0 Disabled (OFF) 1 Enabled (ON)
Example	**SOUR1:PWM:STAT?** **ON** PWM modulation is currently enabled.

SOURce[1|2|3]: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. The RF channel supports only the internal modulation mode.
Syntax	**SOURce[1|2|3]:PWM:SOURce {INTernal|EXTernal}**
Example	**SOUR1:PWM:SOUR EXT** Sets the PWM source to external.
Query Syntax	**SOURce[1|2|3]:PWM:SOURce?**

Return Parameter	INT	Internal
	EXT	External

Example **SOUR1:PWM:SOUR? INT**

The PWM source is set to internal.

SOURce[1|2|3]: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|2|3]: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|2|3]: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|2|3]: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|2|3]: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|2|3]: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|2|3]:PWM:DUTY

Source Specific Command

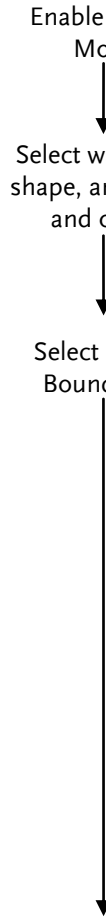
Description	Sets or queries the duty cycle deviation. The default duty cycle is 50%.	
Note	The duty cycle is limited by period, edge time and minimum pulse width.	
	The duty cycle deviation of an external source is controlled using the ±5V MOD INPUT terminal on the rear panel. A positive signal (>0~+5V) will increase the deviation (up to the set duty cycle deviation), whilst a negative voltage will reduce the deviation.	
Syntax	SOURce[1|2|3]: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|2|3]:PWM:DUTY?	
Return Parameter	<NR3>	Returns the deviation in %.
Example	SOUR1:PWM:DUTY?	

+3.0000E+01
The current duty cycle is 30%.

频率扫描(Sweep)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|2|3|3RF]: 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|2|3|3RF]:FREQ:STAR and SOURce[1|2|3|3RF]: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|2|3|3RF]:FREQ:CENT and SOURce[1|2|3|3RF]:FREQ:SPAN commands to set the center frequency and the frequency span. To sweep up or down, set the span as positive or negative.

Select Sweep Mode

4. Choose Linear or Logarithmic spacing using the SOURce[1|2|3|3RF]:SWE:SPAC command.

Select Sweep Time ↓

5. Choose the sweep time using the SOURce[1|2|3|3RF]:SWE:TIME command.

Select the sweep trigger source ↓

6. Select an internal or external sweep trigger source using the SOURce[1|2|3|3RF]:SOUR command.

Select the marker frequency

7. To output a marker frequency from the trigger out, use The SOURce[1|2|3|3RF]:MARK:FREQ command. To enable marker frequency output, use the SOURce[1|2|3|3RF]:MARK ON command.

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

SOURce[1|2|3|3RF]:SWEep:STATe

Source Specific Command

Description	Sets or disables Sweep mode. By default Sweep is disabled. Sweep 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|2|3|3RF]:SWEep:STATe {OFF|ON}**	
Example	**SOUR1:SWE:STAT ON** Enables sweep mode.	
Query Syntax	**SOURce[1|2|3|3RF]:SWEep:STATe?**	
Return Parameter	0	Disabled (OFF)
	1	Enabled (ON)

Example	**SOUR1:SWE:STAT?** **1** Sweep mode is currently enabled.

SOURce[1|2|3|3RF]: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|2|3|3RF]:FREQuency:STARt {<frequency>|MINimum|MAXimum}**	
Parameter	<frequency>	1uHz to Max Frequency
Example	**SOUR1:FREQ:STAR +2.0000E+03** Sets the start frequency to 2kHz.	
Query Syntax	**SOURce[1|2|3|3RF]:FREQuency:STARt? [MINimum|MAXimum]**	
Return Parameter	<NR3>	Returns the start frequency in Hz.
Example	**SOUR1:FREQ:STAR?** +2.0000000000000E+03 Returns the maximum start frequency allowed.	

SOURce[1|2|3|3RF]: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|2|3|3RF]:FREQuency:STOP {<frequency>|MINimum|MAXimum}**	
Parameter	<frequency>	1uHz to Max Frequency

Example	**SOUR1:FREQ:STOP +2.0000E+03** Sets the stop frequency to 2kHz.	
Query Syntax	**SOURce[1|2|3|3RF]:FREQuency:STOP? [MINimum|MAXimum]**	
Return Parameter	<NR3>	Returns the stop frequency in Hz.
Example	**SOUR1:FREQ:STOP? MAX** +2.0000000000000E+03 Returns the maximum stop frequency allowed.	

SOURce[1|2|3|3RF]: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|2|3|3RF]:FREQuency:CENTer {<frequency>|MINimum|MAXimum}**	
Parameter	<frequency>	450Hz~ 25MHz 450Hz~ 1MHz (Ramp)
Example	**SOUR1:FREQ:CENT +2.0000E+03** Sets the center frequency to 2kHz.	
Query Syntax	**SOURce[1|2|3|3RF]:FREQuency:CENTer? [MINimum|MAXimum]**	
Return Parameter	<NR3>	Returns the stop frequency in Hz.
Example	**SOUR1:FREQ:CENT?** +2.0000000000000E+03 Returns the maximum center frequency allowed, depending on the span.	

SOURce[1|2|3|3RF]: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|2|3|3RF]:FREQuency:SPAN {<frequency>|MINimum|MAXimum}**	
Parameter	<frequency>	1μHz~25MHz 1μHz~ 1MHz (Ramp)
Example	**SOUR1:FREQ:SPAN +2.0000E+03** Sets the frequency span to 2kHz.	
Query Syntax	**SOURce[1|2|3|3RF]:FREQuency:SPAN? [MINimum|MAXimum]**	
Return Parameter	<NR3>	Returns the frequency span in Hz.
Example	**SOUR1:FREQ:SPAN?** +2.0000000000000E+03 Returns the frequency span for the current sweep.	

SOURce[1|2|3|3RF]:SWEep:SPACing

Source Specific Command

Description	Sets linear or logarithmic sweep spacing. The default spacing is linear.
Syntax	**SOURce[1|2|3|3RF]:SWEep:SPACing {LINear|LOGarithmic}**
Example	**SOUR1:SWE:SPAC LIN**

	Sets the spacing to linear.	
Query Syntax	**SOURce[1|2|3|3RF]:SWEep:SPACing?**	
Return Parameter	LIN	Linear spacing
	LOG	Logarithmic spacing
Example	**SOUR1:SWE:SPAC?**	
	LIN	
	The spacing is currently set as linear.	

SOURce[1|2|3|3RF]: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|2|3|3RF]: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|2|3|3RF]:SWEep:TIME? {<seconds>| MINimum|MAXimum}**	
Return Parameter	<NR3>	Returns sweep time in seconds.
Example	**SOUR1:SWE:TIME?**	
	+1.00000E+00	
	Returns the sweep time (1 seconds).	

SOURce[1|2|3|3RF]: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. If the trigger source is set to manual, the function generator starts sweeping each time a trigger command is received. To trigger the function generate from remote interface,it is necessary to send a * TRG trigger command.	
Syntax	**SOURce[1|2|3|3RF]: SWEep:SOURce {IMMediate|EXTernal| MANual}**	
Example	**SOUR1: SWE:SOUR INT** Sets the sweep source to internal.	
Query Syntax	**SOURce[1|2|3|3RF]: SWEep:SOURce?**	
Return Parameter	IMM	Immediate
	EXT	External
	MANual	Manual
Example	**SOUR1:SWE:SOUR?** **IMM** The sweep source is set to internal.	

OUTPut[1|2]: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|2]:TRIGger:SLOPe {POSitive|NEGative}**
Example	**OUTP1:TRIG:SLOP NEG** Sets the Trig out signal as negative edge.
Query Syntax	**OUTPut[1|2]: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|2]: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|2]:TRIGger {OFF|ON}**

Example	**OUTP1:TRIG ON**	
	Enables the Trig out signal.	
Query Syntax	**OUTPut[1|2|3|3RF]:TRIGger?**	
Return Parameter	0	Disabled
	1	Enable
Example	**OUTP1:TRIG?**	
	1	
	The Trig out signal is enabled.	

SOURce[1|2]: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 trigger out signal from the trigger terminal on the rear panel.	
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|2]:MARKer:FREQuency {<frequency>|MINimum|MAXimum}**	
Parameter	<frequency>	1μHz ~ 25 MHz 1μHz ~ 1 MHz (Ramp)
Example	**SOUR1:MARK:FREQ +1.0000E+03**	
	Sets the marker frequency to 1 kHz.	
Query Syntax	**SOURce[1|2]:MARKer:FREQuency? [MINimum|MAXimum]**	
Return Parameter	<NR3>	Returns the marker frequency in Hz.
Example	**SOUR1:MARK:FREQ?**	
	+1.0000000000000E+03	
	Returns the marker frequency (1 kHz).	

SOURce[1|2]: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|2]:MARKer {OFF|ON}**		
Example	**SOUR1:MARK ON** Enables the marker frequency.		
Query Syntax	**SOURce[1|2]:MARKer?**		
Return Parameter	0		Disabled
	1		Enabled
Example	**SOUR1:MARK?** **1** The marker frequency is enabled.		

脉冲串模式(Burst)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.

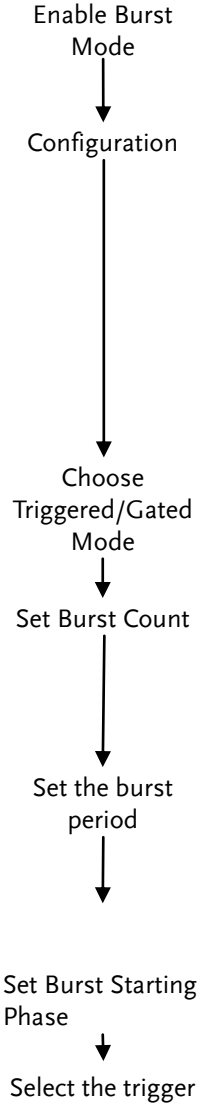
*assuming the Trigger polarity is not inverted.

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

SOURce[1|2|3]: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|2|3]:BURSt:STATe {OFF|ON}**	
Example	**SOUR1:BURS:STAT ON** Turns burst mode on.	
Query Syntax	**SOURce[1|2|3]:BURSt:STATe?**	
Return Parameter	0	Disabled
	1	Enabled
Example	**SOUR1:BURS:STAT?** **0** Burst mode is off.	

SOURce[1|2|3]: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|2|3]:BURSt:MODE {TRIGgered|GATed}**	
Example	**SOUR1:BURS:MODE TRIG** Sets the burst mode to triggered.	
Query Syntax	**SOURce[1|2|3]:BURSt:MODE?**	
Return Parameter	TRIG	Triggered mode
	GAT	Gated mode

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

SOURce[1|2|3]: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|2|3]: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|2|3]: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?** +1.000000E+00 The burst cycles are set to 1.

SOURce[1|2|3]: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|2|3]:BURSt:INTernal:PERiod {<seconds>|MINimum|MAXimum}**
Parameter	<seconds > 1 ms ~ 500 seconds
Example	**SOUR1:BURS:INT:PER +1.0000E+01** Sets the period to 10 seconds.
Query Syntax	**SOURce[1|2|3]:BURSt:INTernal:PERiod? [MINimum|MAXimum]**
Return Parameter	<NR3> Returns the burst period in seconds.
Example	**SOUR1:BURS:INT:PER?** +1.00000000E+01 The burst period is 10 seconds.

SOURce[1|2|3]: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|2|3]: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|2|3]:BURSt:PHASe? [MINimum|MAXimum]**
Return Parameter	<NR3> Returns the phase angle in degrees.
Example	**SOUR1:BURS:PHAS?** +3.600E+02 The burst phase is 360 degrees.

SOURce[1|2|3]: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. If the trigger source is set to manual, the function generator outputs a burst count waveform with the specified number of cycles each time the trigger signal * TRG is received. The function generator stops and waits for the next trigger after the specified number of cycles has been output. You can configure the function generator to use an internal trigger to start a burst or send a trigger signal from the rear panel port connector by pressing the front panel key and you can also send a trigger command * TRG through the remote interface to provide an external trigger source.
Syntax	**SOURce[1|2|3]:BURSt:TRIGger:SOURce {IMMediate|EXTernal|MANual}**
Example	**SOUR1:BURS:TRIG:SOUR INT** Sets the burst trigger source to internal.
Query Syntax	**SOURce[1|2|3]: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|2|3]: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|2|3]: BURSt:TRIGger:DELay {<seconds>|MINimum|MAXimum}**	
Parameter	<seconds>	0~85 seconds
Example	**SOUR1:BURS:TRIG:DEL +1.000E+01** Sets the trigger delay to 1 second.	
Query Syntax	**SOURce[1|2|3]:BURSt:TRIGger:DELay? [MINimum|MAXimum]**	
Return Parameter	<NRf>	Delay in seconds
Example	**SOUR1:BURS:TRIG:DEL ?** **+1.000E+01** The trigger delay is 1 second.	

SOURce[1|2|3]: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|2|3]: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|2|3]:BURSt:TRIGger:SLOPe?**	
Return Parameter	POS	rising edge
	NEG	falling edge
Example	**SOUR1:BURS:TRIG:SLOP ?**	
	NEG	
	The trigger slope is negative.	

SOURce[1|2|3]: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|2|3]: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|2|3]: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|2]: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|2]: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|2]: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.	

SOURce[1|2]:BURSt:OUTPut:TRIGger

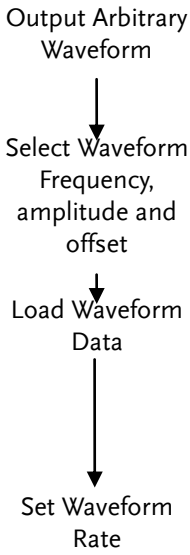
Source Specific Command

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	**SOURce[1|2]:BURSt:OUTPut:TRIGger {OFF|ON}**	
Parameter	OFF	Turns the output off.
	ON	Turns the output on.
Example	**SOURce1:BURSt:OUTPut:TRIGger ON** Turns the output on.	
Query Syntax	**SOURce[1|2]:BURSt:OUTPut:TRIGger?**	
Return Parameter	0	Disabled
	1	Enabled
Query Example	**SOURce1:BURSt:OUTPut:TRIG?** **1** The trigger output is enabled.	

任意波形(ARB)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|2|3]: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 16384 points per waveform) can be downloaded into volatile memory using the DATA:DAC command. Binary integer or decimal integer values in the range of ± 8191can 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:	1μHz ~ 200MHz
	Frequency:	1μHz ~100MHz
	# points:	1~16384

SOURce[1|2|3]:FUNCtion USER

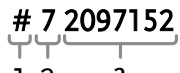
Source Specific Command

Description	Use the SOURce[1|2|3]: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|2|3]: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 (±8192) 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 8192is 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:



1. Initialization character (#)
2. Digit length (in ASCII) of the number of bytes
3. Number of bytes

	IEEE 488.2 uses two bytes to represent waveform data (14 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 ±8192
Example	**DATA:DAC VOLATILE, #216 Binary Data**	
	The command above downloads 5 data values (stored in 14 bytes) using the binary block format.	
	DATA:DAC VOLATILE,1000,511,1024,0,-1024,-511	
	Downloads the data values (511, 1024, 0, -1024, -511) to address 1000.	

SOURce[1|2|3]:ARB:EDIT:COPY

Source Specific Command

Description	Copies a segment of a waveform to a specific starting address.	
Syntax	**SOURce[1|2|3]:ARB:EDIT:COPY [<start>[,<length>[,<paste>]]]**	
Parameter	<start>	Start address: 0~16384
	<length>	0 ~16384
	<paste>	Paste address: 0~16384
Example	**SOUR1:ARB:EDIT:COPY 1000, 256, 1257**	
	Copies 256 data values starting at address 1000 and copies them to address 1257.	

SOURce[1|2|3]: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|2|3]:ARB:EDIT:DELete [<STARt>[,<LENGth>]]**	
Parameter	<STARt>	Start address: 0~16384
	<LENGth>	0 ~16384
Example	**SOURce1:ARB:EDIT:DEL 1000, 256** Deletes a section of 256 data points from the waveform starting at address 1000.	

SOURce[1|2|3]: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|2|3]:ARB:EDIT:DELete:ALL**
Example	**SOUR1:ARB:EDIT:DEL:ALL** Deletes all user waveforms from memory.

SOURce[1|2|3]: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|2|3]:ARB:EDIT:POINt [<address> [, <data>]]**

Parameter	<address>	Address of data point: 0~16384
	<data>	Value data: ±8192
Example	**SOUR1:ARB:EDIT:POIN 1000, 511** Creates a point on the arbitrary waveform at address 1000 with the highest amplitude.	

SOURce[1|2|3]: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|2|3]:ARB:EDIT:LINE [<address1>[,<data>[,<address2>[,<data2>]]]]**	
Parameter	<addrress1>	Address of data point1: 0~16384
	<data1>	Value data2: ±8192
	<address2>	Address of data point2: 0~16384
	<data2>	Value data2: ±8192
Example	**SOUR1:ARB:EDIT:LINE 40, 50, 100, 50** Creates a line on the arbitrary waveform at 40,50 to 100,50.	

SOURce[1|2|3]:ARB:EDIT:PROTect

Source Specific Command

Description	Protects a segment of the arbitrary waveform from deletion or editing.
Syntax	**SOURce[1|2|3]:ARB:EDIT:PROTect [<STARt>[,<LENGth>]**

Parameter	<STARt>	Start address: 0~16384
	<LENGth>	0 ~16384
Example	**SOUR1:ARB:EDIT:PROT 40, 50**	
	Protects a segment of the waveform from address 40 for 50 data points.	

SOURce[1|2|3]:ARB:EDIT:PROTect:ALL

Source Specific Command

Description	Protects the arbitrary waveform currently in non-volatile memory/currently being output.
Syntax	**SOURce[1|2|3]:ARB:EDIT:PROTect:ALL**
Example	**SOUR1:ARB:EDIT:PROT:ALL**

SOURce[1|2|3]:ARB:EDIT:UNProtect

Source Specific Command

Description	Uprotects the arbitrary waveform currently in non-volatile memory/currently being output.
Syntax	**SOURce[1|2|3]:ARB:EDIT:UNProtect**
Example	**SOUR1:ARB:EDIT:UNP**

SOURce[1|2|3]:ARB:NCYCles

Source Specific Command

Description	The arbitrary waveform output can be repeated for a designated number of cycles.	
Syntax	**SOURce[1|2|3]:ARB:NCYCles {< #cycles> |INFinity|MINimum |MAXimum}**	
Parameter	<# cycles>	1~16384 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:NCYCINF**	
	Sets the number of ARB waveform output cycles to continuous (infinite).	
Query Syntax	**SOURce[1|2|3]: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|2]:ARB:OUTPut:MARKer

Source Specific Command

Description	Define a section of the arbitrary waveform for marker output. The marker is output from the trigger terminal on the rear panel.	
Syntax	**SOURce[1|2]:ARB:OUTPut:MARKer [<STARt>[,<LENGth>]]**	
Parameter	<STARt>	Start address*: 0~16384
	<LENGth>	Length*: 0 ~16384
	* 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|2|3]: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|2|3]:ARB:OUTPut [<STARt>[,<LENGth>]]**	
Parameter	<STARt>	Start address*: 0~16384
	<LENGth>	Length*: 0 ~16384
	* Start + Length ≤ currently output arbitrary waveform	
Example	**SOUR1:ARB:OUTP 20,200**	
	Outputs the current arbitrary waveform in memory.	

計頻器(Counter)指令

计频器指令可以远程打开及控制计频器。

COUNTER:STATE		Instrument Command
Description	打開或關閉計頻器功能	
Note		
Syntax	**COUNter:STATe {ON|OFF}**	
Example	**COUNter:STATe ON**	
	打開計頻器	
Syntax	**COUNter:STATe?**	
Return Parameter	1	ON
	0	OFF
Example	**COUNter:STATe?**	
	1	
	當前計頻器打開	

COUNter:GATe		Instrument Command
Description	設置計頻器的計頻門控時間	
Syntax	**COUNter:GATe {0.01|0.1|1|10}**	
Example	**COUNter:GATe 1**	
	設置計頻的計頻門控時間為 1s	
Syntax	**COUNter:GATe? {max|min}**	
Example	**COUNter:GATe?**	
	+1.000E+00	
	當前計頻器的門控時間為 1s	

COUNter:VALue?

Instrument Command

Description	詢問計頻器的值
Syntax	COUNter:VALue?
Example	**COUNter:VALue?** +5.00E+02 當前計頻器的計頻值為 500hz

相位 (Phase)指令

相位指令可以遠端控制相位設定及相位同步

SOURce[1|2|pulse]:PHASe

Instrument Command

Description	設置相位的大小	
Note		
Syntax	**SOURce[1|2|pulse]:PHASe {<phase>|<MIN>|<MAX>}**	
Parameter	phase	-180~180
	min	設置相位值為最小值
	max	設置相位值為最大值
Example	**SOURce1:PHASe 25**	
	設置通道 1 的相位為 25°	
Syntax	**SOURce1:PHASe？{MAX|MIN}**	
Return Parameter	phase	返回當前的相位值
Example	**SOURce1:PHASe？**	
	+2.500E+01	
	當前通道 1 的相位值大小為 25°	

SOURce[1|2|pulse]:PHASe:SYNChronize

Instrument Command

Description	同步通道 1 和通道 2 的相位
Syntax	SOURce[1|2|pulse]:PHASe:SYNChronize
Example	SOURce1:PHASe:SYNChronize
	同步通道 1 的相位

耦合(Couple)指令

The Couple commands can be used to remotely set the frequency coupling and amplitude coupling.

SOURce[1|2]:FREQuency:COUPle:MODE

Instrument Command

Description	Set the frequency coupling mode.	
Syntax	**SOURce[1|2]:FREQuency:COUPle:MODE {Off|Offset|Ratio}**	
Return/ Returnparameter	Off	Disables frequency coupling.
	Offset	Set frequency coupling to offset mode.
	Ratio	Sets frequency coupling to ratio mode.
Example	**SOURce1:FREQuency:COUPle:MODE Offset** Sets the frequency coupling mode to offset.	
Query Syntax	**SOURce[1|2]:FREQuency:COUPle:MODE ?**	
Example	**SOURce1:FREQuency:COUPle:MODE ?** Off Frequency coupling is turned off.	

SOURce[1|2]:FREQuency:COUPle:OFFSet

Instrument Command

Description	Sets the offset frequency when the frequency coupling mode is set to offset.
Syntax	**SOURce[1|2]:FREQuency:COUPle:OFFSet {frequency}**
Example	**SOURce1:FREQuency:COUPle:OFFSet 2khz** Sets the offset frequency to 2kHz (the frequency of CH2 minus CH1 is 2kHz).
Syntax	**SOURce[1|2]:FREQuency:COUPle:OFFSet?**
Example	**SOURce1:FREQuency:COUPle:OFFSet?**

+2.0000000000000E+03

The offset of channel 2 from channel 1 is 2kHz.

SOURce[1|2]:FREQuency:COUPle:RATio

Instrument Command

Description	Sets the frequency coupling ratio when frequency coupling is set to ratio mode.
Syntax	**SOURce[1|2]:FREQuency:COUPle:RATio {ratio}**
Example	**SOURce1:FREQuency:COUPle:RATio 2** Set the frequency ratio of CH2:CH1 as 2:1.
Query Syntax	**SOURce[1|2]:FREQuency:COUPle:RATio?**
Example	**SOURce1:FREQuency:COUPle:RATio?** +1.666000E+00 Returns the CH2 to CH1 frequency ratio as 2.

SOURce[1|2]:AMPlitude:COUPle:STATe

Instrument Command

Description	Enables or disables the amplitude coupling.	
Syntax	SOURce[1|2]:AMPlitude:COUPle:STATe {ON|Off}	
Example	**SOURce1:AMPlitude:COUPle:STATe on**	
Description	Turns amplitude coupling on.	
Query Syntax	**SOURce[1|2]:AMPlitude:COUPle:STATe?**	
Return Parameter	1	ON
	0	Off
Example	**SOURce1:AMPlitude:COUPle:STATe?** 1 Amplitude coupling has been enabled.	

SOURce[1|2]:TRACk

Instrument Command

Description	Turns tracking on or off.	
Syntax	**SOURce[1|2]:TRACk {ON|OFF|INVerted}**	
Parameter/ Return Parameter	ON	ON
	OFF	OFF
	INVerted	INVerted
Example	**SOURce1:TRACkON** Turns tracking on. Channel 2 will "track" the changes of channel 1.	
Query Syntax	**SOURce[1|2]:TRACk?**	
Example	**SOURce1:TRACk?** ON Channel tracking is turned on.	

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.

错误信息

The MFG-2000 has a number of specific error codes. Use the SYSTem:ERRor command to recall the error codes. For more information regarding the error queue.

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 11000 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|2|3]: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 16384 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 MFG-2000, 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|2|3]: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|2|3]: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|2|3]: APPL: USER or SOURce[1|2|3]: 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|2|3]: APPL: RAMP or SOURce[1|2|3]: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|2|3]: APPL:PULS or SOURce[1|2|3]: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|2|3]: 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|2|3]: 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.

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 状态寄存器

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

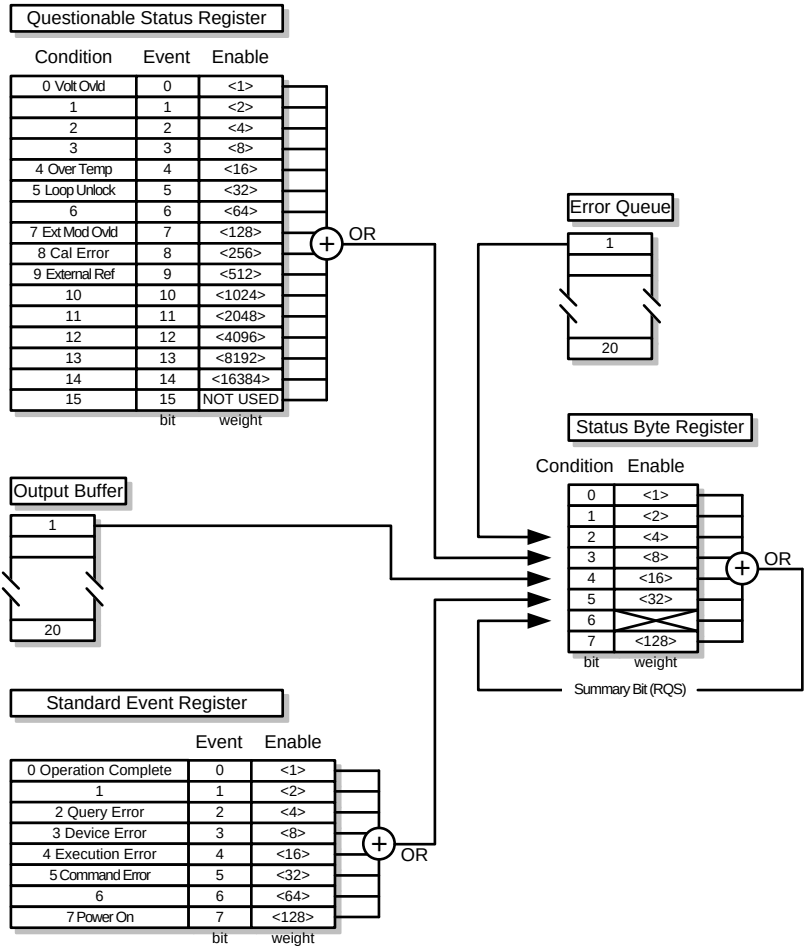
As well as the output and error queues.

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.

MFG-2000 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

MFG-2000 系列规格

此規格適用條件：+18 ℃~+28 ℃，開機 30 分鐘以上。

MFG-2000seriesspecific functions						
	CH1 Function With 200MSa/sARB	CH2 Function With 200MSa/sARB	25MHz Pulse Generator	RF Generator (function with ARB)	Power Amplifier	Modulation /Sweep/Burst/Frequency.Counter
MFG-2110	●10MHZ		●			
MFG-2120	●20MHZ		●			
MFG-2120MA	●20MHZ		●		●	●
MFG-2130M	●30MHZ		●			●
MFG-2160MF	●60MHZ		●	● 160MHZ		●
MFG-2160MR	●60MHZ		●	● 320MHZ		●
MFG-2230M	●30MHZ	●30MHZ	●			●
MFG-2260M	●60MHZ	●60MHZ	●			●
MFG-2260MFA	●60MHZ	●60MHZ	●	● 160MHZ	●	●
MFG-2260MRA	●60MHZ	●60MHZ	●	● 320MHZ	●	●

CH1/ CH2

Waveforms	Standard	Sine,Square,Ramp,Pulse,Noise
Arbitrary Functions	ARB function	Built-in
	Built-in Arbitrary waveforms, please see page 387	
	Absatan,Abssine,Abssinehalf,Ampalt,Attalt,Diric.even,Diric.odd, Gauspuls,Havercosine,Haversin,N_pulse,Negramp,Rectpuls,Roundhalf,Sawtoot,Sinetra,Sinever,Stair_down,Stair_ud,Stair_up,Stepresp,Traperia,Tripuls,Airy,Bessel,Beta,Gamma,Legendre,Neemann,Arccos,Arccot,Arccsc,Arcsec,Arcsin,Arcsinh,Arctan,Arctanh, Cosh,Cot,Csc,Dlorentz,expofall,exporise,gauss,In,lorentz,Sec,Sech,Sinc,Sinh,Sqrt,Tan,Tanh,Xsquare,Barthannwin,Bartlett,Blackman,Bohmanwin,Chebyshev,Flatttopwin,Hamming,Hann,Hanning, Kaiser,Triang,Tukeywin etc.	
	Sample Rate	200 MSa/s
	Repetition Rate	100MHz
	Waveform Length	16k points

	Amplitude Resolution	14 bits
	Non-Volatile Memory	10sets 16k points(1)
	User-defined output section	From point 2~16384 (optional)
	User-defined output marker section	From point 2 ~ 16384(optional)
	Output mode	1~1000000 cycles or infinite mode
Frequency Characteristics		
	Range	Sine60MHz(max)
		Square25MHz(max)
		Triangle, Ramp1MHz
	Resolution	1μHz
	Accuracy Stability	±20 ppm
	Aging	±1 ppm, per 1 year
	Tolerance	≤1μHz
Output Characteristics(2)		
	Amplitude Range	1mVpp to 10 Vpp (into 50Ω) 2mVpp to 20 Vpp (open-circuit)
	Accuracy	±2% of setting ±1 mVpp (at 1 kHz/into 50Ω without DC offset))
	Resolution	0.1mV or 4 digits
	Flatness	± 1% (0.1dB) ≦1MHz ± 3% (0.3dB) ≦50 MHz ± 16% (1.5dB) ≦60MHz(6) (sinewave relative to 1 kHz/into 50Ω)
	Units	Vpp, Vrms, dBm
Offset	Range	±5 Vpk ac +dc (into 50Ω) ±10Vpk ac +dc (Open circuit)
	Accuracy	±(1% of setting + 5mV+ 0.5% of amplitude)
Waveform Output		
	Impedance	50Ω typical (fixed) >10MΩ (output disabled)
	Protection	Short-circuit protected Overload relay automatically disables main output
	Ground Isolation	42Vpk max

Sync Output	Range	TTL-compatible into>1kΩ
	Impedance	50Ω standard
	Ground Isolation	42Vpk max
Sine wave Characteristics(3)		
	Harmonic distortion	–60 dBc <200kHz, Ampl>0.1 Vpp –55 dBc 200kHz～1 MHz, Ampl>0.1 Vpp –45 dBc 1MHz～10 MHz, Ampl ＞0.1Vpp –35 dBc 10MHz～30MHz, Ampl ＞0.1Vpp –27 dBc 30MHz～60MHz, Ampl ＞0.1Vpp
	Total harmonic distortion	< 0.1% (Ampl>1Vpp) DC~100 kHz
Square wave Characteristics		
	Rise/Fall Time	<15ns
	Overshoot	<5%
	Asymmetry	1% of period +5 ns
	Variable duty Cycle	0.01% to 99.99%(limited by the current frequency setting)
	Jitter	20ppm+500ps(4)
Ramp Characteristics		
	Linearity	< 0.1% of peak output
	Variable Symmetry	0% to 100%
Pulse Characteristics		
	Frequency	1uHz~25MHz
	Pulse Width	≧20nS(limited by the current frequency setting)
	Variable duty Cycle	0.01%~99.99%(limited by the current frequency setting)
	Overshoot	<5%
	Jitter	20ppm+500ps(4)
Pulse Generator		
	Amplitude	1mVpp to 2.5 Vpp (into 50Ω)

		2mVpp to 5 Vpp (open-circuit)
	Offset	±1 Vpk ac +dc (into 50Ω) ±2Vpk ac +dc (Open circuit)
	Frequency	1uHz~25MHz
	Pulse Width	20nS~999.7ks(limited by the current frequency setting)
	Variable duty Cycle	0.1%~99.9%(limited by the current frequency setting)
	Leading and Trailing Edge Time(5)	10nS~20S(1ns resolution) (limited by the current frequency and pulse width settings)
	Overshoot	<5%
	Jitter	100ppm+500ps(4)
RF Generator		
Arbitrary Functions		
	ARB function	Built-in
	Sample Rate	200 MSa/s
	Repetition Rate	100MHz
	Waveform Length	16k points
	Amplitude Resolution	14 bits
	User-defined output section	From point 2~16384 (optional)
	Jitter	20ppm+5ns
Frequency Characteristics		
	Range	Sine MFG-2XXXMF 1uHz~160MHz (DDS) 1uHz~60MHz (ARB) (MFG-2XXXMR) 1uHz~320MHz (DDS) 1uHz~60MHz (ARB)
		Square25MHz(max)
		Triangle, Ramp1MHz
	Resolutio	1μHz
	Accuracy Stability	±20 ppm
	Aging	±1 ppm, per 1 year
	Tolerance	≤1μHz
Output Characteristics(2)		
	Amplitude(into 50Ω)	1mVpp to 2 Vpp

		(MFG-2XXXMF) 1mVpp to 1 Vpp (MFG-2XXXMR)
	Accuracy	±2% of setting ±1 mVpp (at 1 kHz/into 50Ω without DC offset))
	Resolution	1mV or 3 digits
	Flatness	± 1% (0.1dB) ≦1MHz ± 3% (0.3dB) ≦50 MHz ± 10% (0.9dB) ≦160MHz ± 35% (3.5dB) ≦320MHz (sinewave relative to 1 kHz/into 50Ω)
Offset		±1 Vpk ac +dc (into 50Ω) ±2Vpk ac +dc (Open circuit)
Waveform Output	Impedance	50Ω typical (fixed) >10MΩ (output disabled)
Sine wave Characteristics(3)		
	Harmonic Distortion(sine,1vpp,50Ω)	–60 dBc <200kHz –55 dBc 200kHz～1 MHz –45 dBc 1MHz～10 MHz –30 dBc 10MHz～320MHz
	Total harmonic distortion	< 0.1% (Ampl>1Vpp) DC~100 kHz
Square wave Characteristics		
	Rise/Fall Time	<15ns
	Overshoot	<5%
	Asymmetry	1% of period +5 ns
	Variable duty Cycle	0.01% to 99.99%(limited by the current frequency setting)
	Jitter	20ppm+500ps(4)
Ramp Characteristics		
	Linearity	< 0.1% of peak output
	Variable Symmetry	0% to 100%
Modulation/ Sweep		
	Modulation Type	AM,ASK,FM,FSK,PM,PSK,PWM (The detail same as CH1

		modulation specification)
	Sweep type	Frequency
	Source	INT/EXT（INT onlyforAM,FM,PM, PWM)
	Modulating Frequency	Sine-DDS 5us~327.68mS (Resolution:5uS) Sine-ARB 2mHz to20kHz (Resolution:1mHz)
PSK		
	Carrier Waveforms	Sine-DDS
	Modulating Waveforms	50% duty cycle square
	Internal Frequency	2mHz to 1 MHz
	Phase Range	0°~360.0°
	Source	Internal / External
ASK		
	Carrier Waveforms	Sine-DDS
	Modulating Waveforms	50% duty cycle square
	Internal Frequency	2mHz to 1 MHz
	Amplitude Range	0%~100.0%
	Source	Internal / External
Power Amplifier		
	Input Impedance	10KΩ
	Input voltage	1.25Vpmax
	Working Mode	Constant Voltage
	Gain	20dB
	Output Power （RL=8Ω）	20W(Square）
	Output Voltage	12.5Vpmax
	Output Current	1.6Amax
	Rise/Fall Time	<2.5uS
	FullPower Bandwidth	5Hz-100KHz
	Overshoot	5%
	Total harmonic distortion	< 0.1% (Ampl>1Vpp) 20Hz~20 kHz
	Ground Isolation	42Vpk max
Advanced Functions		
AM Modulation		

	Carrier Waveforms	Sine, Square, Triangle, Ramp, Pulse,Arb
	Modulating Waveforms	Sine, Square, Triangle,Upramp, Dnramp
	Modulating Frequency	2mHz to 20kHz (Int)DC to 20kHz (Ext)
	Depth	0% to 120.0%
	Source	Internal / External
FM Modulation		
	Carrier Waveforms	Sine, Square, Triangle, Ramp
	Modulating Waveforms	Sine, Square, Triangle,Upramp, Dnramp
	Modulating Frequency	2mHz to20kHz (Int)DC to 20kHz (Ext)
	Peak Deviation	DC to max frequency
	Source	Internal / External
PM Modulation		
	Carrier Waveforms	Sine, Square, Triangle, Ramp
	Modulating Waveforms	Sine, Square, Triangle, Upramp, Dnramp
	Modulation Frequency	2mHz to20kHz (Int)DC to 20kHz (Ext)
	Phase deviation	0°~360.0°
	Source	Internal / External
SUM Modulation		
	Carrier Waveforms	Sine, Square, Triangle, Ramp
	Modulating Waveforms	Sine, Square, Triangle, Upramp, Dnramp
	Modulation Frequency	2mHz to20kHz (Int)DC to 20kHz (Ext)
	SUM depth	0%~100.0%
	Source	Internal / External
PWM Modulation		
	Carrier Waveforms	Sine, Square, Triangle, Ramp
	Modulating Waveforms	Sine, Square, Triangle, Upramp, Dnramp
	Modulation Frequency	2mHz to20kHz (Int)DC to 20kHz (Ext)
	Phase deviation	0%~100.0% pulse width

	Source	Internal / External
FSK		
	Carrier Waveforms	Sine, Square, Triangle, Ramp,Pulse
	Modulating Waveforms	50% duty cycle square
	Internal Frequency	2mHz to 1 MHz
	Frequency Range	1μHz to max frequency
	Source	Internal / External
Sweep		
	Waveforms	Sine, Square, Triangle, Ramp
	Type	Linear or Logarithmic
	Sweep direction	Sweep up or sweep down
	Start/Stop Freq	1uHz to max frquency
	Sweep Time	1ms to 500s
	Source	Internal / External
	Trigger	Single, External, Internal.
	Marker	Marker signal on falling edge(programmable)
	Source	Internal / External
Burst		
	Waveforms	Sine, Square, Triangle, Ramp
	Frequency	Max Frequency 25MHz
	Pulse count	1~1000000 Cycles or intfinite
	Start/ Stop Phase	-360.0°~+360.0°
	Internal Frequency	1 us~500 s
	Gate source	External Trigger
	Trigger Source	Single, External, Internal.
Trigger Delay	NCycle, Infinite	0s~100 s
External Trigger Input		
	Type	For FSK, Burst, Sweep
	Input Level	TTL Compatibility
	Slope	Rising or Falling(Selectable)
	Pulse Width	>100ns
	Input Impedance	10kΩ，DC coupled
External Modulation Input		
	Type	For AM,FM, PM,SUM,PWM

	Voltage Range	±5V full scale
	Input Impedance	10kΩ
	Frequency	DC to 20kHz
	Ground Isolation	42Vpk max
Trigger Output		
	Type	For ARB,Burst,Sweep
	Level	TTL Compatible into 50Ω
	Pulse Width	>16ns
	Maximum Rate	25MHz
	Fan-out	≥4 TTL Load
	Impedance	50Ω Typical
Frequency Counter		
	Range	5Hz to 150MHz
	Accuracy	Time Base accuracy±1count
	Time Base	±20ppm (23°C ±5°C)
	Resolution	The maximum resolution is: 100nHz for 1Hz, 0.1Hz for 100MHz.
	Input Impedance	1kΩ/1pf
	Sensitivity	35mVrms ~ 30Vrms (5Hz to 150MHz)
	Ground Isolation	42Vpk max
Dual Channel Function (CH1/CH2)		
	Phase	-180° ~180°
		Synchronize phase
	Track	CH2=CH1
	Coupling	Frequency(Ratio or Difference)
		Amplitude & DC Offset
	Dsolink	√
Save/Recall		10 Groups of Setting Memories
Interface		LAN, USB
Display		4.3" TFT LCD 480 × 3 (RGB) × 272
General Specifications		

Power Source	AC100~240V, 50~60Hz or AC100~120V, AC220~240V, 50~60Hz(With power amplifier)
Power Consumption	30W or 80W(With power amplifier)
Operating Environment	Temperature to satisfy the specification : 18 ~ 28°C Operating temperature : 0 ~ 40°C Relative Humidity: ≤ 80%, 0 ~ 40°C ≤70%, 35 ~ 40°C Installation category : CAT II
Operating Altitude	2000 Meters
Pollution Degree	IEC 61010 degree 2, Indoor use
Storage Temperature	-10~70°C, Humidity: ≤70%
Dimensions (WxHxD)	266(W) x 107(H) x 293(D) mm
Weight	Approx. 2.5kg Approx. 4kg(With power amplifier)
Safety designed to	EN61010-1
Accessories	GTL-101× 1(MFG-21XX) GTL-101× 2(MFG-22XX) Quick Start Guide ×1 CD (user manual + software) ×1 Power cord×1

(1). A total of ten waveforms can be stored. (Every waveform can be composed of a maximum of 16k points.)
(2). Add 1/10th of output amplitude and offset specification per °C for operation outside of 0°C to 28°C range (1-year specification).
(3). DC offset set to zero,
(4). Jitter specification for RF Generator: 20ppm+5ns.
(5).Only Pluse channel support
(6).Only one channel output

EC 符合性声明书

We

GOOD WILL INSTRUMENT CO., LTD.

No.7-1, Jhongsing Rd., Tucheng Dist., New Taipei City 236, Taiwan

GOOD WILL INSTRUMENT (SUZHOU) CO., LTD.

No. 69, Lushan Road, Suzhou New District Jiangsu, China

declares that the below mentioned product

MFG-2110, MFG-2120,MFG-2120MA,MFG-2130M,MFG-2230M,MFG-2260M,MFG-2160MF,MFG-2260MFA,MFG-2160MR,MFG-2260MRA

Are herewith confirmed to comply with the requirements set out in the Council Directive on the Approximation of the Law of Member States relating to Electromagnetic Compatibility (2004/108/EC&2014/30/EU) and Low Voltage Equipment DirectiveEMC: 2014/30/EU,LVD: 2014/35/EU, WEEE: 2012/19/EU and RoHS: 2011/65/EU. For the evaluation regarding the Electromagnetic Compatibility and Low Voltage Equipment Directive, the following standards were applied:

◎EMC

EN 61326-1: EN 61326-2-1:	**Electrical equipment for measurement, control and laboratory use—EMC requirements (2013)**
Conducted and Radiated Emissions EN 55011: 2009+A1:2010	Electrostatic Discharge EN 61000-4-2: 2009
Current Harmonic EN 61000-3-2: 2014	Radiated Immunity EN 61000-4-3: 2006+A1 : 2008+A2:2010
Voltage Fluctuation EN 61000-3-3: 2013	Electrical Fast Transients IEC 61000-4-4: 2012
----------	Surge Immunity EN 61000-4-5: 2006
----------	Conducted Susceptibility EN 61000-4-6: 2014
----------	Power Frequency Magnetic Field EN 61000-4-8: 2010
----------	Voltage Dips/ Interrupts IEC 61000-4-11: 2004

◎Safety

Low Voltage Equipment Directive 2014/35/EU
Safety Requirements **EN 61010-1: 2010(Third Edition)**

GLOBL HEADAQARTERS

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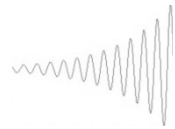
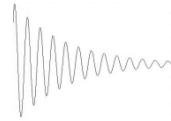
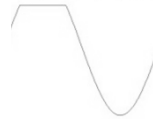
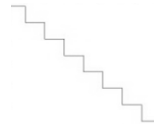
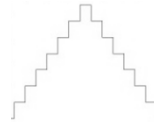
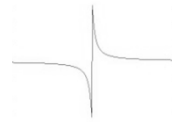
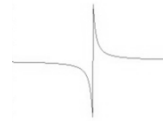
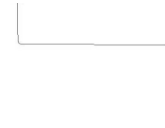
任意波内建波形

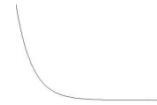
Common		
Absatan	y=|atan(x)| The absolute of atan(x)	
Abssin	y=|sin(x)| The absolute of sin(x)	
Abssinehalf	y=sin(x),0<x<pi y=0,pi<x<2pi Half_wave function	
Ampalt	y=e(x).sin(x) Oscillation rise	
Attalt	y=e(-x).sin(x) Oscillation down	
Diric	Even f(x)=-1^(x*(n-1)/2*pi) x=0,±2*pi,±4*pi,……	
Diric	Odd f(x)=sin(nx/2)/n*sin(x/2) x=±pi,±3pi，……	
Gauspuls	f(x)=a*e^(-(x-b)^2)/c^2) Gaussian-modulated sinusoidal pulse	

Havercosine	y=(1-sin(x))/2 Havercosine function	
Haversin	y=(1-cos(x))/2 Haversine function	
N_pulse	Negative pulse	
Negramp	y=-x Line segment	
Rectpuls	Sampled aperiodic rectangle	
Roundhalf	y=sqrt(1-x^2) The half roud	
Sawtoot	Sawtooth or triangle wave	
Sinetra	Piecewise function	
Sinever	Piecewise sine function	

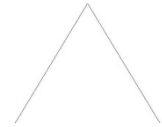
Stair_down	Step down	
Stair_ud	Step up and step down	
Stair_up	Step up	
Stepresp	Heaviside step function	
Trapezia	Piecewise function	
Tripuls	Sampled aperiodic triangle	

Math		
Arccos	Arc cosine	
Arccot	Arc cotangent	

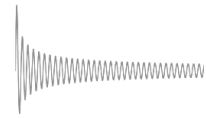
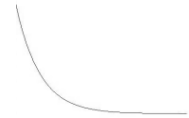
Arccsc	Arc cosecant	
Arcsec	Arc secant	
Arcsin	Arc sine	
Arcsinh	Hyperbolic arc sine	
Arctan	Arc tangent	
Arctanh	Hyperbolic arc tangent	
Cosh	Hyperbolic cosine	
Cot	Cotangent	
Csc	Cosecant	

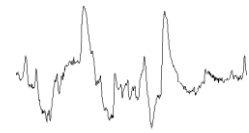
Dlorentz	The derivative of the lorentz function y=-2x/(k*x^2+1)	
Exp Fall	Exponential fall	
Exp Rise	Exponential rise	
Gauss	A waveform representing a gaussian bell curve	
Ln	Logarithm function	
Lorentz	Lorentz function y=1/(k*x^2+1)	
Sec	Secant	
Sech	Hyperbolic secant	
Sinec	y=sin(x)/x	

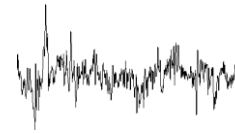
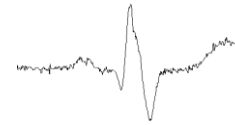
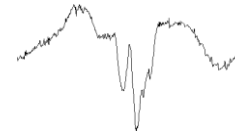
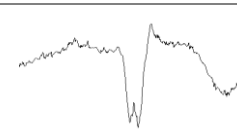
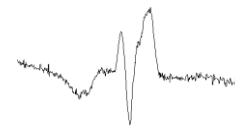
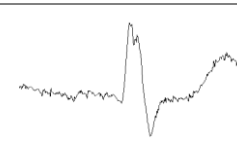
Sinh	Hyperbolic sine	
Sqrt	y=sqrt(x)	
Tan	Tangent	
Tanh	Hyperbolic tangent	
Xsquare	Parabola	

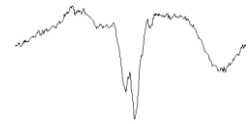
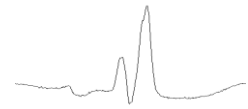
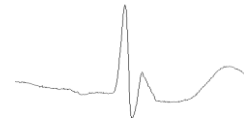
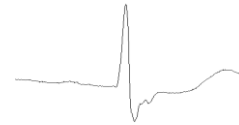
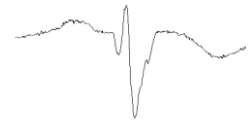
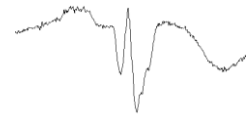
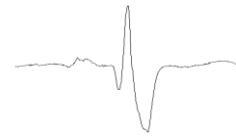
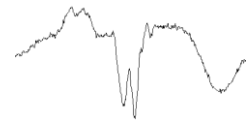
Window		
Barthannwin	Modified Bartlett-Hann window	
Bartlett	The Bartlett window is very similar to a triangular window as returned by the triang function.	
Blackman	The Blackman window function	

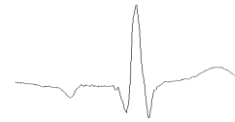
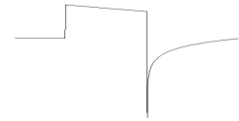
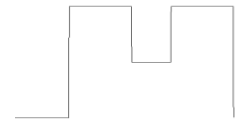
Bohmanwin	The Bohman window function	
Chebywin	The Chebyshev window function	
Flattopwin	The Flattopwin window function	
Hamming	The Hamming window function	
Hann	The Hann window function	
Hanning	The Hanning window function	
Kaiser	The Kaiser window function	
Triang	The Triang window function	
Tukeywin	The Tukey window function	

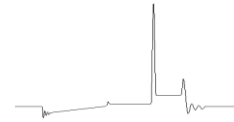
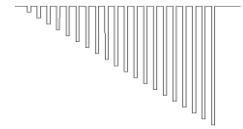
Engineer		
Airy	The airy function	
Bessel	The Bessel function	
Beta	The beta function	
Gamm	The gamma function	
Legendre	Associated Legendre function	
Neumann	The Neumann function	

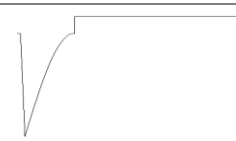
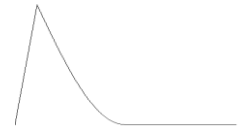
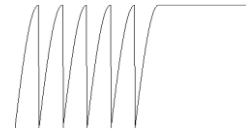
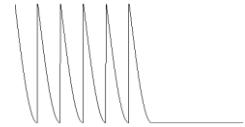
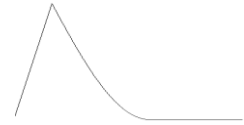
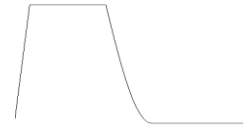
Medical		
Cardiac	Cardiac signal	
EOG	Electro-oculogram	

EEG	Electroencephalogram	
EMG	Electromyogram	
Pleth	Pulsilogram	
Resp	Speed curve of the respiration	
ECG1	Electrocardiogram 1	
ECG2	Electrocardiogram 2	
ECG3	Electrocardiogram 3	
ECG4	Electrocardiogram 4	
ECG5	Electrocardiogram 5	

ECG6	Electrocardiogram 6	
ECG7	Electrocardiogram 7	
ECG8	Electrocardiogram 8	
ECG9	Electrocardiogram 9	
ECG10	Electrocardiogram 10	
ECG11	Electrocardiogram 11	
ECG12	Electrocardiogram 12	
ECG13	Electrocardiogram 13	
ECG14	Electrocardiogram 14	

ECG15	Electrocardiogram 15	
LFpulse	Waveform of the low frequency pulse electrotherapy	
Tens1	Waveform 1 of the nerve stimulation electrotherapy	
Tens2	Waveform 2 of the nerve stimulation electrotherapy	
Tens3	Waveform 3 of the nerve stimulation electrotherapy	

AutoElec		
Ignition	Ignition waveform of the automotive motor	
ISO16750-2 SP	Automotive starting profile with ringing	
ISO16750-2 VR	Automotive supply voltage profile for resetting	

ISO7637-2 TP1	Automotive transients arising from disconnection	
ISO7637-2 TP2A	Automotive transients arising from inductance in wiring	
ISO7637-2 TP2B	Automotive transients arising from the ignition switching off	
ISO7637-2 TP3A	Automotive transients arising from switching	
ISO7637-2 TP3B	Automotive transients arising from switching	
ISO7637-2 TP4	Automotive working profile during start-up	
ISO7637-2 TP5A	Automotive transients arising from cut-off of battery power	
ISO7637-2 TP5B	Automotive transients arising from cut-off of battery power	

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