多通道函数信号发生器

MFG-2000 系列

使用手册

固纬料号 NO.82MF32K000EF1

ISO-9001 认证企业

2015.07

固纬电子实业股份有限公司
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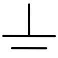
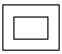
目录

安全说明

本章节包含操作和存储信号发生器时必须遵照的重要安全说明。在操作前请详细阅读以下内容，确保安全和优化的使用。

安全符号

这些安全符号会出现在本使用手册或 MFG-2000 上。

警告	警告：产品在某一特定情况下或实际应用中可能对人体造成伤害或危及生命
注意	注意：产品在某一特定情况下或实际应用中可能对产品本身或其它产品造成损坏
	高压危险
	注意: 请参考使用手册
	保护导体端子
	接地端子
	表面高温危险
	双层绝缘
	勿将电子设备作为未分类的市政废弃物处理。请单独收集处理或联系设备供应商

安全指南

通常 ⚠注意	勿将重物置于仪器上 勿将易燃物置于仪器上 避免严重撞击或不当放置而损坏仪器 避免静电释放至仪器 请使用匹配的连接线，切不可用裸线连接 若非专业技术人员，请勿自行拆装仪器 (测量等级) EN 61010-1:2010(第三版）规定了如下测量等级，MFG-2000属于等级II。 测量等级 IV：测量低电压设备电源 测量等级 III：测量建筑设备 测量等级 II：测量直接连接到低电压设备的电路 测量等级 I：测量未直接连接电源的电路
电源 ⚠警告	交流输入电压: 100 ~ 240V AC, 50 ~ 60Hz 或 100 ~ 120V AC, 220 ~ 240V AC,50 ~ 60Hz（功率输出型号） 将交流电源插座的保护接地端子接地，避免电击触电
保险丝 ⚠警告	保险丝类型: T0.5A/250V 或 T1A/250V（功率输出型号）. 请专业技术人员更换保险丝 请更换指定类型和额定值的保险丝 更换前请断开电源插座和所有测试导线 更换前请查明保险丝的熔断原因
清洁仪器	清洁前先切断电源 以中性洗涤剂和清水沾湿软布擦拭仪器。不要直接将任何液体喷洒到仪器上 不要使用含苯，甲苯，二甲苯和丙酮等烈性物质的化学药品或清洁剂

操作环境	地点: 室内，避免阳光直射，无灰尘，无导电污染(下注)，避免强磁场 相对湿度: < 80% 海拔: < 2000m 温度: 0°C~40°C (污染等级) EN 61010-1:2010（第三版）规定了如下污染程度。MFG-2000 系列属于等级 2。 污染指“可能引起绝缘强度或表面电阻率降低的外界物质，固体，液体或气体(电离气体)”。 污染等级 1：无污染或仅干燥，存在非导电污染，污染无影响 污染等级 2：通常只存在非导电污染，偶尔存在由凝结物引起的短暂导电 污染等级 3：存在导电污染或由于凝结原因使干燥的非导电性污染变成导电性污染。此种情况下，设备通常处于避免阳光直射和充分风压条件下，但温度和湿度未受控制
存储环境	地点: 室内 相对湿度: < 70% 温度: -10°C~70°C
处理 	勿将电子设备作为未分类的市政废弃物处理。请单独收集处理或联系设备供应商。请务必妥善处理丢弃的电子废弃物，减少对环境的影响

英制电源线

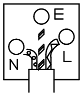
在英国使用信号发生器时，确保电源线符合以下安全说明。

注意: 导线/设备连接必须由专业人员操作

警告: 此装置必须接地

重要: 导线颜色应与下述规则保持一致:

绿色/黄色:	接地
蓝色:	零线
棕色:	火线(相线)



导线颜色可能与插头/仪器中所标识的略有差异，请遵循如下操作:

颜色为绿色/黄色的线需与标有字母“E”，或接地标志，或颜色为绿色/黄绿色的接地端子相连；

颜色为蓝色的线需与标有字母“N”，或颜色为蓝色或黑色的端子相连；

颜色为棕色的线需与标有字母“L”或“P”，或者颜色为棕色或红色的端子相连；

若有疑问，请参照本仪器提供的用法说明或与经销商联系。

电缆/仪器需有符和额定值和规格的 HBC 保险丝保护：保险丝额定值请参照仪器说明或使用手册。如: 0.75mm² 的电缆需要 3A 或 5A 的保险丝。保险丝型号与连接方法有关，再大的导体通常应使用 13A 保险丝。

在移动保险丝或保险丝座时连接器定会被损坏，然而将带有裸线的插头插入火线插座是非常危险的。若需重复连接，必须严格按照本手册说明操作。

产品介绍

本章节介绍了信号发生器的主要特点、外观、设置过程和开机。

主要特点

型号

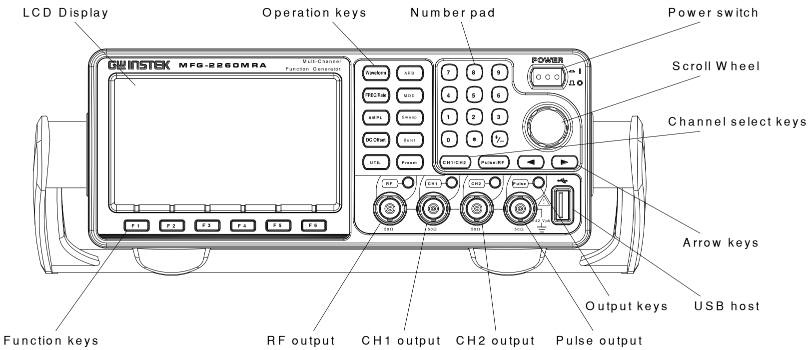
MFG-2000seriesspecific functions						
	CH1 Function With 200MSa/sARB	CH2 Function With 200MSa/sARB	25MHz Pulse Generator	RF Generator (function with ARB)	Power Amplifier	Modulation /Sweep/Burst/ Frequency.Counter
MFG-2110	●10MHZ		●			
MFG-2120	●20MHZ		●			
MFG-2120MA	●20MHZ		●		●	●
MFG-2130M	●30MHZ		●			●
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 全频段 1μHz 高频分辨率 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 组 16k 的波形存储器 显示真实波形输出 用户定义输出部分 用户定义标记输出部分 DWR(直接波形重建)能力 无需 PC 就可编辑波形 -60dBc 低失真正弦波
特点	正弦波, 方波, 斜波, 脉冲波, 噪声波 内部和外部 LIN/LOG 扫描，带标记输出 内部/外部 AM, FM, PM, FSK,SUM,PWM 调制 内部和外部触发的脉冲串信号 最大允许隔离电压是 42Vpk

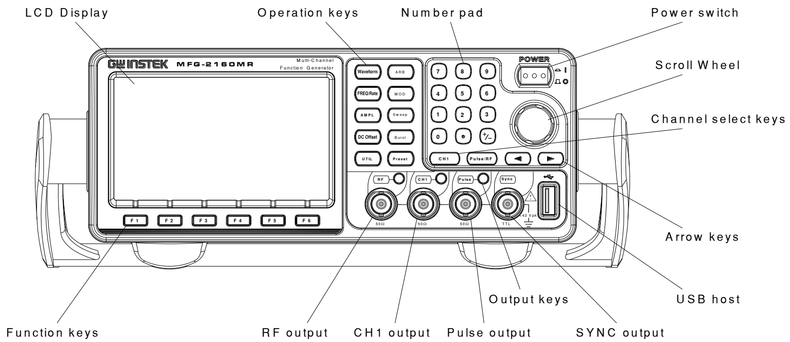
	可调整脉冲上升/下降沿时间 存储/调取 10 组设置存储器 输出过载保护
接口	USB 标准接口,LAN 标准接口(仅 MFG-22XX) 4.3’’彩色 TFT LCD (480× 272)用户界面 AWES (任意波形编辑软件) PC 软件

面板介绍

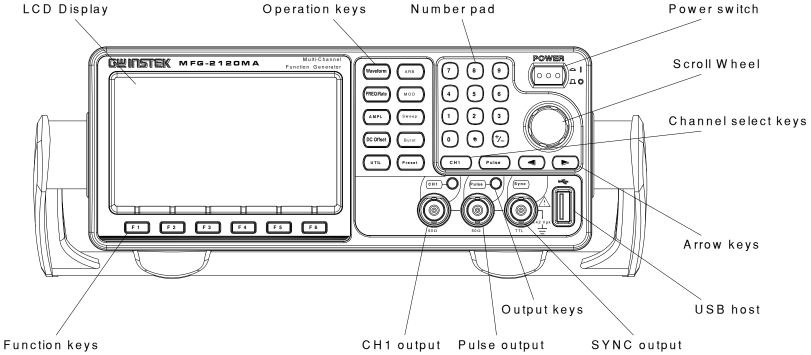
MFG-2260MRA/MFG-2260MFA 前面板



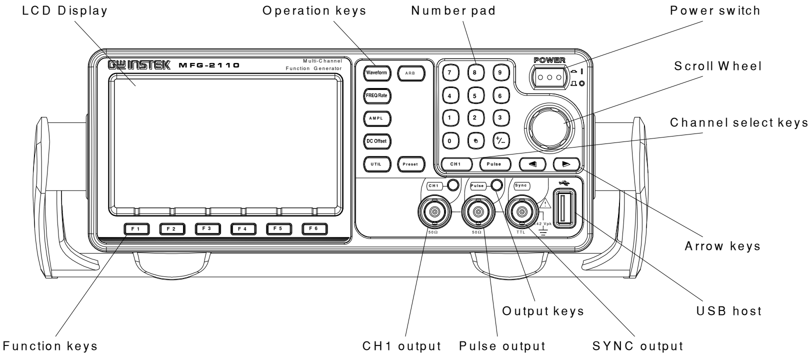
MFG-2160MR/MFG-2160MF 前面板



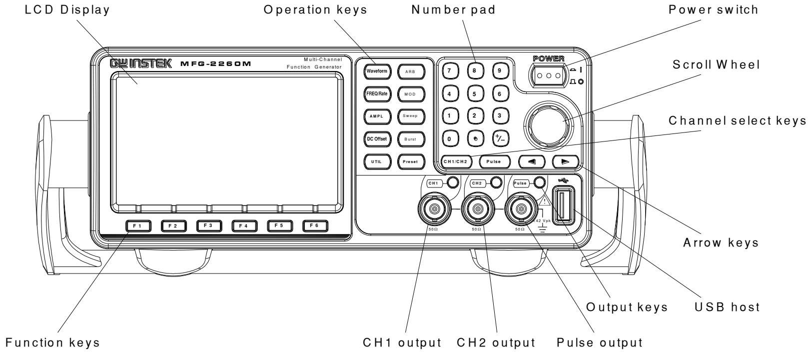
MFG- 2120MA/MFG-2130M 前面板



MFG-2110/MFG-2120 前面板

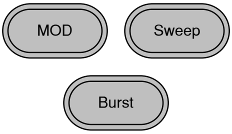
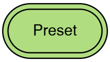
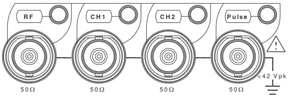
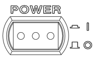
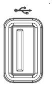
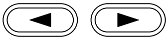
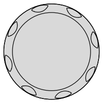
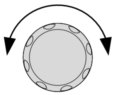
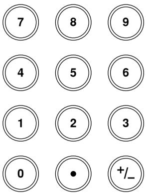


MFG-2260M/MFG-2230M 前面板

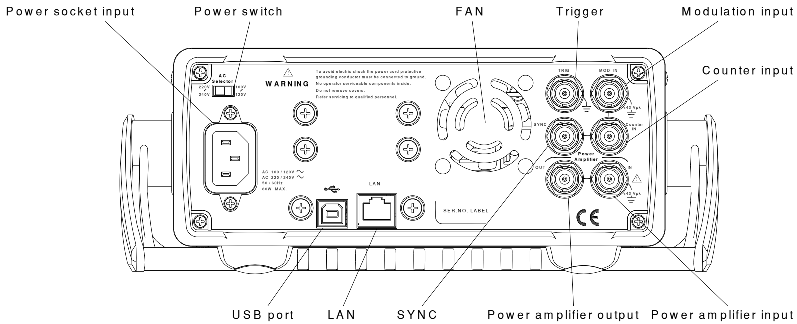


LCD 显示　TFT 彩色 LCD 显示, 480 x 272 分辨率

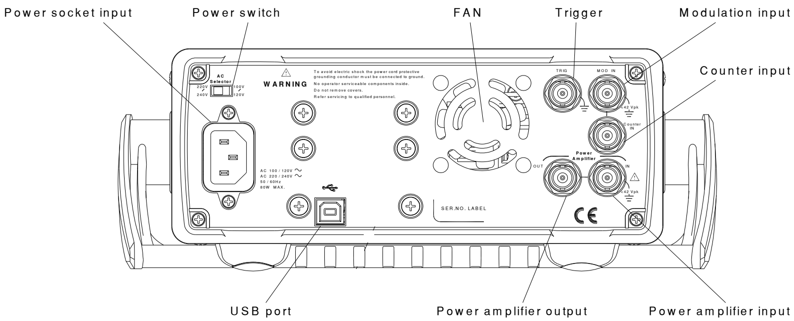
功能键: F1~F6	F 1	位于 LCD 屏下侧，用于功能激活
操作键	Waveform	用于选择波形类型
	FREQ/Rate	用于设置频率或采样率
	AMPL	用于设置波形幅值
	DC Offset	设置直流偏置
	UTIL	用于进入存储和调取选项、更新和查阅固件版本、进入校正选项、系统设置、双信道功能、计频计。
	ARB	用于设置任意波形参数

		MOD, Sweep 和 Burst 键用于设置调制、扫描和脉冲串选项和参数
复位键		用于调取预设状态
输出键		用于打开或关闭波形输出
通道切换		用于切换通道
输出端口		RF 为 RF 通道输出端口 CH1 为通道一输出端口 CH2 为通道二输出端口 Pulse 为 Pulse 通道输出端口
开机按钮		用于开关机
USB Host		USB Host 接口
方向键		当编辑参数时，可用于选择数字
可调旋钮		用于编辑值和参数  减小 增加
数字键盘		用于键入值和参数，常与方向键和可调旋钮一起使用

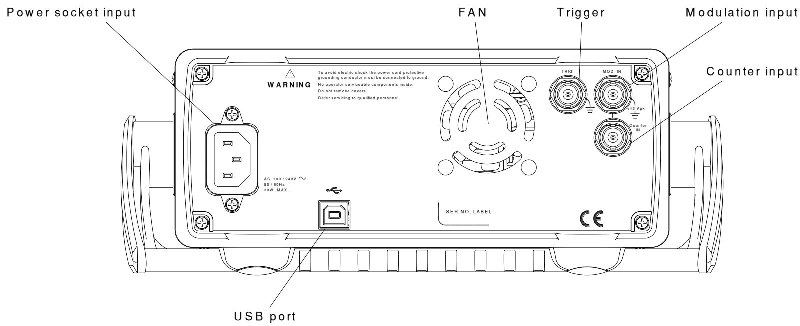
MFG-2260MRA/MFG-2260MFA 后面板



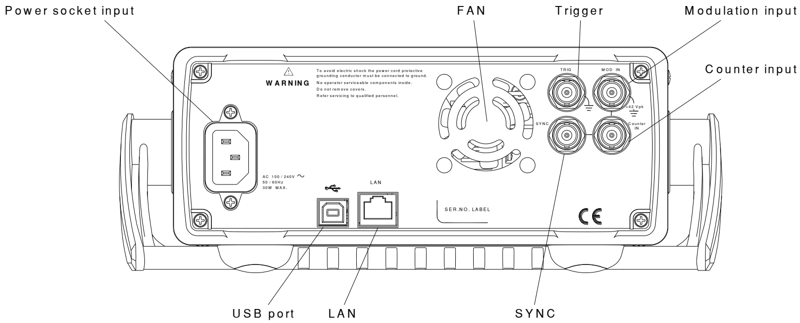
MFG- 2120MA 后面板



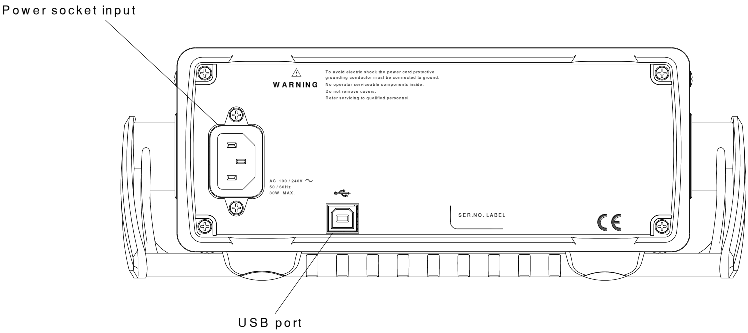
MFG-2160MR/MFG-2160MF/MFG-2130M 后面板

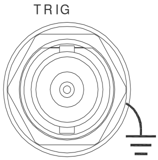
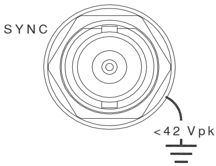
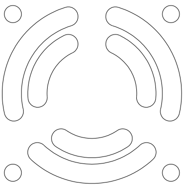


MFG-2260M/MFG-2230M 后面板

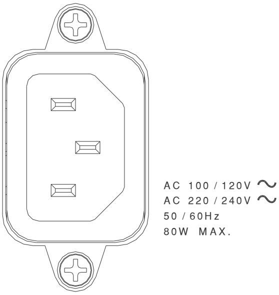


MFG-2110/MFG-2120 后面板



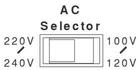
触发		详见 P23 表格
Sync 输出		详见 P23 表格
风扇		风扇

电源插座



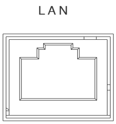
电源输入:
100~240V AC
50~60Hz. 或
100~120V AC
220~240V AC
50~60Hz.

电源选择



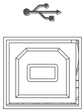
AC 电压选择：100V~120V 或 220V~240V.此功能仅使用在有 Power Amplifier 的机器里：MFG-2120MA, MFG-2260MFA, MFG-2260MRA

LAN 接口



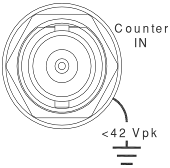
LAN 接口用于远程控制（仅 MFG-22XX)

USB 接口



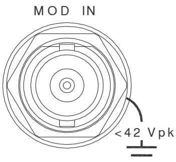
Mini-B 类 USB 接口用于连接 PC 机和远程控制

Counter in



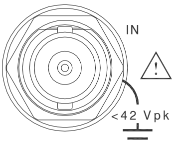
计频计输入端子

MOD 输入

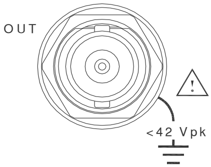


详见 P23 表格

Power Amplifier in



功率放大输入端

Power Amplifier out		功率放大输出端

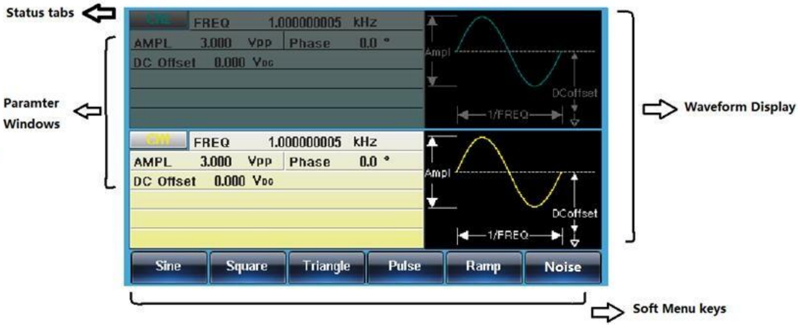
21XX:

端子	功能	所属模式
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	所属模式
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



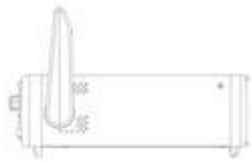
参数窗口	参数显示和编辑窗口
状态菜单	显示当前通道的设置状态
波形显示	用于显示波形
软菜单键	功能键(F1~F6)与左侧的软菜单键对应

设置信号发生器

背景	本章节介绍了如何调整信号发生器的把手以及如何开机。

调整把手

将把手拉至侧面并旋转



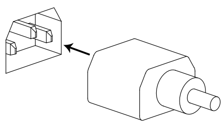
水平放置 MFG

或倾斜放置

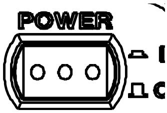
手把垂直放置以方便手提

开机

1. 将电源线接入后面板插座



2. 打开位于前面板的电源开关



3. 当按下电源开关后，屏幕显示载入状态

此时，信号发生器已经可以使用。

快速操作

本章节介绍了 MFG-2000 的快捷方式、内置帮助和默认出厂设置，方便用户快速入门。有关参数、设置和限制的详细内容，参见 MFG-2000 用户手册。

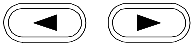
如何使用数字输入

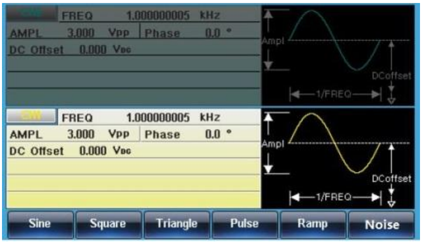
背景

MFG-2000 有三类主要的数字输入: 数字键盘, 方向键和可调旋钮。下面将为您介绍如何使用数字输入编辑参数。

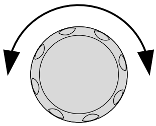
1. 按(F1~F6)对应功能键选择菜单项。例如，功能键 F1 对应软键“Sine”

2. 使用方向键将光标移至需要编辑的数字

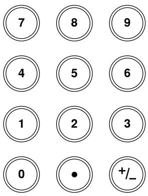




3. 使用可调旋钮编辑数字。顺时针增大，逆时针减小



4. 数字键盘用于设置高光处的参数值



如何使用帮助菜单

背景

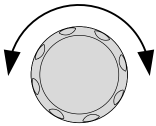
帮助菜单详细描述了每个键的含义和它的功能.(以 MFG-22xx 系列机器为例)

1. 按 UTIL

2. 按 System (F4)

3. 按 Help (F3)

4. 可调旋钮用于导航帮助菜单。按 Select 选择该项

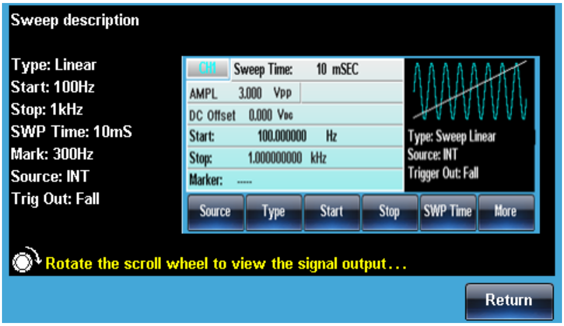


Keypad	用于解释任一前面板键
Create Arbitrary Waveform	解释如何创建任意波形
Modulation Function	解释如何创建调制波形
Sweep Function	解释扫描功能

Burst Function	解释脉冲串功能
DSO Link	提供 DSO 连接
Hardcopy	解释如何使用硬拷贝功能

5. 例如，选择项目 5 可以查看扫描功能

6. 可调旋钮用于导航帮助页面



7. 按 Return 返回上级菜单

顯示區域的分配

输出通道

MFG 系列机器分为 21xx 及 22xx 两个系列共 10 个机型，主要是 CH1/CH2/Pulse/RF 4 个输出通道的不同搭配， CH1/Pulse 为标配，CH2/ RF 为选配. CH1 的显示位置固定，Pulse 的显示位置会随着 CH2 的存在与否而变化.

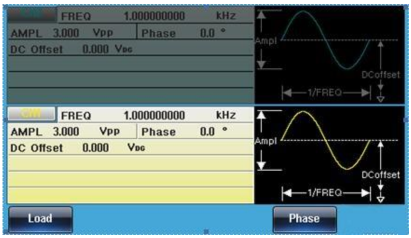
为有效区别各个通道，分别给他们赋予了不同的颜色.

CH1	黄色	
CH2	蓝色	
Pulse	粉红色	
RF	橙色	

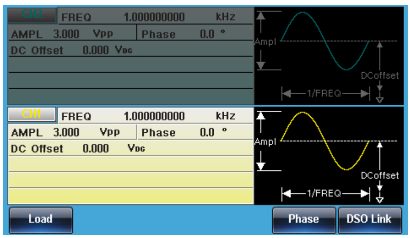
DSO Link

此功能只有 22xx 系列机型所有，切换通道操作后：

21xx



22xx

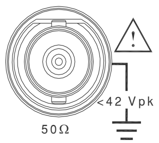


选择波形

方波

例子: 方波, 3Vpp, 75% 占空比, 1 kHz

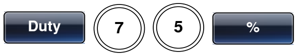
输出



输入: N/A

1. 按 Waveform 键, 选择 Square (F2)

2. 分别按(F1), 7 + 5 + %(F5)



3. 分别按 Freq/Rate, 1 + kHz (F5)

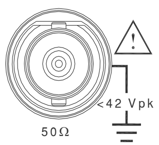
4. 分别按 AMPL, 3 + VPP (F6)

5. 按 Output 键

三角波

例子: 斜波, 5Vpp,10kHz，50%对称度

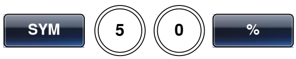
输出



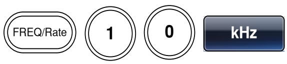
输入: N/A

1. 按 Waveform 键, 选择 Ramp (F5)

2. 分别按(F1), 5 + 0 + %(F5)



3. 分别按 Freq/Rate 键, 1 + 0 + kHz (F5)



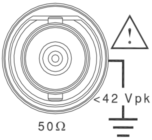
4. 分别按 AMPL 键, 5 +VPP (F6)

5. 按 Output 键

正弦波

例子: 正弦波, 10Vpp,100kHz

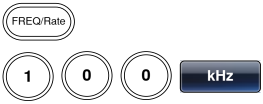
输出



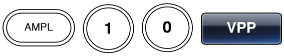
输入: N/A

1. 按 Waveform 键, 选择 Sine (F1)

2. 分别按 Freq/Rate 键, 1 + 0 +0 + kHz (F5)



3. 分别按 AMPL 键, 1 + 0 +VPP (F6)



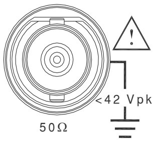
4. 按 Output 键

调制

AM

例子: AM 调制. 100Hz 调制方波. 1kHz 正弦载波. 80%调制深度

输出



输入: N/A

1. 按 MOD 键, 选择 AM (F1)

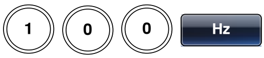
2. 按 Waveform, 选择 Sine (F1)

3. 分别按 Freq/Rate 键, 1 + kHz (F5)

4. 按 MOD 键, 选择 AM (F1), Shape (F4), Square (F2)

5. 按 MOD 键, 选择 AM (F1), AM Freq (F3)

6. 按 1 + 0 + 0 + Hz (F2)



7. 按 MOD 键, 选择 AM (F1), Depth (F2)

8. 按 8 + 0 + % (F1)

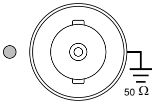
9. 按 MOD, AM (F1), Source (F1), INT (F1)

10. 按 Output 键

ASK

例子: ASK 调制，50%调制占空比, 1kHz 载波, 正弦波, 10 Hz 频率, 内部源

输出



输入: N/A

1. 按 MOD 键, 选择 ASK(F2)

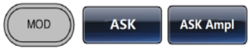
2. 按 Waveform, 选择 Sine (F1)

3. 分别按 Freq/Rate 键, 1 + kHz (F5)

4. 按 MOD 键, 选择 ASK(F2),ASK Rate(F3)

5. 按 1+ 0 + Hz (F2)

6. 按 MOD 键, 选择 ASK(F2),ASK Ampl(F2)



7. 按 5+0+%(F3)

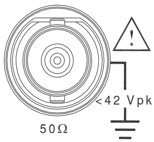
8. 按 MOD, ASK(F2), Source (F1), INT (F1)

9. 按 Output 键

FM

例子: FM 调制. 100Hz 调制方波, 1kHz 正弦载波, 100 Hz 频移, 内部源

输出



1. 按 MOD 键, 选择 FM (F2)

2. 按 Waveform, 选择 Sine (F1)

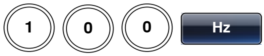
输入: N/A

3. 分别按 Freq/Rate 键, 1 + kHz (F5)

4. 按 MOD 键, 选择 FM (F2), Shape (F4), Square (F2)

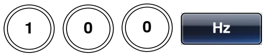
5. 按 MOD 键, 选择 FM (F2), FM Freq (F3)

6. 按 1 + 0 + 0 + Hz (F2)



7. 按 MOD 键, 选择 FM (F2), Freq Dev (F2)

8. 按 1 + 0 + 0 + Hz (F3)



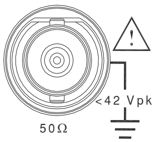
9. 按 MOD, FM (F2), Source (F1), INT (F1)

10. 按 Output 键

FSK

例子: FSK 调制, 100Hz 跳跃频率, 1kHz 载波, 正弦波, 10 Hz 频率, 内部源

输出



输入: N/A

1. 按 MOD 键, 选择 FSK (F3)

2. 按 Waveform, 选择 Sine (F1)

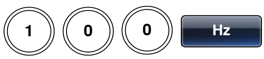
3. 分别按 Freq/Rate 键, 1 + kHz (F5)

4. 按 MOD 键, 选择 FSK (F3), FSK Rate (F3)

5. 按 1 + 0 + Hz (F2)

6. 按 MOD 键, 选择 FSK (F3), Hop Freq (F2)

7. 按 1 + 0 + 0 + Hz (F3)



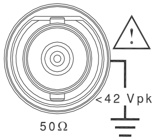
8. 按 MOD, FSK (F3), Source (F1), INT (F1)

9. 按 Output 键

PM

例子: PM 调制,800Hz 正弦载波, 1 5kHz 调制正弦波, 180 °相位频偏, 内部源

输出

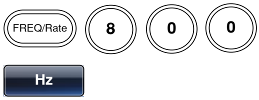


1. 按 Waveform, 选择 Sine (F1)

2. 按 MOD 键, 选择 PM (F4)

输入: N/A

3. 分别按 Freq/Rate 键, 8 + 0 + 0 + Hz (F4)



4. 按 MOD 键, 选择 PM (F4), Shape (F4), Sine (F1)

5. 按 MOD 键, PM (F4), PM Freq (F3)

6. 按 1 + 5 + kHz (F3)

7. 按 MOD, PM (F4), PM Dev (F2)

8. 按 5 + 0 + ° (F1)

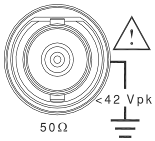
9. 按 MOD, PM (F4), Source (F1), INT (F1)

10. 按 Output 键

PSK

例子: PSK 调制，50%相位偏移，1kHz 载波, 正弦波, 10 Hz 频率, 内部源

输出



1. 按 MOD 键, 选择 PSK(F6)

2. 按 Waveform, 选择 Sine (F1)

输入: N/A

3. 分别按 Freq/Rate 键, 1 + kHz (F5)

4. 按 MOD 键, 选择 PSK(F6), PSK Rate(F3)

5. 按 1 + 0 + Hz (F2)

6. 按 MOD 键, 选择 PSK(F6),PSK Phase(F2)

7. 按 5+ 0 + %(F3)

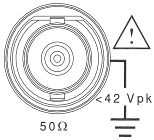
8. 按 MOD, PSK(F6), Source (F1), INT (F1)

9. 按 Output 键

PWM

例子: PWM 调制, 800Hz 载波, 15 kHz 调制正弦波, 50% 占空比, 内部源（仅 1，2 信道有此功能）

输出

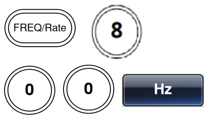


输入: N/A

1. 按 Waveform, 选择 Square (F2)

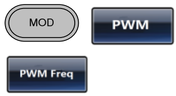
2. 按 MOD 键, 选择 PWM(F6)

3. 分别按 Freq/Rate 键, 8+0+0+Hz(F4)



4. 按 MOD 键, 选择 PWM(F6),Shape(F4),Sine(F1)

5. 按 MOD 键, 选择 PWM(F6),PWM Freq(F3)

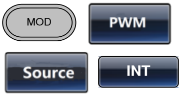


6. 按 1 + 5+ kHz(F3)

7. 按 MOD 键, 选择 PWM(F6),Duty(F2)

8. 按 5 + 0 + % (F1)

9. 按 MOD, PWM(F6), Source(F1),INT(F1)

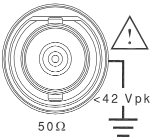


10. 按 Output 键

SUM

例子: SUM 调制. 100Hz 调制方波, 1kHz 正弦载波, 50%振幅深度, 内部源

输出



1. 按 MOD 键, 选择 SUM (F5)

2. 按 Waveform, 选择 Sine (F1)

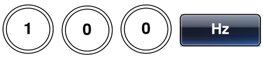
输入: N/A

3. 分别按 Freq/Rate 键, 1 + kHz (F5)

4. 按 MOD 键, 选择 SUM (F5), Shape (F4), Square (F2)

5. 按 MOD 键, 选择 SUM (F5), SUM Freq (F3)

6. 按 1 + 0 + 0 + Hz (F2)



7. 按 MOD 键, 选择 SUM (F5), SUMAmpl (F2)

8. 按 5 + 0 + ° (F1)

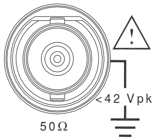
9. 按 MOD, SUM (F5), Source (F1), INT (F1)

10. 按 Output 键

扫描

例子: 频率扫描. 起始频率 10mHz, 截止频率 1MHz. Log 扫描, 1 s 扫描, 标记频率 550 Hz, 手动触发, 上升沿触发

输出



输入: N/A

1. 按 Sweep, Start (F3)

2. 按 1 + 0 + mHz (F2)

3. 按 Sweep, Stop (F4)

4. 按 1 + MHz (F5)

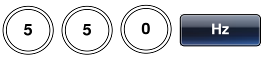
5. 按 Sweep, Type (F2), Log (F2)

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)



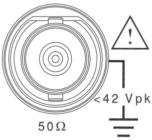
10. 按 Output 键

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

脉冲串

例子: 脉冲串模式, N 次循环(内部触发), 1kHz 脉冲串频率, 脉冲串数=5, 10 ms 脉冲串周期, 0°脉冲串相位, 内部触发, 10 us 延迟, 上升沿触发

输出



输入: 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)

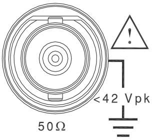
12. 按 Output 键

ARB

ARB–增加内置波形

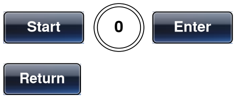
例子: ARB 模式, 上升指数函数. Start 0, Length 100, Scale 327

输出

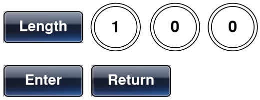


1. 按 ARB, Built in (F3), Wave (F4),Math(F2),选择 Select (F5)

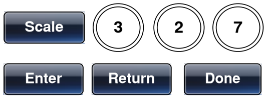
2. 按 Start (F1), 0 + Enter (F2), Return



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



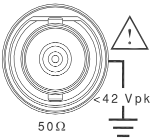
4. 按 Scale (F3), 327, Enter (F2), Return , Done (F5)



ARB–增加点

例子: ARB 模式, 增加点, 地址 40, 数据 300

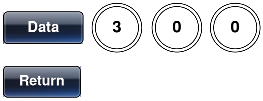
输出



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

6. 按 4 + 0 + Enter (F5), Return

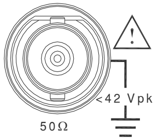
7. 按 Data (F2), 3+0+0, Enter (F5)



ARB–增加线

例子: ARB 模式, 增加线, 地址:数据(10:30, 50:100)

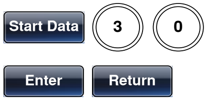
输出



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

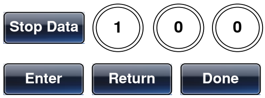
2. 按 1 + 0 + Enter (F5), Return

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)

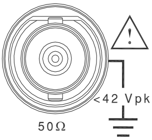


ARB–输出部分

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

输出

1. 按 ARB, Output (F6)



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

   Start 0 Enter Return

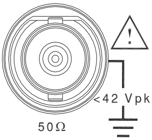
3. 按 Length (F2), 1 + 0 + 0, Enter (F5), Return

   Length 1 0 0 0 Enter Return

ARB–输出 N 次循环

例子: ARB 模式, 输出 N 次循环, Start 0, Length 1000, N 次, 10

输出



1. 按 ARB,Output(F6)

   ARB Output

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

   Start 0 Enter Return

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

   Length 1 0 0 Enter Return

4. 按 N Cycle (F4)

   N Cycle

5. 按 Cycle(F1),1+0

   Cycle 1 0

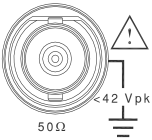
6. 按 Trigger(F5),触发一次输出

   Trigger

ARB–输出无限次循环

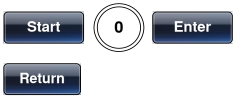
例子: ARB 模式, 输出 N 次循环, Start 0, Length 1000, 循环无限次

输出

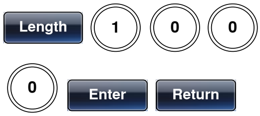


1. 按 ARB,Output(F6)

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



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

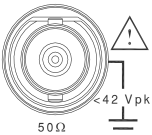


4. 按 infinite(F5), Return(F6)

ARB–输出标记

例子: ARB 模式, 输出标记, Start 30, Length 80

输出



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

存储

例子: 存储至内存文件#5

1. 按 UTIL, Memory (F1), Store (F1)

2. 使用可调旋钮选择文件，按 Done (F5)

调取

例子: 调取内存文件#5

1. 按 UTIL, Memory (F1), Recall (F2)

2. 使用可调旋钮选择文件，按 Done (F5)

菜单树

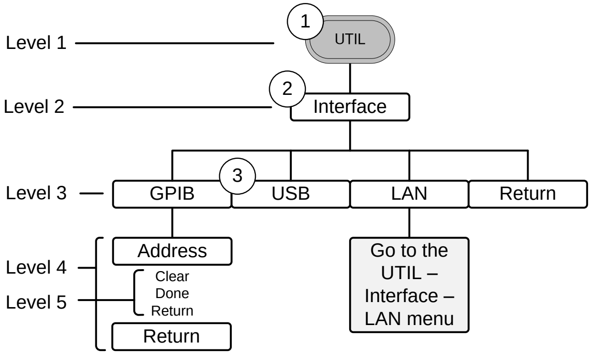
常规

用户可以将菜单树用作对信号发生器的功能和特性的简易参考。MFG-2000 菜单系统逐层排列，每层都有操作或软件导航。返回软键用于返回上级菜单。例如：设置接口 USB

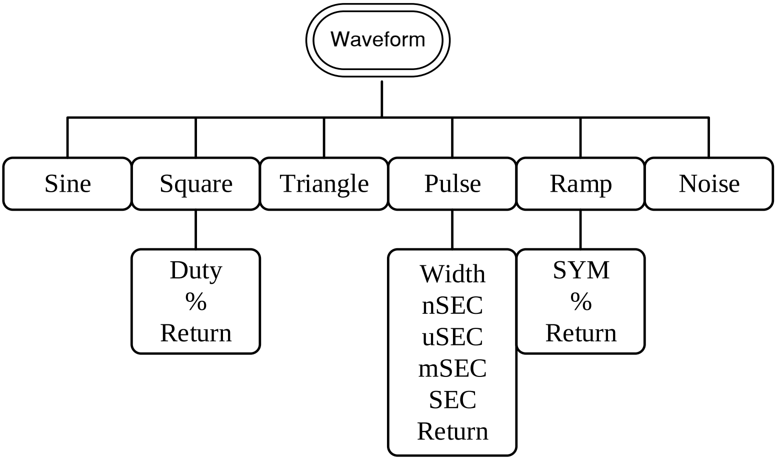
(1)按 UTIL 键.

(2)interface 软键.

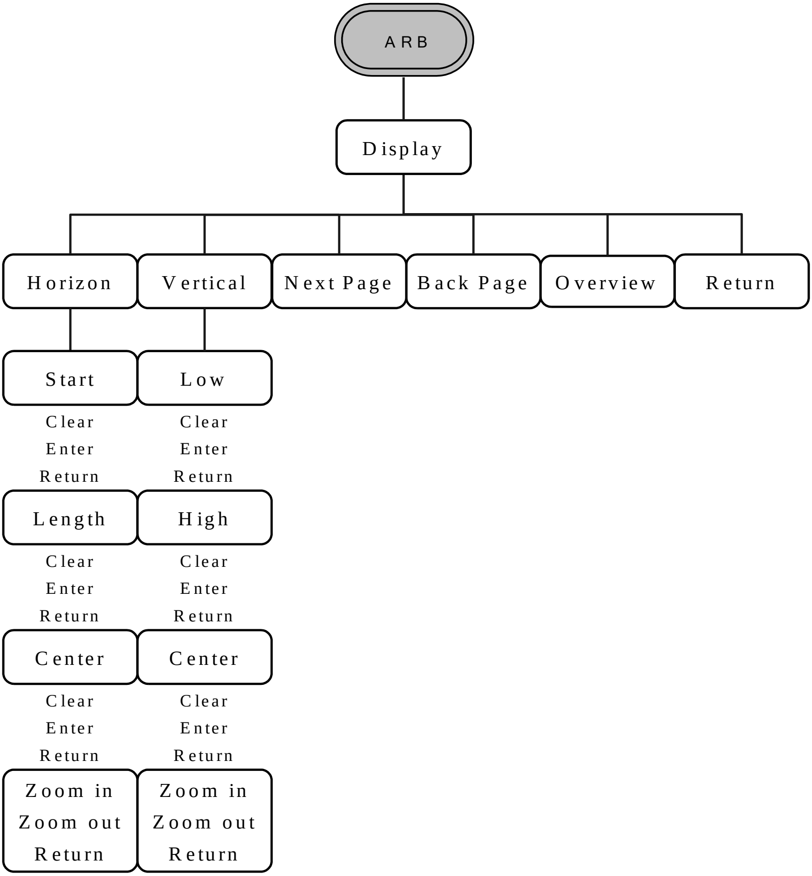
(3) USB.



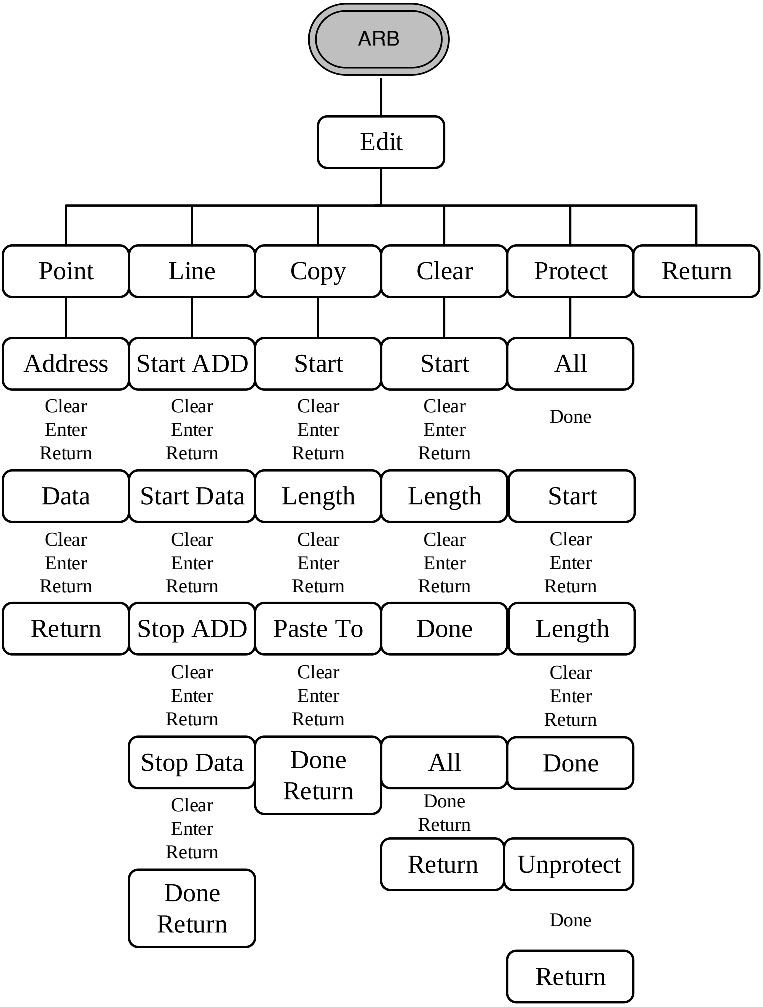
波形


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

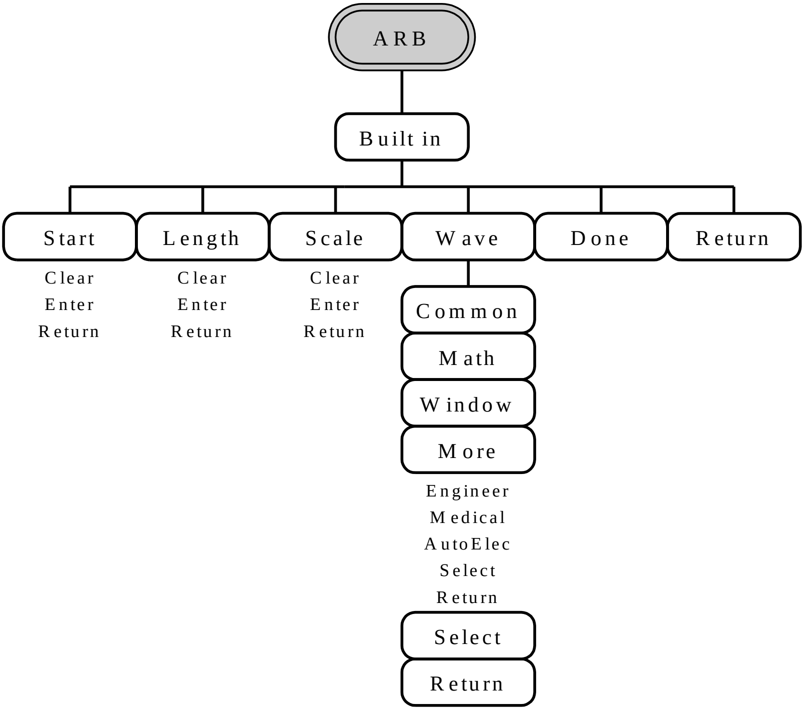
ARB–显示


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

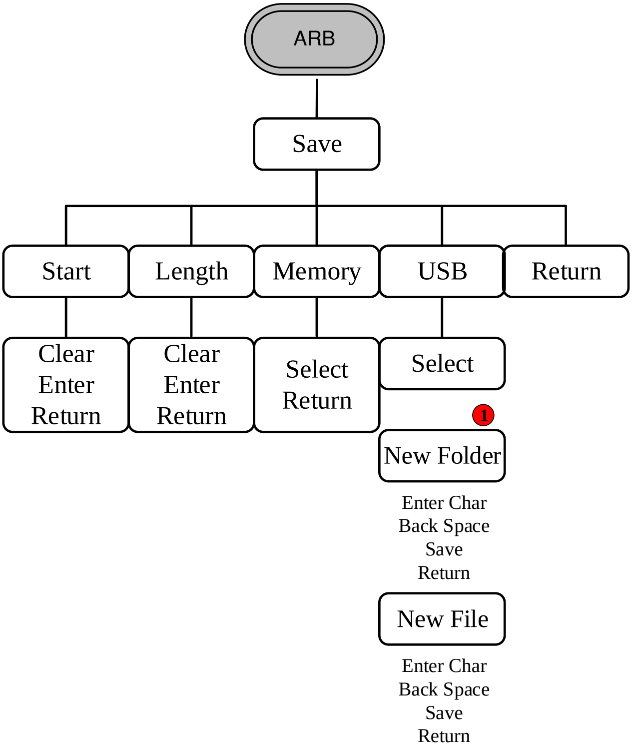
ARB–编辑


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

ARB–内置

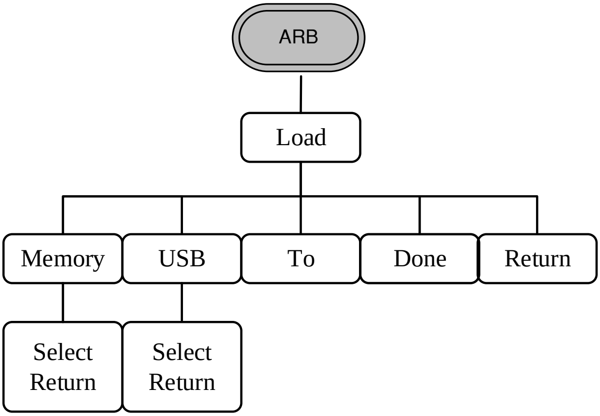

ARB
Built in
Start
Clear
Enter
Return
Length
Clear
Enter
Return
Scale
Clear
Enter
Return
Wave
Common
Math
Window
More
Engineer
Medical
AutoElec
Select
Return
Select
Return
Done
Return

ARB–存储

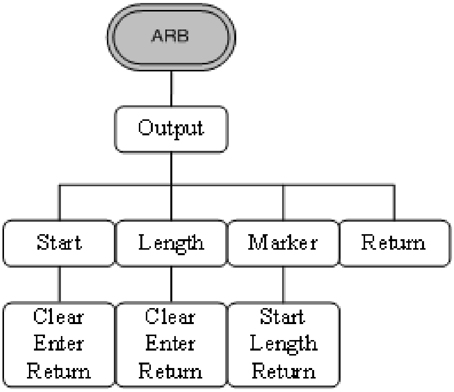


注：标记①部分 New Folder 只在 MFG-22XX 系列機器里才有.

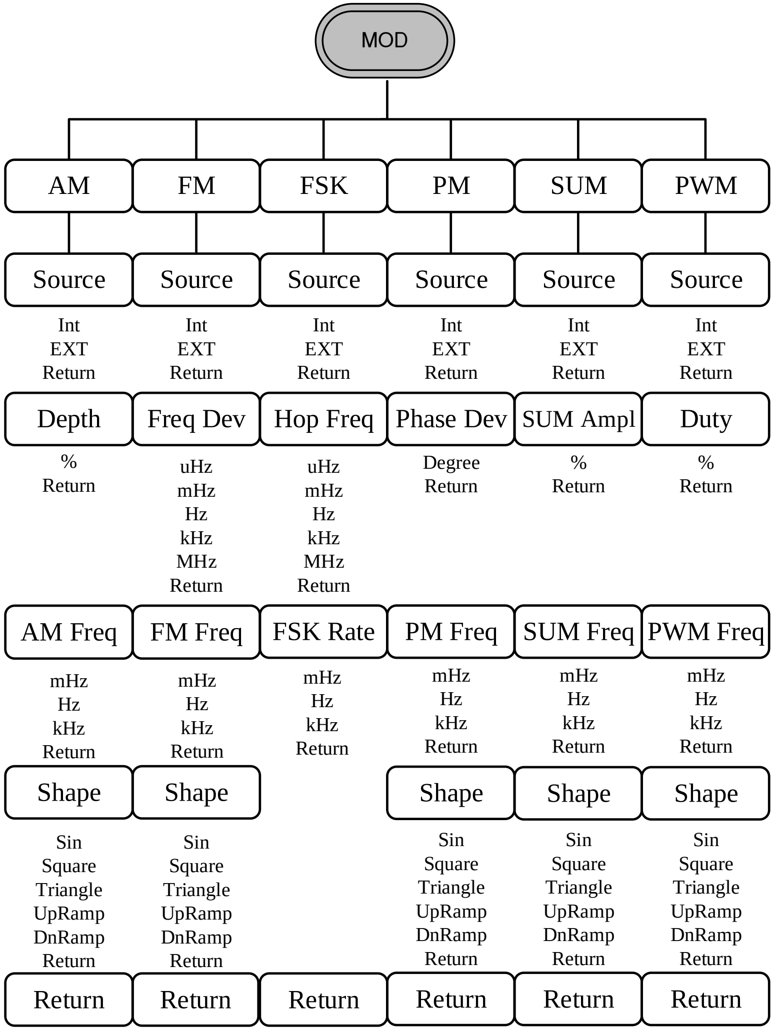
ARB–调取


ARB
Load
Memory
USB
To
Done
Return
Select
Return
Select
Return

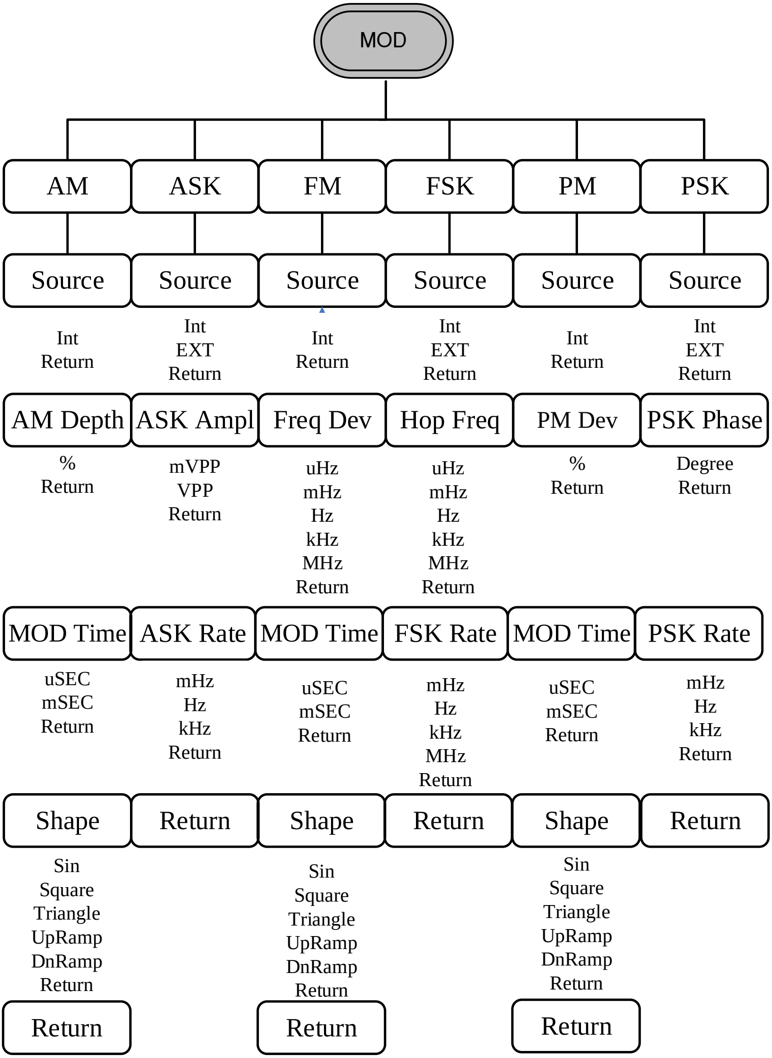
ARB–输出


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

调制_(CH1/CH2)

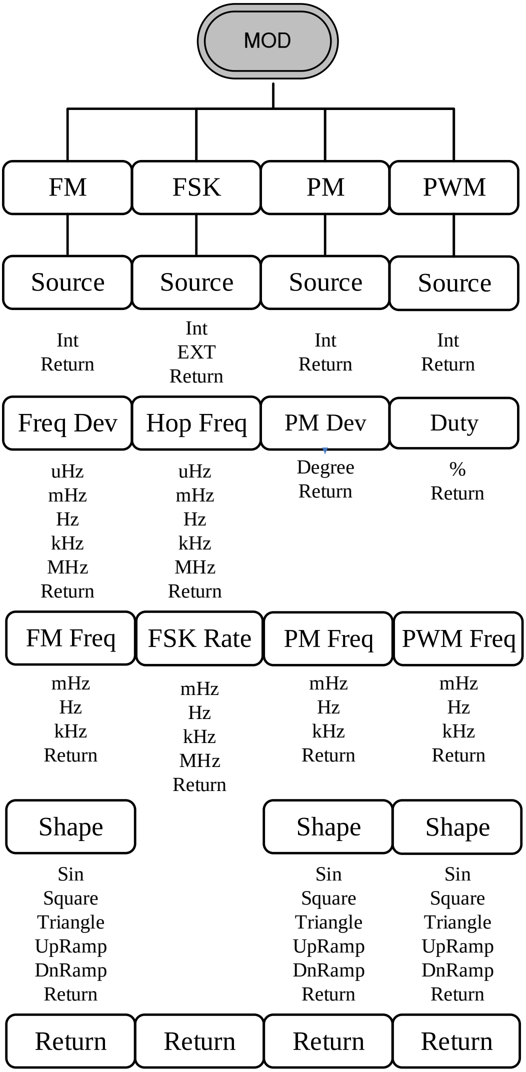

MOD
AM
FM
FSK
PM
SUM
PWM
Source
Int
EXT
Return
Depth
%
Return
Freq Dev
uHz
mHz
Hz
kHz
MHz
Return
Hop Freq
Phase Dev
Degree
SUM Ampl
Duty
AM Freq
FM Freq
FSK Rate
PM Freq
SUM Freq
PWM Freq
Shape
Sin
Square
Triangle
UpRamp
DnRamp
Return

调制_(Sine-DDS)



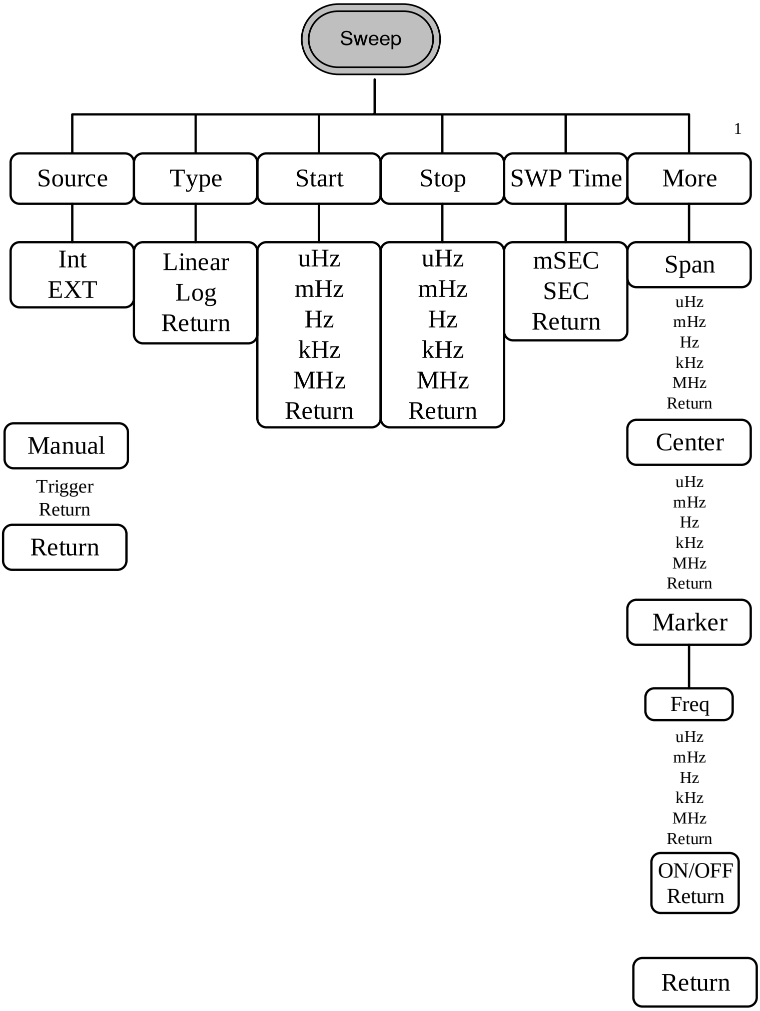
注：此功能为在 RF 波形时选择 Sine-DDS 的调制功能.

调制_(Sine-ARB)

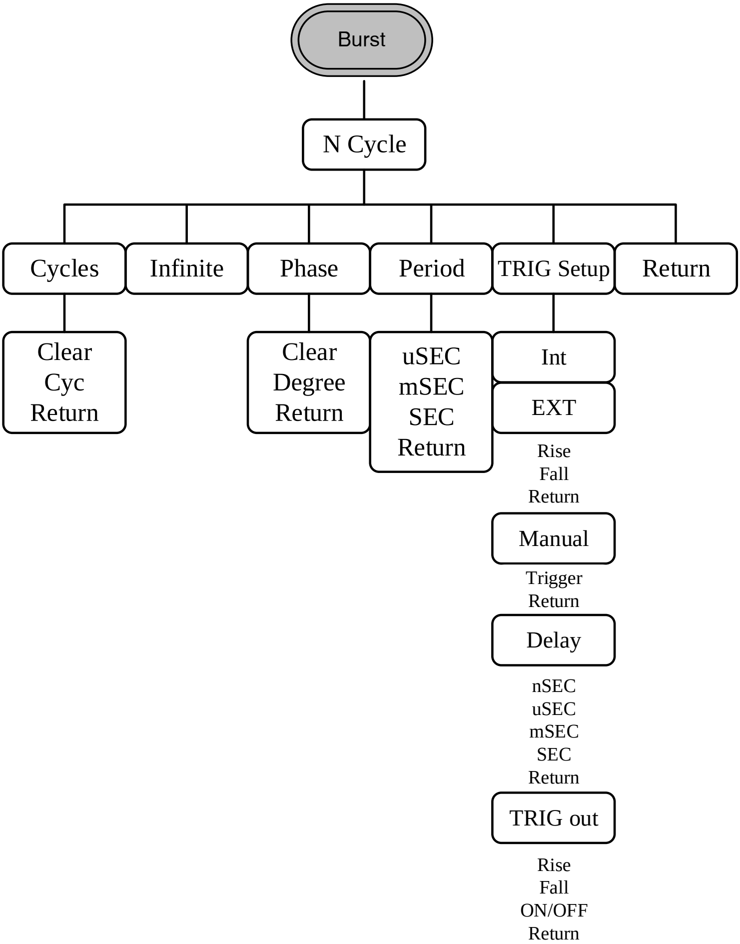


注：此功能为在 RF 波形时选择 Sine-ARB 的调制功能.

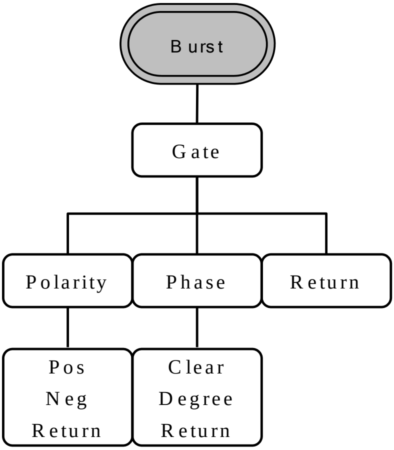
扫描


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

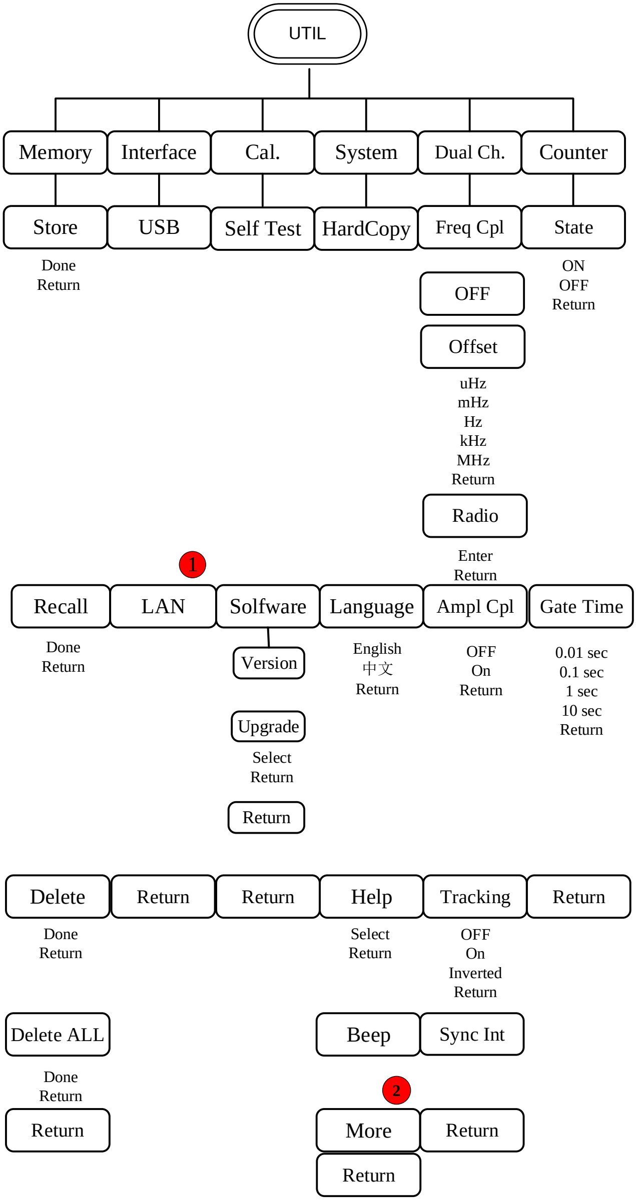
脉冲串–N 次循环

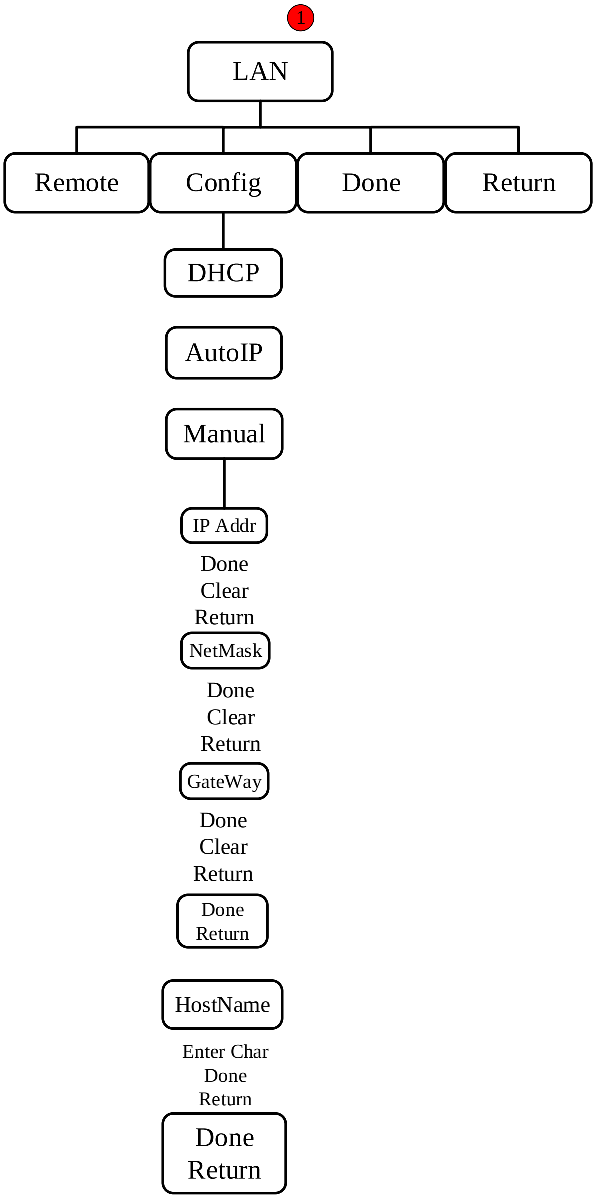

Burst
N Cycle
Cycles
Infinite
Phase
Period
TRIG Setup
Return
Clear
Cyc
Return
Clear
Degree
Return
uSEC
mSEC
SEC
Return
Int
EXT
Rise
Fall
Return
Manual
Trigger
Return
Delay
nSEC
uSEC
mSEC
SEC
Return
TRIG out
Rise
Fall
ON/OFF
Return

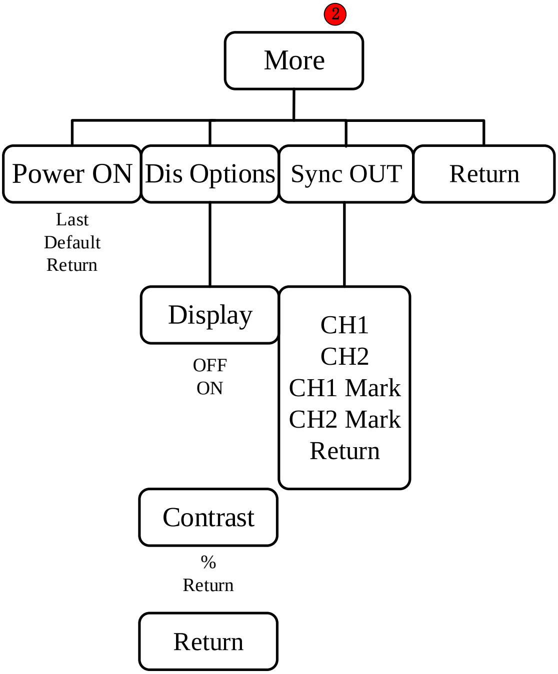
脉冲串–门控


Burst
Gate
Polarity
Phase
Return
Pos
Neg
Return
Clear
Degree
Return

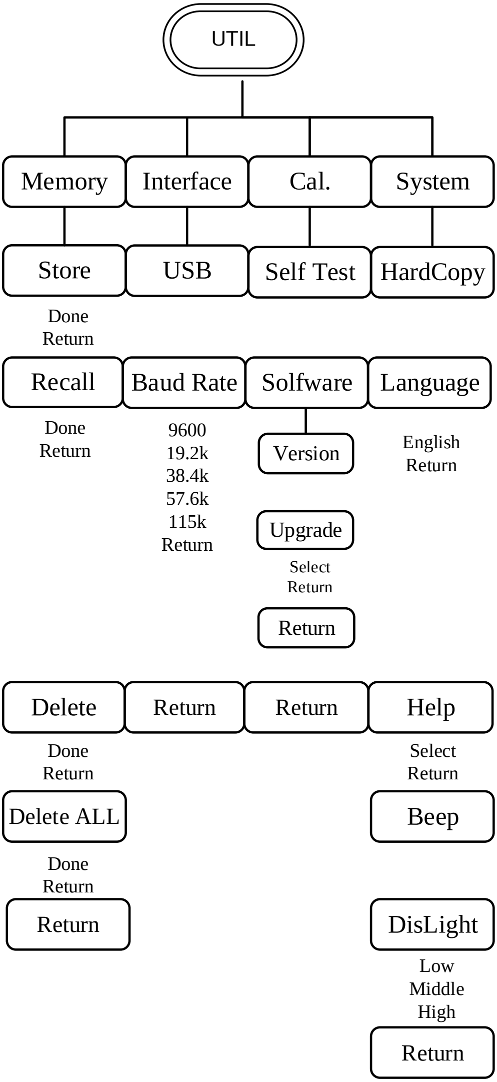
UTIL_(22XX)


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

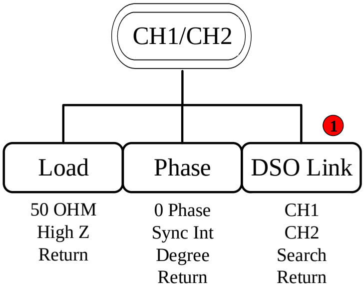

1
LAN
Remote
Config
Done
Return
DHCP
AutoIP
Manual
IP Addr
Done
Clear
Return
NetMask
Done
Clear
Return
GateWay
Done
Clear
Return
Done
Return
HostName
Enter Char
Done
Return
Done
Return


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

UTIL_(21XX)

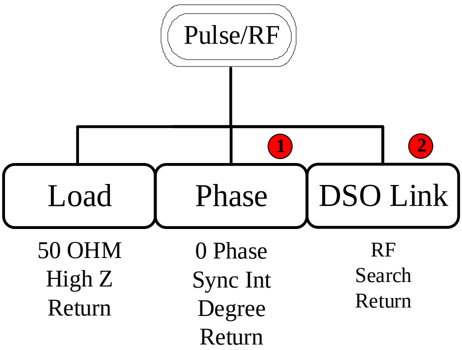

UTIL
Memory
Interface
Cal.
System
Store
USB
Self Test
HardCopy
Done
Return
Recall
Baud Rate
Solfware
Language
Done
Return
9600
19.2k
38.4k
57.6k
115k
Return
Version
English
Return
Upgrade
Select
Return
Return
Delete
Return
Return
Help
Done
Return
Select
Return
Delete ALL
Beep
Done
Return
Return
DisLight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

CH1/CH2



注：标记①处只有 MFG-22XX 系列机器有 DSO-Link.

Pulse/RF



注：标记①处在 RF 信道无 Phase 功能. 标记②处在 Pulse 信道无 DSO-Link 功能, RF 信道只有 MFG-22XX 系列机器才有 DSO-Link.

默认设置

复位键用于恢复默认面板设置。

Preset

输出设置	功能	正弦波
	频率	1kHz
	幅值	3.000 Vpp
	偏置	0.00V dc
	输出单位	Vpp
	输出端	50Ω
调制 (AM/ASK/FM/FSK/PM/PSK/SUM)	载波	1kHz 正弦波
	调制波形	100Hz 正弦波
	AM 深度	100%
	ASK 幅度	50%
	ASK 频率	10Hz
	FM 偏移	100Hz
	FSK 跳跃频率	100Hz
	FSK 频率	10Hz
	PM 相位偏移	180°
	PSK 相位	180°
	PSK 频率	10Hz
	SUM 振幅	50%
	调制解调器状态	Off

PWM 调制	载波	1kHz 方波
	调制波形	20kHz 正弦波
	PWM 占空比	50%
	调制解调器状态	Off
扫描	起始/停止频率	100Hz/1kHz
	扫描时间	1ms
	扫描类型	线性
	扫描状态	Off
脉冲串	脉冲串频率	1kHz
	N 次循环	1
	脉冲串周期	10ms
	脉冲串起始相位	0°
	脉冲串状态	Off
系统设置	断电调用	On
	显示模式	On
	错误队列	已清除
	存储器设置	无更改
	输出	Off
触发	触发源	内部(立即)
校正	校正菜单	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，请看 114 页和 209 页。

CH1/CH2 通道

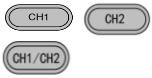
MFG-2000 系列多通道函数信号发生器在输出之前必须先对通道进行操作和选择。

选择通道

Panel Operation

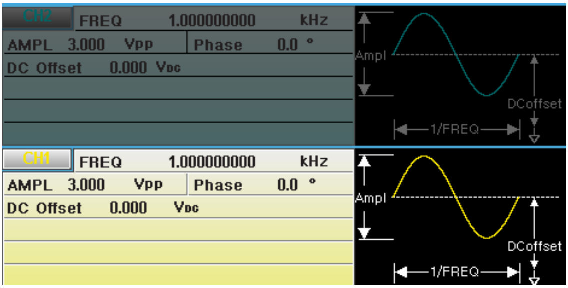
1. 按 CH1 或 CH2 或 CH1/CH2 键.

21xx
22xx



2. 被选择的通道可以很清楚的看到，而未被选择的会变淡。

如下方图所示，CH1 已被选择



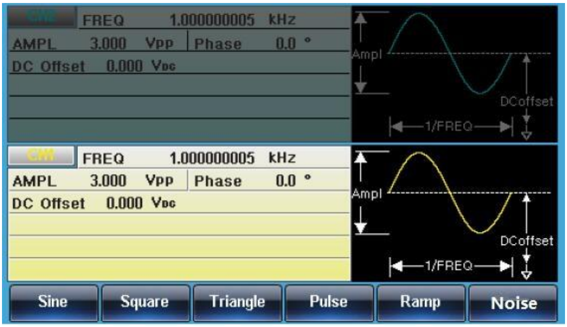
选择波形

MFG-2000 可以输出六种标准波形: 正弦波, 方波, 三角波,脉冲波, 斜波和噪声波。

设置正弦波

面板操作

1. 按 Waveform 键



2. 按 F1 (Sine)

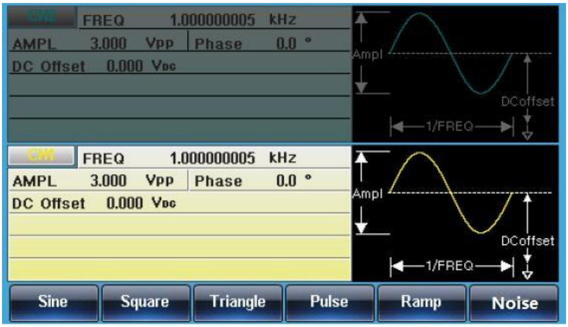
参数设置

3. 要设定 the Load/Frequency/Amplitude/DC Offset/ Phase 参数,请看 83 -88 页.

设置方波

面板操作

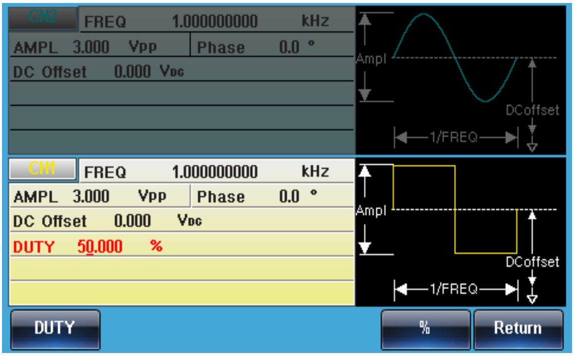
1. 按 Waveform 键



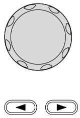
参数设置

2. 按 F2 (Square)创建一个方波

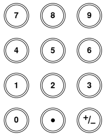
3. 按 F1 (Duty)将使位于参数窗口处的占空比参数变亮



4. 两种方式可设置其大小：a,使用方向键或可调旋钮。



b,使用数字键。



按 F2~F5 选择单位范围.

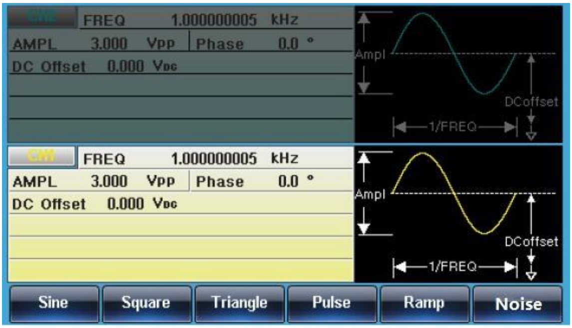
占空比范围 0.01%~99.99%(受限于当前频率的设定)

5. 要设定 theLoad/Frequency/Amplitude/DC Offset/ Phase 参数, 请看 83 -88 页.

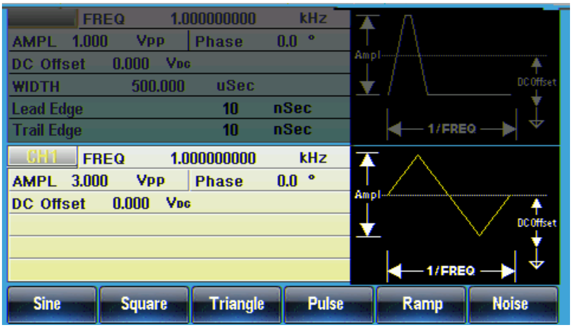
设置三角波

面板操作

1. 按 Waveform 键



2. 按 F3(Triangle)创建一个脉冲波



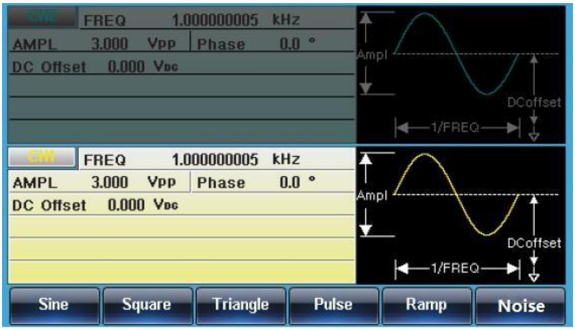
参数设置

3. 要设定 the Load/Frequency/Amplitude/DC Offset/ Phase 参数,请看 83 -88 页.

设置脉冲波

面板操作

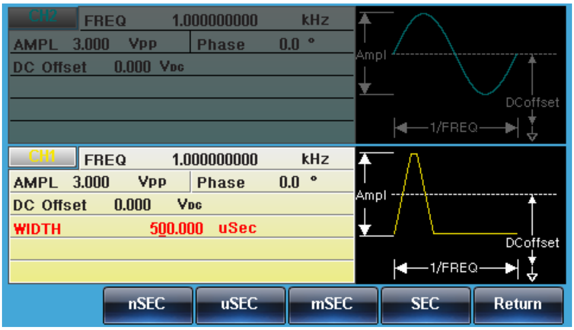
1. 按 Waveform 键



2. 按 F4(Pulse)创建一个脉冲波

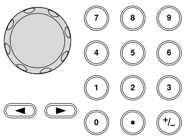
参数设置

3. 按 F1 (Width)将使位于参数窗口处的脉宽参数变亮



4. 两种方式可设置其大小：
   a,使用方向键或可调旋钮

   b,使用数字键.



通过 F2~F5 选择相应单位.

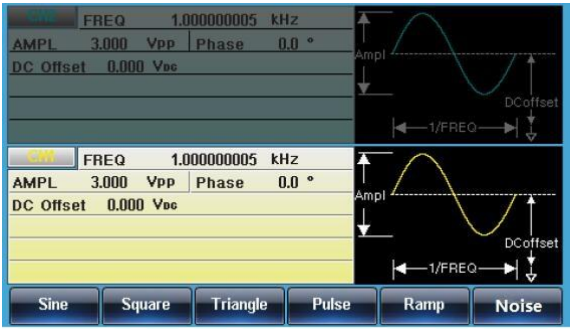
脉冲宽度范围 ≧20ns(受限于当前频率的设定)

5. 要设定 the Load/Frequency/Amplitude/DC Offset/ Phase 参数,请看 83 -88 页.

设置斜波

面板操作

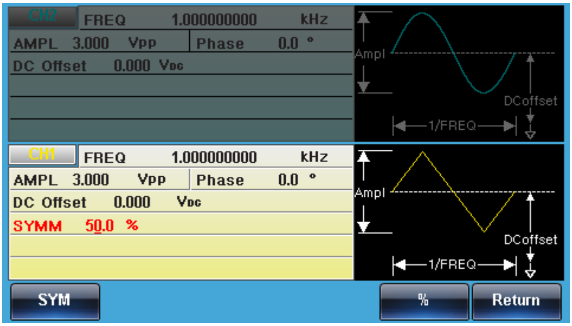
1. 按 Waveform 键



2. 按 F5 (Ramp)创建一个斜波

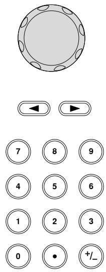
参数设置

3. 按 F1 (SYM)将使位于参数窗口处的 SYMM 参数变亮



4. 两种方式可设置其大小：
   a,使用方向键或可调旋钮。

   b,使用数字键.



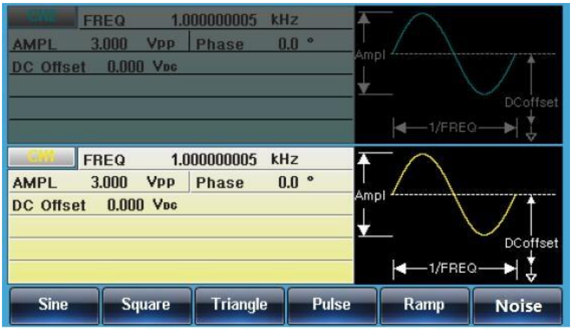
按 F5 (%) 选择% 单位.

对称度范围　　0%~100%

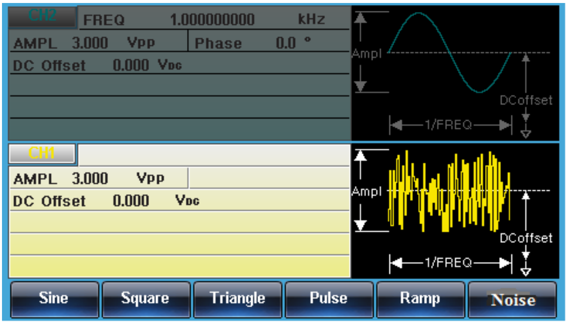
5. 要设定 the Load/Frequency/Amplitude/DC Offset/ Phase 参数,请看 83 -88 页.

设置噪声波

面板操作 1. 按 Waveform 键



2. 按 F6 (Noise)



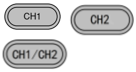
参数设置 要设定 the Load/Amplitude/DC Offset 参数,请看 83 - 86 页.

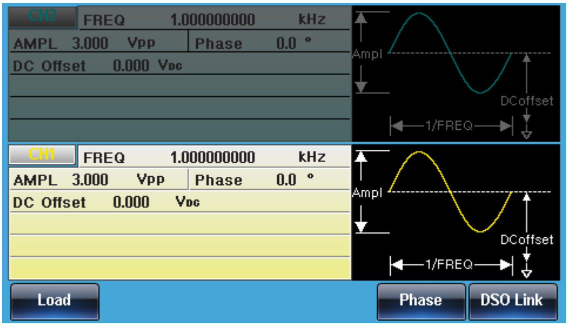
设置负载

面板操作

1. 按 CH1 或 CH2 或 CH1/CH2 键.

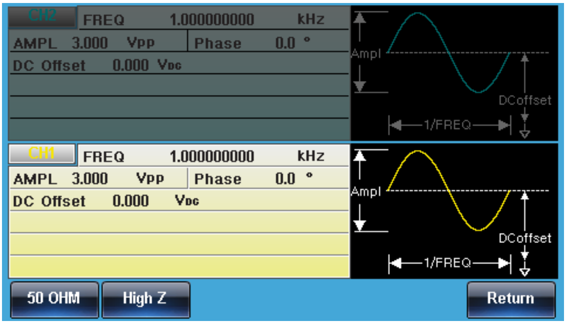
21XX
22XX





参数设置

2. 负载的设定. 选择相应的通道后, 按 F1(Load)， 进入以下界面.



3. 按 F1(50OHM)或 F2(High Z)去设定 Load 的大小.

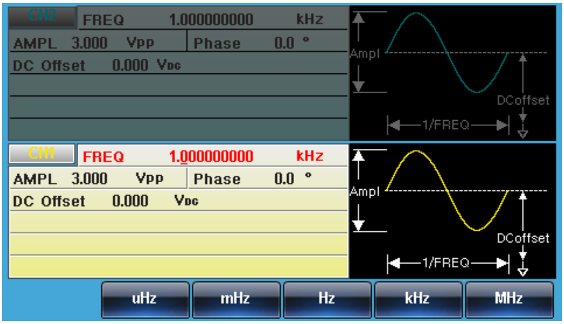
高阻时幅度是 50 奥姆的 2 倍.
可在 UTIL 里可看到各个通道的 Load 设置状态.

设置频率

面板操作

1. 按 FREQ/Rate 键

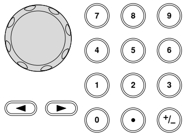
2. 位于参数窗口处的 FREQ 参数将变亮



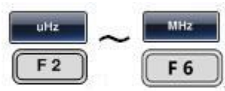
参数设置

3. 两种方式可设置其大小：
   a,使用方向键或可调旋钮。

   b,使用数字键.



   通过 F2 ~F6 选择相应单位.



范围 Sine wave 1μHz~320MHz(max)

Square wave 1μHz~25MHz(max)

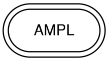
Pulse wave 1μHz~25MHz(max)

Ramp wave 1μHz~1MHz

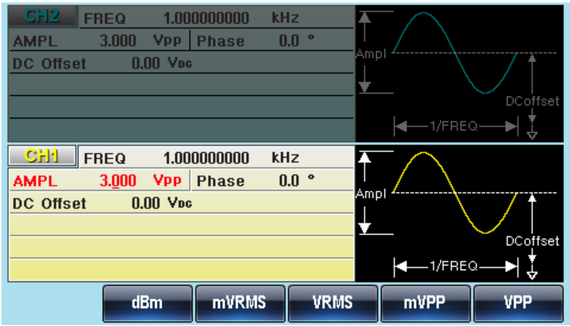
设置幅值

面板操作

1. 按 AMPL 键



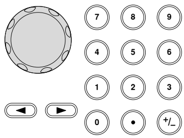
2. 位于参数窗口处的 AMPL 参数将变亮



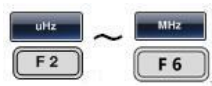
参数设置

3. 两种方式可设置其大小：
   a,使用方向键或可调旋钮

   b,使用数字键.



通过 F2~F6 选择相应单位.



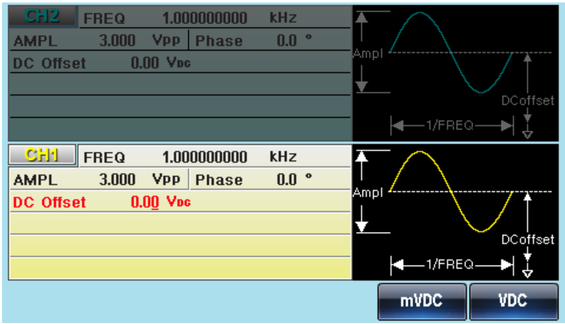
	50Ω load	High Z
范围	1mVpp~10Vpp	2mVpp~20Vpp
单位	Vpp, Vrms, dBm	

设置直流偏置

面板操作

1. 按 DC 偏置键

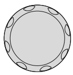
2. 位于参数窗口处的 DC 偏置参数将变亮

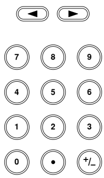


参数设置

3. 两种方式可设置其大小：
a,使用方向键或可调旋钮。

b,使用数字键.





按 F5 (mVDC) 或 F6 (VDC) 来选择电压范围.

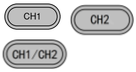
	50Ω load	High Z
范围	±5Vpk	±10Vpk

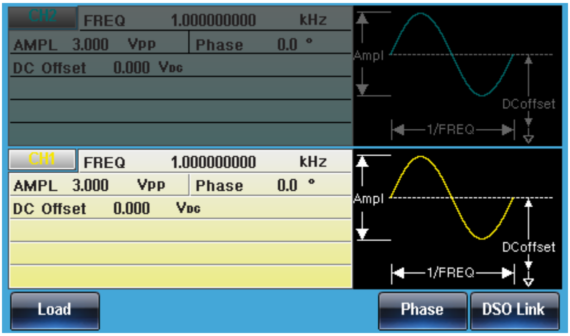
设置相位

面板操作

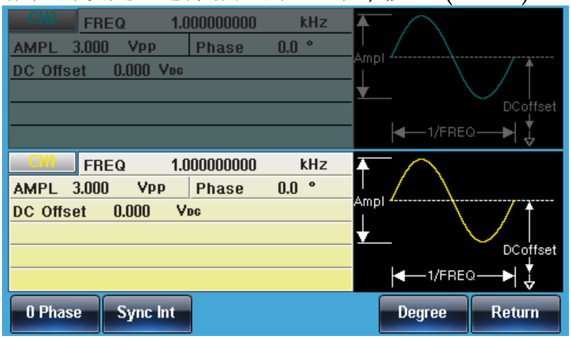
1. 按 CH1 或 CH2 或 CH1/CH2 键.

21XX
22XX





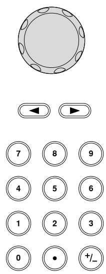
2. 相位的设定. 选择相应的通道后, 按 F5(Phase) .



参数设置

3. 两种方式可设置其大小:
   a,使用方向键或可调旋钮

   b,使用数字键.



按 F5 (Degree) 选择相应单位. Degree F 5

进入相位设定界面有两个快捷的操作：

当前通道相位设为零 0 Phase
CH1/CH2 相位同时设为零 Sync Int

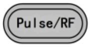
RF 通道

MFG-2000 系列机器有多个通道输出，只有选择了此通道才能对其进行设定操作等. RF 波形中有 Sine-DDS 和 Sine-ARB，两者的采样率不同，对应调制类型也不同。Sine-DDS 支持最高 320MHz 正弦波频率输出。

选择 RF 波形

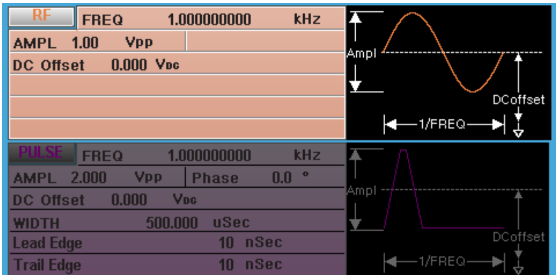
面板操作

1. 按 Pulse/RF 键选择 RF.



2. 被选择的通道可以很清楚的看到，而未被选择的会变淡.

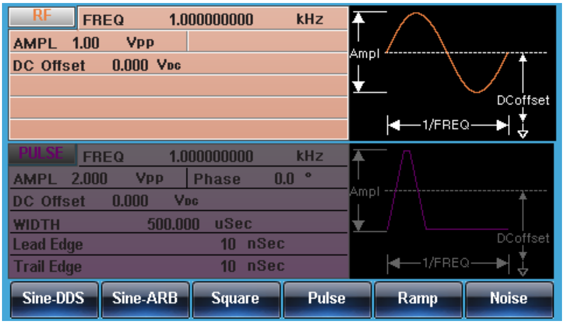
在下图屏幕显示中, RF 被选择.



设置正弦波

面板操作

1. 按 Waveform 键.



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

参数设置

3. 设定 the Load/Frequency/Amplitude/DC Offset 的值, 请看 95 -99 页.

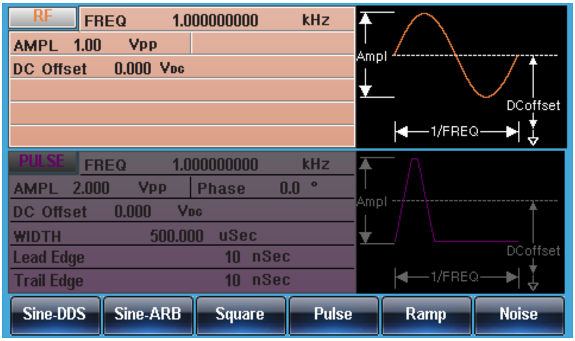
⚠ Sine-DDS, RF 调制功能有 AM,ASK,FM,FSK,PM,PSK. 频率上限 160MHz (MFG-2XXXMF) / 320MHz (MFG-2XXXMR).

Sine-ARB,RF 调制功能有 FM,FSK,PM,PWM.频率上限依型号请参照规格表之 CH1 相同.

设置方波

面板操作

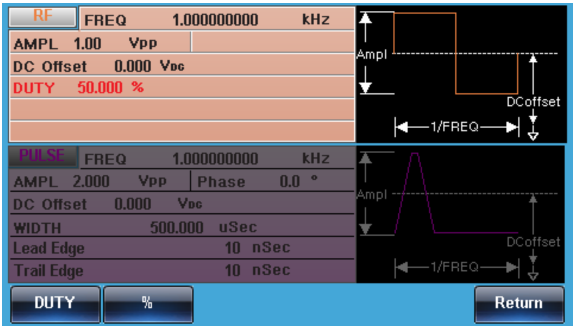
1. 按 Waveform 键.



2. 按 F3 (Square) 创建方波.

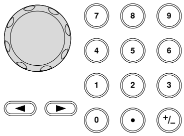
参数设置

3. 按 F1 (Duty). 位于参数窗口处的占空比参数变亮.



4. 两种方式可设置其大小：
a,使用方向键或可调旋钮。

b,使用数字键.



按 F2 (%) 选择% 单位.

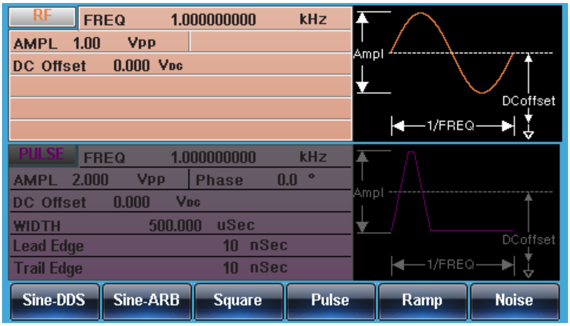
占空比范围	0.01%~99.99%(受限于当前频率的设定)

5. 设定 the Load/Frequency/Amplitude/DC Offset 的值, 请看 95 -99 页.

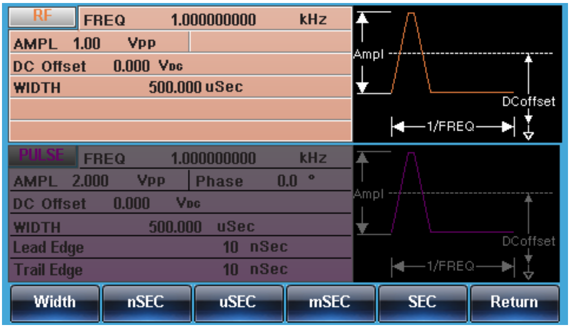
设置脉冲波

面板操作

1. 按 Waveform 键.

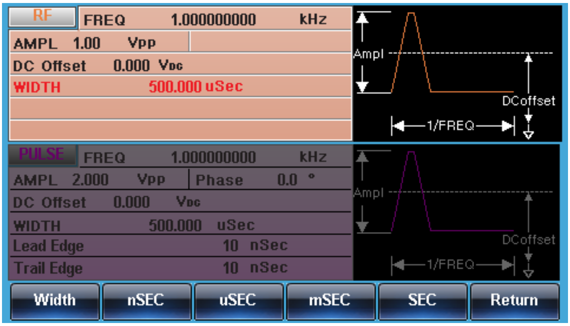


2. 按 F4 (Pulse)创建脉冲波. Pulse F 4



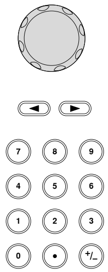
参数设置

3. 按 F1 (Width). 位于参数窗口处的脉冲宽度参数变亮. Width F 1

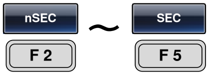


4. 两种方式可设置其大小：
   a,使用方向键或可调旋钮

   b,使用数字键.



   按 F2~F5 选择相应单位.



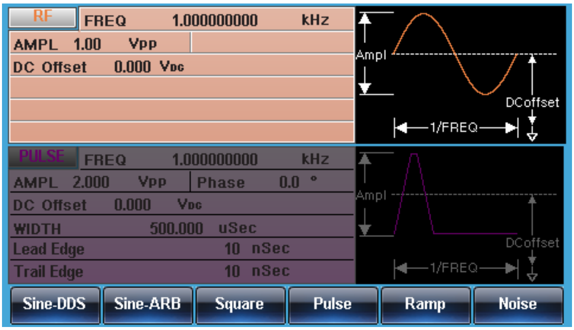
⚠	脉冲波宽度范围	≧20ns(受限于当前频率的设定)

5. 设定 the Load/Frequency/Amplitude/DC Offset 的值, 请看 95 -99 页.

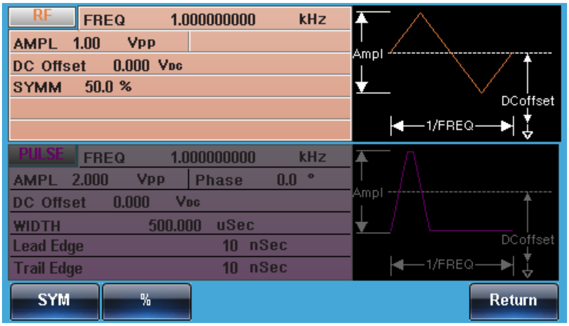
设置斜波

面板操作

1. 按 Waveform 键.

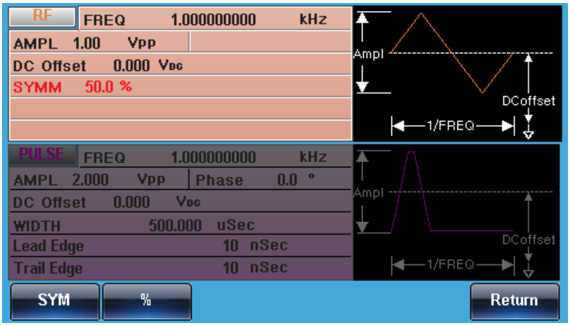


2. 按 F5 (Ramp)创建斜波.



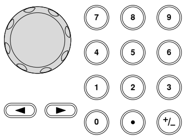
参数设置

3. 按 F1 (SYM). 位于参数窗口处的对称度参数变亮.



4. 两种方式可设置其大小:
a,使用方向键或可调旋钮

b,使用数字键.



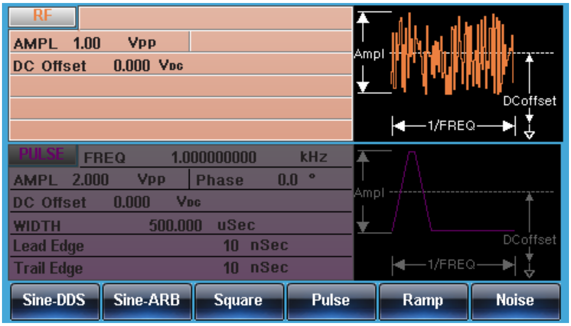
按 F2 (%) 选择% 单位.

对称度范围 0%~100%

5. 设定 the Load/Frequency/Amplitude/DC Offset 的值, 请看 95 -99 页.

设置噪声波

面板操作　　1. 按 Waveform 键.

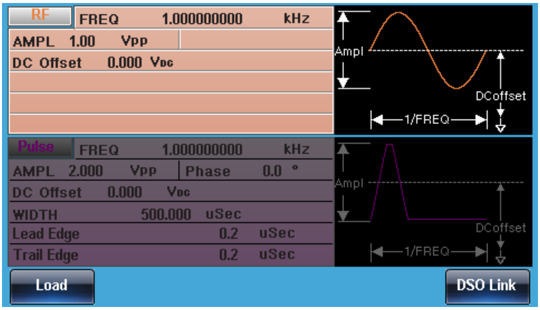


2. 按 F6 (Noise)创建噪声波.

参数设置　　3. 设定 the Load/Amplitude/DC Offset 的值, 请看 95 -99 页.

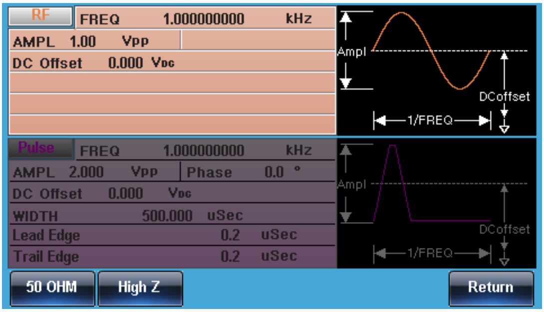
设置负载

面板操作　　1. 按 Pulse/RF 键.



参数设置

2. 负载的设定. 选择相应的通道后, 按 F1(Load) .



3. 按 F1(50OHM)或 F2(High Z)去设定 Load 的大小.

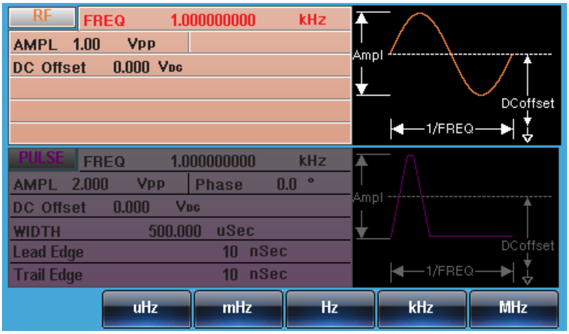
高阻时幅度是 50 奥姆的 2 倍. 可在 UTIL 里可看到各个通道的 Load 设置状态.

设置频率

面板操作

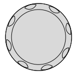
1. 按 FREQ/Rate 键.

2. 位于参数窗口处的频率参数变亮.

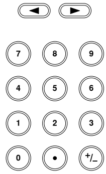


参数设置

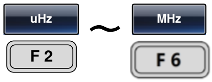
3. 两种方式可设置其大小：
a,使用方向键或可调旋钮。



b,使用数字键.



通过 F2~F6 选择相应单位.

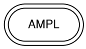


范围	Sine wave	1μHz~320MHz(max)
	Square wave	1μHz~25MHz(max)
	Pulse wave	1μHz~25MHz(max)
	Ramp wave	1μHz~1MHz

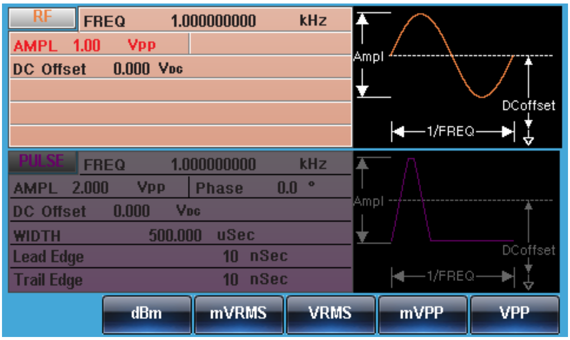
设置幅度

面板操作

1. 按 AMPL 键.



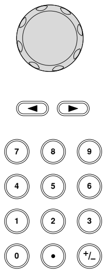
2. 位于参数窗口处的幅度参数变亮.



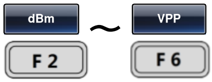
参数设置

3. 两种方式可设置其大小：
a,使用方向键或可调旋钮

b,使用数字键.



通过 F2~F6 选择相应单位.



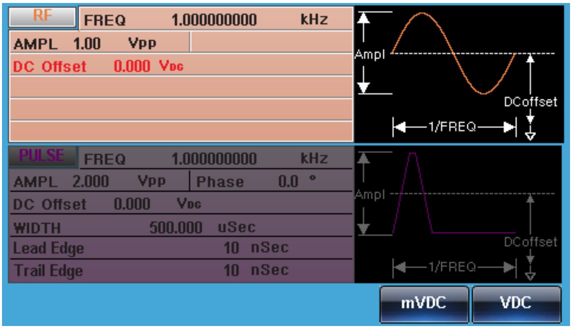
	50Ω load	High Z
范围	1mVpp~10Vpp	2mVpp~20Vpp
单位	Vpp, Vrms, dBm	

设置直流偏置

面板操作

1. 按 DC Offset 键.

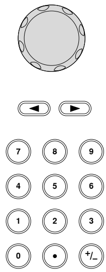
2. 位于参数窗口处的偏移参数变亮.



参数设置

3. 两种方式可设置其大小：
a,使用方向键或可调旋钮

b,使用数字键.



按 F5 (mVDC)或 F6 (VDC) 选择电压范围.

	50Ω load	High Z
范围	±5Vpk	±10Vpk

Pulse 通道

MFG-2000 系列机器有多个通道输出，只有选择了此通道才能对其进行设定操作等.

选择脉冲波

面板操作

1. 按 Pulse 或 Pulse/RF 键选择 Pulse.

21xx 

22xx 

2. 被选择的通道可以很清楚的看到，而未被选择的会变淡.
在下方屏幕显示中, 选择 Pulse.

21xx 系列机型

22xx 系列机型

Pulse 信道的显示位置在 21xx 和 22xx 系列机器有所不同，后续将以 22xx 图示为例.

设置脉冲波占空比

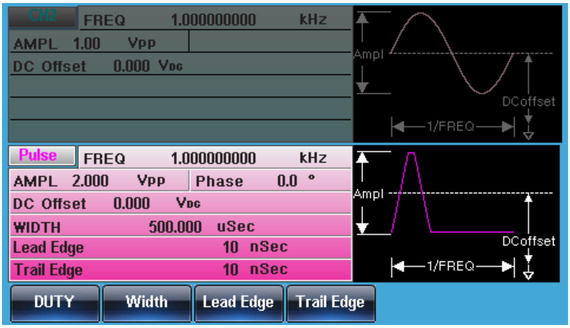
Instead of setting the pulse width of the pulse, the duty of the pulse can be set. The settable duty times depend on the leading&trailing edge time settings, as defined below:

Pulse Duty Cycle ≥ 100×最小脉宽 ÷ Pulse 周期

Pulse Duty Cycle < 100×(1-最小脉宽÷Pulse周期)

面板操作

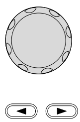
1. 按 Waveform 键



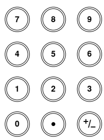
参数设置

2. 按 F1 (DUTY)位于参数窗口处的 DUTY 参数变亮

3. 两种方式可设置其大小：
   a,使用方向键或可调旋钮



   b,使用数字键.



按 F5 选择 % 单位.

4. 设定 the Load/Frequency/Amplitude/DC Offset/Phase 的值,请看 106 -110 页.

占空比范围　　0.01%~99.99%(受限于当前频率的设定)

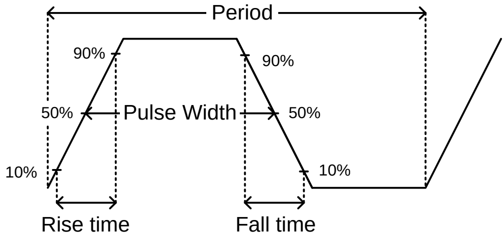
设置脉冲波宽度

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≥最小允许脉冲宽度

脉冲宽度<脉冲周期 -最小允许脉冲宽度

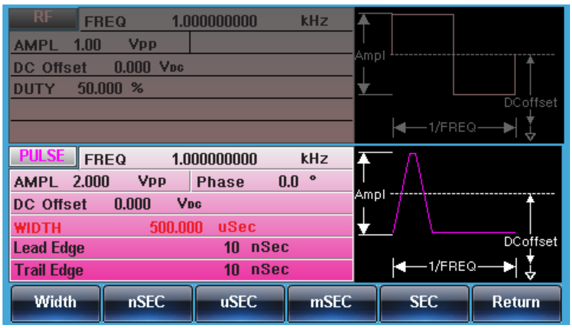
脉冲宽度被定义为从 50%上升沿阈值到一个完整周期的 50%下降沿阈值的时间，如图所示.



面板操作

1. 按 Waveform 键.

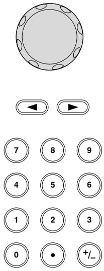
2. 按 F2 (Width). 位于参数窗口处的脉冲宽度参数变亮..



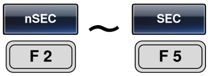
参数设置

3. 两种方式可设置其大小：
   a,使用方向键或可调旋钮

   b,使用数字键.



   通过 F2~F5 来选择相应单位.



4. 设定 the Load/Frequency/Amplitude/DC Offset/Phase 的值, 请看 106 -110 页.

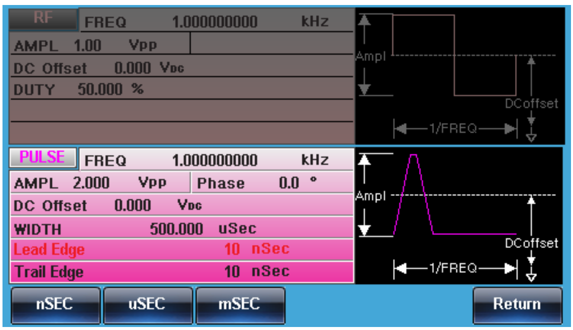
脉冲宽度范围	≧20ns(受限于当前频率的设定)

设置脉冲波前沿时间

面板操作

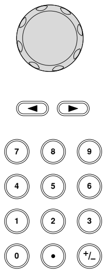
1. 按 Waveform 键.

2. 按 F3 (Lead Edge).位于参数窗口处的前沿参数变亮.

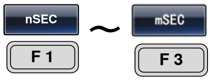


3. 两种方式可设置其大小：
   a,使用方向键或可调旋钮

   b,使用数字键.



4. 通过 F1~F3 来选择相应单位.



5. 对相反时间重复以上步骤.

6. 设定 the Load/Frequency/Amplitude/DC Offset/Phase 的值, 请看 106 -110 页.

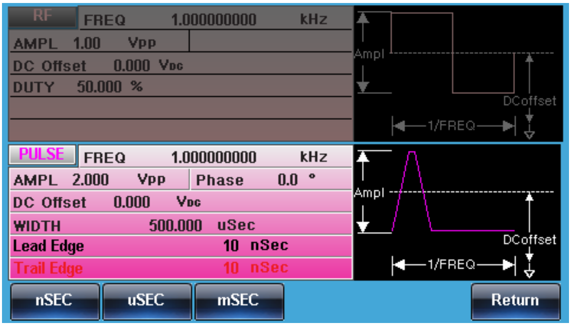
最小后沿时间	≧10nS(受限于当前频率和脉宽的设定)
边沿时间	≤ 0.625 × 脉冲宽度

设置脉冲波后沿时间

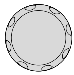
面板操作

1. 按 Waveform 键

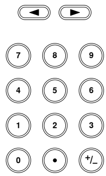
2. 按 F4 (Trail Edge). 位于参数窗口处的上升沿参数变亮



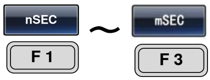
3. 两种方式可设置其大小：
   a,使用方向键或可调旋钮



   b,使用数字键.



通过 F1~F3 来选择相应单位.



4. 对相反时间重复以上步骤.

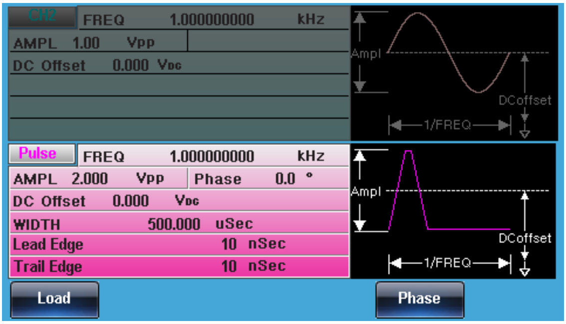
5. 设定 the Load/Frequency/Amplitude/DC Offset/Phase 的值,请看 106 -110 页.

最小后沿时间	≧10nS(受限于当前频率和脉宽的设定)
边沿时间	≤ 0.625 × 脉冲宽度

设置负载

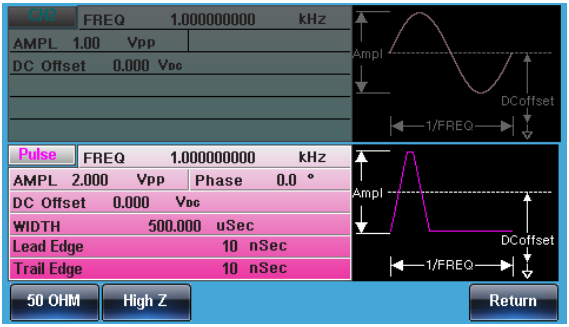
面板操作

1. 按 Pulse 或 RF/Pulse 键. 21XX 22XX



参数设置

2. 负载的设定.选择相应的通道后, 按 F1(Load) .



3. 按 F1(50OHM)或 F2(High Z)去设定 Load 的大小.

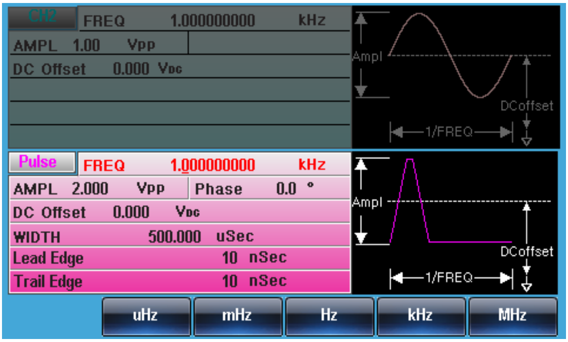
高阻时幅度是 50 OHM 的 2 倍.
可在 UTIL 里可看到各个通道的 Load 设置状态.

设置频率

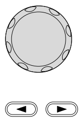
面板操作

1. 按 FREQ/Rate 键.

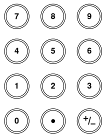
2. 位于参数窗口处的频率参数变亮..



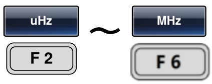
3. 两种方式可设置其大小：
   a,使用方向键或可调旋钮



   b,使用数字键.



通过 F2~F6 选择相应单位.



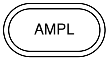
范围

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

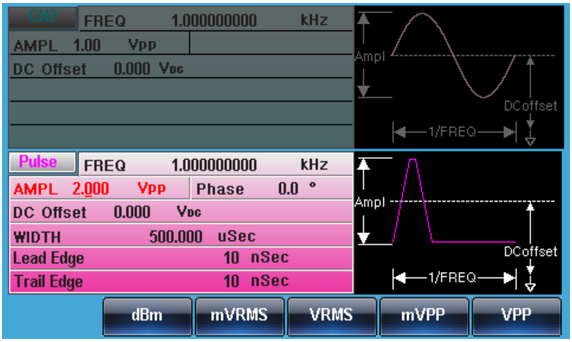
设置幅度

面板操作

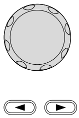
1. 按 AMPL 键.



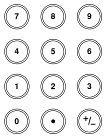
2. 位于参数窗口处的幅度参数变亮.



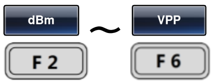
3. 两种方式可设置其大小：
   a,使用方向键或可调旋钮



   b,使用数字按键.



   通过 F2~F6 选择相应单位.



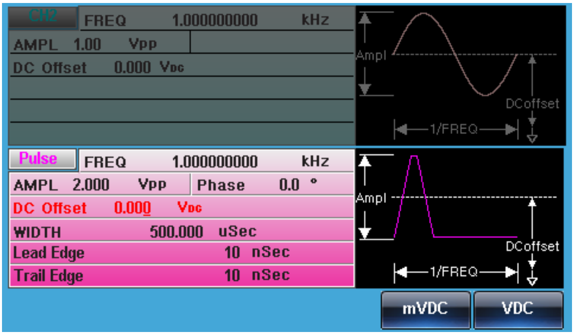
	50Ω load	High Z
范围	1mVpp~10Vpp	2mVpp~20Vpp
单位	Vpp, Vrms, dBm	

设置直流偏置

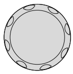
面板操作

1. 按 DC Offset 键.

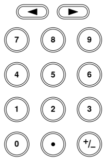
2. 位于参数窗口处的偏移参数变亮.



3. 两种方式可设置其大小：
   a,使用方向键或可调旋钮



   b,使用数字键.



按 F5 (mVDC) 或 F6 (VDC) 选择电压范围.

	50Ω load	High Z
范围	±5Vpk	±10Vpk

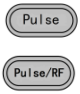
设置相位

面板操作

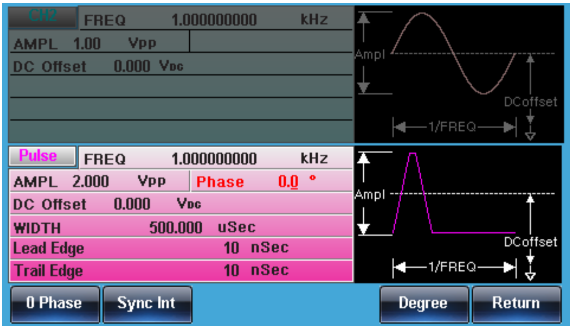
1. 按 Pulse 或 Pulse/RF 键.

21xx

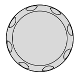
22xx



2. 相位的设定.选择相应的通道后, 按 F5(Phase) .

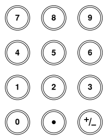


3. 两种方式可设置其大小：
   a,使用方向键或可调旋钮。

   b,使用数字键.

   按 F5 (Degree) 选择相应单位.

进入相位设定界面有两个快捷的操作：

当前通道相位设为零
CH1/CH2 相位同时设为零

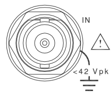
功率放大器

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.

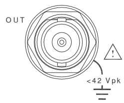
操作

面板操作

1. 从后面板 Power Amplifier BNC 端口输入一外部信号。



2. 从后面板 Power Amplifier BNC 端口输出,用相关测试仪器可直接测量其信号。



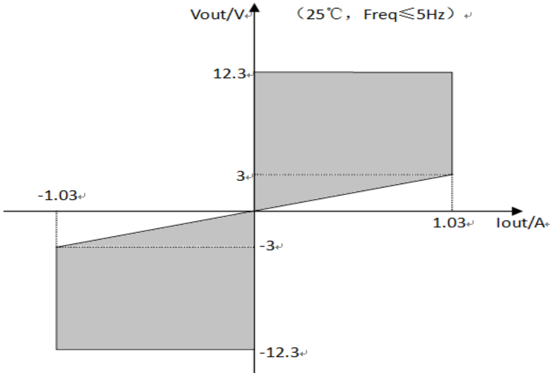
此放大器带宽 DC-100KHz，最大灌入电压 1.25Vpmax，最大带载电流 1.6A，增益 20dB，最大输出功率 20W。

Power Amplifier 的正常工作依赖于 AC 电源的正确输入,请看 21 页.

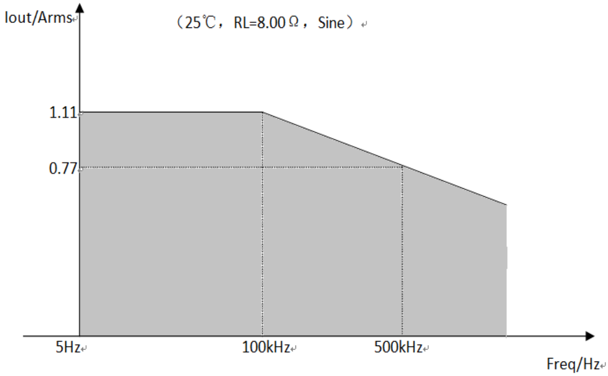
安全工作曲线

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。

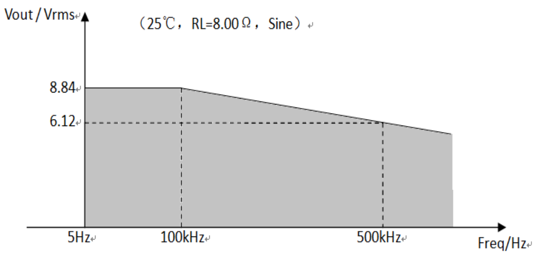
直流工作区域:



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响及其散热条件。当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

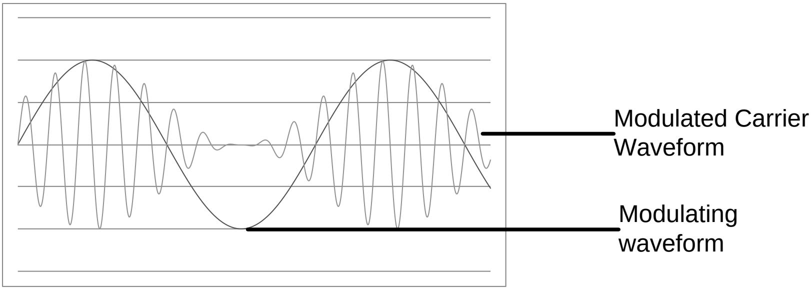
增加，且信号的失真也会随着频率的增加而增大，从而造成放大器发热，性能下降，所以对功率放大器的大幅值输入信号的频率和幅值的关系做了一些限制。

调制

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)

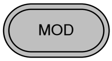
AM 波形由载波和调制波组成。载波幅值与调制波幅值有关。MFG-2000 信号发生器可以设置载波频率、幅值、偏置电压以及内部或外部调制源。



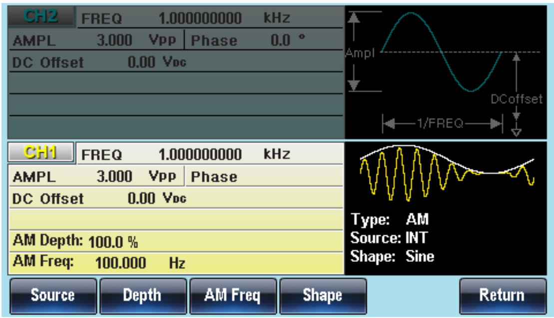
选择 AM 调制

面板操作

1. 按 MOD 键



2. 按 F1 (AM)



AM 载波波形

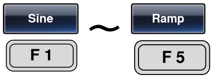
背景

AM 载波波形：正弦波、方波、斜波、脉冲波或任意波。默认情况为正弦波。不能使用噪声波作为载波波形。在选择载波波形前，请先选择 AM 调制模式，参见**错误！未定义书签。**或**错误！未定义书签。**页

选择一个标准载波波形

1. 按 Waveform 键

2. 按 F1~F5 选择载波波形



选择一个任意波的载波波形

3. 有关任意波的使用部分，详见任意波快速指南或章节

范围	AM 载波波形	正弦波, 方波, 脉冲波, 上斜波, 下斜波, 任意波

载波频率

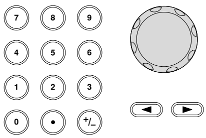
最大载波频率与载波波形的选择有关。默认载波频率为 1kHz。

面板操作

1. 对任一载波波形，按 FREQ/Rate 键

2. 位于参数窗口处的频率参数将变亮

3. 使用方向键和可调旋钮或数字键盘输入载波频率



	4. 按 F2~F6 选择频率范围	uHz F2 ~ MHz F6

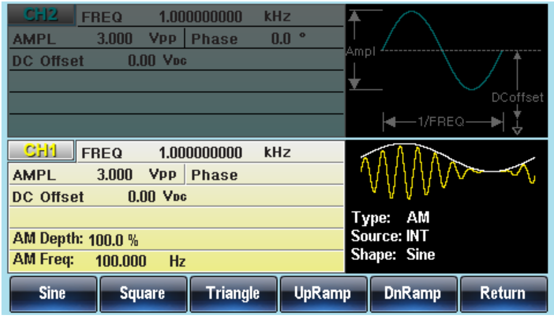
范围	载波波形	Carrier Frequency
	正弦波	1μHz~ 320MHz
	方波	1μHz~25MHz
	三角波	1μHz~1MHz
	斜波	1μHz~1MHz
	默认频率	1 kHz

调制波形

信号发生器可以接收内部和外部源。MFG-2000 的调制波形包括正弦波, 方波, 三角波, 上斜波, 下斜波。默认波形为正弦波。

面板操作	1. 选择 MOD 键	MOD
	2. 按 F1 (AM)	AM F1
	3. 按 F4 (Shape)	Shape F4
	4. 按 F1~F5 选择波形	Sine F1 ~ DnRamp F5
	5. 按 F6 (Return)返回菜单	Return F6

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

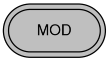


AM 频率

调制波形的频率(AM 频率)可设为 2mHz~20kHz。

面板操作

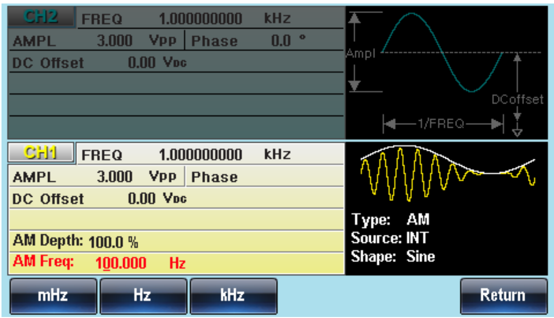
1. 按 MOD 键



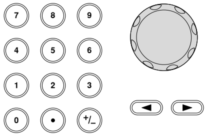
2. 按 F1 (AM)

3. 按 F3 (AM Freq)

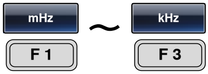
4. 位于波形显示区域处的 AM 频率参数将变亮



5. 使用方向键和可调旋钮或数字键盘输入 AM 频率



6. 按 F1~F3 选择频率范围



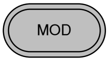
范围	调制频率	2mHz~20kHz
	默认频率	100Hz

调制深度

调制深度为未调载波幅值与调制波形最小幅值偏差的比值(以百分比显示)。换句话说，调制深度就是调制波形与载波波形的最大幅值之比。

面板操作

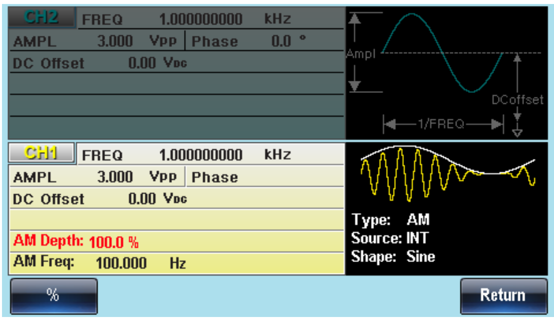
1. 按 MOD 键



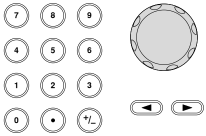
2. 按 F1 (AM)

3. 按 F2 (Depth)

4. 位于波形显示区域处的 AM 深度参数将变亮



5. 使用方向键和可调旋钮或数字键盘输入 AM 深度



6. 按 F1 (%)选择%单位

范围	深度	0%~120%
	默认深度	100%

注意　即使调制深度大于 100%, 输出也不超过±5V 的峰值(10kΩ 负载)

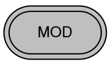
如果选择外部调制源, 那么调制深度将由后面板 MOD INPUT 上的± 5V 信号电压控制。例如, 如果调制深度设置为 100%, 那么最大幅值为+5V, 最小幅值为-5V

设置 (AM)调制源

信号发生器将接受用于 AM 调制的内部或外部源。默认为内部源。

面板操作

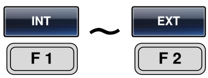
1. 按 MOD 键



2. 按 F1 (AM)

3. 按 F1 (Source)

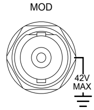
4. 按 F1(INT)或 F2(EXT)选择调制源



5. 按 Return 返回菜单

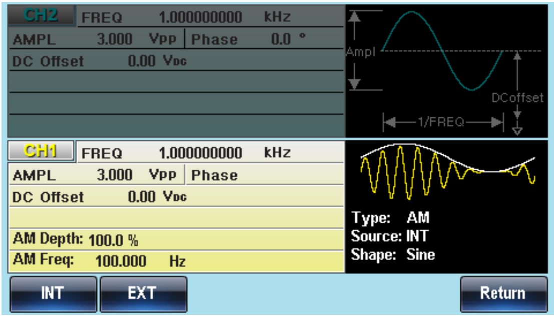
外部源

从后面板的 MOD 输入端子接收外部调制信号



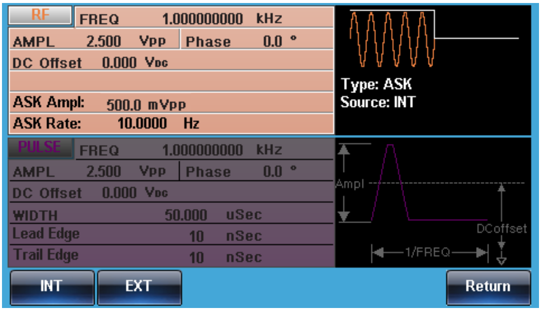
注意

如果选择外部调制源, 那么调制深度将由后面板 MOD INPUT 上的± 5V 信号电压控制。例如, 如果调制深度设置为 100%, 那么最大幅值为+5V, 最小幅值为-5V



幅移键控(ASK)

ASK 调制用于在两个预设幅度(载波幅度和调制幅度)间移动其输出幅度。函数发生器一次只允许启用一种调制模式。当开启 ASK 调制时，其它调制模式将禁用。在启用扫描和脉冲串时不允许启用 ASK 调制。在启用 ASK 时，将关闭扫描或脉冲串模式。只有 RF 通道有 ASK 调制。

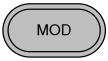


选择 ASK 调制

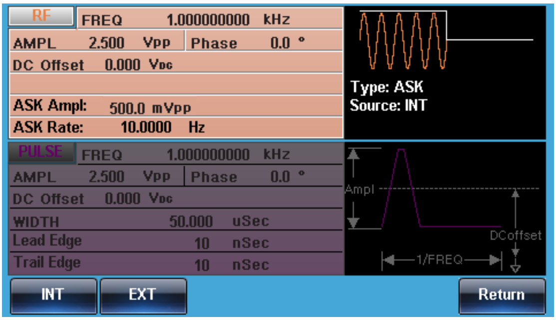
当使用 ASK 模式时, 输出波形使用默认载波频率、幅值和偏置电压。

面板操作

1. 按 MOD 键



2. 按 F2 (ASK)



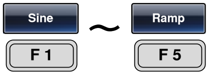
ASK 载波波形

背景　　默认波形为正弦波。噪声波不能用作载波

面板操作

1. 按 Waveform 键

2. 按 F1~F5 选择载波波形



范围	载波波形	正弦波

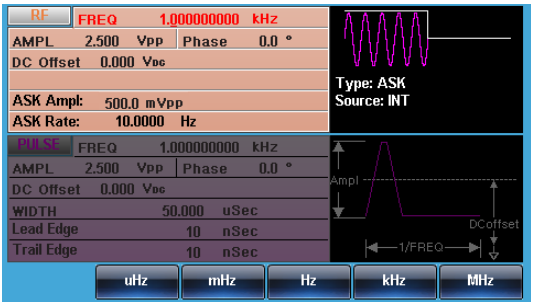
ASK 载波频率

最大载波频率与载波波形有关。默认载波频率均为 1kHz。选择外部源时，TriggerINPUT 信号的信号电平控制输出频率。当信号为逻辑低电平时，输出载波频率；当信号为逻辑高电平时，输出跳跃频率。

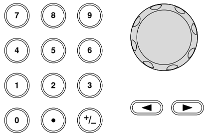
面板操作

1. 按 FREQ/Rate 键选择载波频率

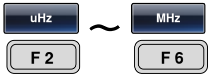
2. 位于参数窗口处的 FREQ 参数将变亮



3. 使用方向键和可调旋钮或数字键盘输入载波频率



4. 按 F2~F6 选择 ASK 频率单位



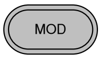
范围	载波波形	载波频率
	正弦波	1µHz~320MHz
	默认频率	1kHz

ASK 调制幅度

默认调制幅度均为 0.5Vpp。内部调制波是占空比为 50%的方波。选择外部源时，TriggerINPUT 信号的信号电平控制输出频率。当信号为逻辑低电平时，输出载波频率；当信号为逻辑高电平时，输出调制幅度。

面板操作

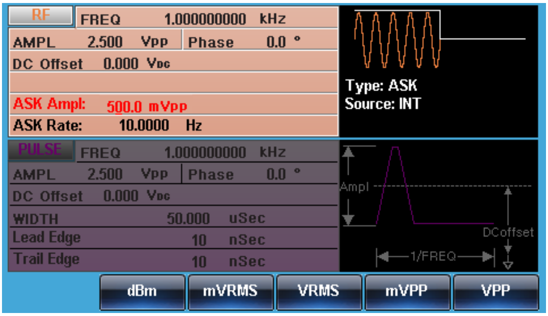
1. 按 MOD 键



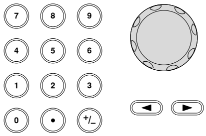
2. 按 F2 (ASK)

3. 按 F2 (ASK Ampl)

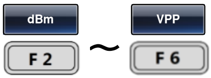
4. 位于波形显示区域处的 ASK Ampl 参数将变亮



5. 使用方向键和可调旋钮或数字键盘输入调制幅度



6. 按 F2~F6 选择单位类型



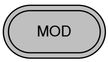
范围	ASK 调制幅度	0V~最大值
	默认	0.5V

ASK 频率

ASK 频率是决定输出载波幅度或调制幅度的频率值。

面板操作

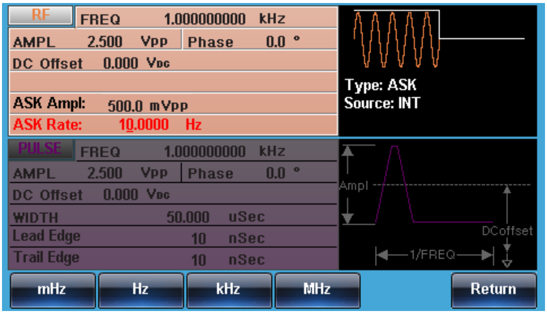
1. 选择 MOD



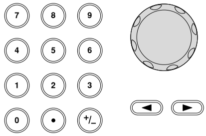
2. 按 F2 (ASK)

3. 按 F3 (ASK Rate)

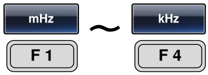
4. 位于波形显示区域处的 ASK Rate 参数将变亮



5. 使用方向键和可调旋钮或数字键盘输入 ASK 频率



6. 按 F1~F4 选择频率单位



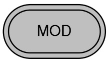
范围	ASK 频率	2mHz~1MHz
	默认	100Hz

注意　如果选择外部源, 忽视 ASK 频率设置

ASK 源

MFG-2000 接受内部和外部 ASK 源，默认为内部 ASK 源。当选择内部 ASK 源时，使用 ASK Rate 功能设置 ASK 频率。当选择外部源时，ASK 频率与后面板 TriggerINPUT 信号的频率一致。

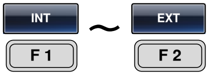
面板操作　1. 按 MOD 键



2. 按 F2 (ASK)

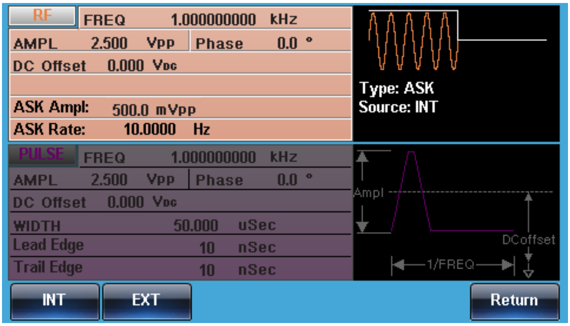
3. 按 F1 (Source)

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



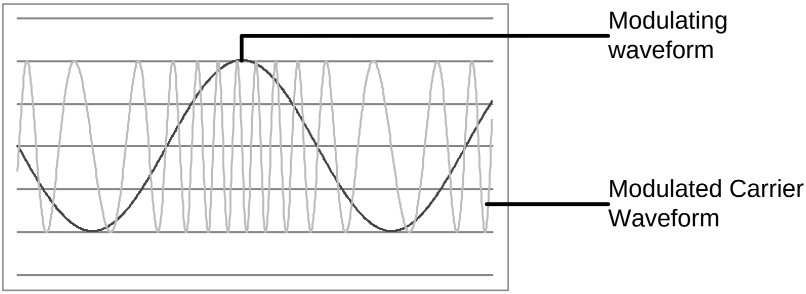
5. 按 Return 返回菜单

注意 Trigger INPUT 端子不能设置边沿极性



频率调制(FM)

FM 波形由载波和调制波组成。载波的瞬时频率随调制波形的幅值而变化。当使用 MFG-2000 时，无论何时只允许启用一种调制模式。

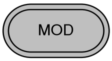


选择频率调制 (FM)

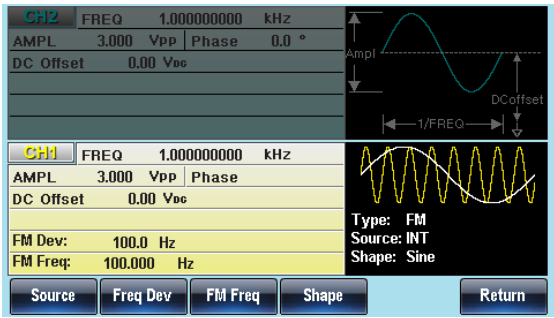
选择 FM 后, 调制波形由载波频率、输出幅值和偏置电压决定。

面板操作

1. 按 MOD 键



2. 按 F2 (FM)



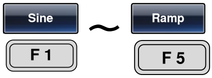
FM 载波波形

背景 FM 载波默认为正弦波。噪声波不能用作载波

面板操作

1. 按 Waveform 键

2. 按 F1~F5 选择载波形



范围	载波波形	正弦波, 方波, 脉冲波, 斜波

FM 载波频率

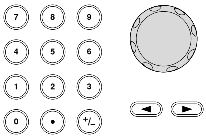
使用 MFG-2000 时，载波频率必须大于或等于频率偏移。如果频率偏移大于载波频率，函数发生器会自动将偏移调整到当前载波频率所允许的最大值。载波最大频率与所选波形有关。

面板操作

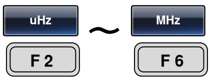
1. 按 FREQ/Rate 键选择载波频率

2. 位于参数窗口处的 FREQ 参数将变亮

3. 使用方向键和可调旋钮或数字键盘输入载波频率



4. 按 F2~F6 选择频率单位



范围	载波波形	载波频率
	正弦波	1μHz~320MHz
	方波	1μHz~25MHz

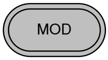
脉冲波	1μHz~25MHz
三角波	1μHz~1MHz
默认频率	1 kHz

FM 波形

信号发生器能接受内部和外部源。MFG-2000 的内部调制波形包括正弦波、方波、脉冲波、正和负斜波(UpRamp, DnRamp)。默认情况为正弦波。

面板操作

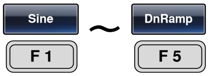
1. 选择 MOD



2. 按 F2 (FM)

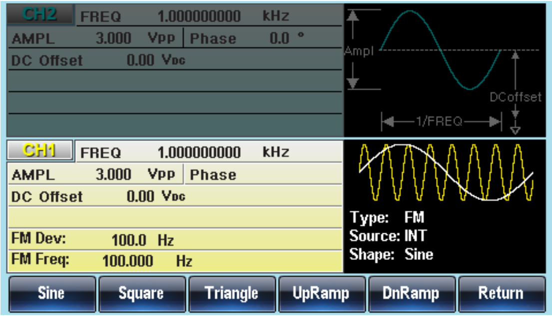
3. 按 F4 (Shape)

4. 按 F1~F5 选择波形



5. 按 Return 返回菜单

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

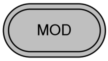

CH2
FREQ 1.000000000 kHz
AMPL 3.000 VPP
Phase 0.0 °
DC Offset 0.00 VDC
Ampl
DCoffset
1/FREQ
CH1
FREQ 1.000000000 kHz
AMPL 3.000 VPP
Phase
DC Offset 0.00 VDC
FM Dev: 100.0 Hz
FM Freq: 100.000 Hz
Type: FM
Source: INT
Shape: Sine
Sine
Square
Triangle
UpRamp
DnRamp
Return

频率调制波形

信号发生器将接受用于 FM 的内部或外部调制源。

面板操作

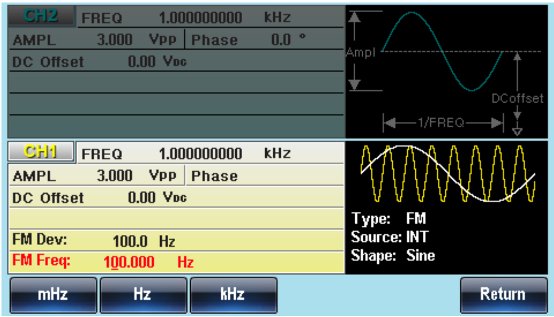
1. 按 MOD 键



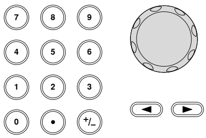
2. 按 F2 (FM)

3. 按 F3 (FM Freq)

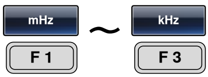
4. 位于波形显示区域处的 FM 频率参数将变亮



5. 使用方向键和可调旋钮或数字键盘输入 FM 频率



6. 按 F1~F3 选择频率单位



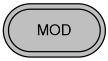
范围	调制频率	2mHz~20kHz
	默认频率	100Hz

频率偏移

频率偏移是载波与调制波的频率最大偏差。

面板操作

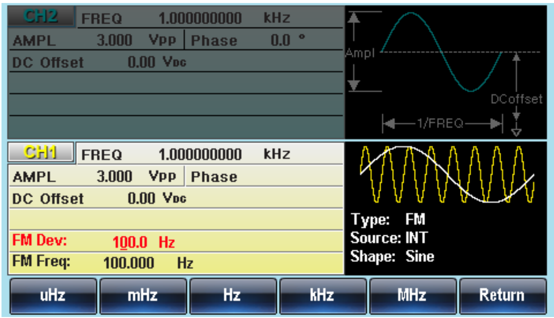
1. 按 MOD 键



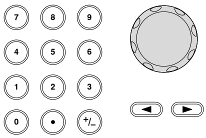
2. 按 F2 (FM)

3. 按 F2 (Freq Dev)

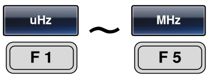
4. 位于波形显示区域处的 Freq Dev 参数将变亮



5. 使用方向键和可调旋钮或数字键盘输入频率偏移



6. 按 F1~ F5 选择频率单位



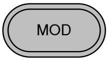
范围	频率偏移	DC~Max Frequency
	默认深度	100Hz

选择(FM)调制源

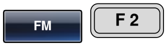
信号发生器将接受用于 FM 调制的内部或外部源。默认为内部源。

面板操作

1. 按 MOD 键

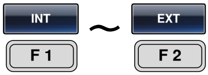


2. 按 F2 (FM)



3. 按 F1 (Source)

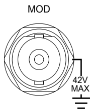
4. 按 F1 (INT)或 F2 (EXT)选择调制源



5. 按 Return 返回菜单

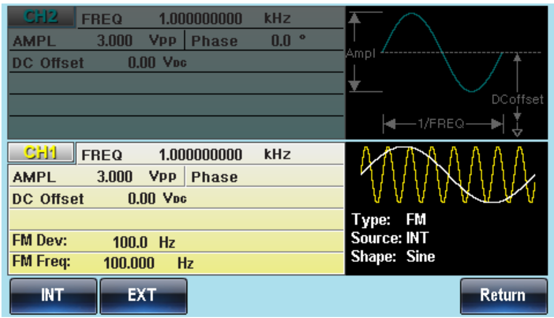
外部源

从后面板的 MOD 输入端子接收外部调制信号



注意

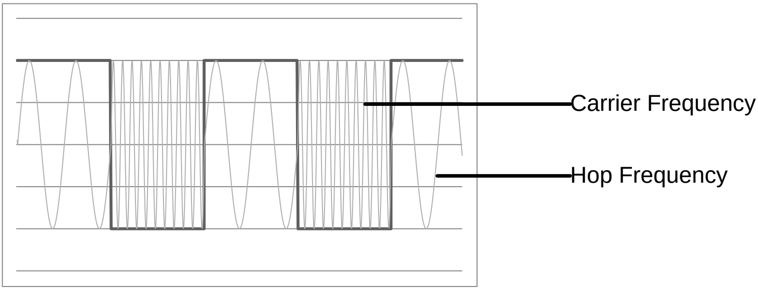
如果选择外部调制源, 那么频偏将由后面板 MOD INPUT 上的± 5V 信号电压控制。频偏与调制信号电平成比例。例如，如果调制电压为+5V, 那么频偏将等于设置的频偏。外部信号电平越低，偏移就越小；而负信号电平将会使频偏频率降至载波频率之下。



频移键控(FSK)

FSK 调制用于在两个预设频率(载波频率和跳跃频率)间交替输出频率。内部频率发生器或后面板 Trigger INPUT 上的信号电平决定交替频率。

函数发生器一次只允许启用一种调制模式。当开启 FSK 调制时，其它调制模式将禁用。在启用扫描和脉冲串时不允许启用 FSK 调制。在启用 FSK 时，将关闭扫描或脉冲串模式。

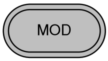


选择 FSK 调制

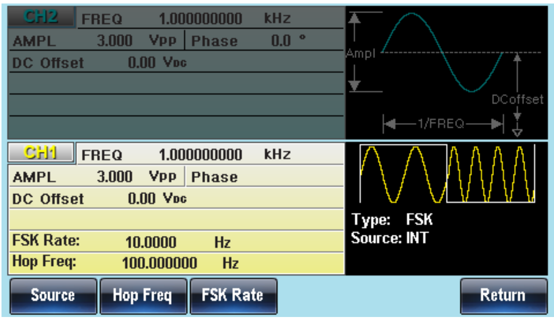
当使用 FSK 模式时, 输出波形使用默认载波频率、幅值和偏置电压。

面板操作

1. 按 MOD 键



2. 按 F3 (FSK)



FSK 载波波形

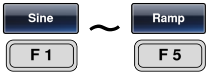
背景

默认波形为正弦波。噪声波不能用作载波

面板操作

1. 按 Waveform 键

2. 按 F1~F5 选择载波波形



范围	载波波形	正弦波, 方波, 斜波, 脉冲波

FSK 载波频率

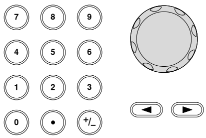
最大载波频率与载波波形有关。默认载波频率均为 1kHz。选择外部源时，TriggerINPUT 信号的信号电平控制输出频率。当信号为逻辑低电平时，输出载波频率；当信号为逻辑高电平时，输出跳跃频率。

面板操作

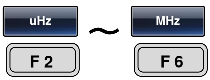
1. 按 FREQ/Rate 键选择载波频率

2. 位于参数窗口处的 FREQ 参数将变亮

3. 使用方向键和可调旋钮或数字键盘输入载波频率



4. 按 F2~F6 选择 FSK 频率单位



范围	载波波形	载波频率
	正弦波	1μHz~320MHz
	方波	1μHz~25MHz

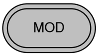
斜波	1μHz~1MHz
脉冲波	1μHz~25MHz
默认频率	1kHz

FSK 跳跃频率

默认跳跃频率均为 100 Hz。内部调制波是占空比为 50%的方波。选择外部源时，TriggerINPUT 信号的信号电平控制输出频率。当信号为逻辑低电平时，输出载波频率；当信号为逻辑高电平时，输出跳跃频率。

面板操作

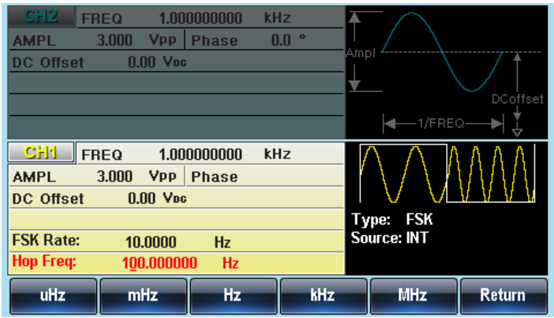
1. 按 MOD 键



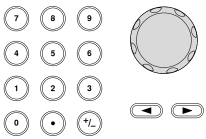
2. 按 F3 (FSK)

3. 按 F2 (Hop Freq)

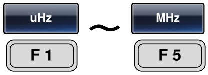
4. 位于波形显示区域处的 Hop Freq 参数将变亮



5. 使用方向键和可调旋钮或数字键盘输入跳跃频率



6. 按 F1~F5 选择频率范围



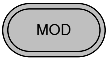
范围	波形	载波频率
	正弦波	1µHz~320MHz
	方波	1µHz~25MHz
	斜波	1µHz~1MHz
	脉冲波	1µHz~25MHz
	默认频率	100Hz

FSK 频率

FSK 频率是决定输出载波频率或跳跃频率的频率值。

面板操作

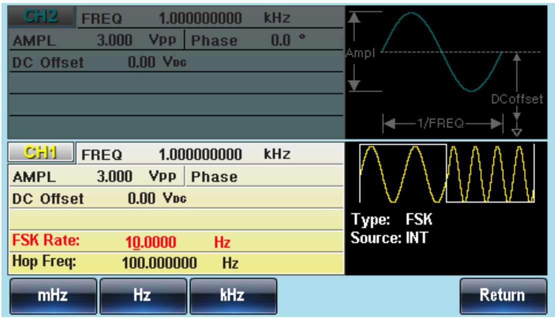
1. 选择 MOD



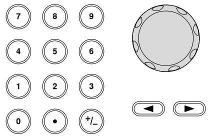
2. 按 F3 (FSK)

3. 按 F3 (FSK Rate)

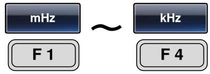
4. 位于波形显示区域处的 FSK Rate 参数将变亮



5. 使用方向键和可调旋钮或数字键盘输入 FSK 频率



6. 按 F1~F4 选择频率单位



范围	FSK 频率	2mHz~1MHz
	默认	10Hz

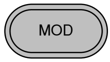
注意　　如果选择外部源, 忽视 FSK 频率设置

FSK 源

MFG-2000 接受内部和外部 FSK 源，默认为内部 FSK 源。当选择内部 FSK 源时，使用 FSK Rate 功能设置 FSK 频率。当选择外部源时，FSK 频率与后面板 TriggerINPUT 信号的频率一致。

面板操作

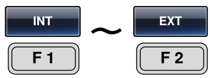
1. 按 MOD 键



2. 按 F3 (FSK)

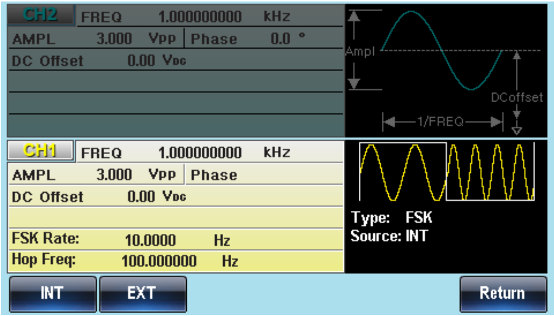
3. 按 F1 (Source)

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



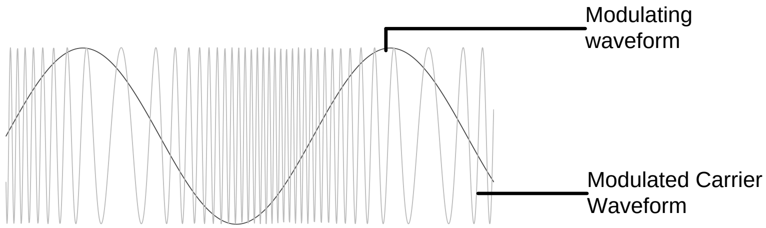
5. 按 Return 返回菜单

注意　　Trigger INPUT 端子不能设置边沿极性


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)

对于相位调制，相位由调制波形的瞬时电压决定。无论何时仅允许启用一种调制模式。若使用 PM，将禁用其它调制模式。此外不允许扫描和脉冲串模式与 PM 同时使用。若使用 PM，将关闭扫描和脉冲串模式。

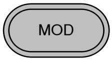


选择相位调制 (PM)

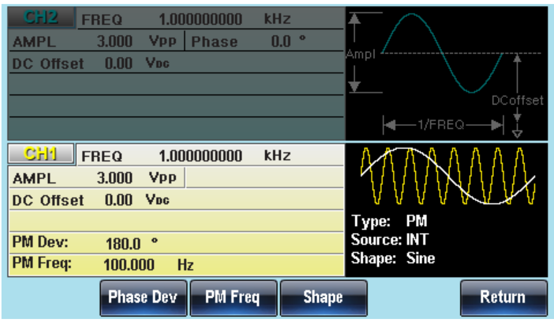
选择 PM 后, 调制波形由载波频率、输出幅值和偏置电压决定。

面板操作

1. 按 MOD 键



2. 按 F4 (PM)



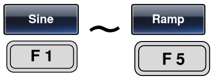
PM 载波波形

背景 PM 载波默认为正弦波。噪声波不能用作载波

面板操作

1. 按 Waveform 键

2. 按 F1~F5 选择载波形



范围	载波波形	正弦波, 方波, 脉冲波, 斜波

PM 载波频率

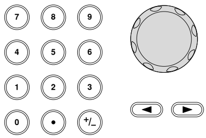
最大载波频率与载波波形的选择有关。默认载波频率为 1kHz。

面板操作

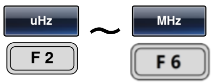
1. 按 FREQ/Rate 键选择载波频率

2. 位于参数窗口处的 FREQ 参数将变亮

3. 使用方向键和可调旋钮或数字键盘输入载波频率



4. 按 F2~F6 选择频率单位



范围	载波波形	载波频率
	正弦波	1μHz~320MH
	方波	1μHz~25MHz

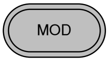
脉冲波	1μHz~25MHz
三角波	1μHz~1MHz
斜波	1μHz~1MHz
默认频率	1 kHz

PM 波形

信号发生器能接受内部和外部源。MFG-2000 的内部调制波形包括正弦波、方波、脉冲波、正和负斜波(UpRamp, DnRamp)。默认情况为正弦波。

面板操作

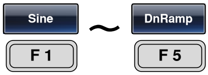
1. 选择 MOD



2. 按 F4 (PM)

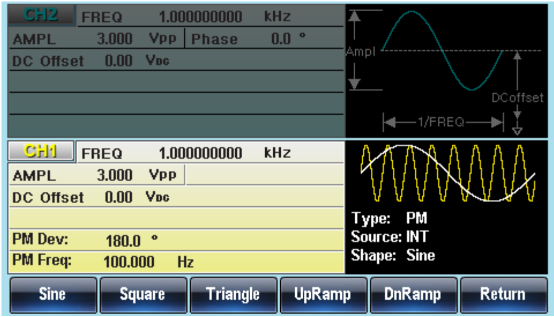
3. 按 F4 (Shape)

4. 按 F1~F5 选择波形



5. 按 Return 返回菜单

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

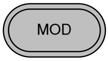


频率调制波形

信号发生器将接受用于 FM 的内部或外部调制源。

面板操作

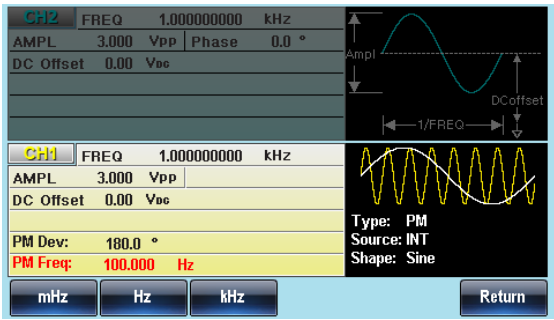
1. 按 MOD 键



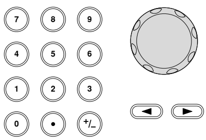
2. 按 F4 (PM)

3. 按 F3 (PM Freq)

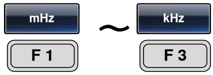
4. 位于波形显示区域处的 PM 频率参数将变亮



5. 使用方向键和可调旋钮或数字键盘输入 PM 频率



6. 按 F1~F3 选择频率单位



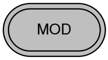
范围	调制频率	2mHz~20kHz
	默认频率	100Hz

频率偏移

频率偏移是载波与调制波的频率最大偏差。

面板操作

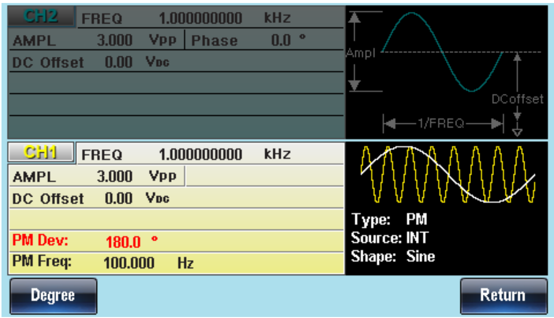
1. 按 MOD 键



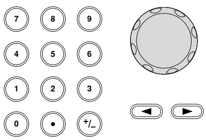
2. 按 F4 (PM)

3. 按 F2 (Phase Dev)

4. 位于波形显示区域处的 Phase Dev 参数将变亮



5. 使用方向键和可调旋钮或数字键盘输入频率偏移



6. 按 F1 选择相位单位

范围	相位偏移	0~360°

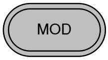
默认相位	180°

选择 (PM) 调制源

信号发生器将接受用于 FM 调制的内部或外部源。默认为内部源。

面板操作

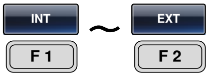
1. 按 MOD 键



2. 按 F4 (PM)

3. 按 F1 (Source)

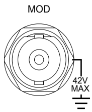
4. 按 F1 (INT)或 F2 (EXT)选择调制源



5. 按 Return 返回菜单

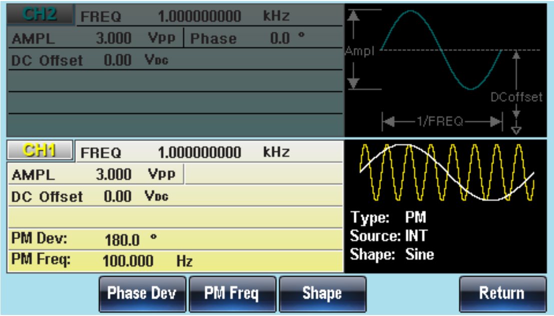
外部源

从后面板的 MOD 输入端子接收外部调制信号



注意

如果选择外部调制源, 那么频偏将由后面板 MOD INPUT 上的± 5V 信号电压控制。频偏与调制信号电平成比例。例如，如果调制电压为+5V, 那么频偏将等于设置的频偏。外部信号电平越低，偏移就越小；而负信号电平将会使频偏频率降至载波频率之下。


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)

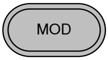
PSK 调制用于在两个预设相位(载波相位和调制相位)间交替输出相位。函数发生器一次只允许启用一种调制模式。当开启 PSK 调制时，其它调制模式将禁用。在启用扫描和脉冲串时不允许启用 PSK 调制。在启用 PSK 时，将关闭扫描或脉冲串模式。只有 RF 通道有 PSK 调制。

选择 PSK 调制

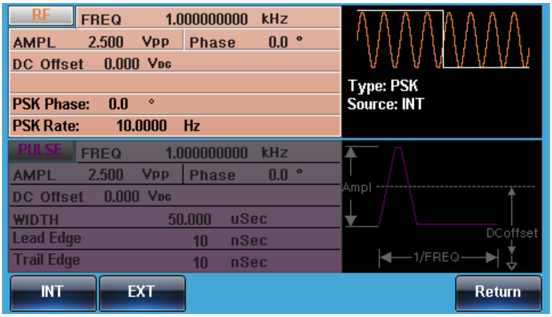
当使用 PSK 模式时, 输出波形使用默认载波频率、幅值和偏置电压。

面板操作

1. 按 MOD 键



2. 按 F6 (PSK)



PSK 载波波形

背景

默认波形为正弦波。噪声波不能用作载波

面板操作

1. 按 Waveform 键

2. 按 F1~F5 选择载波波形

范围	载波波形	正弦波

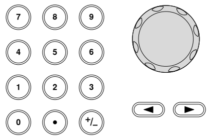
PSK 载波频率

最大载波频率与载波波形有关。默认载波频率均为 1kHz。

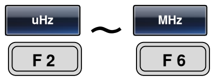
面板操作

1. 按 FREQ/Rate 键选择载波频率

2. 位于参数窗口处的 FREQ 参数将变亮
3. 使用方向键和可调旋钮或数字键盘输入载波频率



4. 按 F2~F6 选择 PSK 频率单位



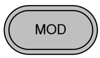
范围	载波波形	载波频率
	正弦波	1μHz~320MHz
	默认频率	1kHz

PSK 调制相位

默认调制相位均为 180°。内部调制波是占空比为 50%的方波。

面板操作

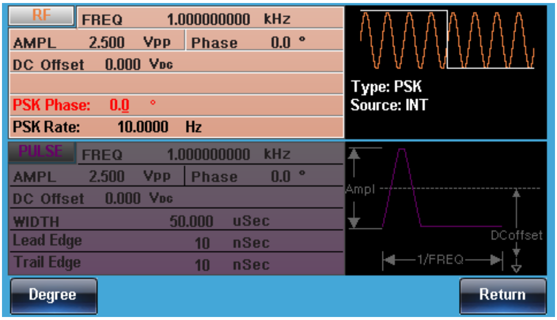
1. 按 MOD 键



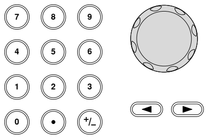
2. 按 F6 (PSK)

3. 按 F2 (PSK Phase)

4. 位于波形显示区域处的 PSK Phase 参数将变亮



5. 使用方向键和可调旋钮或数字键盘输入调制相位



6. 按 F1 选择°

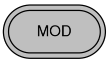
范围	PSK 调制相位	0~360°
	默认相位	180°

PSK 频率

PSK 调制频率设置载波相位和调制相位交替输出的频率。

面板操作

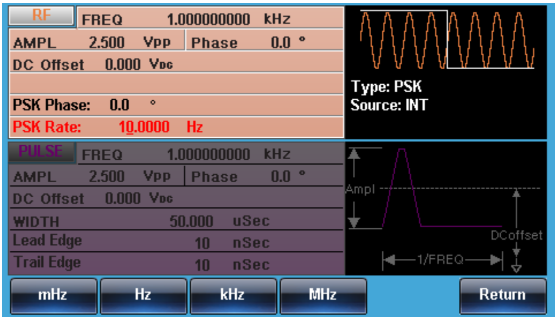
1. 选择 MOD



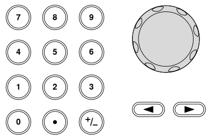
2. 按 F3 (PSK)

3. 按 F3 (PSK Rate)

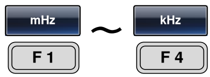
4. 位于波形显示区域处的 PSK Rate 参数将变亮



5. 使用方向键和可调旋钮或数字键盘输入 PSK 频率



6. 按 F1~F4 选择频率单位



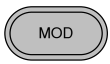
范围	PSK 频率	2mHz~1MHz
	默认	10Hz
注意	如果选择外部源, 忽视 PSK 频率设置	

PSK 源

MFG-2000 接受内部和外部 PSK 源，默认为内部 PSK 源。当选择内部 PSK 源时， 使用 PSK Rate 功能设置 PSK 频率。当选择外部源时，PSK 频率与后面板 TriggerINPUT 信号的频率一致。

面板操作

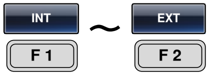
1. 按 MOD 键



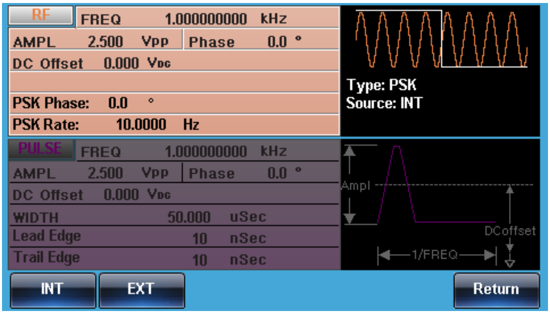
2. 按 F6 (PSK)

3. 按 F1 (Source)

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

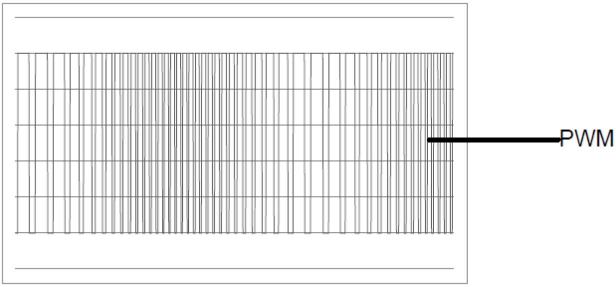


5. 按 Return 返回菜单



脉冲宽度调制(PWM)

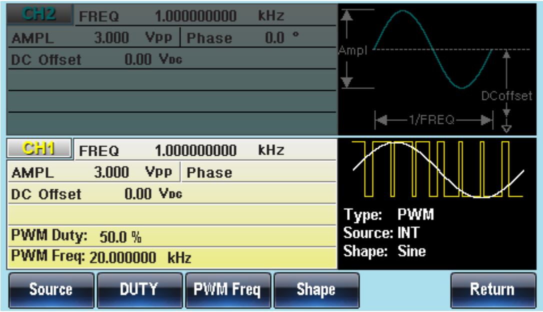
对于脉宽调制，脉冲宽度由调制波形的瞬时电压决定。无论何时仅允许启用一种调制模式。若使用PWM，将禁用其它调制模式。此外不允许扫描和脉冲串模式与PWM同时使用。若使用PWM，将关闭扫描和脉冲串模式。



选择脉冲宽度调制

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 键	MOD
	2. 按 F6 (PWM)	PWM F 6
	3. 按 F1 (Source)	Source F 1
	4. 按 F1 (INT)或 F2 (EXT)选择调制源	INT F 1 ~ EXT F 2
	5. 按 Return 返回菜单	Return



PMW 载波波形

PWM仅使用方波作为载波波形，否则会弹出错误信息。

PMW 载波频率

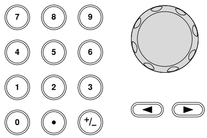
载波频率与方波有关。默认载波频率为1kHz。

面板操作

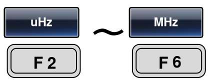
1. 按 FREQ/Rate 键选择载波频率

2. 位于参数窗口处的 FREQ 参数将变亮

3. 使用方向键和可调旋钮或数字键盘输入载波频率



4. 按 F2~F6 选择频率单位

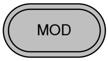


PMW 调制波形

调制波形(内部源)包括正弦波、方波、三角波、正斜波和负斜波。默认波形为正弦波。

面板操作

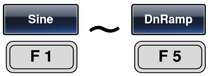
1. 选择 MOD



2. 按 F6 (PWM)

3. 按 F4 (Shape)

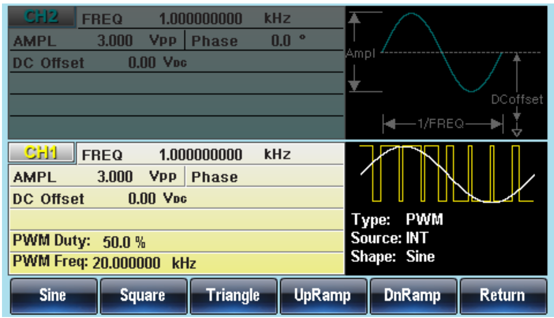
4. 按 F1~F5 选择波形



5. 按 Return 返回菜单

范围

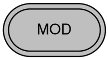
波形	
方波	50%占空比
正斜波	100%对称
三角波	50%对称
负斜波	0%对称



调制波形频率

面板操作

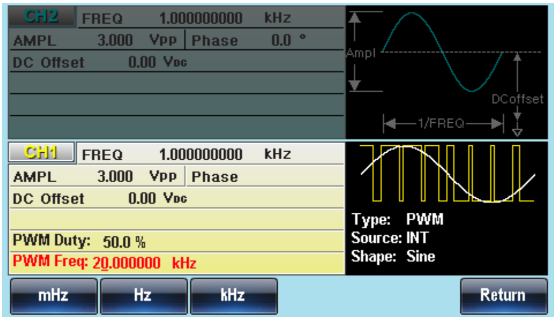
1. 按 MOD 键



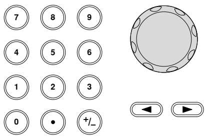
2. 按 F6 (PWM)

3. 按 F3 (PWM Freq)

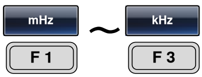
4. 位于波形显示区域处的 PM 频率参数将变亮



5. 使用方向键和可调旋钮或数字键盘输入 PWM 频率



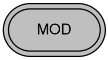
6. 按 F1~F3 选择频率单位



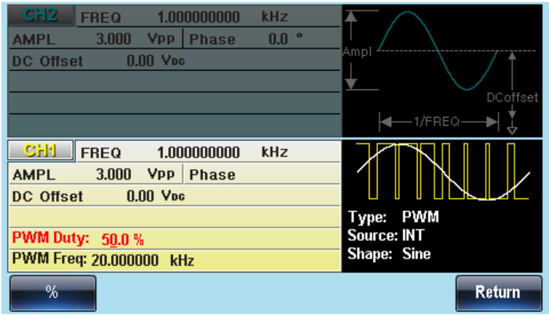
范围	PWM 频率	2mHz~20kHz
	默认	20kHz

调制占空比

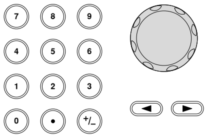
用于设置占空比(%)

面板操作	1. 按 MOD 键	
	2. 按 F6 (PWM)	
	3. 按 F2 (Duty)	

4. 位于波形显示区域处的 PWM 频率参数将变亮



5. 使用方向键和可调旋钮或数字键盘输入 PWM 频率



6. 按 F1(%)选择百分号

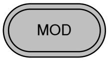
范围	占空比	0%~100%
	默认	50%
注意	如果使用外部调制源，则脉冲波形由外部调制源调制。此时，MOD INPUT端子上的±5V电压控制脉宽。	

PWM 调制源

MFG-2000 接受内部和外部 PWM 调制源。默认为内部调制源。

面板操作

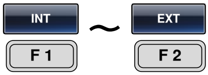
1. 选择 MOD



2. 按 F6 (PWM)

3. 按 F1 (Source)

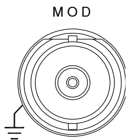
4. 按 F1 (INT)或 F2 (EXT)选择调制源



5. 按 Return 返回菜单

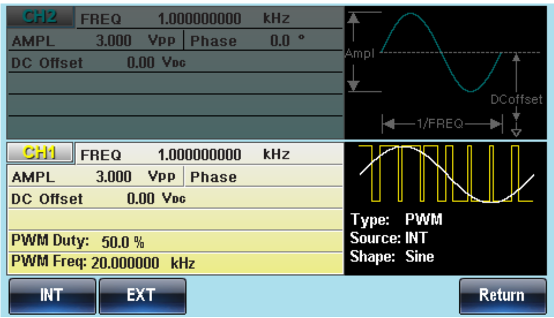
外部源

选择外部调制源时，需要使用后面板的MOD INPUT端子



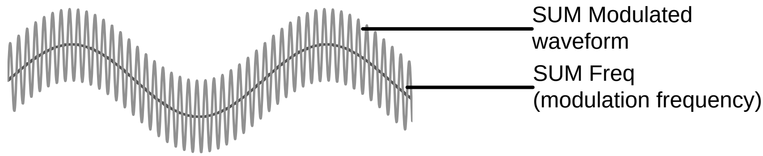
注意

当您选择外部调制源时，脉宽调制由后面板MOD INPUT端子上的±5V电压控制。例如：如果您已将调制深度设为100％，则在调制信号为+5V时，输出最大脉宽；在调制信号为-5V时，输出最小脉宽。



总和调制(SUM)

对于总和调制，深度由调制波形的瞬时电压决定。无论何时仅允许启用一种调制模式。若使用 SUM，将禁用其它调制模式。此外不允许扫描和脉冲串模式与 SUM 同时使用。若使用 SUM，将关闭扫描和脉冲串模式。

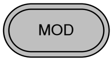


选择总和调制 (SUM)

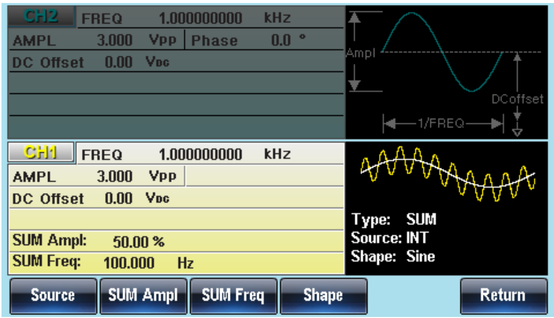
选择 SUM 后, 调制波形由载波频率、输出幅值和偏置电压决定。

面板操作

1. 按 MOD 键



2. 按 F5 (SUM)

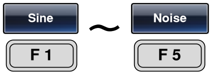


SUM 载波波形

背景　SUM 载波默认为正弦波。

面板操作
1. 按 Waveform 键

2. 按 F1~F5 选择载波形



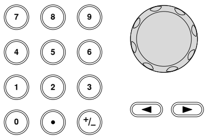
范围	载波波形	正弦波, 方波, 脉冲波,三角波,斜波,噪声波

SUM 载波频率

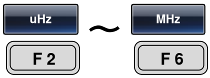
最大载波频率与载波波形的选择有关。默认载波频率为 1kHz。

面板操作
1. 按 FREQ/Rate 键选择载波频率

2. 位于参数窗口处的 FREQ 参数将变亮
3. 使用方向键和可调旋钮或数字键盘输入载波频率



4. 按 F2~F6 选择频率单位



范围	载波波形	载波频率
	正弦波	1μHz~320MH
	方波	1μHz~25MHz

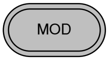
脉冲波	1μHz~25MHz
三角波	1μHz~1MHz
默认频率	1 kHz

SUM 波形

信号发生器能接受内部和外部源。MFG-2000 的内部调制波形包括正弦波、方波、脉冲波、正和负斜波(UpRamp, DnRamp)。默认情况为正弦波。

面板操作

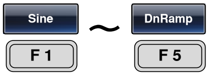
1. 选择 MOD



2. 按 F5 (SUM)

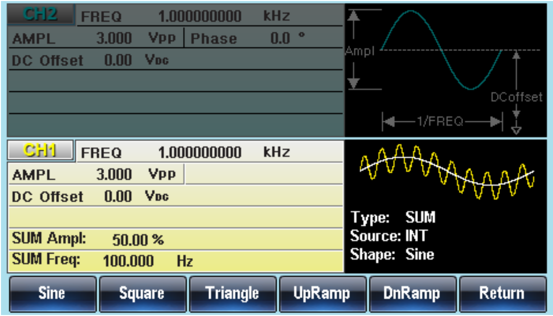
3. 按 F4 (Shape)

4. 按 F1~F5 选择波形



5. 按 Return 返回菜单

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



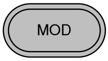
CH2
FREQ 1.000000000 kHz
AMPL 3.000 Vpp
Phase 0.0 °
DC Offset 0.00 VDC
Ampl
DCoffset
1/FREQ
CH1
FREQ 1.000000000 kHz
AMPL 3.000 Vpp
DC Offset 0.00 VDC
SUM Ampl: 50.00 %
SUM Freq: 100.000 Hz
Type: SUM
Source: INT
Shape: Sine
Sine
Square
Triangle
UpRamp
DnRamp
Return

频率调制波形

信号发生器将接受用于 FM 的内部或外部调制源。

面板操作

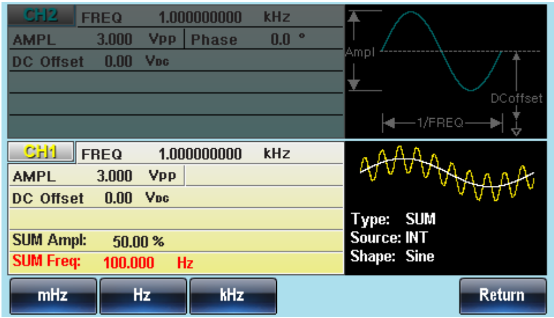
1. 按 MOD 键



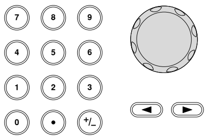
2. 按 F4 (PM)

3. 按 F3 (SUM Freq)

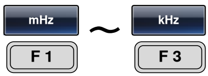
4. 位于波形显示区域处的 PM 频率参数将变亮



5. 使用方向键和可调旋钮或数字键盘输入 PM 频率



6. 按 F1~F3 选择频率单位



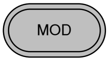
范围	调制频率	2mHz~20kHz
	默认频率	100Hz

总和偏移

总和偏移是载波与调制波的幅度最大偏差。

面板操作

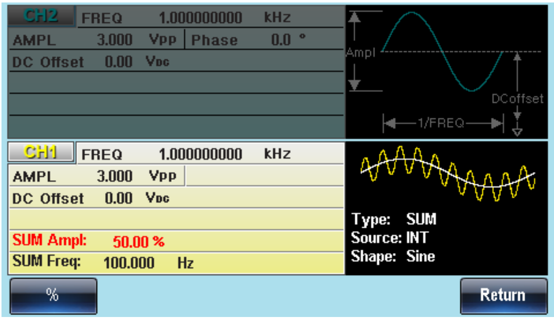
1. 按 MOD 键



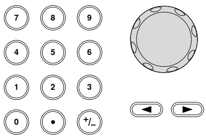
2. 按 F5 (SUM)

3. 按 F2 (SUM Ampl)

4. 位于波形显示区域处的 SUM Ampl 参数将变亮



5. 使用方向键和可调旋钮或数字键盘输入频率偏移



6. 按 F1 选择相位单位

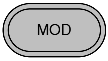
范围	相位偏移	0~100%
	默认相位	50%

选择 (SUM) 调制源

信号发生器将接受用于 FM 调制的内部或外部源。默认为内部源。

面板操作

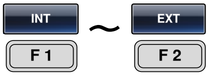
1. 按 MOD 键



2. 按 F5 (SUM)

3. 按 F1 (Source)

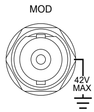
4. 按 F1 (INT)或 F2 (EXT)选择调制源



5. 按 Return 返回菜单

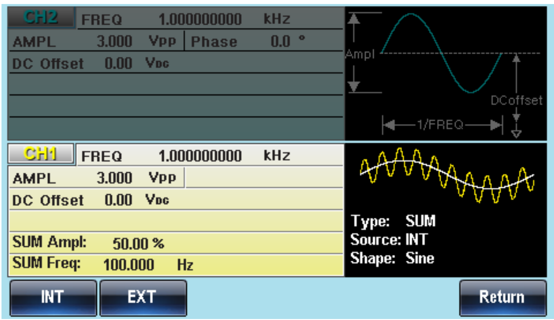
外部源

从后面板的 MOD 输入端子接收外部调制信号



注意

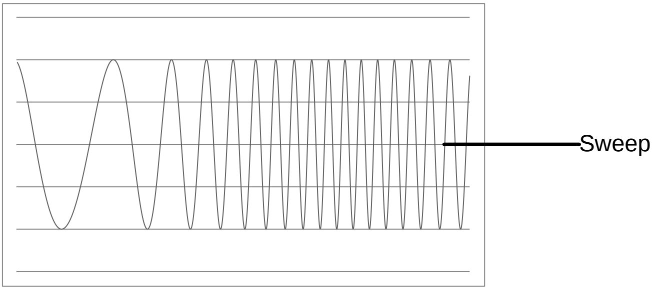
如果选择外部调制源, 那么频偏将由后面板 MOD INPUT 上的± 5V 信号电压控制。频偏与调制信号电平成比例。例如，如果调制电压为+5V, 那么频偏将等于设置的频偏。外部信号电平越低，偏移就越小；而负信号电平将会使频偏频率降至载波频率之下。



频率扫描

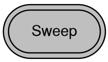
除噪声波和脉冲波外，信号发生器可以对正弦波、方波或斜波产生一个扫频。在启动扫描模式时，将关闭脉冲串或其它调制模式。

在扫描模式下，信号发生器以指定步进从起始频率到停止频率扫描。您能够以线性或对数间隔由高频向低频扫描，或者由低频向高频扫描。您也可以配置信号发生器，使其用外部触发或手动触发输出单个扫描。



选择扫描模式

选择 Sweep 按钮，进入扫描模式。如果不预先设置，输出幅值、偏移和频率使用默认值。

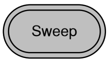


设置起始和停止频率

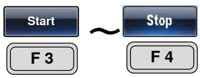
起始频率和停止频率定义扫描上限和下限。信号发生器从起始频率开始，一直扫描到停止频率，然后又复位回起始频率。在整个扫描范围内，相位连续

面板操作

1. 按 SWEEP 键

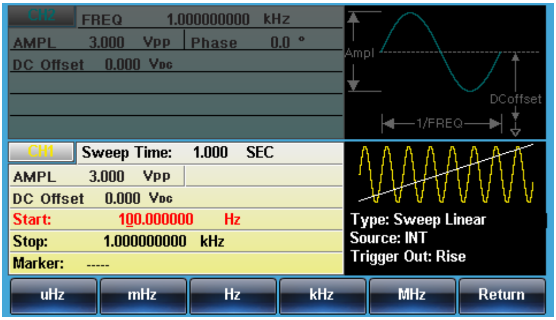


2. 按 F3 (Start)或 F4 (Stop)选择起始或停止频率

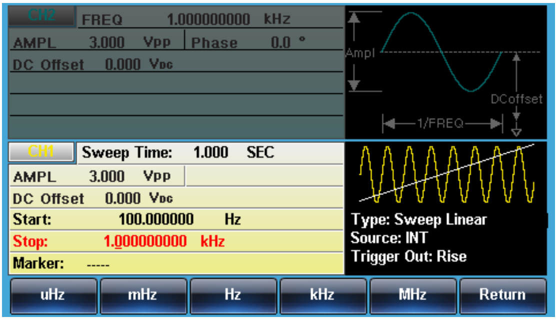


3. 位于波形显示区域处的 Start 或 Stop 参数将变亮

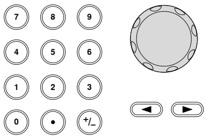
起始



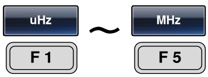
停止



4. 使用方向键和可调旋钮或数字键盘输入 Stop/Start 频率



5. 按 F1~F5 选择 Start/Stop 频率单位



范围	扫描范围	
	正弦波	1μHz~320MHz (max)
	方波	1μHz~25MHz (max)
	脉冲波	1μHz~25MHz (max)
	三角波	1μHz~1MHz
	起始	100Hz
	终止	1KHz

注意

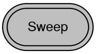
从低频到高频扫描，设置起始频率＜停止频率。从高频到低频扫描，设置起始频率＞停止频率。关闭标记后，同步信号为 50% 占空比的方波。在扫描开始时，同步信号处于 TTL 低电平，扫描中点上升到 TTL 高电平。同步信号频率与指定扫描时间相等。打开标记，在扫描开始时同步信号处于 TTL 高电平，到达标识频率处下降到 TTL 低电平。标记输出端输出同步信号。

中心频率和跨距

使用中心频率和跨距来设置扫描上限和下限(起始/停止)。

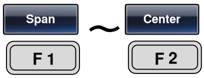
面板操作

1. 按 SWEEP 键



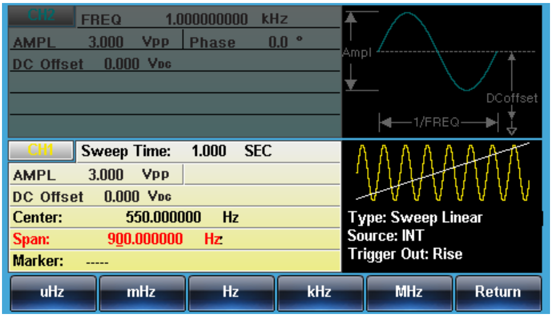
2. 按 F6 (More)

3. 按 F1 (Span)或 F2 (Center) 选择跨距或中心

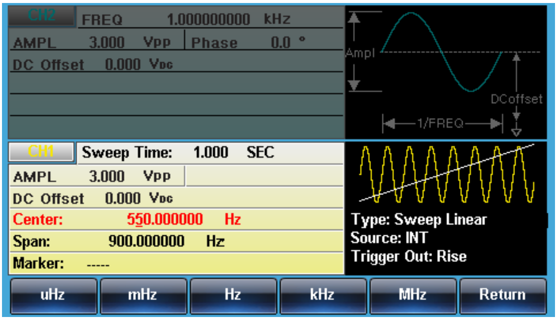


4. 位于波形显示区域处的 Span 或 Center 参数将变亮

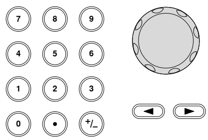
跨距



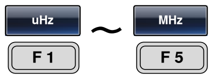
中心



5. 使用方向键和可调旋钮或数字键盘输入 Span/Center 频率



6. 按 F1~F5 选择 Start/Stop 频率单位



范围	中心频率	
	正弦波	1μHz~320MHz (max)
	方波	1μHz~25MHz (max)
	脉冲波	1μHz~25MHz (max)
	三角波	1μHz~1MHz
	跨距频率	
	正弦波	1μHz~320MHz (max)
	方波	1μHz~25MHz (max)
	脉冲波	1μHz~25MHz (max)
	三角波	1μHz~1MHz
	中心 – 默认	550Hz
	跨距 – 默认	900Hz

注意

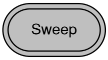
从低频到高频扫描，设置正频率跨距。从高频到低频扫描，设置负频率跨距。关闭标记后，同步信号为 50% 占空比的方波。在扫描开始时，同步信号处于 TTL 低电平，扫描中点上升到 TTL 高电平。同步信号频率与指定扫描时间相等。打开标记，在扫描开始时同步信号处于 TTL 高电平，到达标识频率处下降到 TTL 低电平。标记输出端输出同步信号。

扫描模式

扫描模式用于选择线性或对数扫描。默认线性扫描。

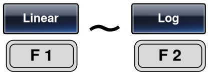
面板操作

1. 按 SWEEP 键

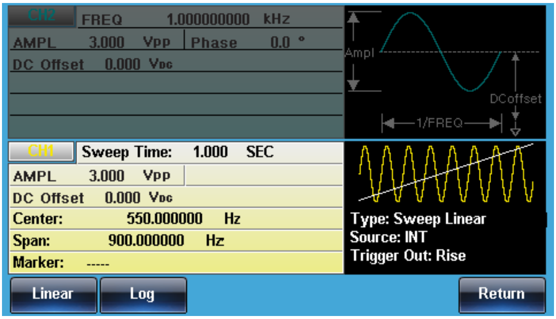


2. 按 F2 (Type)

3. 按 F1 (Linear)或 F2 (Log)选择线性或对数扫描



4. 按 Return 返回菜单

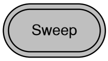


扫描时间

从起始频率到截止频率完成一次扫描所需的时间称为扫描时间。信号发生器自动限定扫描的离散频率点，该数目与扫描长度有关。

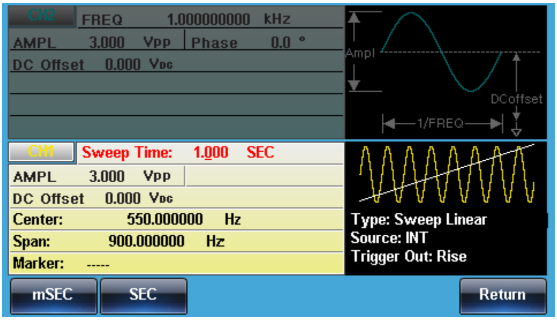
面板操作

1. 按 SWEEP 键

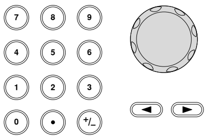


2. 按 F5 (SWP Time)

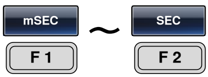
3. 位于波形显示区域处的扫描时间参数将变亮



4. 使用方向键和可调旋钮或数字键盘输入扫描时间



5. 按 F1~F2 选择时间单位



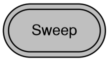
范围	扫描时间	1ms ~ 500s
	默认	1ms

标记频率

标记信号变为低电平时的频率称为标记频率(扫描开始时标记信号都处于高电平)。后面板 MARK 端子输出标记信号。默认 550 Hz。

面板操作

1. 按 SWEEP 键



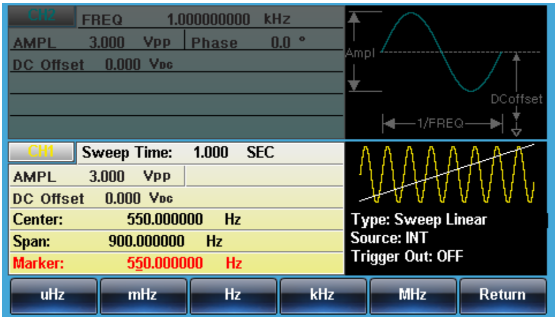
2. 按 F6 (More)

3. 按 F3 (Marker)

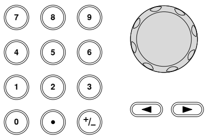
4. 按 F2 (ON/OFF)打开/关闭标记

5. 按 F1 (Freq)选择标记频率

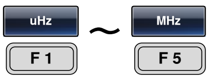
6. 位于波形显示区域处的频率参数将变亮



7. 使用方向键和可调旋钮或数字键盘输入频率



8. 按 F1~F5 选择频率单位



范围	频率	
	正弦波	1μHz~320MHz (max)
	方波	1μHz~25MHz (max)
	脉冲波	1μHz~25MHz (max)
	三角波	1μHz~1MHz
	默认	550Hz

注意

标记频率必须设置在起始频率和停止频率之间。如果无设置，标记频率将等于起始频率和停止频率的均值。

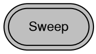
启用扫描模式后，标记模式将忽略同步模式的设置。

扫描触发源

扫描模式下，信号发生器在收到触发信号时输出一个扫描。扫描输出完成后，信号发生器输出起始频率，并等待下一次触发。默认内部触发源。

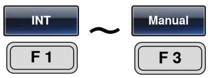
面板扫描

1. 按 SWEEP 键



2. 按 F1 (Source)

3. 按 F1 (Internal), F2 (External)或 F3 (Manual)选择触发源



4. 按 Return 返回菜单

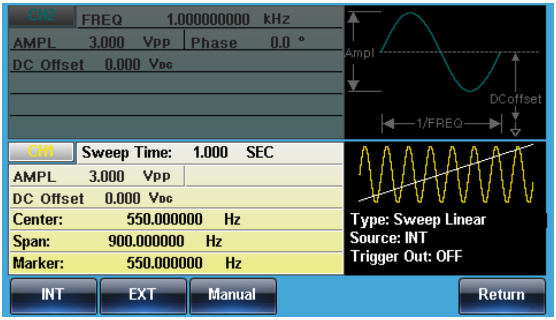
注意

选择内部源时，信号发生器输出一个连续的扫描，其频率由扫描时间决定。

选择外部源时，每收到一个从后面板 Trig Out 的 TTL 脉冲，信号发生器就输出一个扫描。

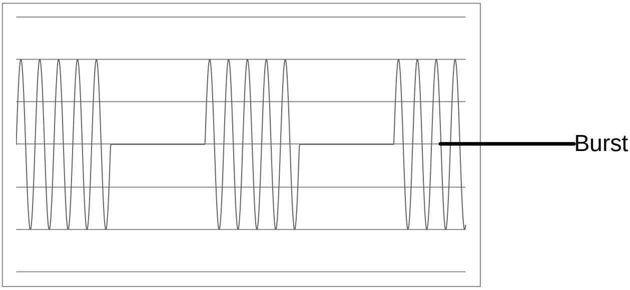
触发周期必须大于或等于扫描时间+1ms。

5. 如果选择手动触发，按 F1 (Trigger)执行手动扫描



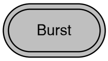
脉冲串模式

信号发生器能创建一个具有指定循环数的波形脉冲串。脉冲串模式支持正弦波、方波、三角波和斜波。



选择脉冲串模式

选择脉冲串模式后，任何调制或扫描模式都将自动关闭。如果无设置，输出幅值、偏移和频率启用默认值。



脉冲串模式

触发(N 次循环模式)或门控模式可以设置脉冲串模式。在 N 次循环/触发模式下，每次接收触发时信号发生器都将输出一个指定循环次数的波形(脉冲串)。执行完成后，信号发生器将停止并等待下一次触发。默认为 N 次循环模式。内部或外部触发均可使用。

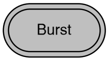
相比指定循环次数，门控模式使用外部触发打开或关闭输出。当触发输入信号为高电平时，波形持续输出。当触发输入信号为低电平时，信号发生器在输出最后一个完整波形后停止。输出电压电平仍与脉冲串波形的起始相位相同。

脉冲串模式	脉冲串计数	脉冲串周期	相位	触发源
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

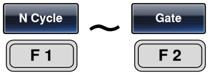
门控模式下，关闭脉冲串计数、脉冲串周期和触发源。如果此时触发，将不会有任何效果，也不会产生任何错误。

面板操作

1. 按 Burst 键



2. 选择 N 次循环(F1)或门控(F2)



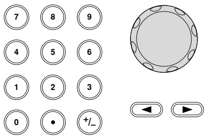
脉冲串频率

在 N 次循环和门控模式下，波形频率定义了脉冲串波形的重复率。在 N 次循环模式下，以指定循环次数输出波形。在门控模式下，当触发信号为高电平时输出波形频率。脉冲串模式支持正弦波、方波、三角波或斜波。

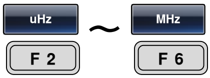
面板操作

1. 按 FREQ/Rate 键

2. 位于参数窗口处的 FREQ 参数将变亮
3. 使用方向键和可调旋钮或数字键盘输入频率



4. 按 F2~F6 选择频率单位



范围	频率-正弦波	1uHz~60MHz（最大）
	频率 - 方波	1uHz~25MHz（最大）
	频率 – Ramp 波	1uHz~1MHz
	默认	1kHz

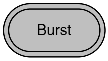
注意　波形频率不同于脉冲串周期。脉冲串周期指 N 次循环模式下脉冲串波形之间的时间间隔。

脉冲串循环/计数

脉冲串循环/计数是指脉冲串波形的循环次数。仅用于 N Cycle 模式(内部, 外部或手动触发)。默认 1 次循环。

面板操作

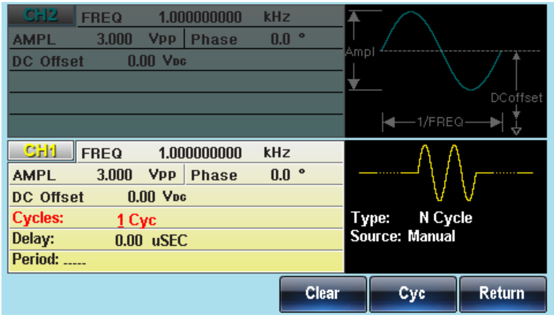
1. 按 Burst 键



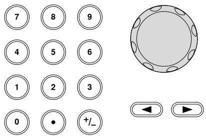
2. 按 F1 (N Cycle)

3. 按 F1 (Cycles)

4. 位于波形显示区域处的 Cycles 参数将变亮



5. 使用方向键和可调旋钮或数字键盘输入循环数



6. 按 F5 选择 Cyc 单位

范围	循环	1~1000000

注意

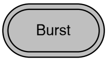
选择内部触发源时，持续输出循环数。脉冲串周期决定脉冲串频率和脉冲串之间的时间间隔。脉冲串计数须小于脉冲串周期和波形频率的乘积。脉冲串计数< (脉冲串周期 x 波形频率)

如果脉冲串计数超出上述限制，信号发生器将自动增大脉冲串周期，以满足条件。选择门控脉冲串模式时，忽略脉冲串计数。如果从远程接口更改计数，信号发生器将记录新计数，并在下次使用。

无限脉冲串计数

面板操作

1. 按 Burst 键

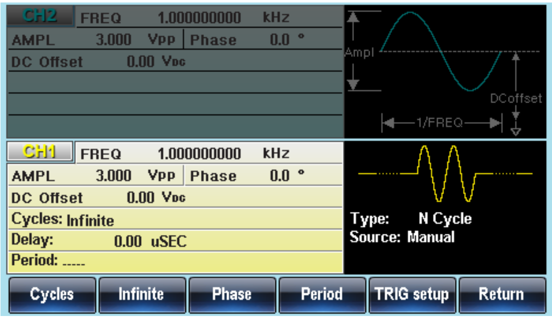


2. 按 F1 (N Cycle)

3. 按 F2 (Infinite)

注意

无限脉冲串仅用在手动触发模式

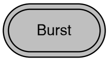


脉冲串周期

从一个脉冲串的开始至下一个脉冲串的开始所经历的时间称为脉冲串周期。仅用于内部触发脉冲串模式。

面板操作

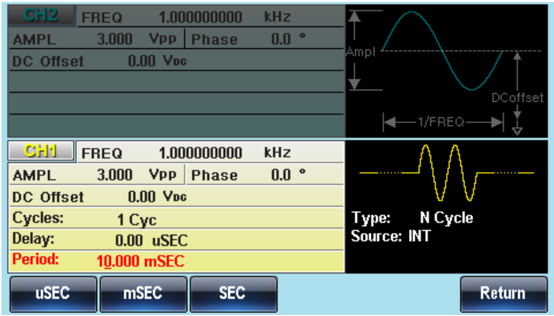
1. 按 Burst 键



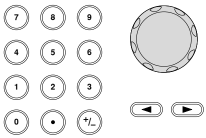
2. 按 F1 (N Cycle)

3. 按 F4 (Period)

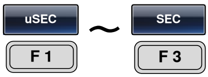
4. 位于波形显示区域处的周期参数将变亮



5. 使用方向键和可调旋钮或数字键盘输入周期



6. 按 F1~F3 选择周期单位



范围	周期	1ms~500s
	默认	10ms

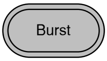
注意	脉冲串周期仅用于内部触发。当使用门控脉冲串模式或外部和手动触发时，关闭脉冲串周期设置。 脉冲串周期一定要够长，且满足如下条件: 脉冲串周期>脉冲串计数/波形频率 + 200ns

脉冲串相位

脉冲串波形的起始相位称为脉冲串相位，默认 0°。

面板操作

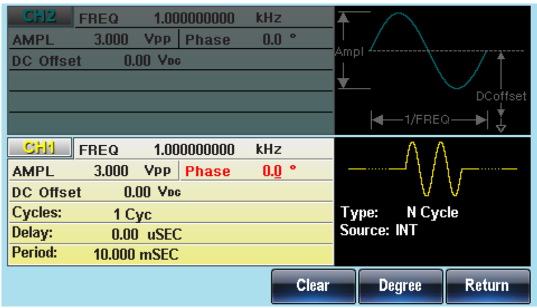
1. 按 Burst 键



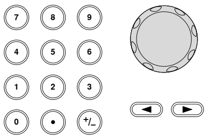
2. 按 F1 (N Cycle)

3. 按 F3 (Phase)

4. 位于波形显示区域处的相位参数将变亮



5. 使用方向键和可调旋钮或数字键盘输入相位



6. 按 F5 (Degree)选择相位单位

范围	相位	-360°~+360°
	默认	0°

注意

当使用正弦波、方波、三角波或斜波时，0˚与波形0V 点相对应。

0˚是波形的起始点。对于正弦波、方波或三角波、斜波，0˚对应 0V 电压(假设没有 DC 偏置)

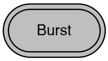
脉冲串相位用于 N 次循环和门控脉冲串模式。在门控脉冲串模式下，当触发 INPUT 信号下降到低电平时，信号发生器完成当前波形后停止输出。电压输出电平仍与起始脉冲串相位对应的电压值相同。

脉冲串触发源

触发脉冲串(N-Cycle)模式下，信号发生器在收到触发后输出一个波形脉冲串。脉冲串循环(脉冲串计数)指定每个脉冲串的波形数。输出完成后，信号发生器停止并等待下一次触发。默认启用内部触发的脉冲串(N-cycle)模式。

面板操作

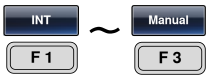
1. 按 Burst 键



2. 按 F1 (N Cycle)

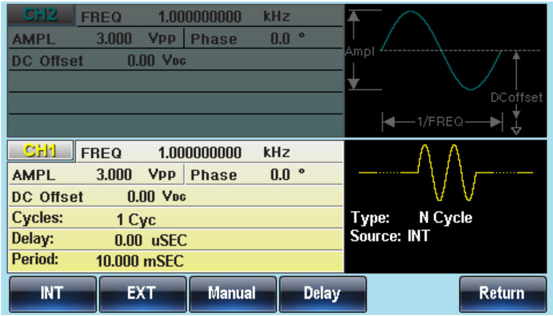
3. 按 F5 (TRIG setup)

4. 按 F1(INT), F2(EXT)或F3(Manual)选择触发类型



手动触发

如果选择手动触发，每按一次触发软键(F1)输出一个脉冲串



注意

选择内部触发源时，脉冲串以指定频率持续输出，该频率和脉冲串之间的时间间隔由脉冲串周期决定。

选择外部触发时，信号发生器接收后面板触发输入端的触发信号(TTL)。每收到一个触发信号，信号发生器就输出一个脉冲串(循环数已设)。输出脉冲串期间接收到的触发信号将被忽略。

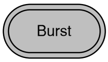
若使用手动或外部触发，仅可用脉冲串相位和脉冲串循环/计数，脉冲串周期不可用。

在接收触发后、脉冲串开始之间可以插入时间延迟。

脉冲串延迟

面板操作

1. 按 Burst 键

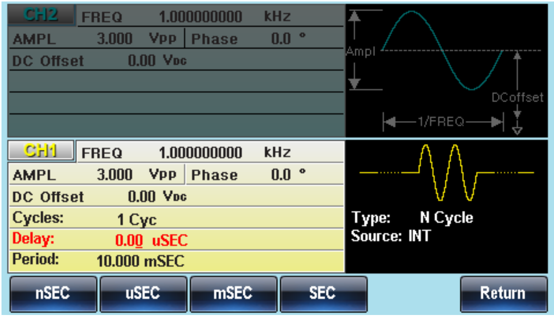


2. 按 F1 (N Cycle)

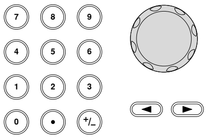
3. 按 F5 (TRIG setup)

4. 按 F4 (Delay)

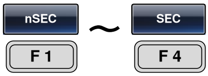
5. 位于波形显示区域处的 Delay 参数将变亮



6. 使用方向键和可调旋钮或数字键盘输入周期



7. 按 F1~F4 选择延迟时间单位



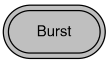
范围	延迟时间	0ns~100s
	默认	0s

脉冲串触发输出

触发输出端在后面板可用于脉冲或扫描模式输出一个上升沿触发信号，TTL 兼容。默认情况下触发信号上升沿。触发信号是每一个脉冲串开始输出。

面板操作

1. 按 Burst 键.



2. 按 F1 (N Cycle).

3. 按 F5 (TRIG setup).

4. 按 F5 (TRIG out).

5. 按 F3 (ON/OFF) 来切换触发开关.

ON/OFF F 3

6. 选 F1 (Rise) 或 F2 (Fall) 边沿触发

Rise ~ Fall
F 1 F 2

注意

当选择内部或外部触发，触发输出信号将在一个 TTL 低/高水平，将在切换时指定的波形周期内完成。

当选择手动触发时，按下触发软按键触发输出。

当手动触发时，函数发生器自动禁用触发器输出。使用手动触发时，函数发生器从触发输出端输出一个脉冲波（大于 1）。

辅助系统功能设置

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 的非易失性存储器有 10 个内存文件 0~9，可以保存仪器状态、波形数据(ARB)和设置。内存文件中的数据(ARB 或设置数据)以红色字体显示。若没有数据则呈现蓝色。

存储/调取内容

ARB

- 速率
- 频率
- 长度
- 显示水平位置
- 显示垂直位置
- 输出开始
- 输出长度

设置

- 功能
  - 波形
  - 频率
  - 脉冲宽度
  - 方波占空比
  - 斜波对称性
  - 幅值
  - 幅值单位
  - 偏移
  - 调制类型
  - 蜂鸣器设置
  - 阻抗
  - 主输出
- 扫描
  - 源
  - 类型
  - 触发
  - 标记
- AM
  - 调制源
  - 波形
  - 深度
  - AM 频率
- ASK
  - 调制源
  - 波形
  - 速率
  - 幅度
- FM
  - 调制源
  - 波形
  - 偏移
  - FM 频率
- FSK
  - 调制源
  - 波形

时间

起始频率

停止频率

中心频率

跨距频率

标记频率

SUM

调制源

波形

速率

相位

速率

跳跃频率

PM

调制源

波形

占空比

频率

PSK

调制源

波形

速率

相位

脉冲串类型

源

触发

类型

循环数

相位

周期

延迟

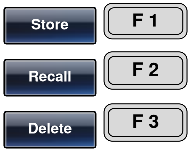
面板操作

1. 按 UTIL 键

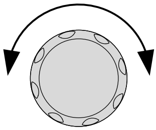
2. 按 F1 (Memory)

3. 选择文件操作:

F1 存储文件, F2 调取文件, F3 删除文件

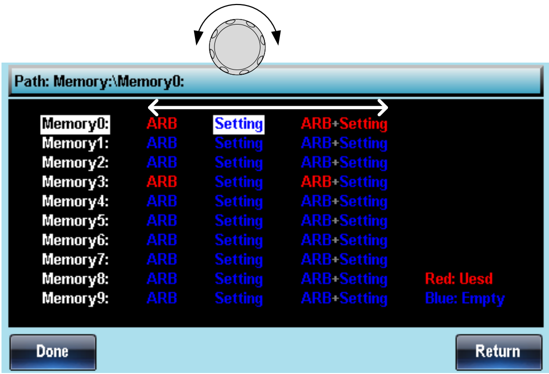


4. 使用可调旋钮选择一个内存文件



5. 使用可调旋钮选择数据类型

范围	内存文件	Memory0 ~ Memory9
	数据类型	ARB, 设置, ARB+设置



	6. 按 F5 (Done)确认操作	Done F 5
删除所有	7. 按 F4 删除 Memory0~Memory9 所有文件	Delete All F 4
	8. 按 F1 (Done)确认删除	Done F 1

选择远程接

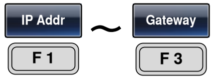
MFG-2000 具有远程控制局域网和 USB 接口,只有一个远程接口可以在同一时间使用. LAN 接口只存在于 MFG-22xx 系列机器里.

LAN 接口

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 键.	UTIL
	2. 按 F2 (Interface).	Interface F 2
	3. 按 F3 (LAN).	LAN F 3
	4. 按 F2 (Config).	Config F 2
	5. 选择如何配置网络地址。按 F1（DHCP）、F2（自动 IP）、F3（手动）。	DHCP F 1 ~ Manual F 3

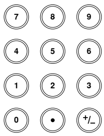
范围	DHCP	使用 DHCP 自动配置一个 DHCP 服务器作为网络单元的 IP 地址。
	自动 IP	通过以太网电缆直接连接到主机时，使用自动配置单元的地址。
	手动	手动配置地址。

6. 如果选择手动设置（IP 地址），F1，F2 和 F3（子网掩码）（网关）反过来。



7. 把参数窗口中的地址、网络掩码或网关设置为高亮显示.

8. 使用数字键盘输入地址、网络掩码或网关。使用小数点作为字段分隔符。



9. 按 F5（做）确认设置。

10. 最后，按 F5（完成）以确认所有的 IP 配置设置。

局域网内的主机名

背景	下面介绍了如何在局域网接口中使用该单元的主机名。
面板操作	1. 按 UTIL 键.

2. 按 F2 (Interface).

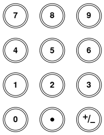
3. 按 F3 (LAN).

4. 按 F2 (Config).

5. 按 F4（主机名）设置为单位的主机名。

6. 把参数窗口中的主机名设置高亮显示。

7. 使用滚动轮滚动每个字符。



8. 按 F1（输入字符）来选择一个角色，继续下一个字符

9. 按 F5（做）来确认主机名。

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 键.

2. 按 F2 (Interface).

3. 按 F2 (USB).

系统和设置

用户也可以设置语言选项、输出阻抗、DSO 连接以及固件配置等。

查看和更新固件版本

面板操作	1. 按 UTIL 键	UTIL
	2. 按 F3(Cal.)	Cal. F 3
	3. 按 F2 (Software)	Software F 2
查看版本	4. 按 F1(Version)查看固件版本 屏幕显示版本信息: 仪器, 版本, FPGA 版次, Bootload 版本	Version F 1
更新固件	5. 将包含固件文件的 USB 闪盘插入 USB host 驱动中，按 F2 (Upgrade)更新固件	Upgrade F 2
	6. 按 F1（Select）选择 CPU 文档	Select F 1

⚠注意　FPGA 档需放在 USB 根目录下，升级选 CPU 档即可，不可选 FPGA 档。

语言选择

背景	MFG-2000 提供英语(默认)和简体中文两种语言操作环境。	
面板操作	1. 按 UTIL 键	UTIL

2. 按 F4 (System) System F 4

3. 按 F2 (Language) Language F 2

   22XX 还有 F1 中文选择

4. Language 参数将变亮

5. F2 (English)选择语（21XX） English F 2

   22XX 还有中文（按 F1）

设置蜂鸣器

背景 打开或关闭蜂鸣器。

面板操作

1. 按 UTIL 键 UTIL

2. 按 F4 (System) System F 4

3. 按 F4 (Beep)打开或关闭蜂鸣器 Beep F 4

4. Beep 参数将变亮

显示亮度

背景 显示的亮度可从实用程序系统菜单中设置。

面板操作

1. 按 UTIL 键. UTIL

2. 按 F4 (System).

3. Press F5 (DisLight)(21XX)

   22XX 是按 F5(More)后再按 F2(DisLight)

4. 按 F1~F3 选择相应亮度。

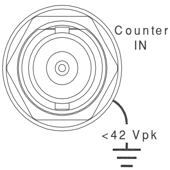
频率计数

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

Output: N/A

1. Press UTIL, F6 (Counter).

Input:



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.

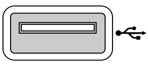
4. Input a 1kHz square wave signal into the Counter input on the rear panel. Set the gate time to 1S.

屏幕截图

背景　　信号发生器能截取屏幕图像并将它们保存在 U 盘中

连接

1. 将 USBkey 插入后面板的 USB 端子



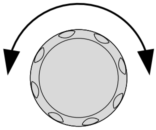
面板操作

2. 按 UTIL 键

3. 按 F4 (System)

4. 按 F1 (Hardcopy)

5. 使用可调旋钮选择屏幕图像，每次截取一张



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

6. 选择屏幕图像，按 F1 保存。2s 后再次出现 Utility 菜单，说明屏幕图像已经保存

信道功能设置

信道功能设置包括输出阻抗设置、输出幅度档位设置、输出波形极性、输出相位设置、DSO 连接设置。

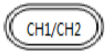
设置输出阻抗

背景

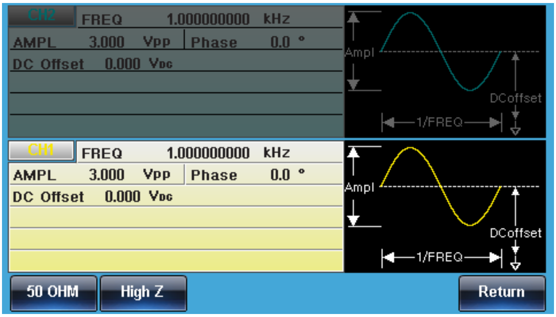
MFG-2000 提供可选输出阻抗: 50Ω(默认)或 High-Z。输出阻抗仅供参考，如果与实际负载阻抗不同，那么实际幅值和偏移也将相应改变。

面板操作

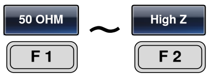
1. 按 CH1/CH2 键



2. 按 F1 (Load)



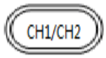
3. 按 F1 (50 OHM)或 F2 (High Z)选择输出阻抗



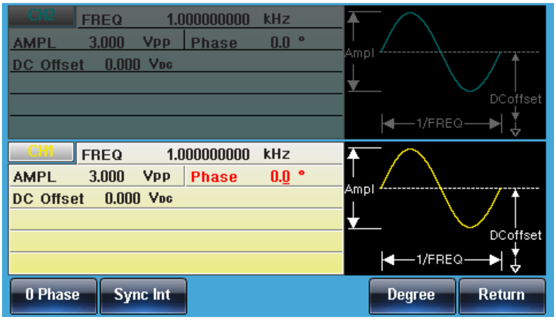
设置输出波形相位

面板操作

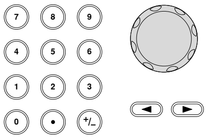
1. 按 CH1/CH2 键



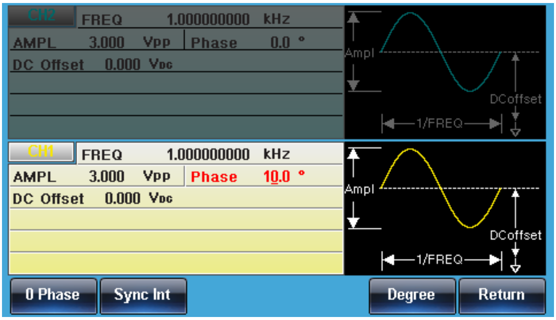
2. 按 F5(Phase)位于参数窗口处的 Phase 偏置参数将变亮



3. 使用方向键和可调旋钮或数字键盘输入 DC 偏置



4. 按 F5(Degree)选择角度



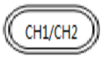
设置双通道同相位

背景

MFG-2000 提供双信道同相位功能。

面板操作

1. 按 CH1/CH2 键



2. 按 F5 (Phase)

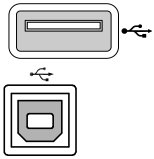
3. 按 F2 (S_Phase)同步双通道相位

DSO 连接(只有 MFG-22XX 有)

背景

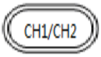
DSO 连接使 MFG-2000 和 GDS-1000/2000/3000 系列数字存储示波器之间进行无损数据传输。(支持最大记录长度 1M 点）

1. 将 MFG-2000 USB host 接口与 GDS-1000/2000/3000 的 USB B device 接口相连



面板操作

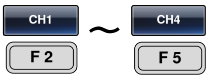
2. 按 CH1/CH2 键



3. 按 F6 (DSOLink)

4. 按 F1 (Search)

5. 按 F2 (CH1), F3(CH2), F4(CH3)或 F5(CH4)选择 DSO 通道。屏幕显示捕获的数据



双通道操作

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。

频率耦合(只有 22XX 有)

背景

频率耦合即选择的通道的频率偏移与为所选通道的频率的频率比。

面板操作

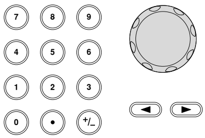
1. 按 UTIL 键.

2. 按 F5 (Dual Ch).

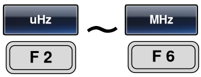
3. 按 F1 (Freq Cpl).

4. 设置选定通道的频率，按 F2（偏移）。

使用选择键，数字键或滚动轮输入频率偏移。

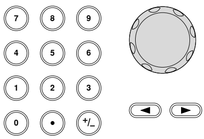


按 F2 ~ F6 选择偏移频率单位。



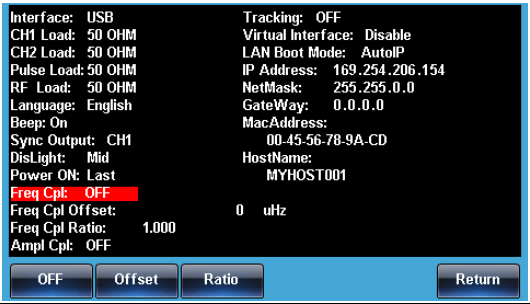
5. 按 F3 设置选中的通道频率作为选择的通道的频率比

使用选择键和滚动轮或数字键进入该比例。



按 F5 键（回车）确认

6. 另外，按 F1（关）禁用频率耦合。



范围	直流偏移范围	-60MHz ~ 60MHz (最大)
	频移分辨率	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
	系数范围	1000.000 ~ 0.001
	系数分辨率	0.001. 系数=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　振幅耦合即传递的一个信道到另一个信道的幅度。当一个通道的振幅设置改变时，这些相同的设置会自动地反映在另一个通道中。

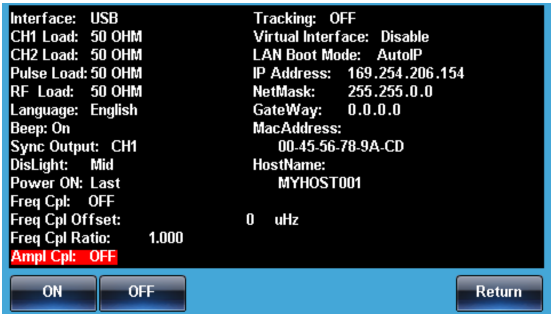
面板操作

1. 按 UTIL 键。

2. 按 F5 (Dual Ch)。

3. 按 F2 (Ampl Cpl)。 Ampl Cpl F 2

4. 按 F1 或 F2 关闭或打开振幅耦合。 ON F 1 ~ OFF F 2



通道跟踪(只有 22XX 有)

背景

信道跟踪将设置一个通道的波形输出与其他通道相同。当一个通道的设置改变时，这些变化跟踪到另一个通道上。此功能还具有执行反向跟踪的能力，其中一个通道的输出与另一个通道的关系是反向的。

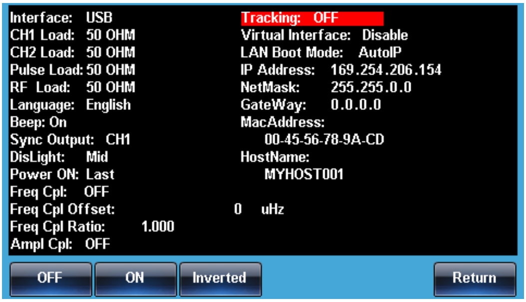
面板操作

1. 按 UTIL 键。 UTIL

2. 按 F5 (Dual Ch)。 Dual Ch F 5

3. 按 F3 (Tracking)。 Tracking F 3

4. 选择跟踪功能，按 F1，F2（下）（上）、F3（回车）。 OFF F 1 ~ Inverted F 3



相位同步(只有 22XX 有)

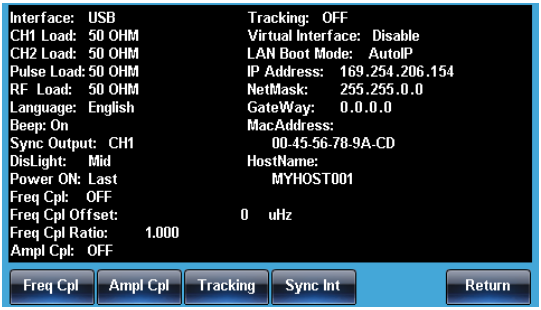
背景　　同时把两个信道的相位置为 0º。

面板操作

1. 按 UTIL 键。

2. 按 F5 (Dual Ch)。

3. 按 F4 (Sync Int)。



任意波形

MFG-2000 系列信号发生器能够创建自定义的任意波形，采样率 200MHz。每个波形 16k 数据点，垂直范围在±8192(16384)以内。

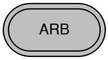
插入内置波形

MFG-2000 系列信号发生器可以创建一些常见波形，包括公用，数学，窗函数和工程函数 66 种波形。

创建公用波

面板操作

1. 按 ARB 键



2. 按 F3(Built in)

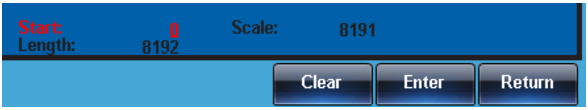
3. 按 F4 (Wave)

4. 按 F5（Select）

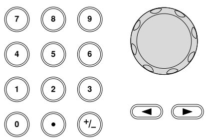
5. 按 F6（Return）

6. 按 F1 (Start)

7. Start 将变亮



8. 使用方向键和可调旋钮或数字键盘输入起始地址



9. 按 F2 (Enter)确认 Start 点

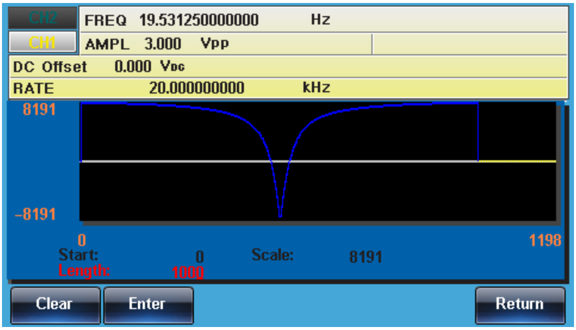
10. 按 Return 返回上级菜单 Return F 6

11. 重复 4~8 步完成 Length (F2) 和 Scale (F3)设置 Length ~ Scale F 2 F 3

12. 按 F5 (Done)完成操作 Done F 5

13. 按 Return 返回上级菜单 Return

如下创建一个波，start:0, Length: 1000, Scale: 8191



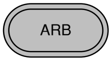
显示任意波形

设置水平显示范围

两种方式设置水平显示范围: 使用起始点和长度或者使用中心点和长度

面板操作

1. 按 ARB 键



2. 按 F1 (Display)进入显示菜单

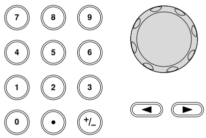
3. 按 F1 (Horizon)进入水平菜单

使用起始点

4. 按 F1(Start)

5. Horizontal From 参数变亮

6. 使用方向键和可调旋钮或数字键盘输入水平值



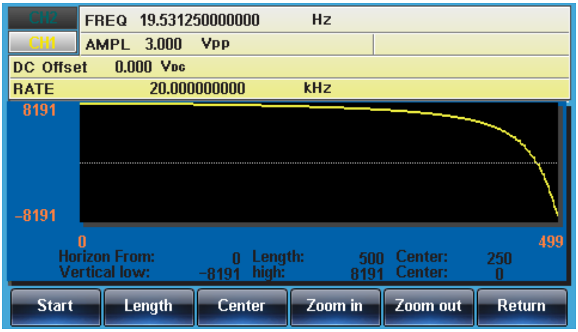
7. 按 Clear (F4)取消

8. 按 F5 (Enter)保存设置

9. 按 Return 返回上级菜单

设置长度	10. 重复 4~9 步完成 Length (F2) 设置	Length F 2
使用中心点	11. 重复 4~9 步完成 Center (F3) 设置	Center F 3
Zoom in	12. 按 F4 (Zoom In)放大波形。长度每次减小一半。允许的最小长度为 3	Zoom in F 4
Zoom out	13. 按 F5 (Zoom out)沿波形中点缩小。长度每次增加一倍。允许的最大长度为 16384	Zoom out F 5

如下任意正弦波：start0、length 500、center 250

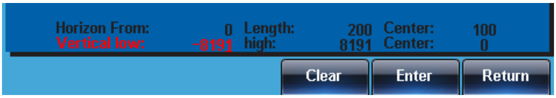


设置垂直显示范围

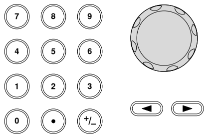
与水平窗口类似，两种方式设置垂直显示范围：设置高和低值，或者设置中心点。

面板操作	1. 按 ARB 键	ARB
	2. 按 F1 (Display)	Display F 1

	3. 按 F2 (Vertical)	Vertical F 2
设置最低点	4. 按 F1 (Low)	Low F 1
	5. Vertical Low 参数变亮	

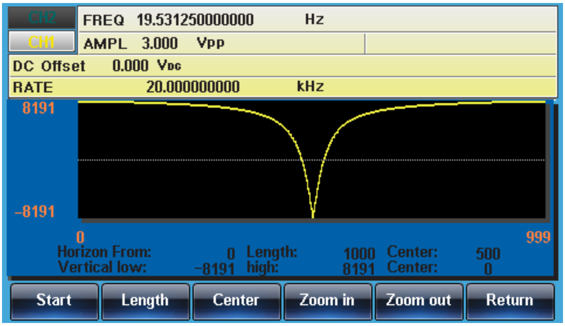


	6. 使用方向键和可调旋钮或数字键盘输入垂直最小值	



	7. 按 Clear (F4)取消	Clear F 4
	8. 按 F5 (Enter)保存设置	Enter F 5
	9. 按 Return 返回上级菜单	Return
设置最高点	10. 重复 4~9 步完成 High (F2)设置	High F 2
设置中心点	11. 重复 4~9 步完成 Center (F3)设置	Center F 3
Zoom	12. 按 F4 (Zoom In)沿波形的中心放大。长度每次减小一半。允许的最小垂直低点为-2，最小垂直高点为 2	Zoom in F 4
	13. 按 F5 (Zoom out)缩小波形。长度每次增加一倍。允许的最大垂直低点为- 8192，最大垂直高点为+8192	Zoom out F 5

如下正弦波：垂直最低点-8191、垂直最高点 8191、中心点 0



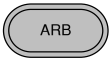
页面导航(前移)

背景

观察波形时，使用 Next/Back Page 功能可以向前/向后移动显示窗口。

面板操作

1. 按 ARB 键



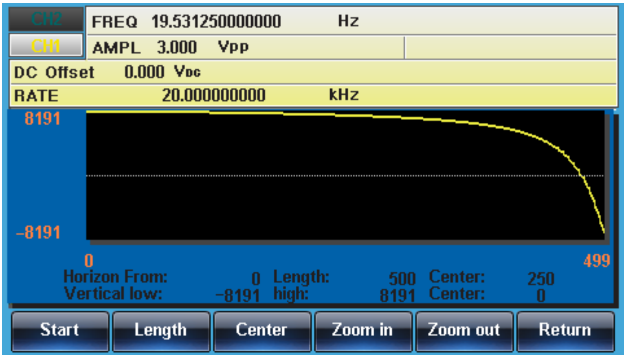
2. 按 F1 (Display)

3. 按 F4 (Back Page)将显示窗口向前移动一个观察长度

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

选择 Back Page 后，屏幕显示如下：

Horizon From: 200→ 0
Length: 500
Center:450→250



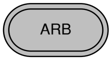
页面导航(后移)

背景

观察波形时，使用 Next/Back Page 功能可以向前/向后移动显示窗口。

面板操作

1. 按 ARB 键



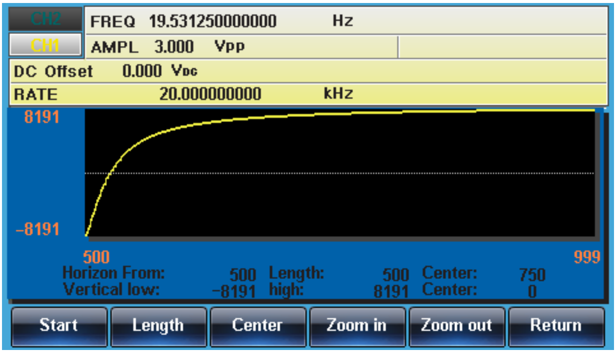
2. 按 F1 (Display)

3. 按 F3 (Next Page)将显示窗口向后移动一个观察长度

Horizon start*＝Horizon start + Length
Center=Center + Length
*Horizon start +Length≤16384

选择 Next Page 后，屏幕显示如下：

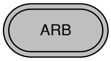
Horizon From: 0 →500
Length: 500
Center:250→750



显示

面板操作

1. 按 ARB 键

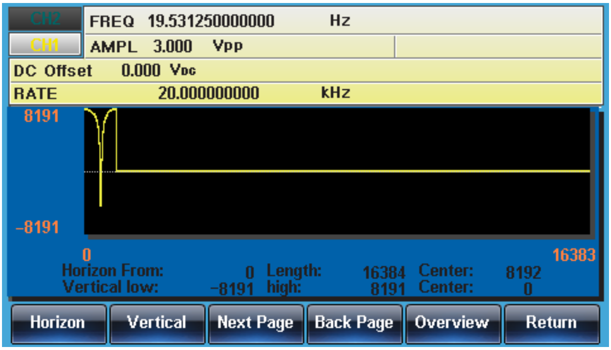


2. 按 F1 (Display)

3. 按 F5 (Overview)显示整个波形

水平: 0~1000,
垂直: -8192~ 8192

选择 Overview 后，屏幕显示如下：
Horizon From: 200→ 0
Length: 1199→16384
Center:799→8192
Vertical low/high: ±8192


CH2
CH1
FREQ 19.531250000000 Hz
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

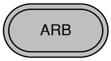
增加一个点

背景

MFG-2000 提供强大的编辑功能，用户可以在波形的任何位置创建点或线

面板操作

1. 按 ARB 键



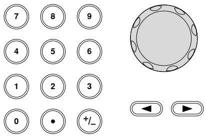
2. 按 F2 (Edit)

3. 按 F1 (Point)

4. 按 F1 (Address)

5. Address 参数呈现亮红色

6. 使用方向键和可调旋钮或数字键盘输入地址



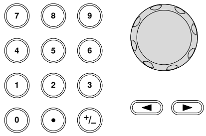
7. 按 F5 (Enter)保存设置

8. 按 Return 返回上级菜单

9. 按 F2 (Data)

10. Value 参数呈现红色

11. 使用方向键和可调旋钮或数字键盘输入 Data 值



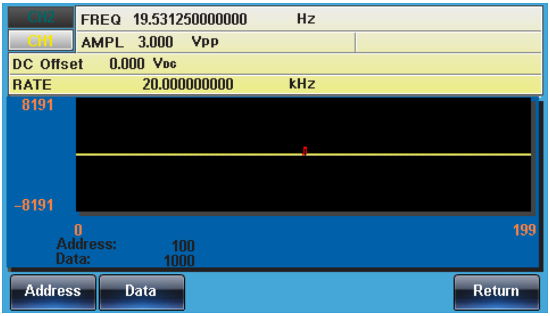
12. 按 F5 (Enter)保存设置

13. 按 Return 返回上级菜单

14. 再按 F6 (Return)返回 ARB 菜单

如下图显示：

Address 100， Data 1000

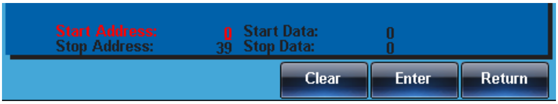


增加一条线

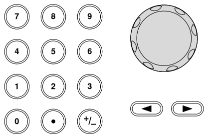
背景　MFG-2000 提供强大的编辑功能，用户可以在波形的任何位置创建点或线

面板操作

1. 按 ARB 键
2. 按 F2 (Edit)
3. 按 F2 (Line)
4. 按 F1 (Start ADD)
5. Start Address 参数呈现亮红色



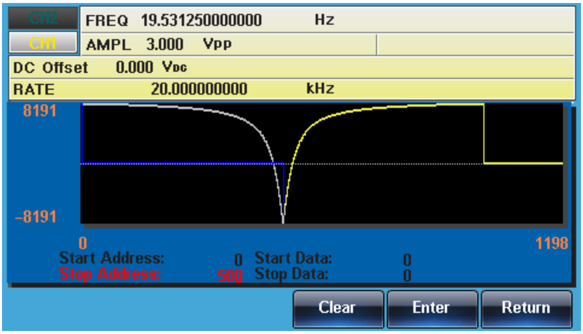
6. 使用方向键和可调旋钮或数字键盘输入起始地址



7. 按 F5 (Enter)保存设置
8. 按 Return 返回上级菜单
9. 重复 4~8 步，完成 Start Data (F2), Stop Address (F3)和 Stop Data (F4)设置
10. 按 F5 (Done)确认编辑
11. 按 Return 返回上级菜单

创建一条红线，参数如下:

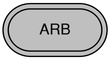
Start Address: 0, Start Data: 0
Stop Address: 500, Stop Data: 0



复制波形

面板操作

1. 按 ARB 键

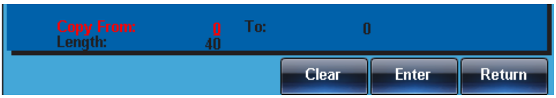


2. 按 F2 (Edit)

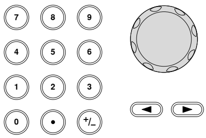
3. 按 F3 (Copy)

4. 按 F1 (Start)

5. Copy From 呈现红色



6. 使用方向键和可调旋钮或数字键盘输入复制波形的地址



7. 按 F5 (Enter)保存设置

8. 按 Return 返回上级菜单 Return

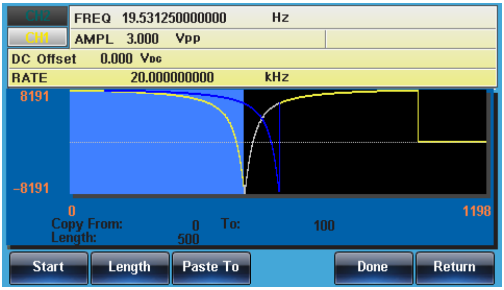
9. 重复 4~8 步完成 Length (F2)和 Paste To (F3)

10. 按 F5 (Done)确定选择 Done F 5

11. 按 Return 返回上级菜单 Return

将点 150~250 内的波形复制到点 300~400:

Copy From: 0
Length: 500
To: 100



清除波形

面板操作

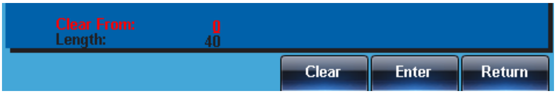
1. 按 ARB 键 ARB

2. 按 F2 (Edit) Edit F 2

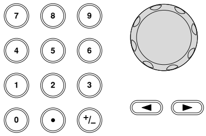
3. 按 F4 (Clear) Clear F 4

4. 按 F1 (Start) Start F 1

5. Clear From 呈现亮红色



6. 使用方向键和可调旋钮或数字键盘输入清除波形的地址



7. 按 F5 (Enter)保存设置

8. 按 Return 返回上级菜单

9. 重复 4~8 步完成 Length (F2) 设置

10. 按 F3 (Done)清除部分任意波形

11. 按 Return 返回上级菜单

删除所有

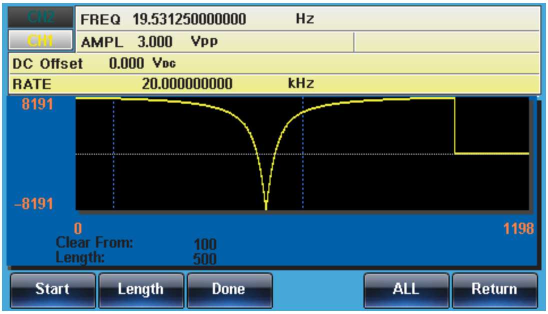
12. 按 F5 (ALL)删除整个波形

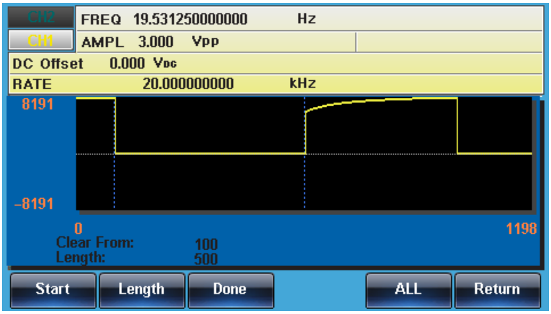
13. 再按 F5 (Done)确认删除

14. 按 Return 返回上级菜单

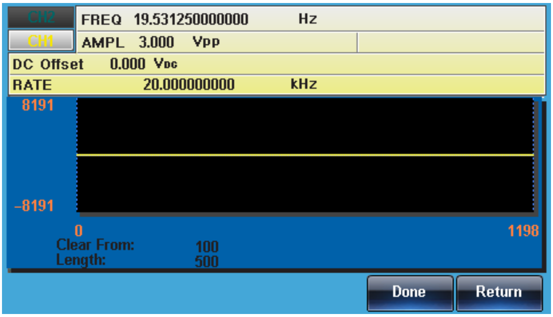
Start: 100, Length: 500.

清除部分波形后：





删除整个波形后：

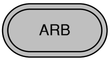


ARB 保护

保护任意波形的某个区域不被改变。

面板操作

1. 按 ARB 键



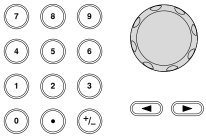
2. 按 F2 (Edit)

3. 按 F5 (Protect)

4. 按 F2 (Start)

5. Protect Start 呈现亮红色

6. 使用方向键和可调旋钮或数字键盘输入 Protect Start 地址



7. 按 F5 (Enter)保存设置

8. 按 Return 返回上级菜单

9. 重复 4~8 步完成 Length (F3) 设置

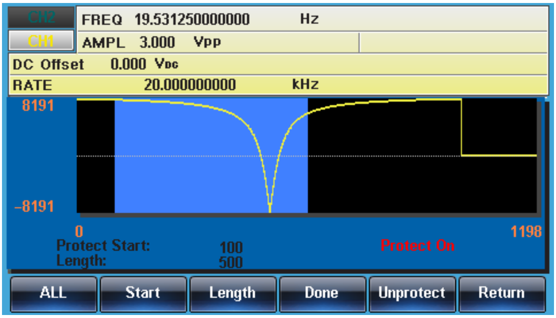
10. 按 F4 (Done)确认保护区域

11. 按 Return 返回上级菜单

	12. 按 F4 (Done)保护所选区域或波形	Done F 4
保护整个波形	13. 按 F1 (ALL)保护整个波形	ALL F 1
	14. 按 F6 (Done)确认	Done F 6
	15. 按 Return 返回上级菜单	Return
解除保护	16. 按 F5 (Unprotect)解除保护波形	Unprotect F 5
	17. 按 F6 (Done)确认	Done F 6
	18. 按 Return 返回上级菜单	Return
	19. 波形背景变回黑色。“Unprotected”呈灰色	

波形保护区域以蓝色背景显示，如下图：

Start:100, Length: 500



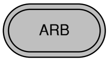
输出任意波形

信号发生器能够输出高达 16k(2~16384)的任意波形。

输出任意波形

面板操作

1. 按 ARB 键

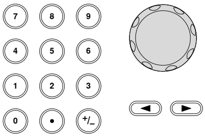


2. 按 F6 (Output)

3. 按 F1 (Start)

4. Start 参数呈现亮红色

5. 使用方向键和可调旋钮或数字键盘输入起始地址



6. 按 F5 (Enter)确认起始点

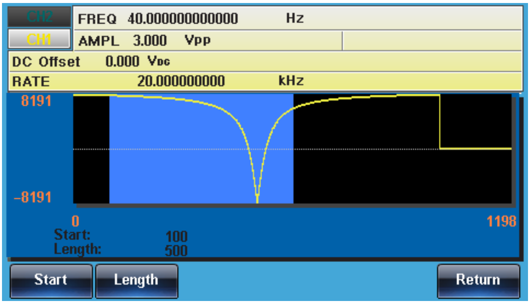
7. 按 Return 返回上级菜单

8. 重复 4~7 步完成 Length (F2)设置

9. 按 Return 返回上级菜单

前面板端子输出如下波形：

Start100，length 500


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

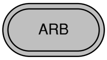
存储/调取任意波形

MFG-2000 系列信号发生器可以创建一些常见波形，包括正弦波、方波、斜波、sinc、指数上升、指数下降和 DC 波形。

将波形保存至内部存储器

面板操作

1. 按 ARB 键

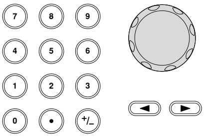


2. 按 F4 (Save)

3. 按 F1 (Start)

4. Start 参数呈现亮红色

5. 使用方向键和可调旋钮或数字键盘输入起始地址



6. 按 F5 (Enter)确认起始点

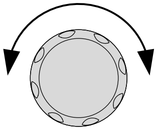
7. 按 F6 (Return)返回上级菜单

8. 重复 4~8 步完成 Length (F2)设置

9. 按 F3 (Memory)

10. 使用可调旋钮选择内存文件

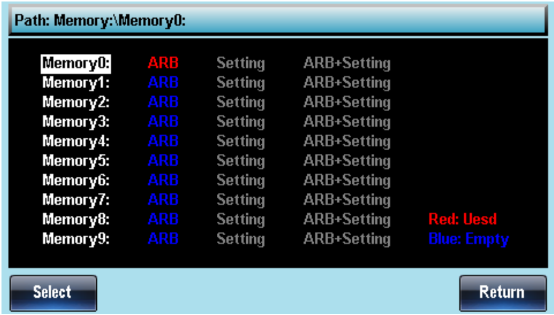
ARB0~ARB9



11. 按 F1 (Select)将波形保存至所选文件

12. 按 Return 返回上级菜单

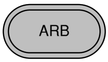
使用可调旋钮选择 ARB1 文件，如下图所示：



将文件保存至 USB 存储器

面板操作

1. 按 ARB 键

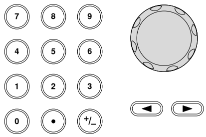


2. 按 F4 (Save)

3. 按 F1 (Start)

4. Start 参数呈现亮红色

5. 使用方向键和可调旋钮或数字键盘输入起始地址



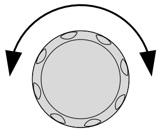
6. 按 F5 (Enter)确认起始点

7. 按 F6 (Return)返回上级菜单

8. 重复 4~8 步完成 Length (F2) 设置

9. 按 F4 (USB)

10. 使用可调旋钮查找文件系统

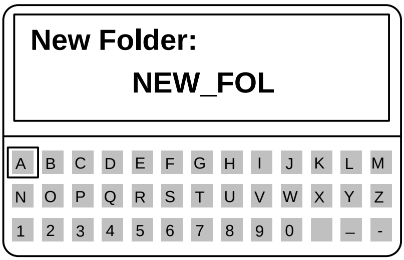


11. 按 Select 选择目录或文件名

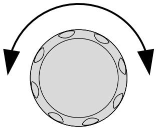
创建文件夹

12. 按 F2 (New Folder)

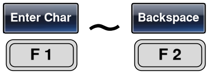
13. 显示默认文件夹名称“NEW_FOL”



14. 使用可调旋钮移动光标



15. 使用 F1 (Enter Char)或 F2 (Backspace)创建文件夹名称

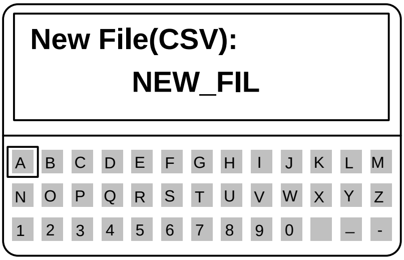


16. 按 F5 (Save)保存

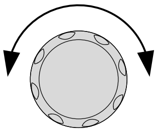
创建新文件

17. 按 F3 (New File)

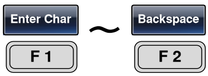
18. 显示默认文件名“NEW_FIL”



19. 使用可调旋钮移动光标

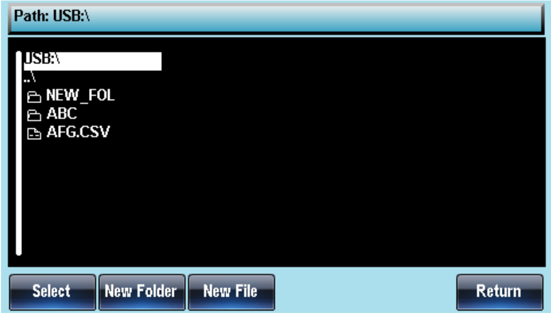


20. 使用 F1 (Enter Char)或 F2 (Backspace)创建文件名



21. 按 F5 (Save)保存

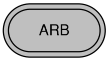
在根目录下创建 ABC 文件夹和 MFG.CSV 文件，如图所示：


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

从内部存储器调取波形

面板操作

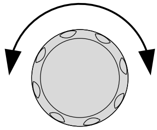
1. 按 ARB 键



2. 按 F5 (Load)

3. 按 F1 (Memory)

4. 使用可调旋钮查找文件系统

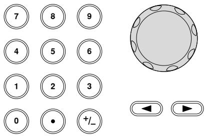


5. 按 Select 选择目录或文件名

6. 按 F3 (To)选择已调取波形的起始点

7. “Load To”呈现亮红色

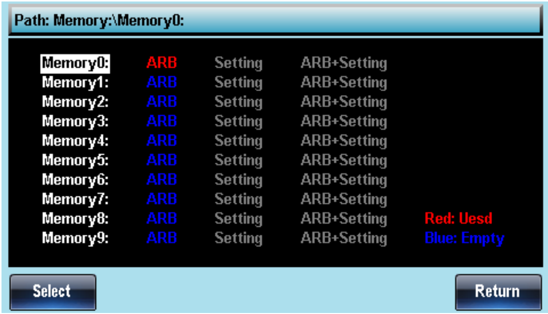
8. 使用方向键和可调旋钮或数字键盘输入起始点

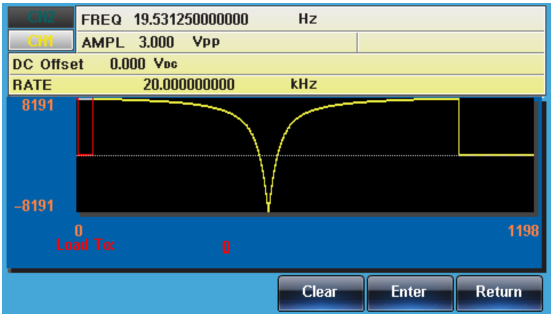


9. 按 F6 (Return)返回上级菜单

10. 按 F5 (Done)

使用可调旋钮选择 ARB1 文件，调取波形的起始点为 0，如下图所示：

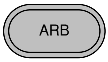




从 USB 调取波形

面板操作

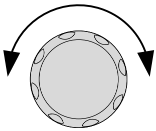
1. 按 ARB 键



2. 按 F5 (Load)

3. 按 F2 (USB)

4. 使用可调旋钮选择文件名

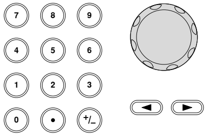


5. 按 F1 (Select)选择文件

6. 按 F3 (To)选择已调取波形的起始点

7. “Load To”呈现亮红色

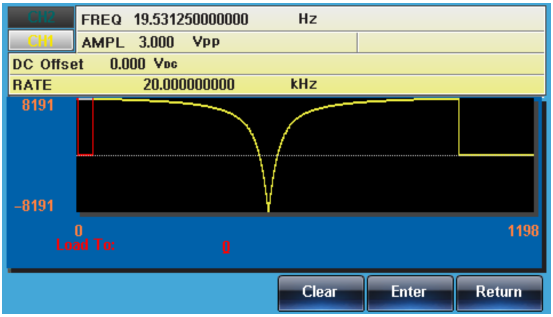
8. 使用方向键和可调旋钮或数字键盘输入起始点



9. 按 F5 (Enter)确认起始点

10. 按 F5 (Done)

使用可调旋钮选择 AFG.CSV 文件，调取波形的起始点为 0，如下图所示：



远程接口

确立远程连接

The MFG-2000 supports USBremote connections.

Configure USB interface

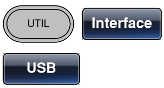
USB configuration	PC side connector	Type A, host
	MFG-2000 side connector	Type B, slave
	Speed	1.1/2.0 (full speed)

Panel Operation

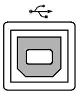
1. Download and install the USB driver from the GW Instek website, www.gwinstek.com. Go to the Product > Signal Sources > Arbitrary Function Generators > AFG-30XX product page to find the USB driver setup file.

   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

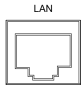
LAN configuration	MAC Address	Domain Name
	Instrument Name	DNS IP Address
	User Password	Gateway IP Address

Instrument IP Address   Subnet Mask

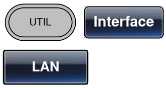
HTTP Port 80 (fixed)

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.

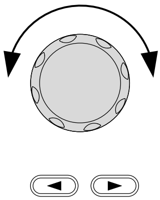
8. Press Gateway (F3) and set the gateway address using the number pad. Press Done (F1) to complete setting the gateway.

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.

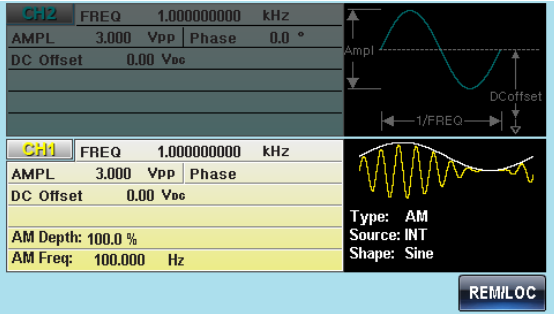
PC Software

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

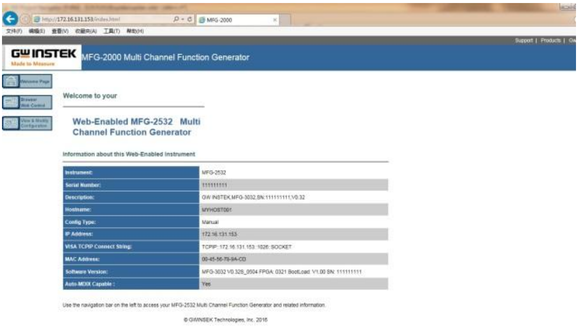
网络浏览器控制界面

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

Overview

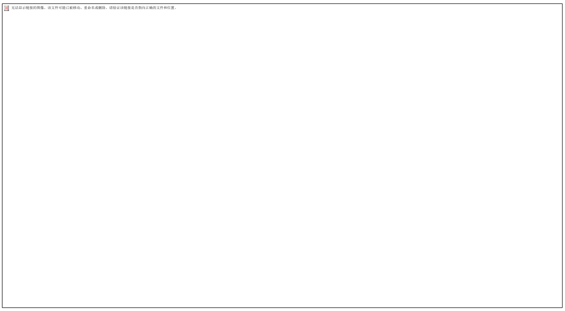
Welcome Page

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

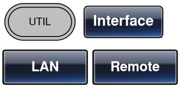
The View & Modify Configuration page displays all the LAN configuration settings and allows you to edit the configuration.

Operation

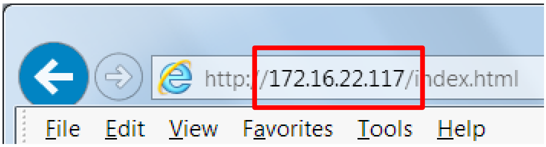
1. Configure the AFG-30XX interface to LAN and connect it to the LAN or directly to the PC (if the LAN interface is set to Auto IP).

   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.

指令语法

Compatible standard

IEEE488.2, 1992 (fully compatible)

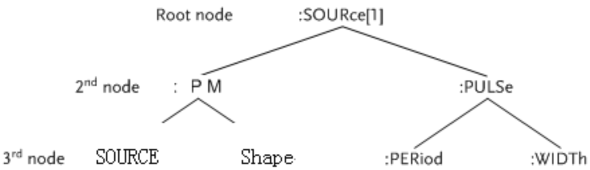
SCPI, 1994 (partially compatible)

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.

$$\overbrace{\underbrace{\text{SOUR}}_{\text{short}}\text{ce1}}^{\text{long}}:\overbrace{\underbrace{\text{DCO}}_{\text{short}}\text{ffset}}^{\text{long}}$$

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

SOURce1:DCOffset <*offset*>LF

1 2 3 4

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. $\lvert V_{offset} \rvert < V_{max} - V_{pp}/2$ 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.	

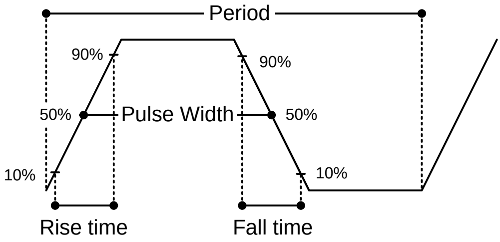
SOURCE[1|2|3|3RF|pulse]:VOLTage:UNIT

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 介绍

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

Enable AM Modulation	1. Turn on AM modulation using the SOURce[1|2|3RF]:AM:STAT ON command
Configure Carrier	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.
Select Modulation Source	3. Select an internal or external modulation source using the SOURce[1|2|3RF]: AM:SOUR command.
Select Shape	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.
Set Modulating Frequency	5. Set the modulating frequency using the SOURce[1|2|3RF]: AM:INT:FREQ command. For internal sources only.
Set Modulation Depth	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 介绍

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

Enable ASK Modulation	1. Turn on ASK modulation using the SOURce[3RF]: ASK:STAT ON command.
↓ Configure Carrier	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.
↓ Select ASK Source	3. Select an internal or external modulation source using the SOURce[3RF]:ASK:MOD:INT command.
↓ Select ASK Amplitude	4. Set the hop frequency using the SOURce[3RF]:ASK:FREQ command.
↓ Set ASK Rate	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 介绍

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

Enable FM Modulation	1. Turn on FM modulation using the SOURce[1|2|3|3RF]: FM:STAT ON command.
Configure Carrier	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.
Select Modulation Source	3. Select an internal or external modulation source using the SOURce[1|2|3|3RF]:FM:SOUR command.
Select shape	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.
Set Modulating Frequency	5. Set the modulating frequency using the SOURce[1|2|3|3RF]: FM:INT:FREQ command. For internal sources only.
Set Peak Frequency Deviation	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 介绍

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

Enable FSK Modulation ↓	1. Turn on FSK modulation using the SOURce[1|2|3|3RF]:FSK:STAT ON command.
Configure Carrier ↓	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.
Select FSK Source ↓	3. Select an internal or external modulation source using the SOURce[1|2|3|3RF]:FSK:SOUR command.
Select FSK HOP Frequency ↓	4. Set the hop frequency using the SOURce[1|2|3|3RF]:FSK:FREQ command.
Set FSK Rate	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 介绍

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

Enable PM Modulation	1. Turn on PM modulation using the SOURce[1|2|3|3RF]: PM:STATe ON command.
Configure Carrier	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.
Select Modulation Source	3. Select an internal or external modulation source using the SOURce[1|2|3|3RF]:PM:SOUR command.
Select Shape	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.
Select Modulating Frequency	5. Set the modulating frequency using the SOURce[1|2|3|3RF]:PM:INT:FREQ command. For internal sources only.
Set DEViation	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 介绍

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

Enable PSK Modulation	1. Turn on FSK modulation using the SOURce[3RF]: PSK:STAT ON command.
Configure Carrier	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.
Select PSK Source	3. Select an internal or external modulation source using the SOURce[3RF]:PSK:MOD:INT command.
Select PSK Phase	4. Set the hop frequency using the SOURce[3RF]:PSK:PHASE command.
Set PSK Rate	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 介绍

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

Enable SUM Modulation	1. Turn on SUM modulation using the SOURce[1|2]: SUM:STATe ON command.
Configure Carrier	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.
Select Modulation Source	3. Select an internal or external modulation source using the SOURce[1|2]:SUM:SOUR command.
Select Shape	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.
Select Modulating Frequency	5. Set the modulating frequency using the SOURce[1|2]:SUM:INT:FREQ command. For internal sources only.
Set AMPL	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 介绍

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

Enable PWM Modulation ↓	1. Turn on PWM modulation using the SOURce[1|2|3]: PWM:STATe ON command.
Configure Carrier ↓	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.
Select Modulation Source ↓	3. Select an internal or external modulation source using the SOURce[1|2|3]:PWM:SOUR command.
Select Shape ↓	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.
Select Modulating Frequency ↓	5. Set the modulating frequency using the SOURce[1|2|3]:PWM:INT:FREQ command. For internal sources only.
Set Duty Cycle/Pulse Width	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

扫描介绍

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

Enable Sweep Mode ↓	1. Turn on Sweep mode modulation using the SOURce[1|2|3|3RF]: SWE:STAT ON command.
Select waveform shape, amplitude and offset ↓	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.
Select Sweep Boundaries ↓	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

脉冲串模式介绍

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.

Enable Burst Mode	1. Turn on Burst mode using the SOURce[1|2|3]:BURS:STAT ON command.
Configuration	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.
Choose Triggered/Gated Mode	4. Use the SOURce[1|2|3]: BURS:MODE command to select from triggered or gated burst modes.
Set Burst Count	5. Use the SOURce[1|2|3]:BURS:NCYC command to set the burst count. This command is only for triggered burst mode only.
Set the burst period	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).
Set Burst Starting Phase	7. Use the SOURce[1|2|3]:BURS:PHAS command to set the burst starting phase.
Select the trigger	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

任意波形介绍

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

Output Arbitrary Waveform

1. Use the SOURce[1|2|3]:FUNCtion USER command to output the arbitrary waveform currently selected in memory.

Select Waveform Frequency, amplitude and offset

2. Use the APPLy command to select frequency, amplitude and DC offset. Alternatively, the FUNC, FREQ, AMPl, and DCOffs commands can be used.

Load Waveform Data

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.

Set Waveform Rate

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:

$$\underbrace{\#}_{1}\ \underbrace{7}_{2}\ \underbrace{2097152}_{3}$$

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.	

计频器(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	打开或关闭计频器功能	
Note		
Syntax	**COUNter:STATe {ON|OFF}**	
Example	**COUNter:STATe ON**	
	打开计频器	
Syntax	**COUNter:STATe?**	
Return Parameter	1	ON
	0	OFF
Example	**COUNter:STATe?**	
	1	
	当前计频器打开	

COUNter:GATe

Instrument Command

Description	设置计频器的计频门控时间
Syntax	**COUNter:GATe {0.01|0.1|1|10}**
Example	**COUNter:GATe 1**
	设置计频的计频门控时间为 1s
Syntax	**COUNter:GATe? {max|min}**
Example	**COUNter:GATe?**
	+1.000E+00
	当前计频器的门控时间为 1s

COUNter:VALue?

Instrument Command

Description	询问计频器的值
Syntax	COUNter:VALue?
Example	**COUNter:VALue?** +5.00E+02 当前计频器的计频值为 500hz

相位 (Phase)指令

相位指令可以远程控制相位设定及相位同步

SOURce[1|2|pulse]:PHASe

Instrument Command

Description	设置相位的大小	
Note		
Syntax	**SOURce[1|2|pulse]:PHASe {<phase>|<MIN>|<MAX>}**	
Parameter	phase	-180~180
	min	设置相位值为最小值
	max	设置相位值为最大值
Example	**SOURce1:PHASe 25** 设置通道 1 的相位为 25°	
Syntax	**SOURce1:PHASe？ {MAX|MIN}**	
Return Parameter	phase	返回当前的相位值
Example	**SOURce1:PHASe？** +2.500E+01 当前通道 1 的相位值大小为 25°	

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

Instrument Command

Description	同步信道 1 和信道 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.	

存储和调取指令

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

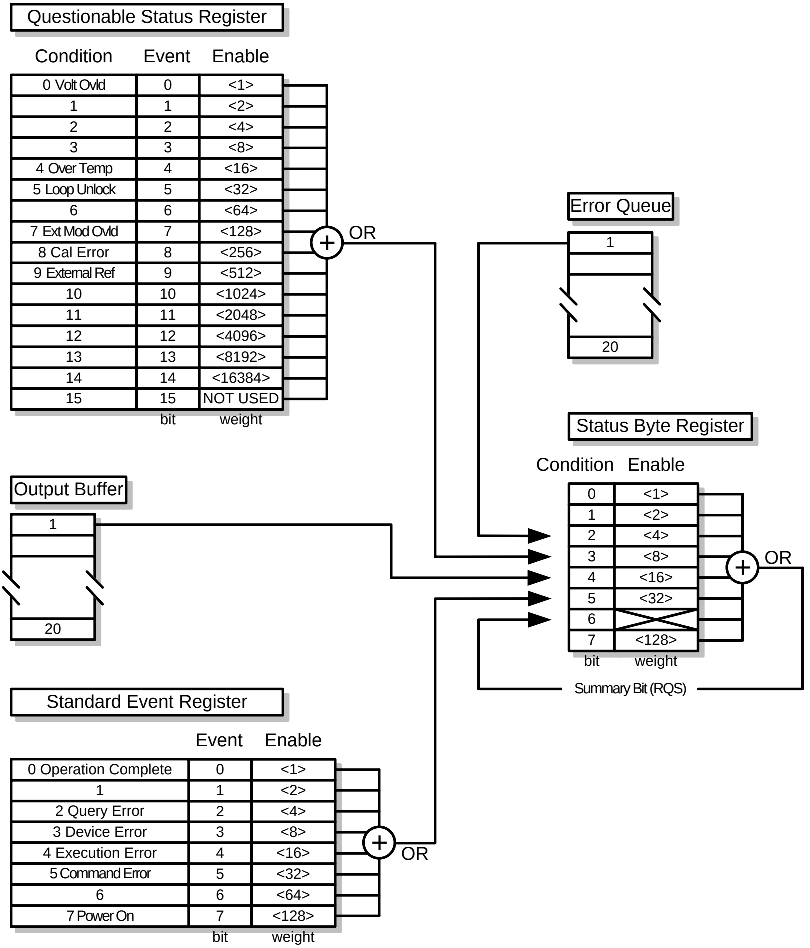
As well as the output and error queues.

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.

附录

MFG-2000 系列规格

此规格适用条件：+18 ℃~+28 ℃，开机 30 分钟以上。

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 386	
	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,ln,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	0.1mV or 4 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, Square, Triangle, Ramp,Pulse
	Modulating Waveforms	50% duty cycle square
	Internal Frequency	2mHz to 1 MHz
	Phase Range	0°~360.0°
	Source	Internal / External
ASK		
	Carrier Waveforms	Sine, Square, Triangle, Ramp,Pulse
	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.

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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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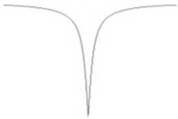
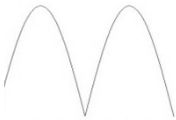
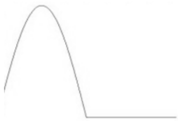
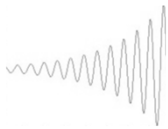
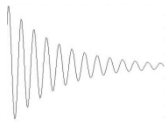
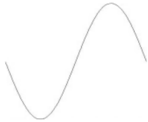
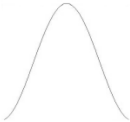
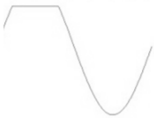
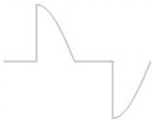
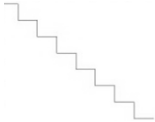
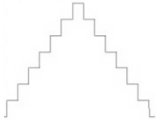
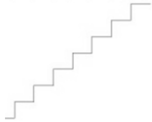
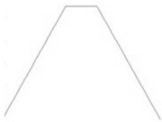
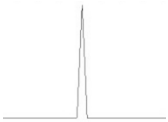
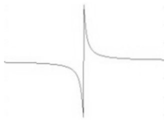
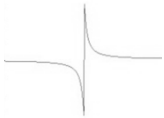
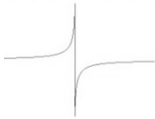
任意波内建波形

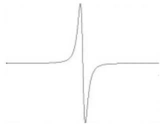
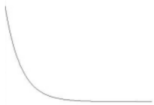
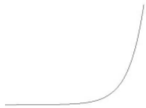
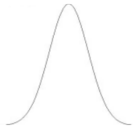
<table>
<tr><td colspan="3">Common</td></tr>
<tr><td>Absatan</td><td>y=|atan(x)|
The absolute of atan(x)</td><td></td></tr>
<tr><td>Abssin</td><td>y=|sin(x)|
The absolute of sin(x)</td><td></td></tr>
<tr><td>Abssinehalf</td><td>y=sin(x),0<x<pi
y=0,pi<x<2pi
Half_wave function</td><td></td></tr>
<tr><td>Ampalt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

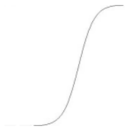
Havercosine	y=(1-sin(x))/2 Havercosine function	
Haversin	y=(1-cos(x))/2 Haversine function	
N_pulse	Negative pulse	
Negramp	y=-x Line segment	
Rectpuls	Sampled aperiodic rectangle	
Roundhalf	y=sqrt(1-x^2) The half roud	
Sawtoot	Sawtooth or triangle wave	
Sinetra	Piecewise function	
Sinever	Piecewise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

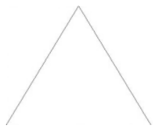
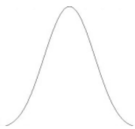
Stair_down	Step down	
Stair_ud	Step up and step down	
Stair_up	Step up	
Stepresp	Heaviside step function	
Trapezia	Piecewise function	
Tripuls	Sampled aperiodic triangle	

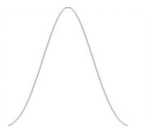
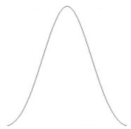
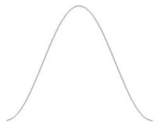
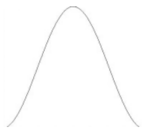
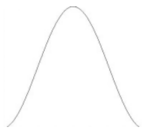
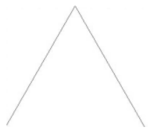
Math		
Arccos	Arc cosine	
Arccot	Arc cotangent	

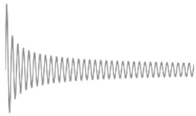
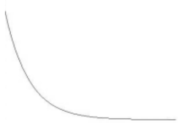
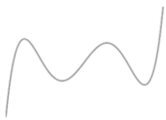
Arccsc	Arc cosecant	
Arcsec	Arc secant	
Arcsin	Arc sine	
Arcsinh	Hyperbolic arc sine	
Arctan	Arc tangent	
Arctanh	Hyperbolic arc tangent	
Cosh	Hyperbolic cosine	
Cot	Cotangent	
Csc	Cosecant	

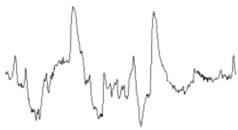
Dlorentz	The derivative of the lorentz function y=-2x/(k*x^2+1)	
Exp Fall	Exponential fall	
Exp Rise	Exponential rise	
Gauss	A waveform representing a gaussian bell curve	
Ln	Logarithm function	
Lorentz	Lorentz function y=1/(k*x^2+1)	
Sec	Secant	
Sech	Hyperbolic secant	
Sinec	y=sin(x)/x	

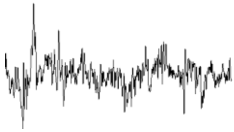
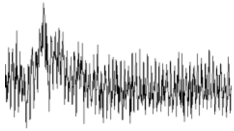
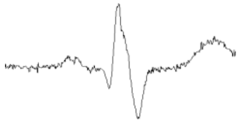
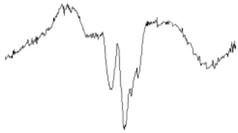
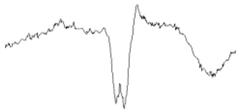
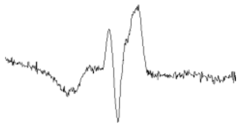
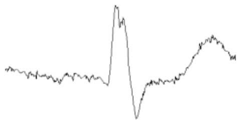
Sinh	Hyperbolic sine	
Sqrt	y=sqrt(x)	
Tan	Tangent	
Tanh	Hyperbolic tangent	
Xsquare	Parabola	

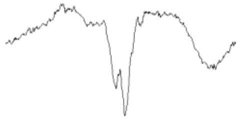
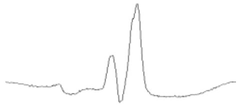
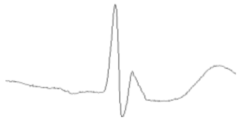
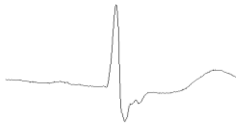
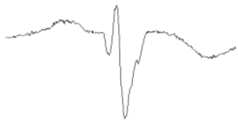
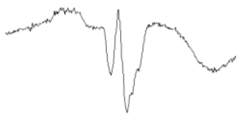
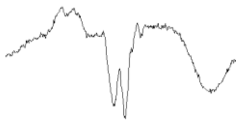
Window		
Barthannwin	Modified Bartlett-Hann window	
Bartlett	The Bartlett window is very similar to a triangular window as returned by the triang function.	
Blackman	The Blackman window function	

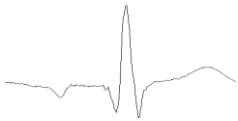
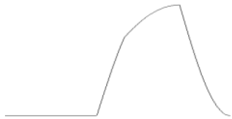
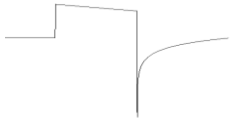
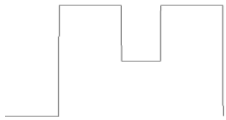
Bohmanwin	The Bohman window function	
Chebywin	The Chebyshev window function	
Flattopwin	The Flattopwin window function	
Hamming	The Hamming window function	
Hann	The Hann window function	
Hanning	The Hanning window function	
Kaiser	The Kaiser window function	
Triang	The Triang window function	
Tukeywin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

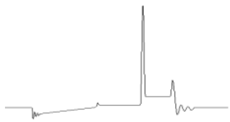
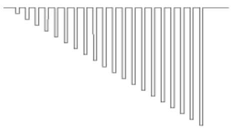
Engineer		
Airy	The airy function	
Bessel	The Bessel function	
Beta	The beta function	
Gamm	The gamma function	
Legendre	Associated Legendre function	
Neumann	The Neumann function	

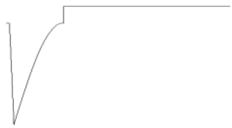
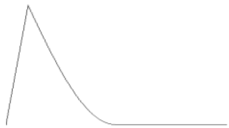
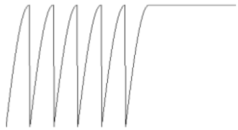
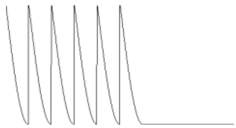
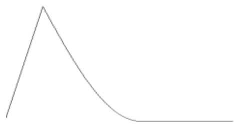
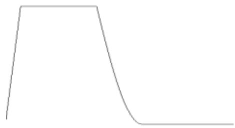
Medical		
Cardiac	Cardiac signal	
EOG	Electro-oculogram	

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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