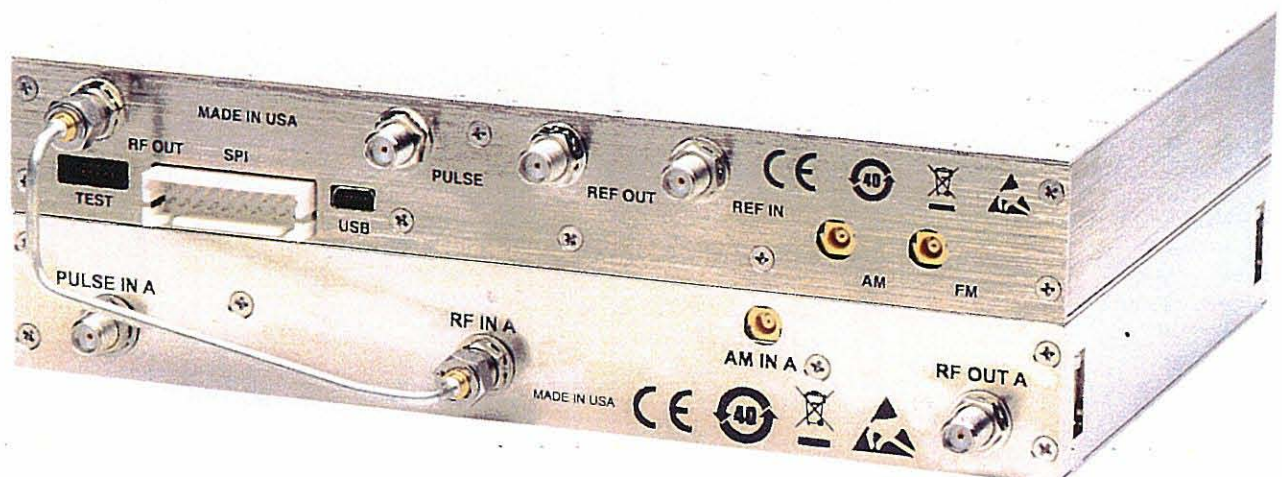# QuickSyn X Frequency Synthesizer

QuickSyn X

The QuickSyn X expands the QuickSyn product line by both extending the operating frequency range as well as extending functionality. These extensions are *extremely* significant, and that's why we call this new product X. With a total frequency coverage of 250 kHz to 20 GHz and added ability of automatic power leveling (ALC) and calibrated AM, the QuickSyn X is an excellent signal-source choice for test-system designs constrained by size and cost. There's no need to spend tens of thousands of dollars on your test system's signal generator.

FSX-0020 Specifications

Description	Specification
Frequency	**FSX-0020**
Range	250 kHz to 20 GHz
Resolution	0.001 Hz
Stability	Same as reference
Switching Time[1]	1 ms (in all modes) 100 µs max. (triggered list mode) (w/Option 3) 200 µs max. (individual SPI commands) (w/Option 3)
List Mode	32,000 points, separate control of frequency, power, RF output mute, and pulse modulation

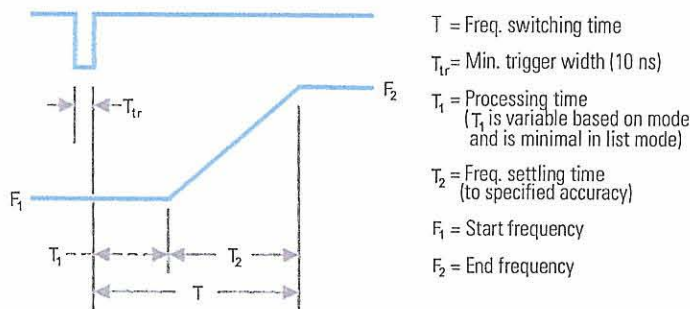[1]Measured at maximum specified power.

TRIGGER EVENT

T = Freq. switching time

T_{tr} = Min. trigger width (10 ns)

T_1 = Processing time
(T_1 is variable based on mode and is minimal in list mode)

T_2 = Freq. settling time (to specified accuracy)

F_1 = Start frequency

F_2 = End frequency

FIGURE 1: Frequency Switching Speed

Description	Specification
Output Power	**FSX-0020**
Power Range	-7 dBm to +13 dBm
Power Accuracy	±1.0 dB typ. (over entire range when in closed-loop ALC)
Power Resolution	0.1 dB typ.
Power Mute	-65 dBm max.
Load VSWR	1.8:1 typ.
Level Switching Time (closed-loop ALC)	5 ms typ.

Description | Specification

Spectral Purity[1] — FSX-0020

Harmonics	-20 dBc max. below 150 MHz -30 dBc max. below 2 GHz -45 dBc max. above 2 GHz
Sub Harmonics	-50 dBc max.
Non-harmonic Spurious at +10 dBm	-60 dBc max.

Phase Noise[1]

dBc/Hz	0.5 GHz (typ.)	0.5 GHz (max.)	1 GHz (typ.)	1 GHz (max.)	5 GHz (typ.)	5 GHz (max.)	10 GHz (typ.)	10 GHz (max.)	20 GHz (typ.)	20 GHz (max.)
100 Hz	-109	-103	-103	-97	-89	-83	-83	-77	-77	-71
1 kHz	-135	-132	-132	-126	-118	-112	-112	-106	-106	-100
10 kHz	-144	-139	-138	-133	-128	-123	-122	-117	-116	-111
100 kHz	-144	-139	-138	-133	-128	-123	-122	-117	-116	-111
1 MHz	-146	-141	-140	-135	-132	-127	-126	-121	-120	-115
Floor	-151	-147	-150	-147	-150	-147	-150	-147	-150	-147

[1]Measured at +10 dBm power out.

Description | Specification

Pulse Modulation[1] — FSX-0020

On-Off Ratio	80 dB min.
Repetition Frequency Range	DC to 10 MHz
Pulse Width Range	100 ns to 1 ms
Delay Time	< 35 ns typ.
Rise-Fall Time (10 to 90%)	20 ns max.
Pulse Under & Overshoot	2 dB max.
Input Level (CMOS)	+5 V (RF on), 0 V (RF off)
Input Impedance	100 kΩ (pulled up to +5 V)

Amplitude Modulation (AM)[2] — FSX-0020

Power Range	-2 dBm to +8 dBm
Modulation Rate	DC to 100 kHz
Modulation Depth	0% to 90% min.
Modulation Accuracy	±10% at 50% depth, 1 kHz rate
AM Input Level	2 V p-p nom.
Sensitivity[3]	Programmable from 0% to 100%, 2 V p-p gives full scale modulation
Absolute Maximum Input Level	±2 V
Input Impedance	50 Ω nom.

Frequency Modulation (FM) — FSX-0020

NB 1 Mode Rate Range	100 Hz to 10 kHz
NB 2 Mode Rate Range	10 kHz to 100 kHz
WB Mode Rate Range	50 kHz to 1 MHz
Phase Mode Rate Range	DC to 100 kHz
Sensitivity[4]	user defined
Absolute Maximum Input Level	±2 V (4 V p-p)
Input Impedance	50 Ω nom.

[1]Measured at +13 dBm power out.
[2]Available with Option 2.
[3]Measured from -2 dBm to +8 dBm. AM may degrade when outside this range.
[4]FM sensitivity is dependent on synthesizer output frequency and can be controlled by software.

Description	Specification
Internal Reference	**FSX-0020**
Output Frequency	10 MHz nom.
Output Power	+5 ±2 dBm
Reference Mute	-60 dBm max.
Frequency Temperature Stability	±0.2 ppm (over 0° C to 50° C)
Aging (after 30 days of operation)	±1.25 ppm for 10 years
Locking Range	±2.0 ppm
Output Impedance	50 Ω nom.
External Reference	**FSX-0020**
Input Frequency	10 MHz nom.
Input Power	+5 dBm ±5 dBm
Absolute Maximum Input Level	+15 dBm
Input Impedance	50 Ω nom.
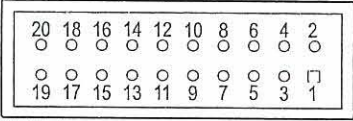
Description	Specification
Electrical	**FSX-0020**
Supply Voltage	+12 V to +12.6 V DC
Absolute Maximum Supply Voltage	+15 V DC
Power Consumption (at warm up[1])	38 W max.
Power Consumption (operating)	32 W nom.

[1]Warm-up time = 20 minutes

Description	Specification
Temperature[1]	**FSX-0020**
Operating	0° C to +50° C
Storage	-40° C to +70° C
Warm-up Time	20 minutes

[1]Adequate heat sinking and airflow must be provided in order to prevent permanent damage.

Description	Specification
Physical	**FSX-0020**
Size (W x L x H)	5 in. x 7 in. x 2.02 in.
Weight	4.6 lb. (2.09 kg)

Description		Specification
Connector	**Function**	**Type**
RF OUT A	RF output	SMA-F
PULSE IN A	Pulse modulation input	SMA-F
AM IN A	Amplitude modulating input	MCX-F
FM	Frequency modulating input	MCX-F
SPI[1]	Power and communications	20 pin, 0.1 in. spaced double-row header 20 18 16 14 12 10 8 6 4 2 19 17 15 13 11 9 7 5 3 1
USB	Soft front panel control	Mini-B receptacle (USB 2.0)
REF OUT	10 MHz reference out	SMA-F
REF IN	10 MHz reference in	SMA-F
AM, PULSE, and TEST	None (not used)	N/A

[1]National Instruments recommends Hirose manufactured socket DF1B-20DS-2.5RC and contacts DF1B-2022SC.
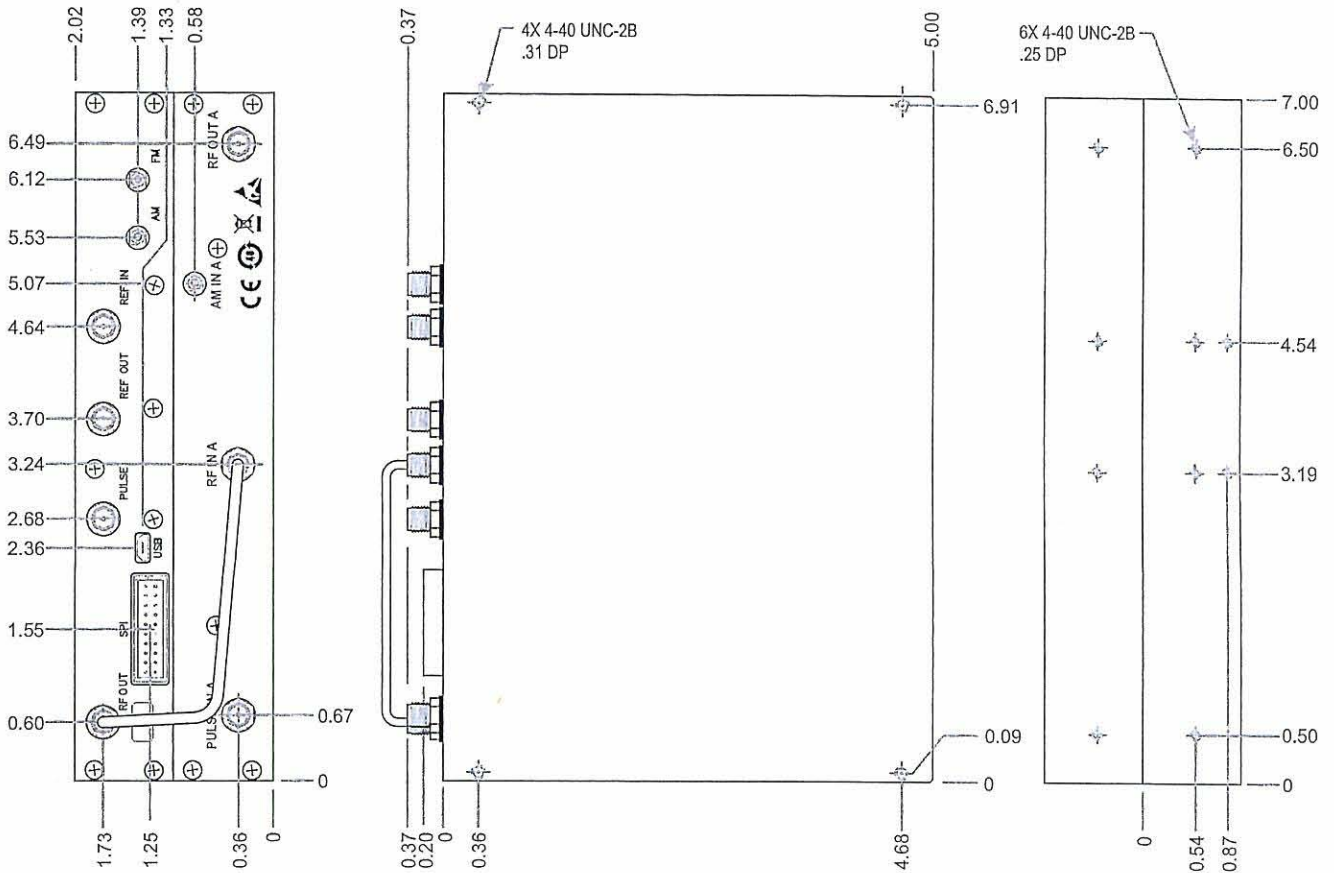
Description

Specification

SPI Interface Programming[1]

Signal	Pin	Description
SPI_CLK	11	SPI clock. Supplied by the controlling computer (not the synthesizer). The controlling computer is the SPI master; the synthesizer is the SPI slave.
SPI_SS	13	SPI Slave Select. This signal is an active low input to the synthesizer. It frames command communications. For each command, SPI_SS goes low before the first bit is sent and goes high after the last bit is sent.
SPI_MISO	7	Master In/Slave Out. Status and other returned information from the synthesizer to the controlling computer.
SPI_MOSI	9	Master Out/Slave In. Command data from the controlling computer to the synthesizer.
TRIGGER	17	Rising edge active input. When enabled, the trigger signal of +3.3 V can initiate freq. change or step through lists or sweeps.
LOCK	15	Output indicates the synthesizer is locked on its current setting (+3.3 V locked, 0 V unlocked).
REF_LOCK	16	Output indicates the synthesizer has detected an external reference signal and locked on that signal (+3.3 V locked, 0 V unlocked).
RESET	18	Internally pulled up to +3.3 V with 100 kΩ resistor. Active "low" signal, which has a minimum width of 1 ms, will reset the synthesizer to a default state.
PWER_+12V	3,4	External +12V DC supply.
GND	8,10,19,20	Ground.
N/C	1,2,5,6,12,14	Do not use. Reserved for factory use.

[1]A QuickSyn communications specification is available on the ni-microwavecomponents.com website.

Mechanical Dimensions

Unless otherwise specified, dimensions are in inches ±0.01.

Description   Specification

SPI Timing

Description	Specification
$T_{SC} > 25$ ns	Slave select low before first CLK
$T_{CS} > 25$ ns	CLK low before slave select high
$T_{SU} > 15$ ns	Data stable before rising edge of CLK
$T_{CH} > 25$ ns	Minimum CLK high time
T_{CL} 25 ns	Minimum CLK low time
$T_{CLK} \leq 12$ MHz	Maximum CLK frequency
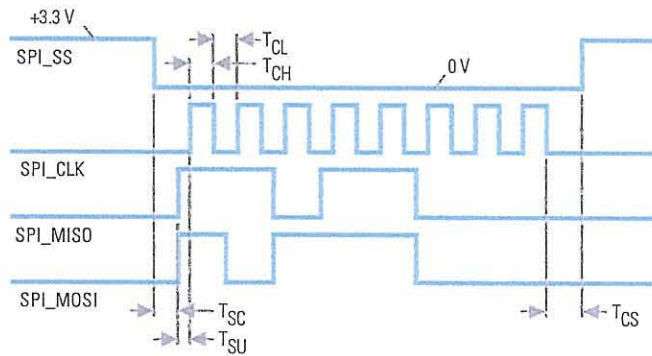
FIGURE 4: SPI Timing

Description   Specification

| Ordering Information	FSX-0020
Models	FSX-0020
Option 3	fast switching
Option 4	USB interface
Option 5	Pulse modulation
Option 6	Amplitude modulation
Option 7	Frequency and phase modulation
Option 8	Two-year warranty extension (three years total)
Accessory 1	Cable, BNC-M to MCX-M
Accessory 2	Cable, USB
Accessory 3	Cable, DC bias
Accessory 4	Test report
Accessory 5[1]	Kit, SPI mating connector with contacts
Accessory 6	Kit, Quickstart (includes Quickstart guide, AM-FM cable, USB cable, DC bias cable, accessory 5, and power supply)
Accessory 7	Kit, RS232 cable
Accessory 8	Kit, Ethernet adapter
Accessory 9	Kit, GPIB adapter
Accessory 11	Certificate of calibration

[1] National Instruments recommends Hirose manufactured socket SFSD-15-28-H-06.00-SL

Soft Front Panel

All QuickSyn synthesizers have a soft front panel (i.e., a graphical user interface) you can use to control the synthesizer's numerous functions such as frequency and power control, RF output and reference mute, blanking, independent frequency and power sweeps, list mode, modulation, and more. The soft front panel for each product is available from the ni-microwavecomponents.com website.
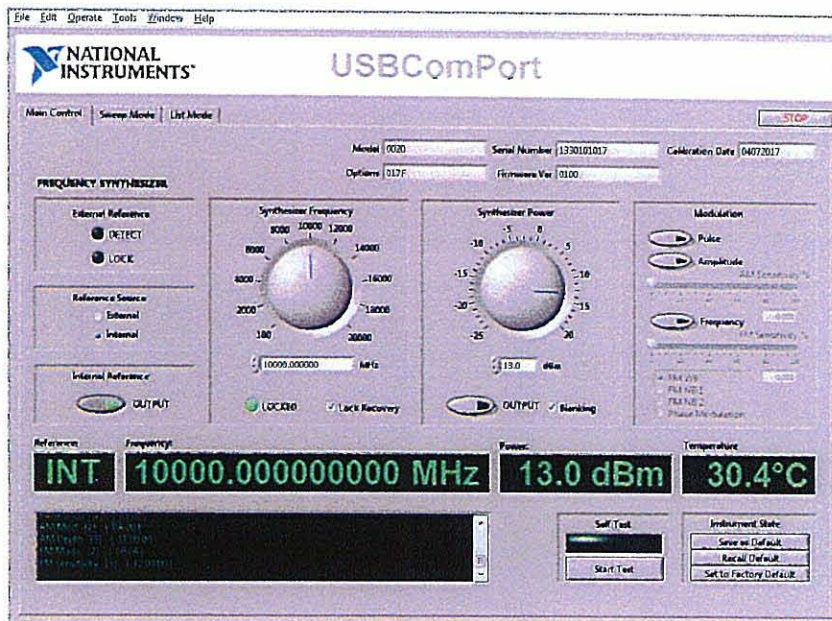
The FSW Series synthesizers soft front panel is shown here. Reference, frequency, power, and modulation controls are presented on the main-control panel along with corresponding indicators and internal temperature.
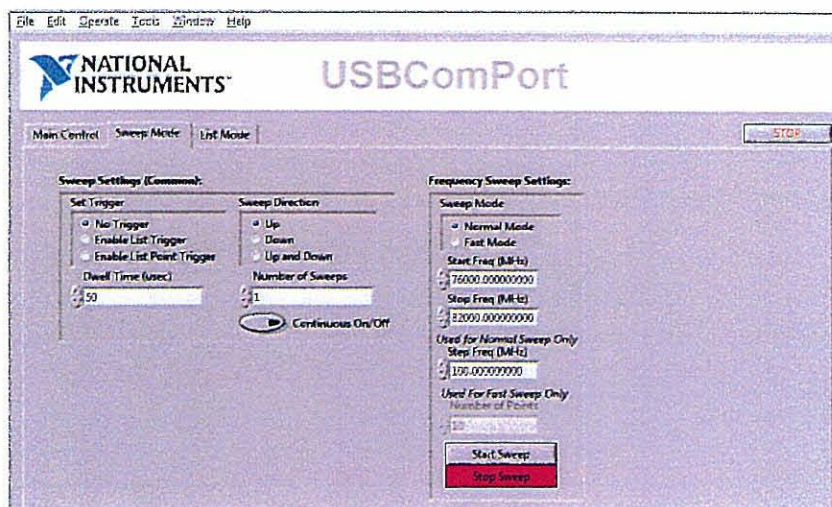
Sweep mode for the FSL Series synthesizers is accessible through the sweep-mode panel shown here. You can set triggering, sweep direction, frequency range, and step size.