# DSI MX SERIES Integrated-LO Mixer User Manual

DS Instruments' various integrated-local-oscillator microwave mixer models are all designed to be as intuitive as possible, ether being controlled by the front panel, or from the USB/Ethernet interface. All models share a similar topology consisting of a low-noise phase-lock-loop frequency source directly connected to the LO port of a general purpose double-balanced wideband microwave mixer. **Buttons and front panel modes are similar across all models.**

This manual applies to the following devices:

- **MX2500** (25-2500MHz RF)
- **MX6000** (1.5-6.0GHz RF)
- **MX6000PRO** (1.5-6.0GHz RF)
- **MX12000** (5-14GHz RF)
- **MX20000** (10-22GHz RF)
- **MX30000** (15-30GHz RF)
- **MX40000PRO** (2-40GHz RF)
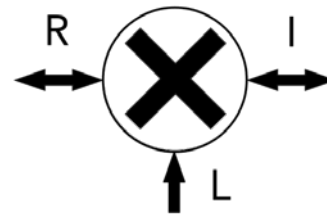
Stand-Alone Use Quick Setup:

- Connect an external 10MHz reference source to the reference **MCX** connector *if desired*. If no external source is detected, the unit will use its own internal crystal oscillator source. Searching for an external frequency only occurs at boot-up, do not connect an external reference **after** the unit is already powered up.
- Connect your device to a blue USB 3.0 port or 5 Volt power source using the included USB cable. A desktop, laptop computer, or smart-phone charger can work. The best source is a 12v powered USB 3.0 hub. Avoid using **unpowered** USB hubs or **long** USB cables. Many older USB ports will not be able to supply enough power.
- Note that the screen will display the model number and firmware version. The unit will beep indicating boot-up and the green power LED should light up if no errors were detected during self-tests. (A flashing red status LED indicates an error is pending.)
- RF and IF cables can be attached before or after USB power is applied.

- The unit is now ready to accept front panel changes or a data connection from the control software.
- To cycle between front control modes, **hold** the MODE button down until there is a beep (~0.5 seconds). The default mode is integer frequency, followed by fractional frequency, LO output on-off, and save system state.
- The **LO** front panel led indicates that the device is successfully locked to the reference and providing the desired LO frequency to the internal mixer.
- Some devices are equipped with an "oven" LED indicator. This is to signal to the user that the oven-controlled reference source is still cold and needs a few minutes to warm up. RF output will not be reliable while this led is active.

Control Software (GUI) Screenshot:
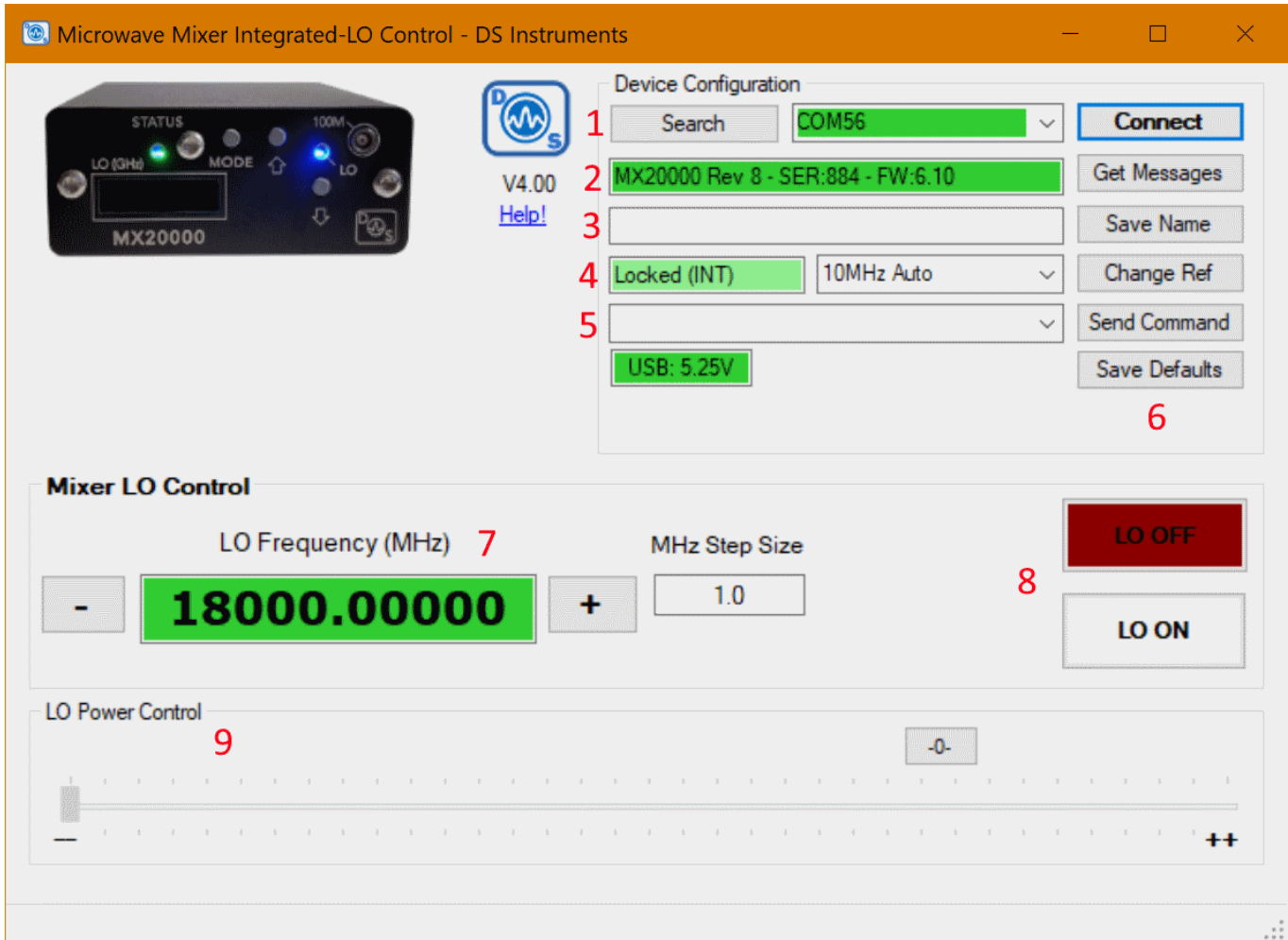
Control Software Feature Descriptions

1. COM / Ethernet search and connect – Lists any USB COM ports or device IP addresses found
2. Connected device information box, request status messages button
3. Custom Name – Lets the user save a TAG ID, Name, or inventory number to non-volatile memory
4. Reference frequency source – Sets internal, external or auto detect for the 10MHz reference input
5. Custom Command – Type or select a custom SCPI serial command to send to the connected device
6. Save all current settings and configuration as the boot-up defaults

7. LO frequency control – set or step the current LO frequency in MHz
8. LO State – Set the mixer LO status to ON or OFF
9. LO Power Tune – Adjust the relative LO output power up (right) or down (left)

USB/Ethernet Computer Control Quick Setup:

- Connect an external 10MHz reference source to the rear MCX connector if desired. If no external source is detected, the unit will use its own internal source. Reference auto-detection can be overridden in the GUI if desired.
- Connect your device to a blue USB 3.0 port using the included USB cable. The best source is a 12v powered USB 3.0 hub. Avoid using **unpowered** USB hubs or **long** USB cables. Many older USB 2.0 ports will not be able to supply enough power. For Ethernet control a smart-phone charger can be used as the USB power source.
- Windows should now install the standard virtual COM port driver. Wait for this to complete.
- Download and open the DS Instruments Signal Generator Control GUI from the website. Install any .NET framework updates from Microsoft if needed.
- Clicking the **search** button will find all COM ports and IP addresses that are accessible. Select a COM port or IP from the top select list and press CONNECT to try to control the device. If the select box turns green, then a connection has been established.
- The model number and firmware versions will appear in the green info box. If this box is turns red, the wrong COM port was selected or an error has occurred.
- At this point a user can enter an LO frequency and change other device settings
- The blue LO led on the front of the MX unit indicates that it is successfully locked and outputting the desired frequency to the mixer
- The physical front control buttons will be **disabled** when a USB or network connection is established to prevent any accidental bumping of the buttons when under computer/automated control.
- Some devices are equipped with an oven-controlled reference source that will need a few minutes to warm up. The control software will display a "Cold" warning, and RF output will not be reliable while this warning is active.

Control Software Notes

- If reference auto-detection is misbehaving with your input signal, it can be forced to external or internal using the select box and "Change Ref" button. Make sure to re-apply your desired frequency after changing the reference source.
- "Send Command" allows a user to send a raw SCPI command to the Signal Generator, in USB mode the GUI will also display any response from the device in the message bar at the bottom.
- Some devices have adjustable LO power letting the user customize the balance between conversion loss and LO leakage
- If the USB voltage box goes into the red, performance will be unpredictable or an error will be indicated by the device. Try finding a better USB power source or cable.

Hardware

- The MCX **10MHz reference** input will accept sine or square wave input between -10 and +10dBm.
- Some models **also** feature a 100MHz reference MCX port
- Network enabled devices ship with DHCP enabled as default. There is a separate PDF app note on how to change these network settings if needed.

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Notes

- 10MHz frequency reference MCX-BNC adapter example:

- A complete SCPI command list is located on the website (https://www.dsinstruments.com/downloads/)
- Tech support email can be reached at **support@dsinstruments.com**