

Optical Chopper System (Page 1 of 2)

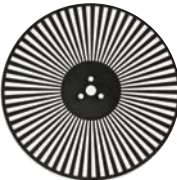
Features

- Crystal-Stabilized Phase-Locked Loop for Low Frequency Drift and Phase Jitter
- Harmonic, Sub-Harmonic, and Fractional Harmonic Chopping with Sum and Difference Reference Outputs
- Microprocessor Controlled
- 2-Frequency Blades Available for Pump-Probe and Other Nonlinear Experiments
- Save and Recall User Setups in Non-Volatile RAM
- USB Interface

Firmware in English
and Chinese



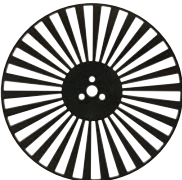
MC1F2



MC1F60



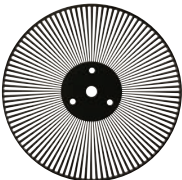
MC1F15



MC1F30



MC2F57



MC1F100

An optical chopper is an electromechanical instrument that periodically interrupts a beam of light. The MC2000 uses a phase-locked loop (PLL) motor speed control design to precisely maintain the chopping speed and phase of a reference signal. An internal, crystal-stabilized, frequency synthesizer provides an accurate and stable reference frequency for long-term stable performance.

Unlike conventional, open-loop speed control designs, the PLL speed control circuit also allows the MC2000 chopper to be synchronized to external reference signals, including other MC2000 choppers and reference sources such as DSP lock-in amplifiers.

For more advanced measurements, the MC2000 can lock to a harmonic, sub-harmonic, or fractional-harmonic of an external reference frequency. The on-board microprocessor multiplies the external reference up to the 15th harmonic or divide the reference down to the 15th sub-harmonic. By combining both the frequency multiplication and division together, a fractional harmonic can be obtained.

A high-quality, rare earth magnet, DC motor and a photo-etched optical chopper wheel are the top two design elements responsible for this device's high precision. The compact optical head has a wide base for extra stability. The base is slotted for two 1/4"-20 mounting screws on 2" centers. The interface cable uses circular snap-on Hirose connectors for easy setup.

The MC2000 controller includes a 240 x 128 pixel graphics display for setting and monitoring chopper functionality. All of the functions are accessible through a front panel control knob with turn and push control. Multiple user setups can be easily saved and recalled from nonvolatile memory. A USB interface is included as a standard feature for remote PC control of the MC2000.

Available Chopper Wheels (MC1F10 Included with MC2000)

ITEM #	# OF SLOTS	CHOPPING FREQUENCY	PHASE JITTER (MAX/TYPICAL)**
MC1F2*	2	1 Hz – 99 Hz	0.05° rms Max
MC1F10	10	20 Hz – 1 kHz	0.42°/0.13° rms
MC1F15	15	30 Hz – 1.5 kHz	0.68°/0.27° rms
MC1F30	30	60 Hz – 3 kHz	1.10°/0.45° rms
MC1F60	60	120 Hz – 6 kHz	1.10°/0.78° rms
MC1F100	100	250 Hz – 10 kHz	1.30°/1.10° rms
MC2F57	7/5	Outer: 14 – 700 Hz Inner: 10 – 500 Hz	0.38°/0.08° rms

* The MC1F2 blade does not support phase lock and adjustment.

** Measured using internal reference signals.

PERFORMANCE SPECIFICATIONS	MAX/TYPICAL
Chopping Frequency, with Various Blades	1 Hz – 10 kHz
Frequency Drift	<20 ppm/°C
External Input Compatibility	TTL/CMOS
Frequency Resolution	1 Hz (10, 15, 30, 60, 100, and 2f Blades) 0.01Hz (2-Slot Blade)
Chopping Range	–
Harmonic	2 to 15x
Sub-Harmonic	1/2 to 1/15x

Thorlabs offers a number of different blades to extend the range of the chopping frequency. A standard ten-slot blade is included with the MC2000. 2-slot, 15-slot, 30-slot, 60-slot, 100-slot and two-frequency blades are also available (see table).

The MC2000 also supports two-frequency chopping from a single chopper blade. A special blade is available with seven outer slots and five inner slots. This slot combination allows a single beam to be split and individually modulated for ratiometric experiments. Another example application is a pump-probe experiment where the pump beam is modulated at the outer frequency, while modulating a probe beam at the inner frequency. The MC2000 provides the sum and difference frequencies of the two-frequency blade for accurate lock-in detection of the frequency-mixed response.

Optical Chopper System (Page 2 of 2)

MC2000 PERFORMANCE SPECIFICATIONS

External Input Compatibility	TTL/CMOS
External Input Voltage Range ^a	0 - 5 V
Input High	>2 V
Input Low	<0.8 V
External Input Impedance	200 Ω
Ref Out Compatibility	TTL/CMOS
Ref Out Voltage Range ^a	0 - 5 V Typical
Ref Out Impedance	200 Ω
Min Load Impedance ^b	500 Ω
Ref Out Signals	Inner/Outer Slot Chopping Blade, Synthesizer, Sum & Diff Frequencies
Ref Out Selection	Selectable Menu or USB command 'O'
Communications	
Communications Port	USB
Protocol	USB (RS232 Emulated)
Baud Rate	115,200 (fixed)
Data Bits	8
Stop Bits	1
Parity	None
Handshaking	None

^a The reference output and external input is short circuit protected by limiting the current to 25 mA. Over and Under voltage protection is available, but continued use will degrade or damage the unit.

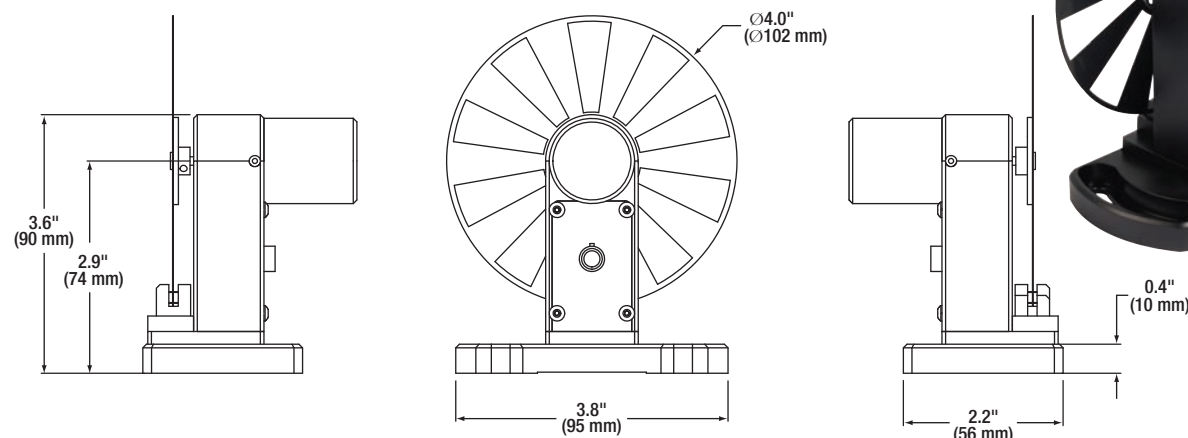
^b The Min Load Impedance represents the smallest allowable terminating resistance. Applying lower impedances will cause the short circuit protection to limit the output voltage. Continued use in this mode will cause circuit degradation and eventual circuit failure.

^c The MC1F10 blade is supplied with the unit. All other blades specified may be purchased separately through Thorlabs.

^d The MC2000 is supplied with a US power cord. Units purchased in other countries must supply their own power cord.

OPTICAL HEAD SPECIFICATIONS

Chopping Blade Diameter	Ø4.0" (Ø101.6 mm)
Chopping Blade Thickness	0.010" (0.254 mm)
Mounting Base	1/4"-20 (or M8) Clearance Slots Spaced 3.0" (Compatible with Thorlabs Breadboards)
Mounting Hole	1/4"-20 with 1/4" Max Screw Depth
Chopping Blade Specifications^c	
MC1F2	2
MC1F10 (Default Blade)	10
MC1F15	15
MC1F30	30
MC1F60	60
MC1F100	100
MC2F57	7 Outer, 5 Inner
Physical Features	
Dimensions (W x H x D)	5.8" x 2.8" x 12.5" (147 mm x 71 mm x 317.5 mm)
Input and Output Connectors	BNC
Input Power Connection ^d	IEC Connector with US Power Cord
Weight	5 lbs (9.1 lbs Shipped Weight)
Operating Temperature	10 - 40 °C
Display Type	240 x 124 Pixel LCD Graphics Display
Frequency Resolution	1 Hz (10, 15, 30, 60, 100, and 2f Blades) 0.01Hz (2-Slot Blade)



Please refer to our website for complete models and drawings.

ITEM #	\$	£	€	RMB	DESCRIPTION
MC2000	\$ 1,100.00	£ 792.00	€ 957.00	¥ 8,767.00	Optical Chopper System with MC1F10 10-Slot (36°) Chopper Blade
MC1F2	\$ 54.00	£ 38.88	€ 46.98	¥ 430.38	2-Slot Blade for Optical Chopper, 1 to 99 Hz
MC1F10	\$ 38.30	£ 27.58	€ 33.32	¥ 305.25	10-Slot Blade for Optical Chopper, 20 Hz to 1 kHz
MC1F15	\$ 38.30	£ 27.58	€ 33.32	¥ 305.25	15-Slot Blade for Optical Chopper, 30 Hz to 15 kHz
MC1F30	\$ 38.30	£ 27.58	€ 33.32	¥ 305.25	30-Slot Blade for Optical Chopper, 60Hz to 3 kHz
MC1F60	\$ 38.30	£ 27.58	€ 33.32	¥ 305.25	60-Slot Blade for Optical Chopper, 120 Hz to 6 kHz
MC1F100	\$ 42.00	£ 30.24	€ 36.54	¥ 334.74	100-Slot Blade for Optical Chopper, 200 Hz to 10 kHz
MC2F57	\$ 55.00	£ 39.60	€ 47.85	¥ 438.35	2 Frequency, 7 Outer/5 Inner Slot Blade, 14-700 Hz/ 10-500 Hz