

Optical Choppers

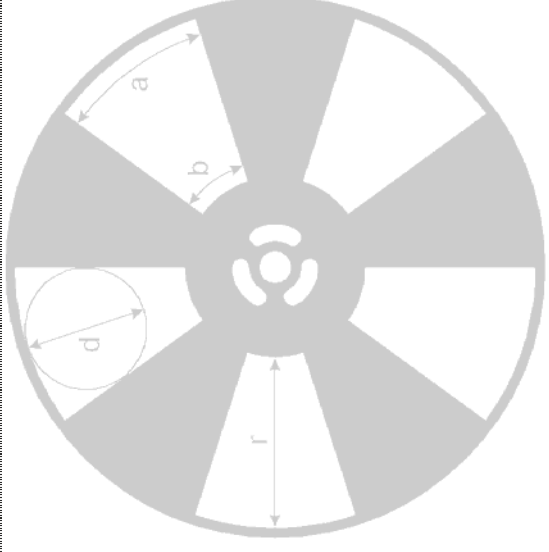
Models 300C/CD, 310CD, 320C/CD, 340CD, 350C/CD, 360C

FEATURES

- ✓ Photochemically etched brass blades available in many combinations
- ✓ 5-digit LED display for direct chopping frequency read-out on CD Models
- ✓ Many accessories available

GENERAL DESCRIPTION

Scitec Instruments Optical Choppers are high-stability variable-frequency optical choppers, comprised of a chopper control unit and chopping head, which is supplied complete with chemically blackened photoetched discs. A wide selection of blades offering different numbers of slots, slot configurations, and surface finishes are available to suit particular requirements. The chopping frequency is set using a ten turn dial mounted on the front panel of the control unit or by applying a voltage to the external control input. The reference output is a TTL pulse at the chopping frequency and has a constant phase relative to the chopping action.



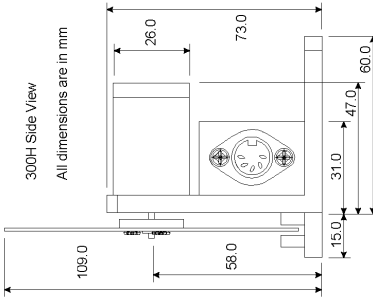
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SPECIFICATIONS

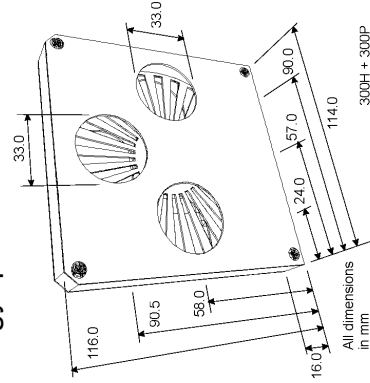
	Model 300CD	Model 310CD	Model 320CD	Model 340CD	Model 350CD	Model 360 OEM	
Frequency Range	5Hz - 20 kHz (0.015Hz to 40kHz options are available)	100Hz - 120kHz	8Hz - 6kHz (0.015Hz option is available)	5 Hz - 220 Hz	10Hz - 20kHz	10Hz - 14 kHz	
Frequency read-out	5 digit LED display with 0.01 Hz resolution, 0.1 Hz or 1 Hz resolution depending on frequency.	5 digit LED display with 1Hz resolution	5 digit LED display with 0.01 Hz resolution, 0.1 Hz or 1 Hz resolution depending on frequency. Switch select between inner and outer ref frequencies.	5 digit LED display with 0.01 Hz resolution, 0.1 Hz or 1 Hz resolution depending on frequency.		none	
Output Voltage	15V DC maximum			4V DC maximum			
Frequency control	Internal-Manual control via ten turn potentiometer fitted with a turns counting dial. External-BNC connector for 0 to 15V						
Frequency stability	Short term- see phase jitter. Long term- better than $\pm 0.1\%$ of maximum frequency						
Reference output	5V HCT TTL signal via BNC socket	5V HCT TTL signal via BNC socket	5V HCT TTL signal via BNC socket. Outer ref is available on the front panel and the inner ref is on the back panel.	5V HCT TTL signal via BNC socket	5 V HCT TTL signal via jack socket.		
Power requirements	100-130V or 200-260V AC, 50 or 60Hz, 12VA						
Dimensions	254(W) x 76(H) x 178(D)mm (control unit)						
Weight	2.6kg (control unit)						
Motor	11 pole DC motor, sleeve bearings with more than 6000 hours lifetime, 0-6000 rpm reversible	50W 2 pole electrically commutated motor with hall sensors and ball bearings with more than 6000 hours lifetime, 0-50000 rpm reversible.	11 pole DC motor, sleeve bearings with more than 6000 hours lifetime, 0-6000 rpm reversible.	5 pole DC motor, sleeve bearings with more than 10000 rpm lifetime, 0-15000 rpm reversible.			
Reference pick-up	IR LED and phototransistor pair with Schmitt trigger		Dual IR led and phototransistor pair.	IR led and phototransistor pair with Schmitt trigger.			
Dimensions	73.0(H) x 75.0(L) x 32.0(W)mm, without blade	73.0(H) x 75.0(L) x 32.0(W)mm, without blade or blade protector	73.0(H) x 75.0(L) x 32.0(W)mm, without blade	122(H) x 75(L) x 40(W)mm, without blade.	50.0(H) x 32.0(L) x 37.0(D)mm, without blade	50.0(H) x 32.0(L) x 37.0(W)mm with blade	
Mounting	Optical stalk: adjustable between 6.5 and 14.0mm in diameter. Mounting holes 2 x 3mm						
Blade Protector	Available	Comes complete with 300P blade protector	Available	Included			
Blade Types	Model 300D Disks 2, 5, 10, 30 and 200 slots standard, other blades available.	Model 310D Disks 2, 5, 10, 30, or 445 slots standard, specify with order.	Model 320D Disks 4/7, 3/30, 8/60 and 53/60 slots	Model 340D Disks 2 or 4 slot as standard, specify with order			Model 350D Disks 2, 4, 10 and 40 slots (20 and 80 slot discs also available)
Material	Half hard brass, 0.5mm thick (apart from the 300D445 which is 0.25mm stainless steel)						
Diameter	102mm						
Surface Finish	Chemically blacked (gold available)						
Mark-Space Ratio	1 to 1 with one blade						

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Scitec Model 310CD is a high speed optical chopper based on our standard 102 mm diameter discs. By spinning the discs many times faster than our standard system, chopping speeds up to 120 kHz can be achieved. The high speed is reached using a 50W electrically commutated motor and drive unit. Wind resistance is the limiting factor on the speed discs can be spun at - see table below. To minimize losses, the chopping disc is enclosed in a carefully designed blade protector which guides the air flow around the disc. As safety is an obvious concern with a system that has parts moving at 130 m/s (290mph), the blade protector also protects against finger entry into the chopping disc. Fast chopping speeds come at a cost however. The 50 W of energy put into the motor has to be released somewhere. The action of the disc moving through the air causes the air to heat significantly. This, coupled with the high speed of the disc, causes jets of warm air to be released through any open apertures in the blade protector. Vibration is



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Model 310CD Frequency Stability

	Model 310 Frequency (Hz)		Aperture (mm)				Model 310 Phase Jitter, Max
	r	a	b	d	d		
300D2 (2 slots)	100 - 800	32	77	26.7	32		±2°
300D5 (5 slots)	250 - 1850	32	30.8	10.7	23.1		±2°
300D10 (10 slots)	500 - 3400	32	15.4	5.4	13.2		±2°
300D30 (30 slots)	1500 - 9000	32	5.1	1.8	4.8		±4°
300D445 (445 slots)	22000 - 120000	10	0.34	0.27	0.34		±30°

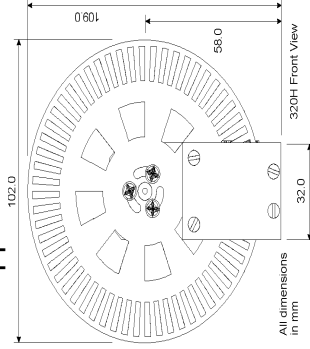
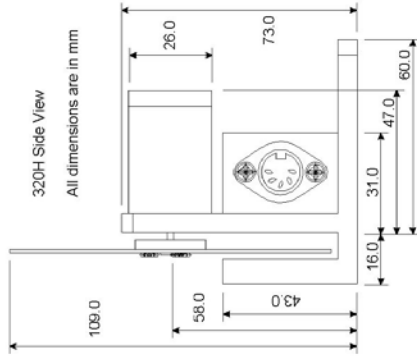
also an issue and it is therefore necessary to ensure that the chopping head is securely bolted to a secure surface at all times. Finally, the motion of the 2 slot disc, in particular, through the air causes a siren effect. This, at maximum speed, is deafening to the extent that ear defenders are considered necessary. Operation with the 445 slot disc is considered loud but only to the point where you would leave the room to make a phone call.

Chopping

Disc	Revolutions/Minute	Frequency Range
300D2 (2 slots)	3000 - 24000 rpm	100 - 800 Hz
300D5 (5 slots)	3000 - 22000 rpm	250 - 1850 Hz
300D10 (10 slots)	3000 - 20000 rpm	500 - 3400 Hz
300D30 (30 slots)	3000 - 18000 rpm	1500 - 9000 Hz
300D445 (445 slots)	3000 - 16000 rpm	22 - 120 kHz

(Note: the 200-slot disc 300D200 is not suitable for use with the Model 310 system as it is not strong enough for the speeds involved)

Scitec Model 320C/CD consists of a control unit, a dual frequency chopping head and a set of four chemically blacked photo-etched dual frequency discs. This system provides operation over the frequency range 8Hz to 6 kHz. A wide selection of additional discs and accessories is available to extend the frequency range and to satisfy individual requirements. Scitec Instruments does not recommend use of discs with greater than 60 slots with the 320 range of optical choppers as the opto-switch will not support these items.



Two versions of the control unit are available. The basic control unit is the 320CU, which has a 10 turn dial for setting the operating frequency. Alternatively, the 320CDU control unit has an additional 5-digit display of the chopping frequency. Other features are common to

both control units. Chopping frequency can be controlled externally by applying an analogue voltage to a "Control" BNC. Two "Reference" BNCs provide TTL level outputs for both the inner and outer set of slots, generated directly from the opto-switches on the chopping head. These signals have constant phase relative to the chopping action and can be used as the reference for other instruments such as lock-in amplifiers.

The 320H chopping head supplied with the standard system may be bench bolted or optical stalk (bench rod) mounted.

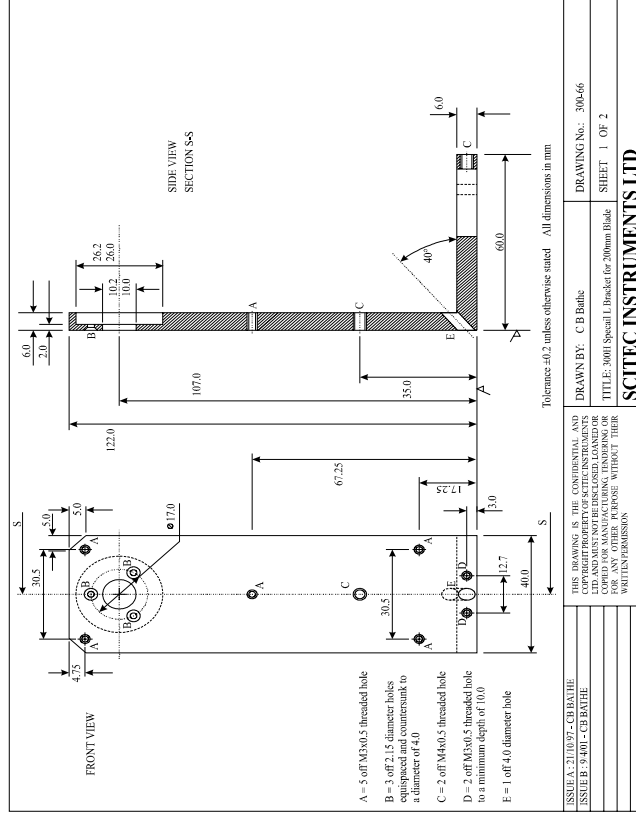
Model 320C/CD Frequency Stability

	Frequency (Hz)	Aperture (mm)				Phase Jitter, Max	
		r	a	b	d		
300D4/7	Outside 7 slots	17.5 - 700	12.5	22	16.4	12.5	±0.7°
	Inside 4 slots	10 - 400	12.5	23.2	13.4	12.5	±0.6°
300D3/30	Outside 30 slots	75 - 3000	12.5	5.1	3.8	4.9	±3°
	Inside 3 slots	7.5 - 300	12.5	30.9	17.8	12.5	±0.5°
300D8/60	Outside 60 slots	150 - 6000	12.5	2.6	1.9	2.5	±6°
	Inside 8 slots	20 - 800	12.5	11.6	6.7	9.6	±1.2°
300D53/60	Outside 60 slots	150 - 6000	15	2.6	1.8	2.5	±6°
	Inside 53 slots	130 - 5300	15	1.9	1	1.8	±8°

Scitec Model 340CD is an optical chopper based on 200 mm diameter disks. The larger disk size allows larger diameter beams to be chopped. Unfortunately, it does not allow smaller diameter beams to be chopped at a faster rate. The chopper system comes with a choice of two 200mm disks.

Model 340CD Frequency Stability

	Frequency Aperture (mm)				Phase Jitter, Max
	r	a	b	d	
340D2 (2 slots)	5 - 110	78	154	31.4	78 ±0.3°
340D4 (4 slots)	10 - 220	78	77	15.7	54.2 ±0.6°



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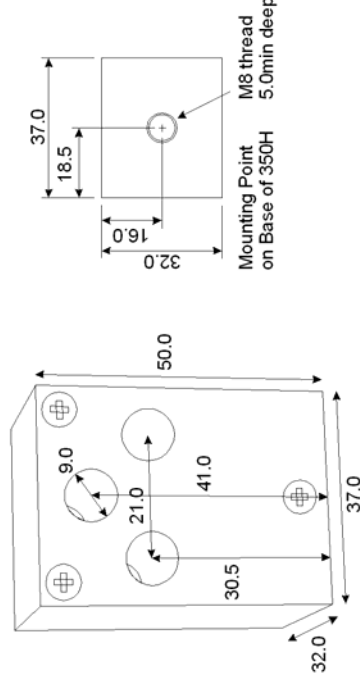
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Scitec Model 350C/CD consists of a control unit and a chopping head. It is supplied with four chemically blacked 30 mm diameter discs. These discs are of 2, 4, 10 and 40 slots and allow operation over the frequency range 10 Hz to 10 kHz. Discs with 20 and 80 slots are also available. The small chopping head allows positioning in areas where space is critical.

Two versions of the control unit are available. The basic control unit is the 350CU, which has a 10 turn dial for setting the operating frequency. Alternatively, the 350CDU control unit has an additional 5-digit display of the chopping frequency.



The 350H chopping head completely encloses the chopping disc, drive motor and reference pick-up. Three optical apertures of 9 mm diameter provide flexibility in beam positioning. The chopper head has an M8 threaded hole in its base for mounting on an optical stalk (bench rod). Mountings are provided to enable parts, such as a high frequency accessory or blade protector, to be attached. For lower frequency operation, the chopper head can be fitted with a reduction gearbox motor.



Model 350C/CD Frequency Stability

	Frequency (Hz)	Aperture (mm)			Phase Jitter, Max	
		r	a	b		d
350D2 (2 slots)	10 - 500	9	23.6	9.4	9	TBA
350D4 (4 slots)	20 - 1000	9	11.8	4.7	8.3	TBA
350D10 (10 slots)	50 - 2500	8	4.4	1.9	3.7	TBA
350D20 (20 slots)	100 - 5000	8	2.2	0.94	2	TBA
350D40 (40 slots)	200 - 10000	8	1.1	0.47	1	TBA
350D80 (80 slots)	400 - 20000	5	0.55	0.35	0.5	TBA

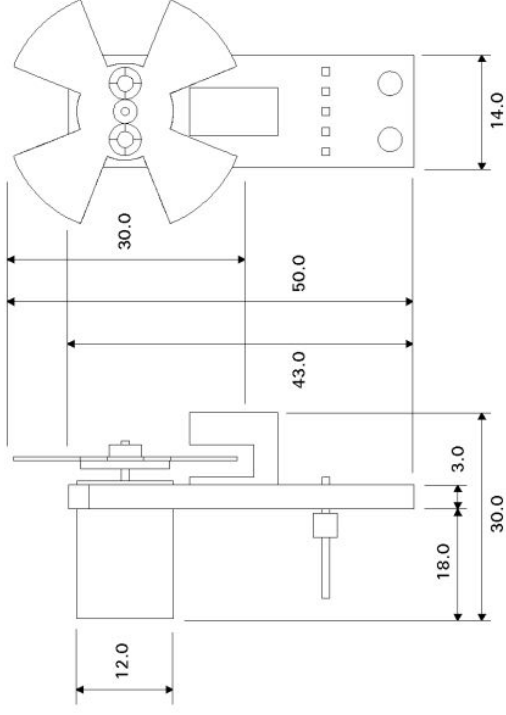
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Scitec Model 360C consists of a chopper head, drive board, photochemically etched discs and an interconnecting cable. This optical chopper uses 30mm diameter discs. The drive board and chopping head have been designed to be as compact as



possible. The small size of the chopping head allows positioning in areas where space is critical. As the system is designed for OEM use, each component is available separately at a lower cost.

Model 360C Frequency Stability

	Frequency (Hz)	Aperture (mm)			Phase Jitter, Max	
		r	a	b		d
350D2 (2 slots)	10 - 350	9	23.6	9.4	9	TBA
350D4 (4 slots)	20 - 700	9	11.8	4.7	8.3	TBA
350D10 (10 slots)	50 - 1750	8	4.4	1.9	3.7	TBA
350D20 (20 slots)	100 - 3500	8	2.2	0.94	2	TBA
350D40 (40 slots)	200 - 7000	8	1.1	0.47	1	TBA
350D80 (80 slots)	400 - 14000	5	0.55	0.35	0.5	TBA



360H Ultra Miniature Chopper Head