



Optical Chopper – High Speed

Model 310CD



↑ 310CD with blade protector

Features

- 100 Hz – 120 kHz standard frequency range, depending on the disc used.
- Compact chopper head
- Photochemically etched non-magnetic discs
- Variable aperture
- Range of accessories
- **Scitec Instruments Model 310CD is a high speed variable frequency optical chopper. The basic system consists of control unit, chopping head, a blade protector and a chemically blacked photo etched disc. This system provides operation over the frequency range 100 Hz to 120 kHz, depending on the disc(s) purchased. A wide selection of additional discs and accessories is available to extend the frequency range and to satisfy individual requirements.**
- The 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 by using a 50W electrically commutated motor and drive unit. The high efficiency of the motor means that a large proportion of the energy is transferred to the disc. Wind resistance is the limiting factor on the speed discs can be spun at. The greater the number of slots, the higher the wind resistance produced by the edge of the slots and hence the slower the maximum speed. To minimise losses, the chopping disc is enclosed in a carefully designed blade protector which guides the air flow around the disc.

- Fast chopping speeds come at a cost however. The 50W 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 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.
- Safety is an obvious concern with a system that has parts moving at 130m/s (290mph). Some protection is achieved by enclosing the chopping disc in a blade protector. However, apertures in the blade protector remain a cause for safety concern. To help reduce the dangers to a minimum, blanking plates are provided to cover all unused apertures. Plates are also supplied to reduce the size of apertures in use. However, in some experiments, due to the size of the optical beam to be chopped, it is not possible to completely remove the danger of finger ingress. It is therefore necessary for the user to ensure that it is not possible for fingers to come into contact with a moving disc through the use of guards etc.

Disc	Revs Per Second	Revs Per Minute	Chopping Frequency Range
300D2 (2 slots)	50 - 400	3000 - 24000	100 - 800 Hz
300D5 (5 slots)	50 - 370	3000 - 22000	250 - 1850 Hz
300D10 (10 slots)	50 - 340	3000 - 20000	500 - 3400 Hz
300D30 (30 slots)	50 - 300	3000 - 18000	1500 - 9000 Hz
300D445 (445 slots)	50 - 270	3000 - 16000	22 - 120 kHz

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

- When switched on and set to minimum speed the motor will rotate at 7 to 10 rps. For the disc to be stopped it is necessary to power off the control unit.
- The speed of the chopping disc can be controlled via a 10 turn potentiometer on the front of the control unit or an external DC voltage can be applied to a front panel BNC input. The motor speed is then set using the equation:

$$\text{Chopping speed (Hz)} = \text{external voltage (V)} \times \text{slots in disc} \times 82.7$$

e.g. an external voltage of 3.26V with a 445 slot disc will give a chopping rate of 120kHz.

Specifications

310CDU Control Unit

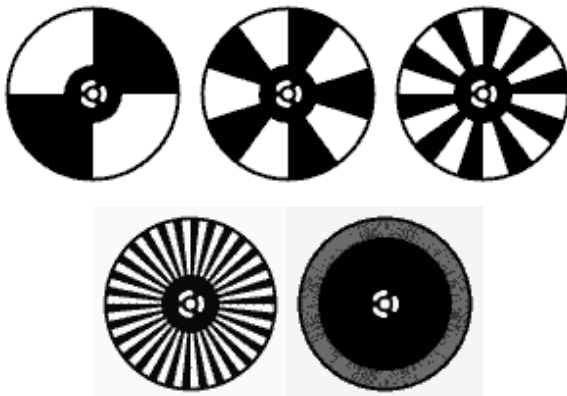
- **Stability:** +/-0.01%/°C.
- **Frequency control:** Internal - Manual Control via 10 turn potentiometer. External - BNC connector for 0 to 5V.
- **Frequency Read Out:** 5 digit 14mm LED display with 1Hz resolution.
- **Frequency stability:** Short term - see phase jitter. Long term - ±0.1% of maximum frequency.
- **Reference output:** 5 V HCT TTL signal via BNC socket.
- **Power requirement:** 100-130V or 200-260V AC, 50 or 60Hz, 60 VA.
- **Dimensions:** 254(W) x 76(H) x 178(D) mm.
- **Weight:** 2.6 kg (approx).

310H Chopping Head

- **Motor:** 50W 2 pole electrically commutated motor with hall sensors and ball bearings with more than 6000 hours lifetime, 0-50000rpm reversible.
- **Reference pick-up:** IR led and phototransistor pair with Schmitt trigger.
- **Dimensions:** 73(H) x 75(L) x 32(W)mm, without disc or blade protector.
- **Blade protector:** Comes complete with 300P blade protector.

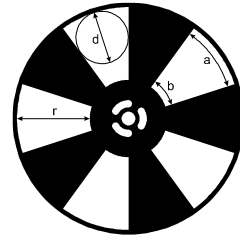
300D Chopping Discs

- **Disc types:** select one of the following on order.
- **Material:** Half hard brass, 0.5mm thick (apart from the 300D445 which is 0.25mm stainless steel).
- **Diameter:** 102 mm.
- **Surface Finish:** Chemically blacked.
- **Mark-Space Ratio:** 1:1 with one blade.



Frequency Range

Blade	Frequency (Hz)	Aperture (mm)				Phase Jitter Max
		r	a	b	d	
300D2	100 - 800	32.0	77.0	26.7	32.0	+/-0.2°
300D5	250 - 1850	32.0	30.8	10.7	23.1	+/-0.5°
300D10	500 - 3400	32.0	15.4	5.4	13.2	+/-1°
300D30	1500 - 9000	32.0	5.1	1.8	4.8	+/-3°
300D445	22000 - 120000	10.0	0.34	0.27	0.34	±30°



Ordering Information

Model 310CD Optical Chopper System: A complete high speed optical chopper system with frequency display includes: 310CDU Control Unit, 310H Chopping Head, 300P Blade Protector, 310I Interconnecting Cable, a single chopping disc (please select on order) and IEC mains lead.

See separate data sheet for details of the complete range of chopper discs and accessories that can be used with the Models 310CD Optical Chopper system.

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