

# Model 198A

## Mixed Beam Light Chopper



### FEATURES

- ◆ Self contained chopper head
- ◆ Dual aperture with three SYNC outputs
- ◆ Quartz crystal frequency accuracy and stability
- ◆ Internal or external frequency reference
- ◆ Fully enclosed housings for safety and low noise

### APPLICATIONS

- ◆ Pump-probe experiments
- ◆ Nonlinear optics

### DESCRIPTION

The model 198A is a dual frequency light chopper, using a thin rotating metal blade with an inner set of 11 apertures and an outer set of 18 apertures to simultaneously chop two light beams. The blade is driven by a precision DC motor whose speed is controlled via a phase locked loop that is referenced to either an internal quartz crystal oscillator or an external reference signal. The chopper has three reference frequency outputs, one at each of the frequencies generated by the inner and outer apertures, and one at a frequency equal to their sum. The three frequencies  $f_1$ ,  $f_2$  and  $f_1 + f_2$  are chosen to be relative primes which significantly reduces mutual harmonic interference.

It is ideal for use in measurements where two modulated beams give rise to a third optical signal at a frequency which is the sum of the two chopped frequencies. The model 198A acts as a chopper for the incident light sources at frequencies  $f_1$  and  $f_2$  and generates a reference signal at a frequency  $f_1 + f_2$  which can be used to drive a subsequent instrument, such as a lock-in amplifier.

In conjunction with the dual reference mode offered by the model 7265 or 7280 DSP lock-in amplifiers, the model 198A can also be used to implement a very cost-effective dual-beam ratiometric measurement system. This technique can eliminate variations in source intensity over several orders of magnitude. It is described further in an Applications Note AN1005 "Dual Beam Ratiometric Measurements using the Model 198A Mixed Beam Light Chopper" on page 129.

The chopper can also be used as a conventional single-beam unit since it also generates reference signals at  $f_1$  and  $f_2$ .

#### Quartz Crystal Frequency Accuracy and Stability

The model 198A, in common with all **SIGNAL RECOVERY** light choppers, uses a quartz crystal oscillator as its primary frequency standard. The oscillator signal is divided down to yield the required chopping frequency, and then the motor speed is continuously adjusted to phase lock the actual chopping frequency to this value. The result is a chopper with an output frequency as stable as any other modern frequency source.

#### External Frequency Control

Like many other choppers, the frequency can be controlled externally. However, unlike other units the control is via an applied reference signal (TTL levels may be used) rather than an analog control voltage. The chopper locks to this applied reference, which is at the same frequency as that generated by the outer set of apertures ( $f_1$ ), but for detection purposes the reference outputs it generates (i.e. at  $f_1$ ,  $f_2$  and  $f_1 + f_2$ ) are of course also available.

# Light Choppers

## Specifications

### General

Dual-aperture self-contained chopper with internal or external reference frequency. Two sync outputs.

Frequency  
 outer sector 55 Hz to 1500 Hz  
 90 Hz to 1500 Hz, 18 apertures,  $f_1$   
 inner sector 55 Hz to 917 Hz, 11 apertures,  $f_2$

Control  
 manual Digital push-button  
 external Application of 0.5 V to 10 V pk-pk sine or squarewave, 90 Hz to 1500 Hz to Sync In  $f_1$  BNC connector

Internal Frequency  
 accuracy  $\pm 20$  ppm at 25 °C  
 stability  $\pm 30$  ppm/ °C (range 10 °C to 60 °C)

Jitter (measured pk-pk and presented as a % of a full cycle)

outer sector  
 90 to 140 Hz blade only: 0.2%;  
 blade + electronics: < 6%

140 to 1500 Hz blade only: 0.2%;  
 blade + electronics: < 1.5%

inner sector  
 55 to 100 Hz  
 100 to 917 Hz

Lock indication

Settling Time  
 7 s nominal at  $f_1 + f_2 = 1$  kHz from switch-on; 9 s nominal for  $f_1 + f_2$  frequency change from 150 to 2400 Hz;  
 30 s nominal for  $f_1 + f_2$  frequency change from 2400 to 150 Hz

### Outputs

Sync Out  $f_1$  10 V pk-pk squarewave at outer sector chopping frequency, 90 - 1500 Hz  
 Sync Out  $f_2$  10 V pk-pk squarewave at inner sector chopping frequency, 55 - 917 Hz  
 Sync Out  $f_1 + f_2$  10 V pk-pk squarewave at sum of chopping frequencies, 145 - 2417 Hz

Connectors  
 Impedance

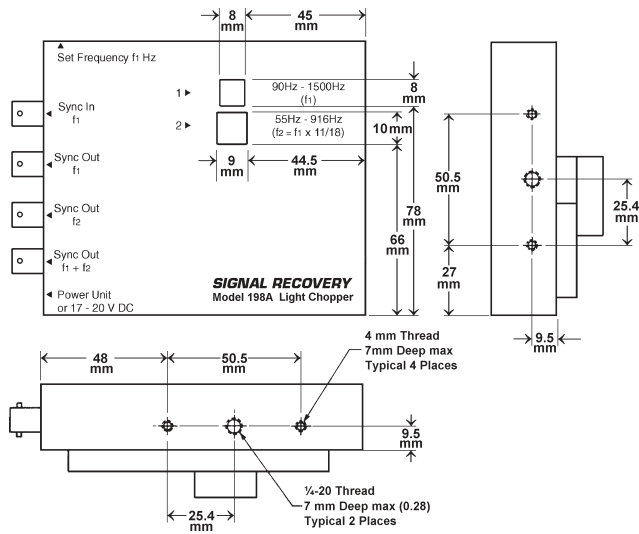
BNC  
 10 k $\Omega$ . Note that although the output voltage is 10 V pk-pk, the high output impedance means that the outputs can be directly connected to the external reference input of any **SIGNAL RECOVERY** lock-in amplifier without causing problems.

### Power & Mechanical

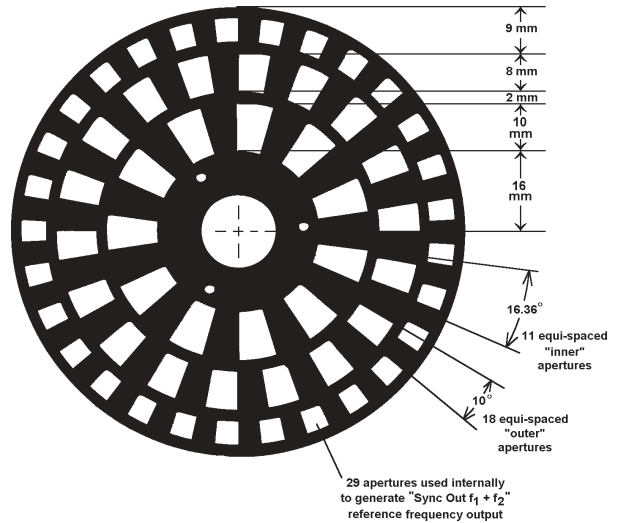
Power Requirements  
 Via separate power adapter for 110 V AC, 50/60 Hz or 220/240 V AC, 50/60 Hz supply. State which voltage is required when ordering

### Dimensions

Width 4 3/4" (122 mm)  
 Height 4" (104 mm)  
 Depth 1 3/4" (44 mm)  
 Weight 1lb (0.45 kg) excluding power supply



Model 198A Mechanical Dimensions



Model 198A Chopper Blade Dimensions