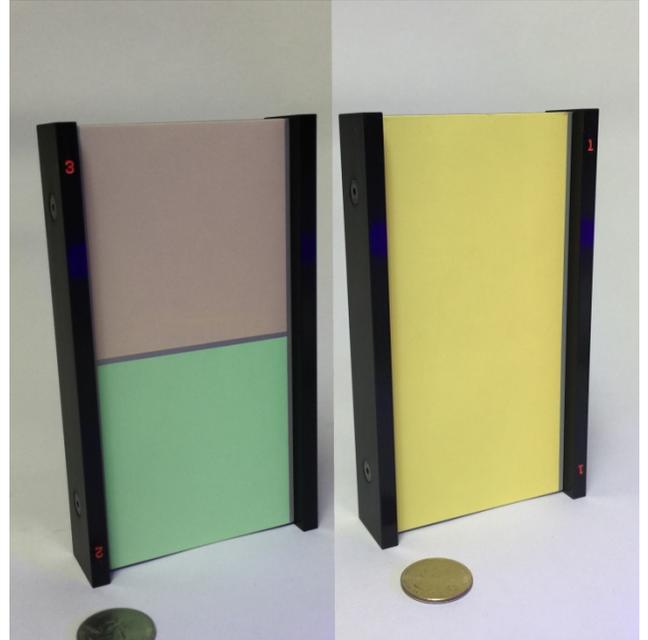




- CW YAG, Pulsed Nd, GaAs
- 200 watts Continuous
- 0.7-1.3 μ Response

The IR Display Plate is a versatile instrument that presents clear, high contrast images of all near IR laser beams. These displays are made on infrared sensitive phosphors which offer a variety of unique features, variable image retention times for pulsed lasers, high resolution for CW YAG, and a good response to gallium arsenide light-emitting diodes. All near IR lasers are capable of being displayed over a wide sensitivity range.



Surfaces

Macken Instruments Model 24 makes use of three different types of IR-sensitive surfaces to cover the varied near IR laser display requirements.

Surface #1 is primarily designed for use with YAG Lasers. When illuminated by an ultraviolet lamp, this surface fluoresces a bright green. Striking the fluorescing surface with near IR light induces a transition which results in a quenching of the fluorescence. Therefore, the IR beam is displayed as a dark image on a bright fluorescent background. The sensitivity of this surface can be varied over a wide range by changing the intensity of the UV illumination; i.e., the distance of the UV lamp from the surface. The response time also depends on the UV illumination but is typically less than 10 milliseconds. This fast a response time is well suited for viewing rapidly changing YAG mode patterns; however, such a recovery time is too rapid to view a single pulsed laser.

Surface #2 is designed to be used with pulsed neodymium and other pulsed IR lasers. This surface fluoresces a bright green-like surface. IR quenching produces a dark image display on a bright background. However, this surface has a much longer decay time which is ideally suited for viewing pulsed lasers depending on the illumination conditions; the image retention time can be varied from one tenth of a second to several minutes. The more intense the UV illumination the shorter the persistence. When no UV illumination is used and when the background illumination is dimmed, the phosphorescence of the surface will retain the laser beam pattern for several minutes.

Surface #3 is used primarily for viewing gallium arsenide light-emitting diodes and for probing CW YAG laser beams. This surface operates on a different principle than previously described. Energy is stored in the phosphor surface when it is exposed to fluorescent room lights or UV light. Near IR radiation stimulates the release of this energy as yellow-orange light. Consequently, the beam appears as a bright image on a dark background. After the phosphors have absorbed a given amount of IR energy, the surface can become depleted. The beam must then be moved to a new area of the surface or the surface recharged.

All plate and imaging surfaces have a matte finish for safe beam displays.

Near IR Display Plates User Instructions



Mack Instruments, Inc.

for YAG & Diode lasers

DISPLAY CHARACTERISTICS

	CW YAG & High Rep. Rate Nd			Pulsed Nd		GaAs Diode— .9μ				
	SATURATED DISPLAY	HIGH RESOLUTION DISPLAY	MINIMUM POWER DENSITY	DEPLETION ENERGY DENSITY	SATURATED DISPLAY	HIGH RESOLUTION DISPLAY	HIGH RESOLUTION DISPLAY	MINIMUM POWER DENSITY	MINIMUM FOCUSED POWER	DEPLETION ENERGY DENSITY
	(1) W/cm2	(2) W/cm2	(4) W/cm2	(3) /cm2	(1) J/cm2	(2) J/cm2	(4) mW/cm2	(3) mW/cm2	MW	mJ/cm2
SURFACE 1	1000-8	8-0.1	0.1							
SURFACE 2					7-3	3-3				
SURFACE 3			.0003	2	7-3	3-3	50-.1	.02	<.001	80

SPECTRAL CHARACTERISTICS

	SPECTRAL CHARACTERISTICS					DAMAGE LIMITS				
	STIMULATION WAVE LENGTHS	EMISSION WAVE-LENGTHS	EXCITATION WAVE-LENGTHS	RESOLUTION	IMAGE DECAY TIME	CW DAMAGE THRESHOLD	PULSED DAMAGE POWER	MAXIMUM AVERAGE POWER	MAXIMUM INTERMITTENT	
	MICRO-METERS	MICRO-METERS	MICRO-METERS	Lines/In.	Seconds	W/cm2	(5) J/cm2	W	W	
SURFACE 1	.7-18	.5-.6	<.43	>300	.005	DISPLAY PLATE	2000	7	200	1000
SURFACE 2	.48-1.6	.48-.57	<.48	>50	.1-200					
SURFACE 3	.53-1.6	.54-.62	<.53	>50	.005-.05	BEAM PROBE	2000	7	40	100



Model 24-K

The photograph shows the IR Display Plate and the two IR Beam Probes which make up Macken Instruments' Model 24-K, Near IR Display Kit. The IR Display Plate contains three surfaces. Surface #1 used primarily for YAG lasers, measures 3" x 6" and covers one side of the plate. The #2 and #3 surfaces each occupy a 3" x 3" area on the reverse side. The Beam Probes, one having a surface #1 and the other a surface #3, measures 1 1/2" x 6" x 1/8". They are used primarily for applications where the flexibility of a thin, hand-held display surface is required; e.g., checking the position of an IR beam as it enters an optical aperture. For many of the IR display applications, it would also be necessary to have a long wavelength ultraviolet lamp. Although any long wavelength UV lamp can be used, Macken Instruments' Model 22-UV offers small

size, high light output, and the ability to stand erect for the most uniform illumination of the Display Plate.

- (1) The beam outline is clearly visible, but line detail of mode patterns is not visible.
- (2) Power densities in this range permit mode patterns and other detail within the beam to be viewed.
- (3) The energy density required to stimulate all the stored energy in the surface.
- (4) The minimum detectable power density is observable only with the room lights dimmed.
- (5) Pulsed neodymium, normal mode of operation.

Enlarged Beam Display

Sometimes the power densities from a particular laser may fall outside the ranges required for high resolution display of mode patterns. Under these circumstances the power density can be changed, without distorting the image, by passing the beam through a lens and allowing it to expand until the enlarged area produces the desired power density. As long as the divergence (or convergence) of the lens is large compared to the divergence of the laser beam, the enlarged pattern will be an accurate representation of the laser beam at the position of the lens. This technique is especially useful with CW YAG lasers where enlargement of the beam is also desirable to see and photograph the complicated mode patterns.



Model 24 and Near IR Beam Probes

The operating instructions are divided to cover three types of lasers

- A. *Continuous Nd:YAG, Diode and high rep rate pulsed lasers.*
- B. *Pulsed MD lasers.*
- C. *GaAs light emitting diodes.*

CONTINUOUS Nd: YAG AND HIGH REP RATE PULSED LASERS

These lasers can effectively use all three surfaces to display different characteristics. For initial experimentation, illuminate surface #1 with Model 22-UV ultraviolet light or equivalent to produce a uniform fluorescence. Stand the UV lamp on end and place it 6" to 9" from the surface. For power densities greater than 8 watts/cm², this will produce a dark spot showing the area struck by the laser but lacking internal detail of the mode patterns. To view the mode patterns, follow the instructions given in the data sheet under "Enlarged Beam Display" or attenuate the beam until the power density is between 0.1 and 8 watts/cm². The sensitivity of the surface depends on the UV illumination level, i.e., the distance of the UV light from the plate.

Surface #3 is useful when one is interested in merely locating the beam without the need for a UV Lamp. With CW YAG lasers, it is often necessary to continually move this surface around because the stored energy in the surface is dumped in a short time.

The beam probes also contain #1 and #3 surfaces. They do not have the heat dissipation capacity of the plates, so they should be allowed to cool if they become too hot to touch.

PULSED Nd LASERS

Pulsed Lasers with repetition rates less than about 20 pps are best displayed on surface #2. For initial experiments, illuminate this surface with a UV lamp using the procedures described in the above section.

Surface #2 has been specially formulated to maximize the allowable energy density from a pulsed or Q-switched laser. However, the damage limits should be observed. When the possibility exists that hot spots within the beam might exceed the limit, the beam should be enlarged or attenuated to decrease the energy density.

CARE OF SURFACES

The thermal sensitive surface of the IR Display Plate and Beam Probes is delicate and should always be treated with care. A Beam Probe should never be laid down on its sensitive surface. Even touching the surface might leave dirt in the matte surface, which would require cleaning. The thermal sensitive surface may be cleaned using a cotton applicator or soft paper tissue freshly dampened with acetone. Cleaning should be done with a light, smooth stroke. Since there is some slight degradation of the surface with each cleaning, frequent cleanings should be avoided. Never clean the surface with water, since this degrades an invisible protective coating on the surface.

SAFETY

Precautions have been taken to eliminate specular reflections from the IR Display Plate and Beam Probes. Both the thermal sensitive surfaces and the anodized aluminum have matte finishes and show little surface reflection at 10.6 microns. However, standard safety precautions, such as wearing protective glasses, should always be observed with working with IR lasers. Naturally, it is expected that the users are familiar enough with their equipment not to get their hand burned when using the Beam Probes. For use with lasers emitting at other wavelengths, tests should be made by the user to determine the appropriate safety precautions.

The laser beam should never be allowed to strike the UV lamp or its cord.

The ultraviolet radiation from the Model 24UV lamp is not harmful. If other UV lamps are used, they should emit only "long wave" ultraviolet.

RESURFACING IR DISPLAY PLATES AND BEAM PROBES

Both the IR Display Plates and Beam Probes can be resurfaced by Macken Instruments, Inc., should the thermal sensitive surface become damaged. Please contact our Customer Service Department for further information.