POWER METER

MODEL 1035-5

11/29/01 Std.

POWER METER

1.0 GENERAL:

The power meter is a full beam absorption design to provide consistent and accurate measurement of the laser beam power. Several mounting and operating techniques are employed depending upon the application.

a) Free Standing Power Meter Head:
In this form, the detector head is not mounted. It may be placed at various locations in the optical train or at the work surface for diagnostics.

b) Slide Mount:
In this form, the power meter head is mounted to a manual slide arm. When a power reading is desired, the detector head is pulled into the beam path to absorb the full beam intensity.

c) Dump Shutter:
In this form, the detector is mounted into a beam shutter. In the Normal operating mode, the beam passes through the detector assembly without obstruction. In the dump mode, the beam is reflected down into the power meter detector, and no beam energy passes through.

To avoid damage to the detector assembly do not transfer the detector into or out of the beam path while the laser is running. Always close the laser shutter before moving the detector.

2.0 DETECTOR:

The detector head is a thermopile design with a black body absorber face. It may be operated with or without cooling water. Without water cooling, the detector is limited to about 30 watts. When cooled, cooling water from the laser head is diverted through the detector to allow beam power dissipation up to 150 watts continuous or 300 watts momentarily. The detector should be moved in or out of the beam path only when the laser shutter is CLOSED to prevent beaming energy into the detector housing.

3.0 CONTROLS:

The interface circuitry is designed to provide a display that is linear and calibrated to absolute power.

3.1 ZERO ADJUST:

The zero adjust is provided to trim the meter to compensate for aging or thermal drift. With the system at a thermal equilibrium, the laser off, and the covers intact, adjust this control for a zero display.

3.2 GAIN ADJUST:

This control is used to calibrate the power meter. After setting the zero adjust, beam the system output into a standard detector and trim the gain to coincide. Since the detector and circuitry are linear, the calibration can be done at most any nominal operating point.

3.3 NOTE:

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This power monitor uses a thermopile detector which generates a detection signal as a function of its surface absorbing temperature and the peripheral temperature. Therefore, before making any alignments (Gain or Zero adjustments) allow some time for thermal equilibrium. Also when a beam is turned off, the meter may read negative. This is normal as the peripheral temperature may now be higher than the junction temperature.

4.0 POWER METER:

Major Alignment.

4.1 DETECTOR HEAD:

The detector head contains the thermopile absorbing element. The only field alignment is to properly introduce the laser beam to the detector. For Nd:YAG lasers, use an IR viewer, beam the laser into the detector, observe the beam incidence on the detector face. The beam should hit centrally on the detector element. The device is most accurate when the beam nearly fills the detecting aperture. Avoid high peak energy density. For example, unexpanded Q-Switched laser beams may be sufficiently powerful to oblate the detector surface. Such beams should be expanded to spread the energy over a larger surface area of the detector face.

W A R N I N G ! ! !

WEAR SAFETY GOGGLES AND PROTECT ADJACENT PERSONNEL WHENEVER OPERATING THE LASER WITH THE COVERS OPENED.

4.2 ELECTRONICS:

Refer to the Power Meter Schematic #604175 and Power Monitor Circuit Schematic #604004 to implement the following alignments.

4.2.1 METER:

Prior to energizing the electronics, check the mechanical zero of the display meter. Align as required.

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4.2.2 **OFFSET NULL ADJUST**:

Disconnect the input to the power meter circuit at the BNC jack on the rear of the display box. Short the center pin of the BNC jack to the shell of the connector with a shorting cap or suitable means. Turn on the meter circuit and connect a digital millivolt meter from the output of U1 (Pin 6) to circuit ground. Adjust R13 for a near zero reading. Remove the short at the input jack and install the detector cable.

4.2.3 **ZERO ADJUST:**

With power on the circuit , but with the laser off, adjust the front panel zero adjust control for zero on the display meter.

4.2.4 **GAIN ALIGNMENT:**

If the meter has been in service and simply needs a trim alignment to compensate for detector absorbing surface damage (for example), the rear mounted trim control may be used to align all scales proportionally.

If the unit has been repaired or for any reason requires alignment of all scales, proceed as follows:

4.2.4.1 Gain Alignment for 100 Watt maximum displays:

a) Set the rear panel gain control to the center of travel (this is typically a 20 turn pot).
b) Set the scale switch to 30 watts.
c) Beam the laser into a reference power meter and adjust the laser to an output which would produce a mid-scale reading on this power meter.
d) Beam the laser into this power meter and adjust R4 on the amplifier circuit to align the power meter to agree with the value measured on the reference display.
e) Now align the 3.0 watt scale. Set the selector switch to 3.0 watts.
f) Beam the laser into a reference power meter and adjust the laser to an output which would produce a mid-scale reading on this power meter.
g) Beam the laser into this power meter and adjust R11 on the amplifier circuit board to align the power meter to agree with the value measured on the reference display.
h) Set the selector switch to the 10.0 watt scale and proceed similarly using the R15 trim pot to align this scale.
i) Set to the 100 watt scale and proceed similarly using the R16 trim pot. This step completes the meter alignment.

4.2.4.2 Gain Alignment for 1000 Watt maximum displays.

a) Set the rear panel gain control to the center of travel (this is typically a 20 turn pot).
b) Set the scale switch to 300 watts.
c) Beam the laser into a reference power meter and adjust the laser to an output which would produce a mid-scale reading on this power meter.
d) Beam the laser into this power meter and adjust R4 on the amplifier circuit to align the power meter to agree with the value measured on the reference display.
e) Now align the 30 watt scale. Set the selector switch to 30 watts.
f) Beam the laser into a reference power meter and adjust the laser to an output which would produce a mid-scale reading on this power meter.

g) Beam the laser into this power meter and adjust R11 on the amplifier circuit board to align the power meter to agree with the value measured on the reference display.

h) Set the selector switch to the 100 watt scale and proceed similarly using the R15 trim pot to align this scale.

i) Set to the 1000 watt scale and proceed similarly using the R16 trim pot. This step completes the meter alignment.

5.0 SCALE AND RANGE SPECIFICATIONS FOR UP TO 100 WATT POWER METER:

5.1 The Meter Display Face indicates: 0 - 10 and 0 - 30.

5.2 The scale switch provides four positions, offering full scale displays of 3.0 watts, 10.0 watts, 30.0 watts, and 100.0 watts.

5.3 CAUTIONS:

5.3.1 The power meter detector will handle 150 watts of average incident laser power, and momentary power to 300 watts. However, surface damage can occur if the incident energy density is too high.

5.3.2 Therefore, avoid Q-Switched frequencies below 5 KHz.

5.3.3 Never focus into the detector.

5.3.4 For high powers, above 10 watts, or high peak energies such as Q-Switched beams, expand the beam with a suitable lens or upcollimator to fill the detector surface.

6.0 SCALE AND RANGE SPECIFICATIONS FOR UP TO 1000 WATT POWER METER:

6.1 The Meter Display Face indicates: 0 - 10 and 0 - 30.

6.2 The scale switch provides four positions, offering full scale displays of 30 watts, 100 watts, 300 watts, and 1000 watts.

6.3 CAUTIONS:

6.3.1 The power meter detector will handle 20 watts of average incident laser power. However, surface damage can occur if the incident energy density is too high.

6.3.2 Therefore, avoid Q-Switched frequencies below 5 KHz.

6.3.3 Never focus into the detector.

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6.3.4 For high powers, above 100 watts, or high peak energies such as Q-Switched beams, expand the beam with a suitable lens or upcollimator to fill the detector surface.