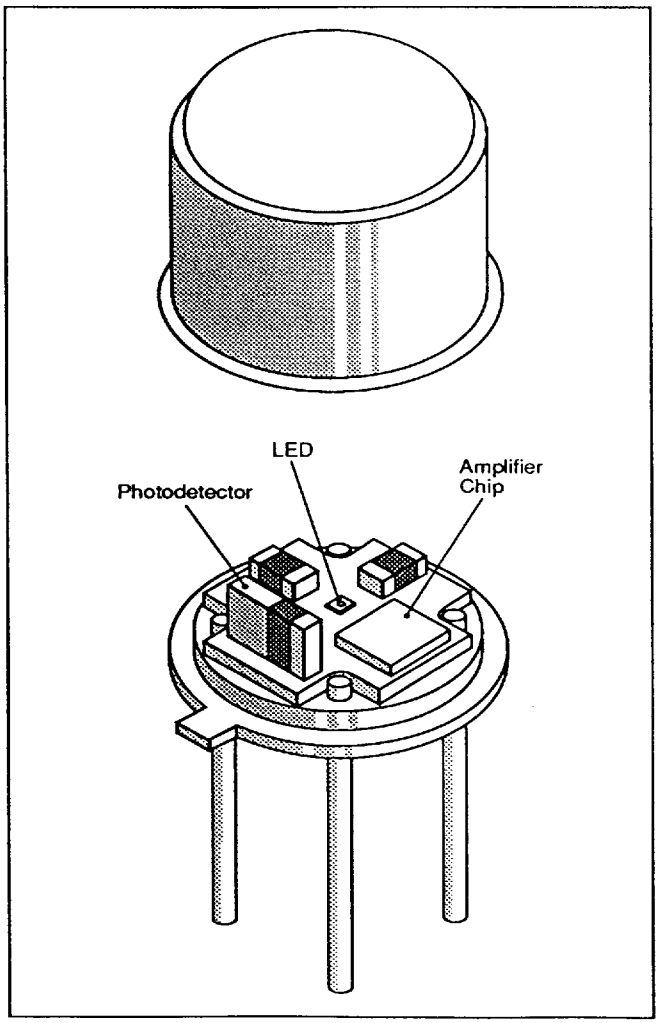
10000 Series Photodetectors

IPL 10530 HYBRID

DETECTOR/EMITTER FAMILY

FOR POLLUTION MONITORING AT GREEN, RED, OR INFRA-RED WAVELENGTHS USING THROUGH BEAM OR SCATTER TECHNIQUE.

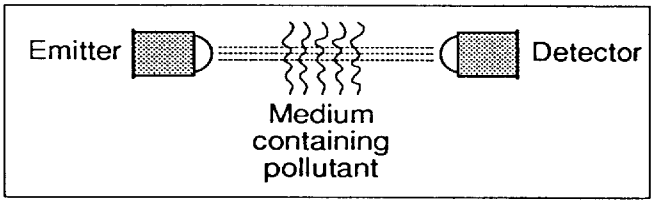
EMITTER DEVICES HAVE INTEGRAL DETECTORS TO ALLOW RATIOMETRIC OPERATION OR CLOSED LOOP LIGHT CONTROL.



Photodetector technology is finding increasing use in liquid and gas monitoring systems. The existance and level of pollutants can be determined by their effect on the transmission of light through the medium concerned.

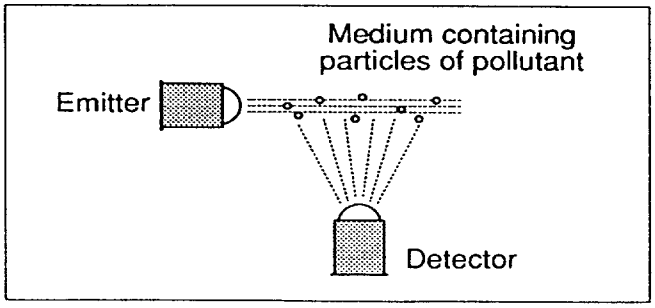
Density Measurement

A monitoring transducer may operate on density measurement where the medium to be monitored passes through a light path. Light from an LED emitter is detected by a photodetector. The output of the detector is a voltage signal that is amplitude modulated by the level of pollutant passing through the light beam.



Scatter Measurement

An alternative method uses the principle of scattered light. This is particularly suitable for pollutants that take the form of particles. Here the detector is set at right angles to the light beam and provides an output that is proportional to the light scattered from particles within the beam.



These techniques are used in a wide variety of applications and are optimised by careful choice of wavelength and also by the design of the measurement electronics.

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System Design Considerations

A problem that arises when simple opto-couplers are used for measurement systems is the variable nature of the emitting source. Power output of the emitter is affected by temperature and ageing of the device itself. These variations would be unacceptable in an absolute intensity monitoring system, especially where accuracy of measurement is required. The problem can be overcome by incorporating a light output monitor detector within the emitter device.

IPL have developed a range of hybrid LED emitting devices that also contain a photodiode and amplifier for monitoring the direct output of the LED. The devices are housed in TO5 cans with lensed windows such that the LED is situated at the focal point of the lens.

The device operates as a normal lensed LED and the light output is not affected by the internal monitoring components. The monitoring photodiode is placed to one side of the LED chip and mounted perpendicularly. This ensures that it is able to receive low angle radiation from the LED but is relatively insensitive to any light that may return to the device through the lens.

The photodiode amplifier is a BIFET device operating as a current to voltage converter. It amplifies photocurrent from the photodiode to give a voltage output. Since photocurrent is linearly related to light level, the voltage output is also a linear function. Photocurrent polarity has been arranged to give a positive going output signal; i.e. amplifier output voltage increases as light level increases.

Feedback components have been chosen to allow the amplifier to accommodate a wide range of LED current without saturation. Output is typically 0.5V with a current of 10mA in the green LED device. Higher currents can be used, particularly in pulsed mode. The amplifier has been compensated to give a clean square wave response without overshoot.

To facilitate balanced design in short path length systems, IPL also produce a hybrid detector IPL10530HAL. This has the same photodiode and amplifier circuit as that in the LED/ photodetector hybrids. For path lengths greater than 300mm higher gain devices such as IPL10530DAL may be used.

The complete family of devices is as follows:-

IPL 10530GAL	565nm GREEN LED/PHOTODETECTOR
IPL 10530HAL	PHOTODETECTOR RECEIVER
IPL 10530JAL	630nm RED LED/PHOTODETECTOR
IPL 10530KAL	880nm IR LED/PHOTODETECTOR

Utilisation

A 5-pin lead out has been provided for the detector/emitter devices to give flexilibity of system design.

The LED cathode is available externally in IPL10530GAL and IPL10530JAL. Control is exercised by variable current sink from the cathode pin to ground.

In IPL10530KAL the LED cathode is connected to -V within the device. External control is exercised by variable source current to the anode pin.

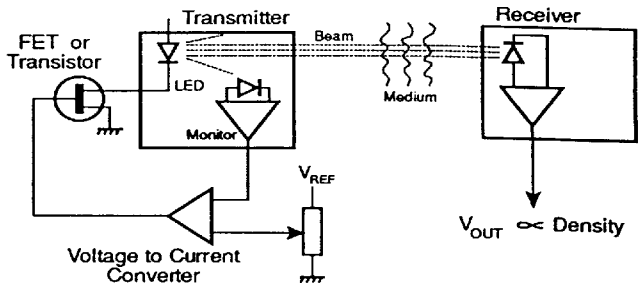
The detector amplifier in all versions is capable of single or dual rail operation. Single rail can be obtained by connecting together the -V and 0V pins externally. Dual rail operation is recommended for small signal and high linearity applications.

Always provide decoupling capacitors as close to the device as possible on both power rails. 10µF tantalum capacitors are recommended.

Peripheral circuit design is dependant on the application. Two suggested methods of use are shown below:-

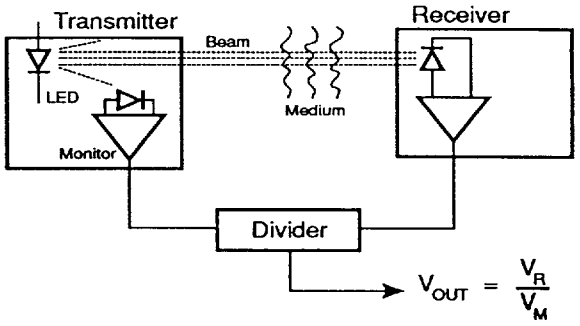
Closed Loop Mode

If the output of the monitor receiver is used to actually control the current flowing in the LED, it is possible to ensure that the required light output is always maintained. This is achieved by closed loop control. Here the monitor voltage is used to control the output of a voltage to current converter circuit that drives the LED. The receiver detector can then be used to give an absolute indication of transmissivity through the medium, since light level is held at a fixed value.



Ratiometric Mode

The monitor signal from the emitter detector is used in conjunction with the signal from the receiver detector. The ratio of these signals will be the same for a given light path transmissivity, irrespective of the actual light level. If the two signals are divided in an analogue or digital divider, the quotient output is a reliable measure of light path transmissivity. Wide variations of LED output can be tolerated.



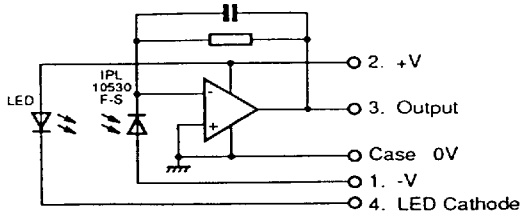
Opto-Electrical Parameters

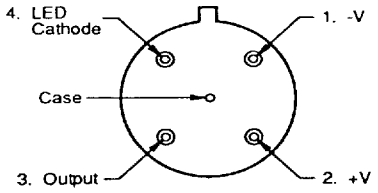
PARAMETER	VALUE		
	10530GAL	10530JAL	10530KAL
DC Supply Voltage	±2 to ±18V	±2 to ±18V	±2 to ±18V
Quiescent Current	1.6mA typ.	1.6mA typ.	1.6mA typ.
LED Current (Peak) LED Current (Continuous) (Derate LED Current linearly from +50° at 0.5mA/°C)	100mA Max. 40mA Max.	100mA Max. 40mA Max.	100mA Max. 40mA Max.
Forward Voltage (at 20mA)	2V typ.	2V typ.	2V typ.
LED Luminous Intensity (at 20mA)	5 to 8 mcd	5 to 8 mcd	2mW
Wavelength (Peak) Wavelength (Bandwidth)	565nM (Green) 60nM	630nM (Red) 70nM	880nM (IR) 80nM
LED Beam Angle (Total angle between 3db points)	10°	10°	10°
Detector Output Voltage (at 15mA LED Current)	0.5V typ.	1.0V typ.	1.0V typ.
Detector Frequency Response (-3db)	100kHz	100kHz	100kHz
Detector Output Current (Sink) Detector Output Current (Source)	1mA 10mA	1mA 10mA	1mA 10mA
Short Circuit Output Duration	Infinite	Infinite	Infinite
Operating Temperature Storage Temperature	-20°C to +85°C -30°C to +100°C	-20°C to +85°C -30°C to +100°C	-20°C to +85°C -30°C to +100°C

PARAMETER	VALUE 10530HAL
DC Supply Voltage (Dual Rail) DC Supply Voltage (Single Rail)	±2 to ±18V +4 to +36V
Quiescent Current	1.6mA typ.
Dissipation (up to 55°C) (above 55°C derate linearly 6.67mW/°C)	630mV
Dark Level Noise	0.3mV typ.
Detector Output Offset	±5mV Max.
Detector Output Voltage (Tungsten source at 2870°K)	14mV/μW/cm²
Detector Frequency Response (-3db)	100kHz
Detector Output Current (Sink) Detector Output Current (Source)	1mA 10mA
Short Circuit Output Duration	Infinite
Operating Temperature Storage Temperature	-20°C to +85°C -30°C to +100°C

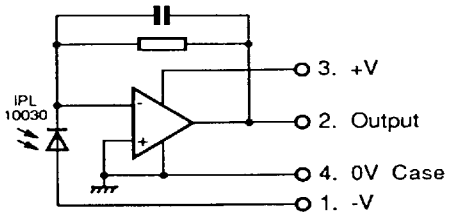
Circuit Diagrams, Pinout Details & Overall Dimensions

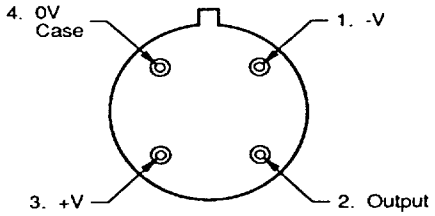
IPL 10530GAL
IPL 10530JAL



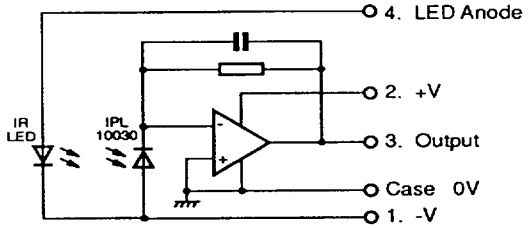


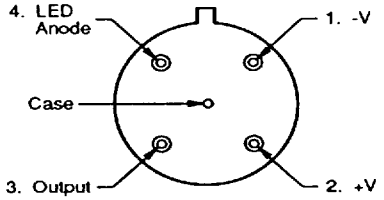
IPL 10539HAL



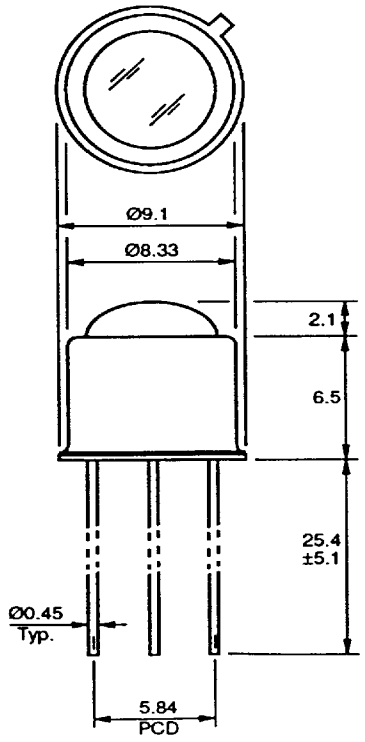


IPL 10530KAL





PACKAGE OUTLINE
(All Types)



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