Converting the Heathcote IRDOT-1 Optical Detector to the IRDOT-1D to Add Off-Delay Feature

Heathcote Electronics is a British company that makes a nice selection of optical detectors; however it is somewhat inconvenient to order them from overseas. It turns out that Micro-Mark, a US-based small tools distributor, now offers the Heathcote IRDOT-1 optical detector through their catalog and internet stores: http://www.micro-mark.com/

Unfortunately the IRDOT-1 does not have the "off-delay" feature like the IRDOT-1D has. This feature holds the output active for a brief time after the sensor turns off, which prevents the signals from "winking" as gaps between cars pass over the sensor.

But all is not lost ... it turns out the IRDOT-1 and the IRDOT-1D use the exact same circuit board; they are just "stuffed" differently. So the IRDOT-1 can be converted to the IRDOT-1D by adding a capacitor and diode, and replacing a resistor. Here's how to do it:

Refer to the photo below.

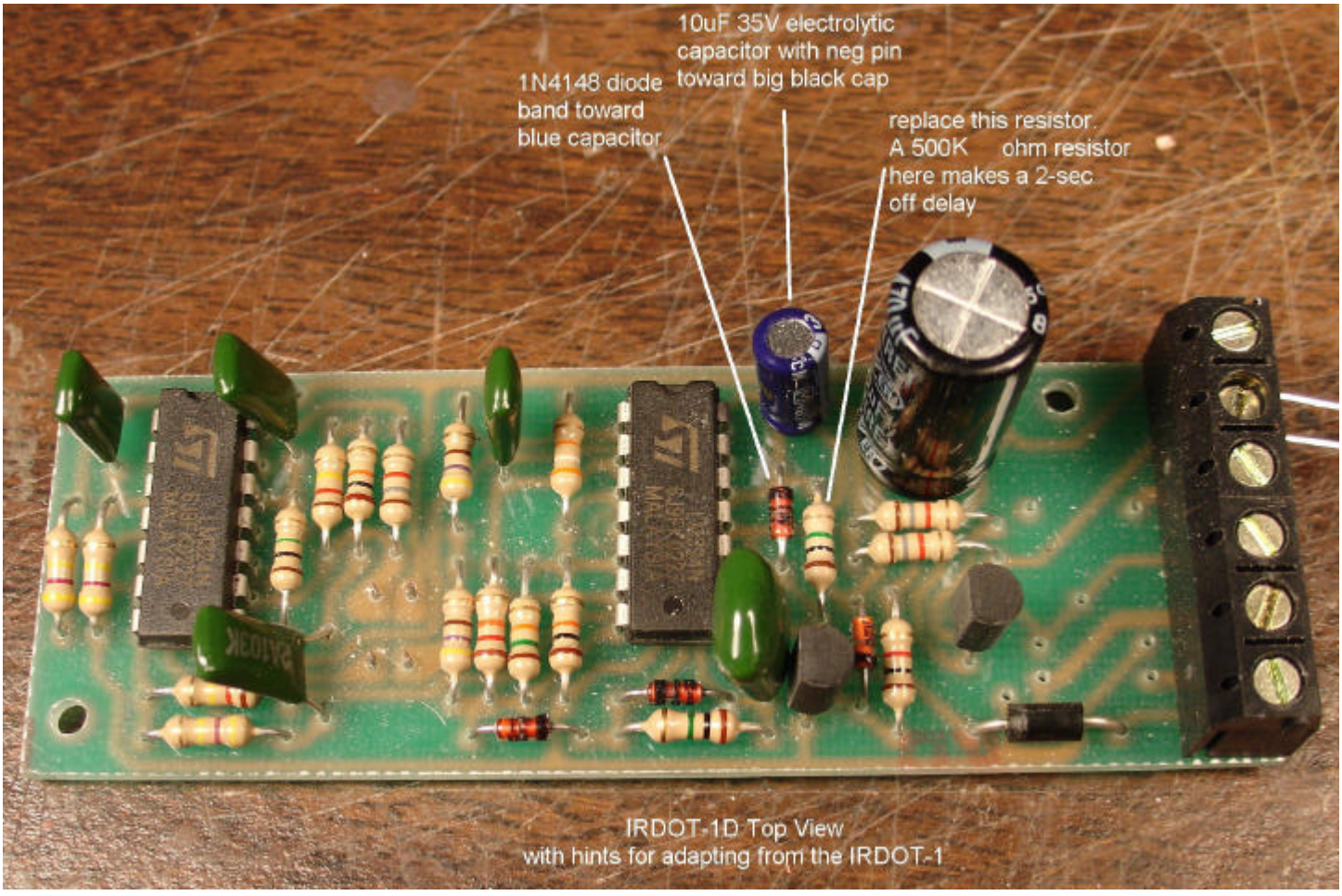
1] add a radial-leaded 10 uF electrolytic capacitor (35V) in the two open holes adjacent to the big black capacitor. The negative pin (marked with a "-" on the capacitor casing) must be toward the big black cap. This capacitor is Digikey part number **P5161-ND**

2] add a 1N4148 diode in the two open holes adjacent to the resistor with a single black band. The diode has a black band on one end - this must be toward the 10 uF capacitor added in step 1] above. This diode is Digikey part number **1N4148DICT-ND**

3] remove (un-solder) the resistor with a single black band, and replace it with a resistor to create the off-delay time of your choice*:

Off Delay Time	Resistor Value	Digikey Part Number	www.digikey.com
1 second	249K ohm	249KXBK-ND	
2 seconds	499K ohm	499KXBK-ND	
4 seconds	1Meg ohm	1.00MXBK-ND	

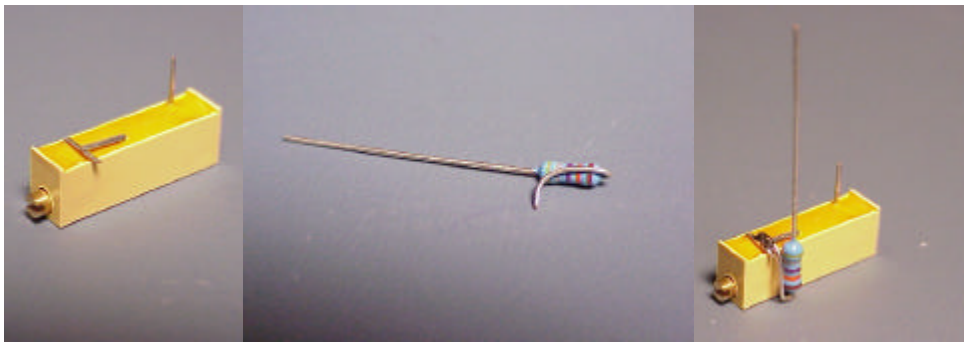
* an adjustable delay can be made by using a potentiometer - see page 2



Modifying the Heathcote IRDOT-1D Optical Detector

Part 1: Adjustable "OFF" Delay (2 - 4 seconds)

The stock IRDOT-1D has a 4-second off delay, which some consider too long. Here is how to make the delay adjustable from 2 to 4 seconds.

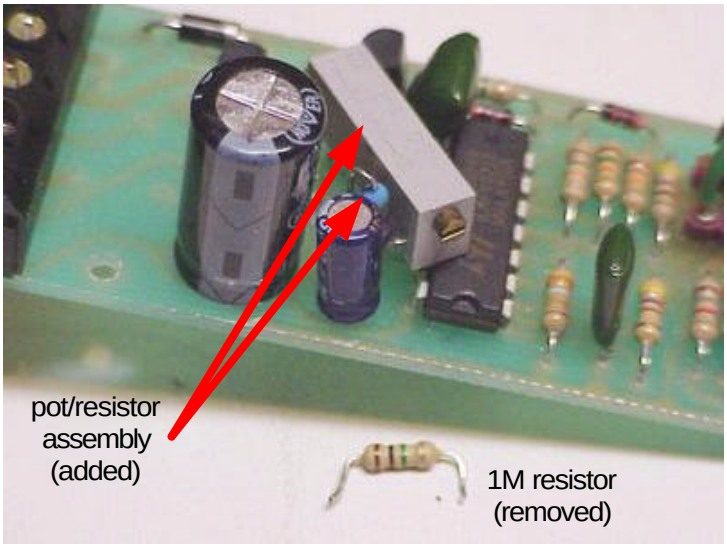


Bend the two 500K pot pins that are closest to each other as shown and solder (left photo).

Bend & cut one 500K resistor lead as shown (center photo).

Solder this bent resistor lead to the two joined pot pins as shown (right photo).

Note: a 487K ohm resistor is shown here.
It works just fine.



On the IRDOT-1D, locate and remove the 1M ohm resistor - it is the only one with a brown/black/green color band.

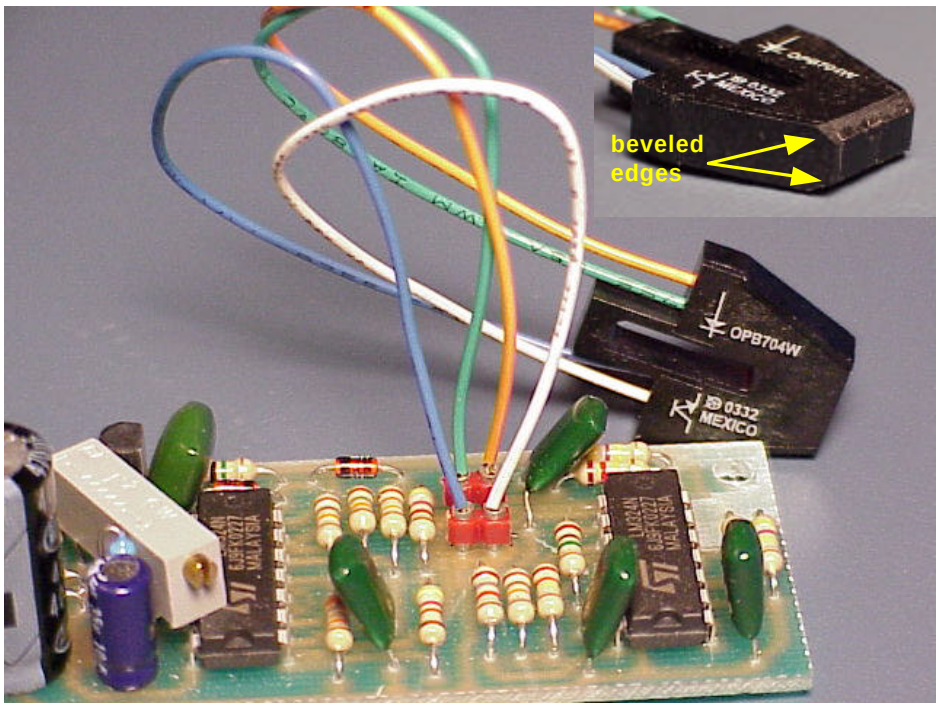
Clear the holes of solder and slip in the pot/resistor assembly as shown. The 3rd unbent pin of the pot goes in one hole, and the unbent lead of the resistor goes in the other hole. Make certain the pot/resistor junction is in free space and does not touch the pins of the black IC or anything else.

Solder in the pot/resistor assembly from the bottom side of the board, and trim the leads if needed.

The IRDOT-1D is available from Heathcote Electronics (U.K.):
http://www.heathcote-electronics.co.uk/IRDetec.htm

Part 2: Using the Optek OPB704W Sensor

The IRDOT-1D includes a two-piece sensor which is difficult to properly align in the track and can falsely react to fluorescent lighting. The Optek OPB704W is a 1-piece sensor whose housing properly aligns the elements at an angle, and it has a built-in filter to reduce false reaction to ambient light.



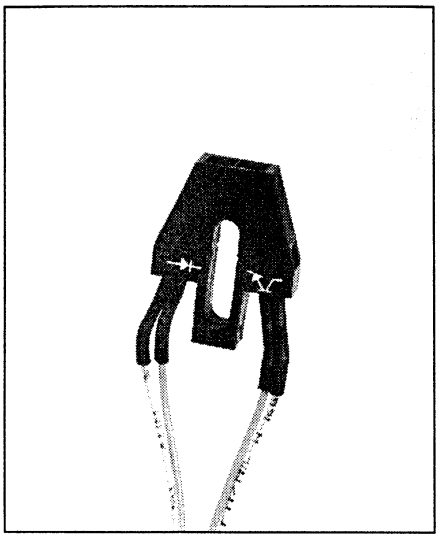
Remove the Heathcote-provided two-piece sensor from the IRDOT-1D. If desired, install connector pins for modularity (see photo).

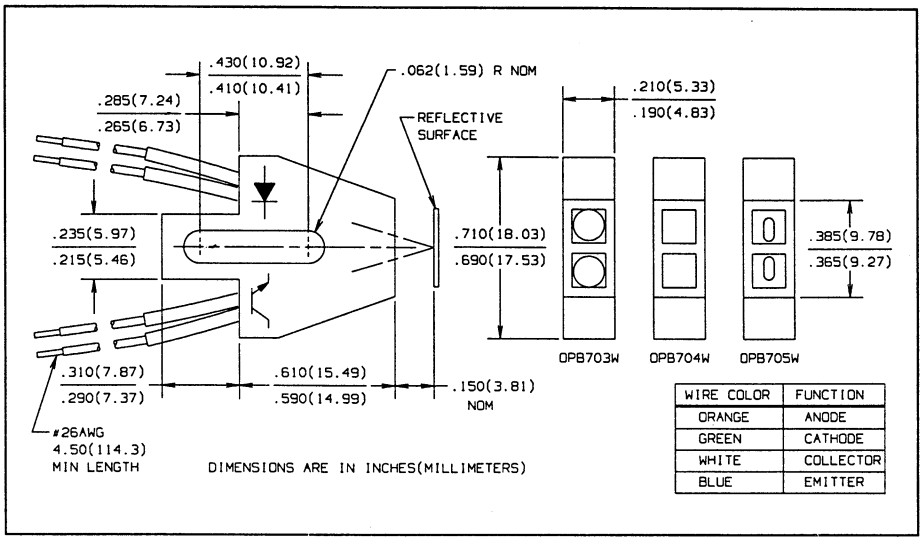
Install the OPB704W as shown; note the colored wire positions. Extend wires if needed.

Mount the OPB704W centered between rails with sensor surface flush with tie tops. Place it at a tie location for disguise - edges can be beveled to match tie width (see inset). But leave a small amount of black housing - don't cut right up to the window edge!

The Optek OPB704W is available from:
Newark Electronics http://www.newark.com
Arrow Electronics http://www.arrow.com

Reflective Object Sensors
Types OPB703W, OPB704W, OPB705W





Features

- Phototransistor output
- High sensitivity
- Low cost plastic housing
- Available with lenses for dust protection and ambient light filtration

Description

The OPB703W, OPB704W and OPB705W each consist of an infrared emitting diode and an NPN silicon phototransistor mounted side-by-side on converging optical axes in a black plastic housing. The phototransistor responds to radiation from the emitter only when a reflective object passes within its field of view. Various options allow no lens, blue polysulfone lens for dust protection or offset lens for improved resolution.

Leads are 26 AWG, PVC insulation, 4.5" (114.3mm) minimum length, stripped & tinned.

Absolute Maximum Ratings (T_A = 25° C unless otherwise noted)

Storage and Operating Temperature ..... -40° C to +80° C
Lead Soldering Temperature [1/16 inch (1.6 mm) from case for 5 sec. with soldering iron] ..... 240° C(1)

Input Diode

Forward DC Current ..... 40 mA
Reverse DC Voltage ..... 2.0 V
Power Dissipation ..... 100 mW(2)

Output Phototransistor

Collector-Emitter Voltage ..... 30 V
Emitter-Collector Voltage ..... 5.0 V
Collector DC Current ..... 25 mA
Power Dissipation ..... 100 mW(2)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Derate linearly 1.82 mW/° C above 25° C.
(3) d is the distance from the assembly face to the reflective surface.
(4) Lower curve is based on a calculated worst case condition rather than the conventional -2σ limit.
(5) All parameters tested using pulse technique.
(6) Crosstalk is the photocurrent measured with current to the input diode and no reflecting surface.
(7) Measured using Eastman Kodak neutral white test card with 90% diffuse reflectance as a reflecting surface. Reference: Eastman Kodak, Catalog #1257795.

DESCRIPTION

OPB703W	No Lens
OPB704W	Blue Polysulfone Lens
OPB705W	Offset Lens

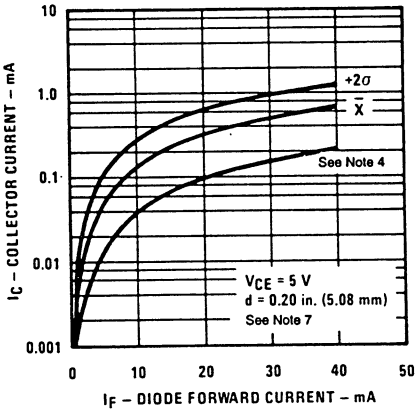
Types OPB703W, OPB704W, OPB705W

Electrical Characteristics (T_A = 25° C unless otherwise noted)

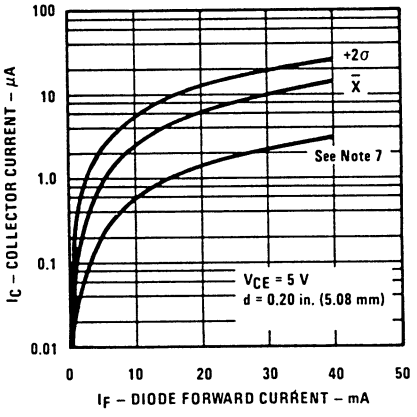
SYMBOL	PARAMETER		MIN	MAX	UNITS	TEST CONDITIONS
Input Diode						
V_F	Forward Voltage			1.70	V	I_F = 40 mA
I_R	Reverse Current			100	µA	V_R = 2.0 V
Output Phototransistor						
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage		30		V	I_{CE} = 100 µA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage		5.0		V	I_{EC} = 100 µA
I_{CEO}	Collector Dark Current			100	nA	V_{CE} = 10 V, I_F = 0, E_e = 0
Combined						
$I_{C(ON)}$	On-State Collector Current	OPB703W OPB704W OPB705W	200 200 100		µA µA µA	V_{CE} = 5 V, I_F = 40 mA, d = 0.15 in. (3.81 mm)(3)(7)
I_{CX}	Crosstalk	OPB703W OPB704W OPB705W		20 20 10	µA µA µA	V_{CE} = 5 V, I_F = 40 mA(6)

Typical Performance Curves

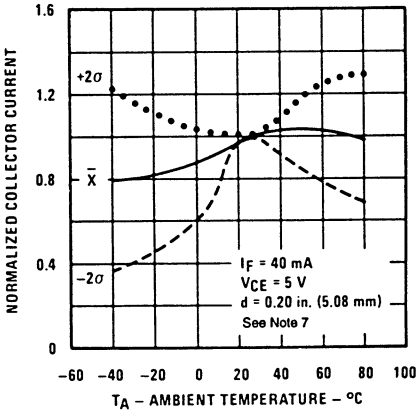
Reflective Surface Collector Current vs. Diode Forward Current



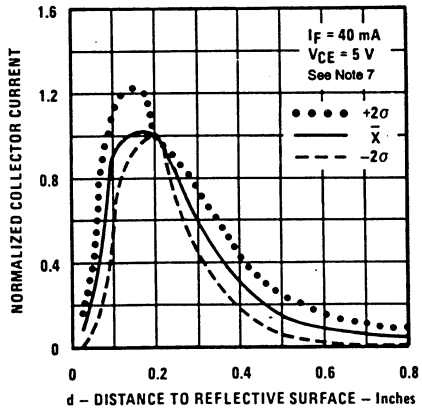
Diffused Surface Collector Current vs. Diode Forward Current



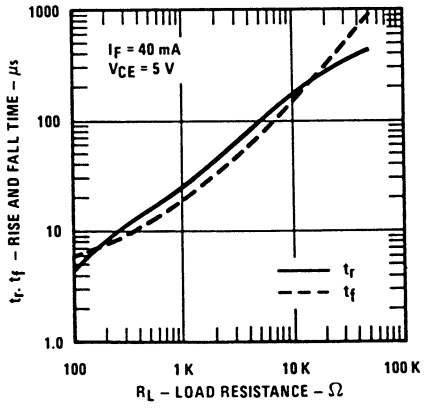
Normalized Collector Current vs. Ambient Temperature



Normalized Collector Current vs. Object Distance



Rise and Fall Time vs. Load Resistance



Test Condition