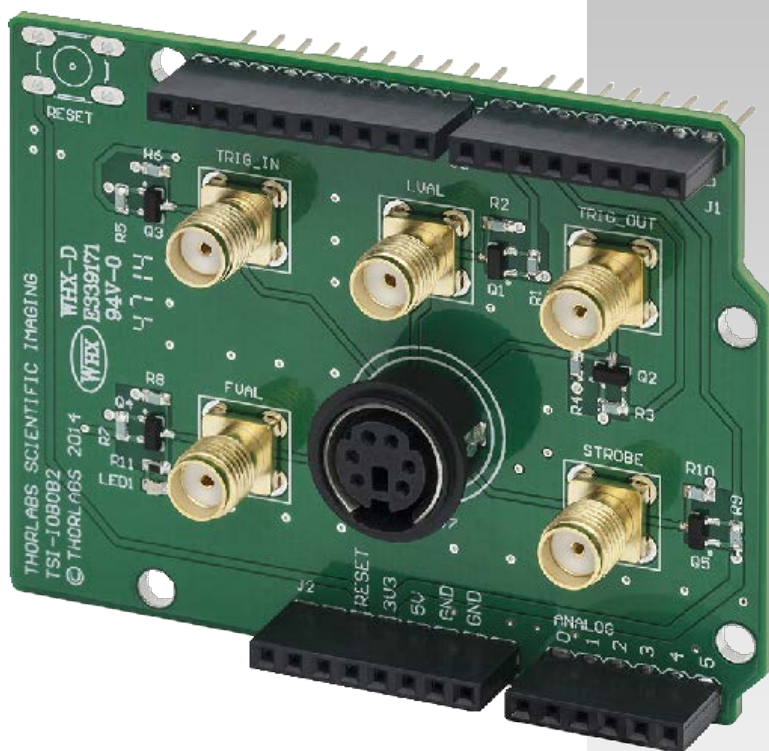


---

# THORLABS

## TSI-IOBOB2

### User Guide



# Table of Contents

<b>Chapter 1</b>	<b>Description .....</b>	<b>2</b>
<b>1.1.</b>	<b><i>Description .....</i></b>	<b>2</b>
<b>1.2.</b>	<b><i>General Usage .....</i></b>	<b>2</b>
1.2.1.	Arduino® based Shield Design .....	3
1.2.2.	Code Example #1 .....	5
1.2.3.	Code Example #2 .....	6
1.2.4.	Code Example #3 .....	8
1.2.5.	Schematic Diagram.....	10
<b>Chapter 2</b>	<b>Regulatory .....</b>	<b>11</b>
<b>2.1.</b>	<b><i>Waste Treatment is Your Own Responsibility.....</i></b>	<b>11</b>
<b>2.2.</b>	<b><i>Ecological Background .....</i></b>	<b>11</b>
<b>Chapter 3</b>	<b>Thorlabs Worldwide Contacts .....</b>	<b>12</b>

# Chapter 1 Description

## 1.1. Description

The Thorlabs' Scientific Imaging I/O Break-Out Board, TSI-IOBOB2, is a general purpose interface board designed primarily as a means of accessing the various I/O signals present in our series of Digital Video Cameras. However, it can just as easily be used to break-out signals from any device compatible with MD6 (mini din) and electrical SMA connections.

The camera-side connector is an industry standard 6-CKT Mini Din style female connector that is routed to five (5) standard SMA receptacles (and 5 Arduino® compatible shield pins), see Figure 1, with a common ground circuit being the sixth circuit. The Mini-Din connector is compatible with standard off-the-shelf 6-pin "mini-din" cables\* as well as any standard 6-pin Mini-Din male connector. When used with our line of Digital Video Cameras it is recommended that you use the appropriate I/O cable offered in our catalog and on our web page (<http://www.thorlabs.com>). Besides being directly compatible with our cameras, these custom cables include the ferrite cable core required for EMC compliance.

For our 1500 Series of cameras please use: **1500-CAB1**

For our 8050 Series and related cameras (340 and 4070) please use:  
**8050-CAB1**

Both of these cables are 10' (3m) long. If you need to extend this length further you can add an additional off-the-shelf extension cable\* in series. Thorlabs also offers a selection of mating SMA cables, in both SMA-SMA and SMA-BNC versions. Please look for the CA-28xx and CA-29xx product lines on our web page and catalog (i.e. CA-2848 for a 48" SMA-BNC cable).

\* L-com DK226MM-10, DK226MF-10, or equivalent

## 1.2. General Usage

The TSI-IOBOB2 was designed to allow users to trigger TSI cameras and monitor their resulting output signals in two different ways. The first way involves using the TSI-IOBOB2 like the TSI-IOBOB and simply connect the signals from the gold SMA connectors directly to an oscilloscope. The second way is to place the TSI-IOBOB2 shield on an Arduino® (or equivalent board) supporting the Arduino-Uno® Rev 3. form factor.

### 1.2.1. Arduino® based Shield Design

The TSI-IOBOB2 is designed around the Arduino-Uno® Rev 3 shield form factor and allows direct connection of the lines exposed in the TSI camera trigger line to the digital IO lines of the Arduino®. There are bi-directional logic level converters between the DIN/SMA connectors and the shield pins to prevent cameras with 5V signals from damaging Arduino® based boards expecting 3.3V logic. In addition, there is an LED connected to the FVAL signal on the SMA/DIN side of the circuit that glows during the camera frame read out period (FVAL). The Arduino® pins currently used in the shield are:

Camera Line	Arduino® Pin	SMA (V Typ)	Arduino® Pin (V Typ)
Trig In	D3 (Output)	5	3.3
Strobe	D4 (Input)	5	3.3
FVal	D5 (Input)	5	3.3
Trig Out	D6 (Input)	5	3.3
LVal	D7 (Input)	5	3.3

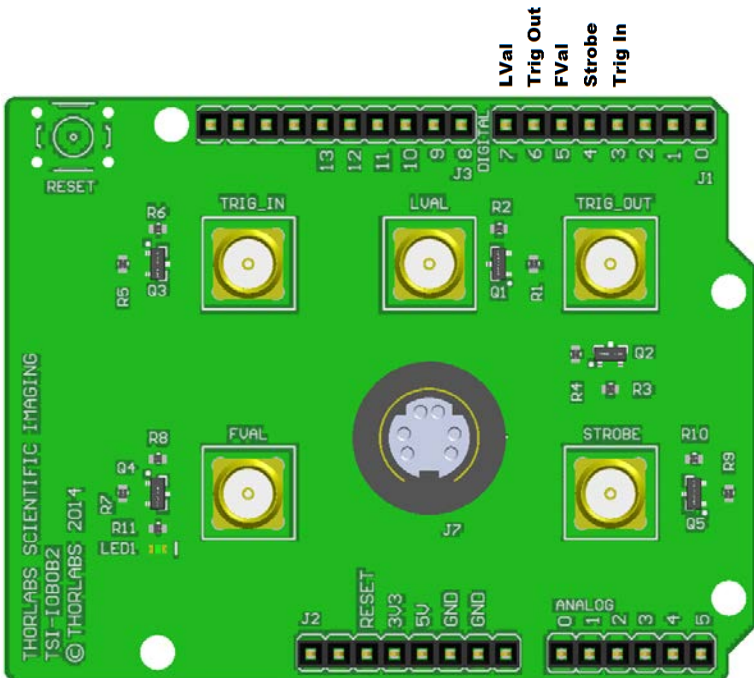
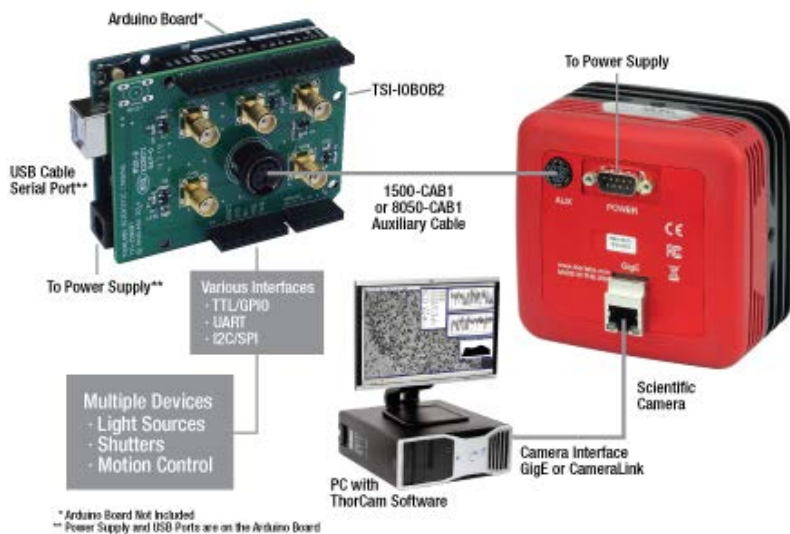


Figure 1 Signal Locations



**Figure 2 Sample Configuration with Camera, PC, and other Devices**

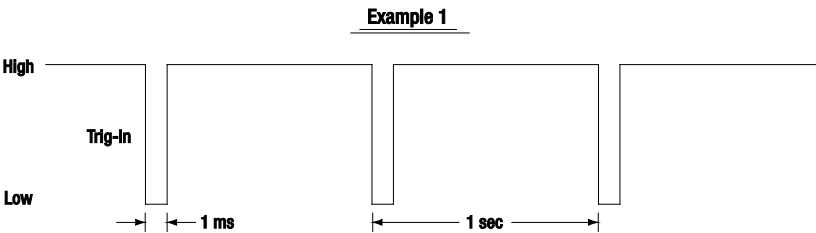
### 1.2.2. Code Example #1

The example below shows how to trigger the camera at a rate of 1 Hz.

```
int trigPin = 3;

void setup()
{
  //Set trigger pin (D3) to output
  pinMode(trigPin, OUTPUT);
  //Camera typically triggers on LOW
  digitalWrite(trigPin, HIGH);
}

void loop()
{
  //Trigger Camera every second
  digitalWrite(trigPin, LOW);
  //Slight delay to give camera time to react
  delay(1);
  //Set trigger line back to HIGH
  digitalWrite(trigPin, HIGH);
  //Delay next trigger
  delay(995);
}
```



**Figure 3** Timing Diagram of the Trig\_In Signal Sent to the Camera

### 1.2.3. Code Example #2

The example below show how to trigger a camera, wait until the camera is done reading out, then trigger the next frame. This allows triggered acquisition at the fastest possible rate.

```
int trigPin = 3;
int fvalPin = 5;
int prevFVal;
int currFVal;

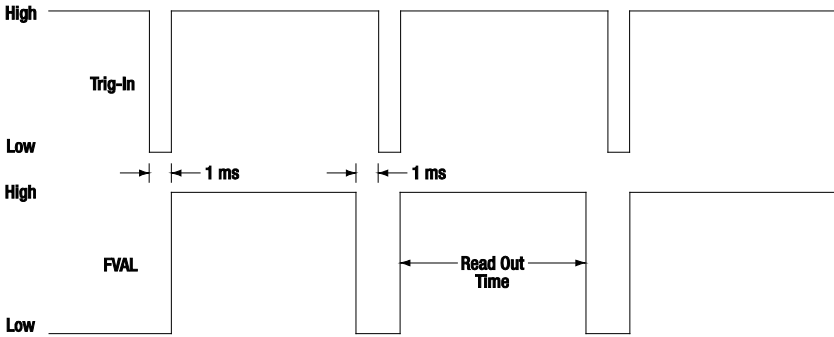
void setup()
{
  //Set trigger pin to output
  pinMode(trigPin, OUTPUT);
  //Set fval pin to input
  pinMode(fvalPin, INPUT);
  //Camera typically triggers on LOW
  digitalWrite(trigPin, HIGH);

  prevFVal = LOW;
}

void loop()
{
  //Trigger Camera
  digitalWrite(trigPin, LOW);
  //Slight delay to give camera time to react
  delay(1);
  //Set trigger line back to HIGH
  digitalWrite(trigPin, HIGH);

  //Wait until FVal falling edge to trigger next frame
  while(1)
  {
    currFVal = digitalRead(fvalPin);
    if(prevFVal == HIGH and currFVal == LOW)
    {
      //1ms delay gives the camera a chance to get ready
      //for the next trigger
      delay(1);
      break;
    }
    prevFVal = currFVal;
  }
}
```

Example 2



*Figure 4 Timing Diagram of the Trigger Signal Sent to the Camera and the FVAL signal measured by Arduino*



### 1.2.4. Code Example #3

The example below shows how to trigger and read values from the camera using the Arduino Uno registers for faster read/write times.

```
byte current,tmp;
byte readAllMask = B11111000;
byte trigMask = B00001000;
byte fvalMask = B00100000;
byte lvalMask = B10000000;
byte strobeMask = B00010000;
byte trigOutMask = B01000000;

void setup()
{
  DDRD = trigMask;//Set all but trigIn to inputs
  PORTD = trigMask;//Set the trigger to high
  current = PIND & readAllMask;//Read current values

  Serial.begin(115200);
}

void loop()
{
  //Trigger Camera
  PORTD = 0;//set trigger low;

  //Read current values
  current = PIND & readMask;

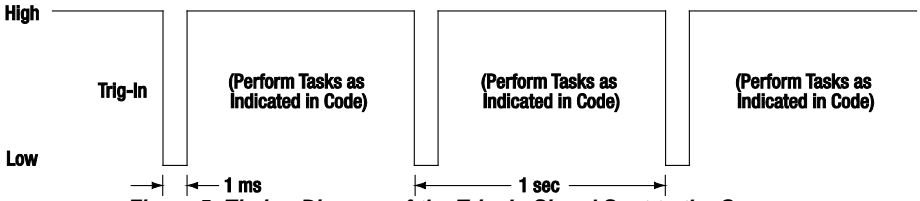
  //While some condition not met
  while(current != /*Add condition here*/)
  {
    //Set trigger line back to HIGH
    PORTD = trigMask;

    //Read current values
    current = PIND & readMask;

    //Add code to perform tasks in response to changes in camera
    signals
  }

  Serial.println("Triggering next image...");
  delay(1000);
}
```

**Example 3**



*Figure 5 Timing Diagram of the Trig\_In Signal Sent to the Camera*

### 1.2.5. Schematic Diagram

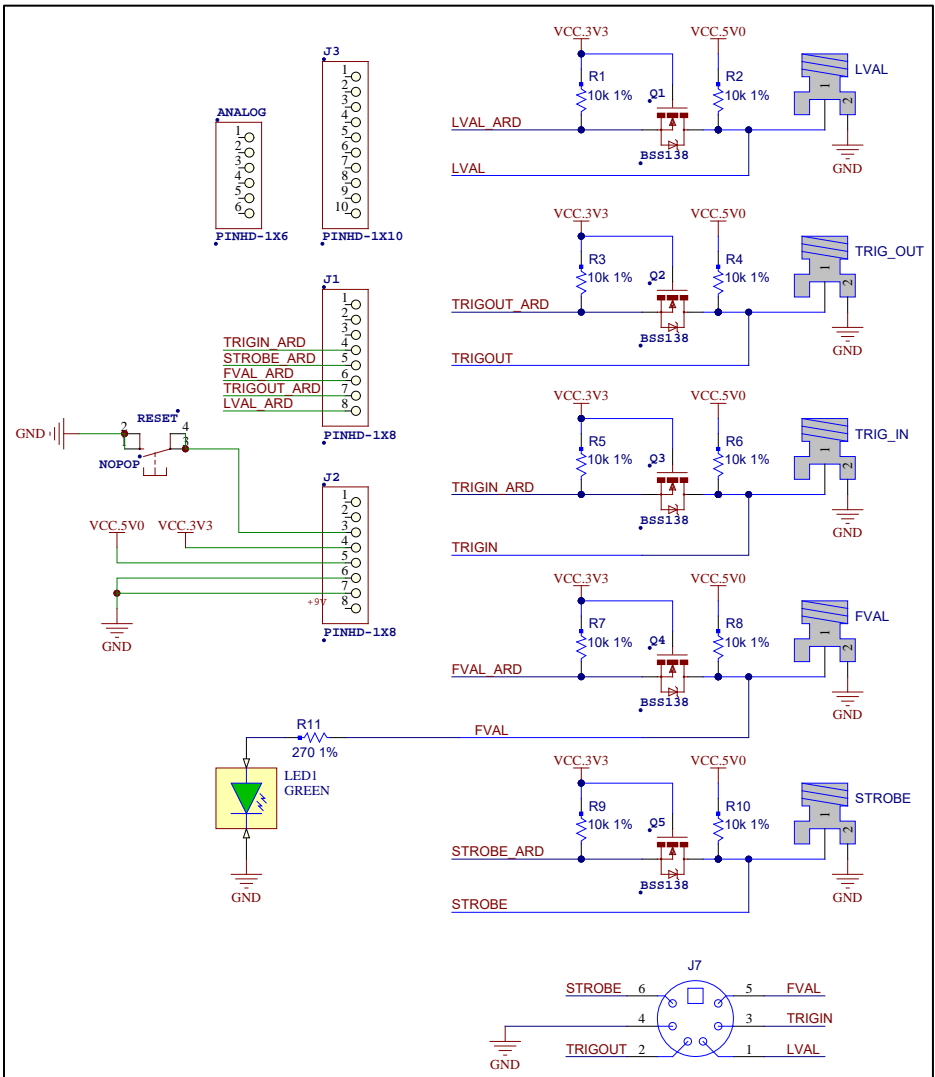


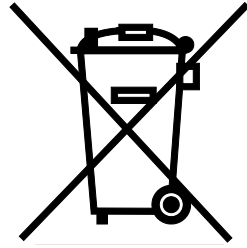
Figure 6 Schematic Diagram

Additional support documentation, including dimensional drawings and 3D models, is available at [www.thorlabs.com](http://www.thorlabs.com).

## Chapter 2 Regulatory

As required by the WEEE (Waste Electrical and Electronic Equipment Directive) of the European Community and the corresponding national laws, Thorlabs offers all end users in the EC the possibility to return “end of life” units without incurring disposal charges.

- This offer is valid for Thorlabs electrical and electronic equipment:
- Sold after August 13, 2005
- Marked correspondingly with the crossed out “wheelie bin” logo (see right)
- Sold to a company or institute within the EC
- Currently owned by a company or institute within the EC
- Still complete, not disassembled and not contaminated



**Wheelie Bin Logo**

As the WEEE directive applies to self contained operational electrical and electronic products, this end of life take back service does not refer to other Thorlabs products, such as:

- Pure OEM products, that means assemblies to be built into a unit by the user (e.g. OEM laser driver cards)
- Components
- Mechanics and optics
- Left over parts of units disassembled by the user (PCB’s, housings etc.).

If you wish to return a Thorlabs unit for waste recovery, please contact Thorlabs or your nearest dealer for further information.

### 2.1. Waste Treatment is Your Own Responsibility

If you do not return an “end of life” unit to Thorlabs, you must hand it to a company specialized in waste recovery. Do not dispose of the unit in a litter bin or at a public waste disposal site.

### 2.2. Ecological Background

It is well known that WEEE pollutes the environment by releasing toxic products during decomposition. The aim of the European RoHS directive is to reduce the content of toxic substances in electronic products in the future.

The intent of the WEEE directive is to enforce the recycling of WEEE. A controlled recycling of end of life products will thereby avoid negative impacts on the environment.

## Chapter 3 Thorlabs Worldwide Contacts

### USA, Canada, and South America

Thorlabs, Inc.  
56 Sparta Avenue  
Newton, NJ 07860  
USA  
Tel: 973-300-3000  
Fax: 973-300-3600  
www.thorlabs.com  
www.thorlabs.us (West Coast)  
Email: sales@thorlabs.com  
Support: techsupport@thorlabs.com

### UK and Ireland

Thorlabs Ltd.  
1 Saint Thomas Place  
Ely CB7 4EX  
Great Britain  
Tel: +44 (0) 1353-654440  
Fax: +44 (0) 1353-654444  
www.thorlabs.com  
Email: sales.uk@thorlabs.com  
Support: techsupport.uk@thorlabs.com

### Europe

Thorlabs GmbH  
Hans-Böckler-Str. 6  
85221 Dachau / Munich  
Germany  
Tel: +49-(0) 8131-5956-0  
Fax: +49-(0) 8131-5956-99  
www.thorlabs.de  
Email: europe@thorlabs.com

### Scandinavia

Thorlabs Sweden AB  
Mölnösvägen 3  
412 63 Göteborg  
Sweden  
Tel: +46-31-733-30-00  
Fax: +46-31-703-40-45  
www.thorlabs.com  
Email: scandinavia@thorlabs.com

### France

Thorlabs SAS  
109, rue des Côtes  
78600 Maisons-Laffitte  
France  
Tel: +33 (0) 970 444 844  
Fax: +33 (0) 825 744 800  
www.thorlabs.com  
Email: sales.fr@thorlabs.com

### Brazil

Thorlabs Vendas de Fotônicos Ltda.  
Rua Riachuelo, 171  
São Carlos, SP 13560-110  
Brazil  
Tel: +55-16-3413 7062  
Fax: +55-16-3413 7064  
[www.thorlabs.com](http://www.thorlabs.com)  
Email: brasil@thorlabs.com

### Japan

Thorlabs Japan, Inc.  
3-6-3, Kitamachi,  
Nerima-ku, Tokyo 179-0081  
Japan  
Tel: +81-3-6915-7701  
Fax: +81-3-6915-7716  
www.thorlabs.jp  
Email: sales@thorlabs.jp

### China

Thorlabs China  
Room A101, No. 100, Lane 2891  
South Qilianshan Road  
Putuo District  
Shanghai  
China  
Tel: +86 (0) 21-60561122  
Fax: +86 (0) 21-32513480  
www.thorlabschina.cn  
Email: chinasales@thorlabs.com

This page left intentionally blank



This page left intentionally blank





**THORLABS**

[www.thorlabs.com](http://www.thorlabs.com)

---