



# Vision

Turbine Flow Meters

## Flow Instrumentation

### Model BV2000

### PURPOSE

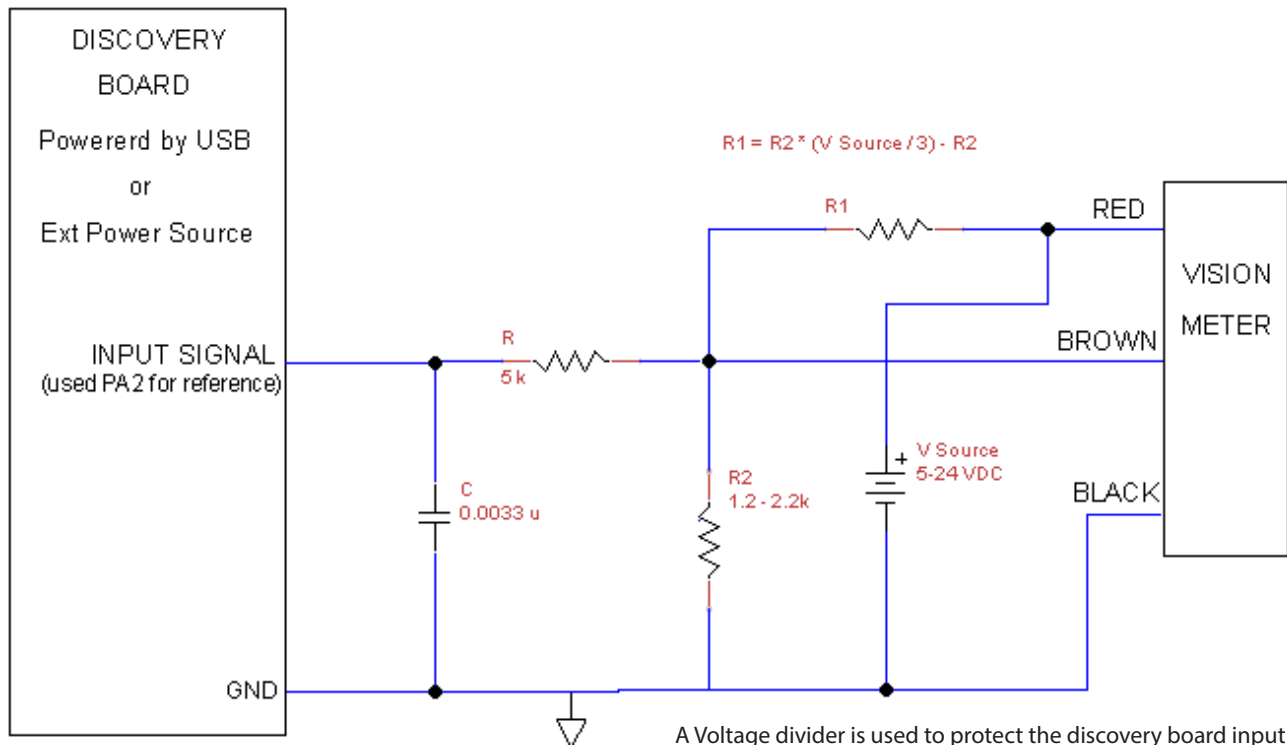
This document provides a reference design to incorporate the Vision BV2000 flow meter into an existing circuit. Customers have the option to include a microcontroller into the circuit that would be used to monitor and possibly display the rate of flow and total accumulated flow.

### HARDWARE DESIGN

For reference purposes, a development kit was used in this illustration. The development kit includes a discovery board with a microcontroller and many built-in peripherals including a 24 segment LCD display. For this design, the ST Microelectronics STM32L-Discovery board was used. The data sheet for the discovery board can be found at: [http://www.st.com/st-web-ui/static/active/en/resource/technical/document/data\\_brief/DM00027566.pdf](http://www.st.com/st-web-ui/static/active/en/resource/technical/document/data_brief/DM00027566.pdf)

There are many free firmware development Toolchain options available to develop on the STM discovery board.

The following is a circuit that could be used to interface the microcontroller into a circuit containing the meter.



A Voltage divider is used to protect the discovery board input pin from a voltage exceeding 5 Volts. Also, a low-pass filter is used to block out external noise that may be coming in on the data line (brown wire).



## Badger Meter

VIS-AS-00984-EN-01 (June 2014)

# Reference Design

## FIRMWARE DESIGN

The firmware in this example was developed using the Keil uVision5 compiler. The interface to the discovery board was over USB-A to mini USB-B cable using the ST-Link Debugger driver. The firmware was developed to execute the following functions:

- Display/Scroll Welcome message upon board power up
- Calculate and display the totalizer value
- Calculate and display the current flow
- Use the "USER" push button to advance screens
- Use the "RESET" push button to reset totalizer and flow and re-display the welcome message

A majority of the code was provided by ST-Microelectronics to run their discover project, which is standard to this version of discovery board. The code can be found on ST's website at <http://www.st.com/web/catalog/tools/PF250990>. This code is used to run the initialization and setup of the discovery board (LCD screen, memory, etc...), but can also be modified to set up an external interrupt driven by the rising and/or falling edges of the pulses generated by the Vision flow meter.

Some basic code snippets (in C/C++) to drive the totalizer count and flow calculation can be seen below:

### Updating the Totalizer:

```
void Update_Total(void) {  
    if (Flow % PPL == 0)  
        Totalizer++;  
}
```

**Flow** is the variable used to track the number of pulses generated by the meter.

**PPL** represents how many pulses there are to make one liter (given by data sheet of meter).

**Totalizer** is the variable used to store the value of the totalizer.

### Updating the Current Flow Rate:

```
void Update_Rate(void)  
{  
    if(prev_rate >= Flow)  
    {  
        Flow_Rate = 0;  
        return;  
    }  
    Flow_Rate = Flow - prev_rate;  
    prev_rate = Flow;  
}
```

**Prev\_rate** is the temporary value of the previous rate of flow.

**Flow\_Rate** is the current flow rate.

**Flow** is the variable representing pulses coming from the meter.

The code works in the following manner: if pulses are coming in from the meter, display the flow rate then wait for ~1 second. Store the flow rate as the previous flow rate, then check how many pulses are coming in and store as the Flow\_Rate. Display the difference between the current flow rate (Flow\_Rate) and the flow rate from 1 second earlier (prev\_rate). Repeat until pulses are no longer being collected at the input.

**INTENTIONAL BLANK PAGE**

## Control. Manage. Optimize.

Trademarks appearing in this document are the property of their respective entities. Due to continuous research, product improvements and enhancements, Badger Meter reserves the right to change product or system specifications without notice, except to the extent an outstanding contractual obligation exists. © 2014 Badger Meter, Inc. All rights reserved.

**[www.badgermeter.com](http://www.badgermeter.com)**

---

**The Americas | Badger Meter** | 4545 West Brown Deer Rd | PO Box 245036 | Milwaukee, WI 53224-9536 | 800-876-3837 | 414-355-0400  
**México | Badger Meter de las Americas, S.A. de C.V.** | Pedro Luis Ogazón N°32 | Esq. Angelina N°24 | Colonia Guadalupe Inn | CP 01050 | México, DF | México | +52-55-5662-0882  
**Europe, Middle East and Africa | Badger Meter Europa GmbH** | Nurtinger Str 76 | 72639 Neuffen | Germany | +49-7025-9208-0  
**Europe, Middle East Branch Office | Badger Meter Europe** | PO Box 341442 | Dubai Silicon Oasis, Head Quarter Building, Wing C, Office #C209 | Dubai / UAE | +971-4-371 2503  
**Czech Republic | Badger Meter Czech Republic s.r.o.** | Mařikova 2082/26 | 621 00 Brno, Czech Republic | +420-5-41420411  
**Slovakia | Badger Meter Slovakia s.r.o.** | Racianska 109/B | 831 02 Bratislava, Slovakia | +421-2-44 63 83 01  
**Asia Pacific | Badger Meter** | 80 Marine Parade Rd | 21-06 Parkway Parade | Singapore 449269 | +65-63464836  
**China | Badger Meter** | 7-1202 | 99 Hangzhong Road | Minhang District | Shanghai | China 201101 | +86-21-5763 5412

Legacy Document Number: N/A