



# Milli-Speed Switch

4-20 mA OUTPUT UNDERSPEED SENSOR



  
C US  
APPROVED  
Class II Div. 1

## INSTALLATION INSTRUCTIONS

# OPERATION MANUAL




Part No. MIL8001V4C

[www.go4b.com/usa](http://www.go4b.com/usa)



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 	 <b>WARNING</b>  Rotating parts can crush, cut and entangle.  Do NOT operate with guard removed.  Lockout power before removing guard or servicing.
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Dear 4B Customer:

Congratulations on your purchase. 4B appreciates your business and is pleased you have chosen our products to meet your needs.

Please read in its entirety and understand the literature accompanying the product before you place the product into service. Please read the safety precautions carefully before operating the product. With each product you purchase from 4B, there are some basic but important safety considerations you must follow to be sure your purchase is permitted to perform its design function and operate properly and safely, giving you many years of reliable service. Please read and understand the Customer Safety Responsibilities listed below. Failure to follow this safety directive and the Operation Manuals and other material furnished or referenced, may result in serious injury or death.

### ***SAFETY NOTICE TO OUR CUSTOMERS***

- A. In order to maximize efficiency and safety, selecting the right equipment for each operation is vital. The proper installation of the equipment, and regular maintenance and inspection is equally important in continuing the proper operation and safety of the product. The proper installation and maintenance of all our products is the responsibility of the user unless you have asked 4B to perform these tasks.
- B. All installation and wiring must be in accordance with Local and National Electrical Codes and other standards applicable to your industry. (Please see the article “Hazard Monitoring Equipment Selection, Installation and Maintenance” at [www.go4b.com](http://www.go4b.com).) The installation of the wiring should be undertaken by an experienced and qualified professional electrician. Failure to correctly wire any product and/or machinery can result in the product or machine failing to operate as intended, and can defeat its design function.
- C. Periodic inspection by a qualified person will help assure your 4B product is performing properly. 4B recommends a documented inspection at least annually and more frequently under high use conditions.
- D. Please see the last page of this manual for all warranty information regarding this product.

### ***CUSTOMER SAFETY RESPONSIBILITIES***

#### **1. READ ALL LITERATURE PROVIDED WITH YOUR PRODUCT**

Please read all user, instruction and safety manuals to ensure that you understand your product operation and are able to safely and effectively use this product.

#### **2. YOU BEST UNDERSTAND YOUR NEEDS**

Every customer and operation is unique, and only you best know the specific needs and capabilities of your operation. Please call the 24-hour hotline at 309-698-5611 for assistance with any questions about the performance of products purchased from 4B. 4B is happy to discuss product performance with you at any time.

### **3. SELECT A QUALIFIED AND COMPETENT INSTALLER**

Correct installation of the product is important for safety and performance. If you have not asked 4B to perform the installation of the unit on your behalf, it is critical for the safety of your operation and those who may perform work on your operation that you select a qualified and competent electrical installer to undertake the installation. The product must be installed properly to perform its designed functions. The installer should be qualified, trained, and competent to perform the installation in accordance with Local and National Electrical Codes, all relevant OSHA Regulations, as well as any of your own standards and preventive maintenance requirements, and other product installation information supplied with the product. You should be prepared to provide the installer with all necessary installation information to assist in the installation.

### **4. ESTABLISH AND FOLLOW A REGULAR MAINTENANCE AND INSPECTION SCHEDULE FOR YOUR 4B PRODUCTS**

You should develop a proper maintenance and inspection program to confirm that your system is in good working order at all times. You will be in the best position to determine the appropriate frequency for inspection. Many different factors known to the user will assist you in deciding the frequency of inspection. These factors may include but are not limited to weather conditions; construction work at the facility; hours of operation; animal or insect infestation; and the real-world experience of knowing how your employees perform their jobs. The personnel or person you select to install, operate, maintain, inspect or perform any work whatsoever, should be trained and qualified to perform these important functions. Complete and accurate records of the maintenance and inspection process should be created and retained by you at all times.

### **5. RETAIN AND REFER TO THE OPERATION MANUAL FOR 4B'S SUGGESTED MAINTENANCE AND INSPECTION RECOMMENDATIONS**

As all operations are different, please understand that your specific operation may require additional adjustments in the maintenance and inspection process essential to permit the monitoring device to perform its intended function. Retain the Operation Manual and other important maintenance and service documents provided by 4B and have them readily available for people servicing your 4B equipment. Should you have any questions, please call the free 24-hour hotline number (309-698-5611).

### **6. SERVICE REQUEST**

If you have questions or comments about the operation of your unit or require the unit to be serviced please contact the 4B location who supplied the product or send your request via fax (309-698-5615) or call us via our 24-hour hotline number in the USA (309-698-5611). Please have available product part numbers, serial numbers, and approximate date of installation. In order to assist you, after the product has been placed into service, complete the online product registration section which is accessed via our website [www.go4b.com/usa](http://www.go4b.com/usa).

## WARNING

- Rotating machinery can cause serious injury or death
- Always lockout and tagout the machine prior to installation

## PRODUCT OVERVIEW

The Milli-Speed Switch with 4-20 mA output is designed to detect belt slip, belt underspeed, stop motion, low speed or zero speed on bucket elevators, conveyors, air locks, mixers, fans, grinders and many other rotating machines. Totally sealed and simple to calibrate, the Milli-Speed works in the harshest of conditions.

An inductive sensing device located in the nose of the Milli-Speed enclosure will detect a metal target. This target can be an existing bolt head or device attached to a shaft, such as 4B's Whirligig® sensor mount.

The Milli-Speed is designed to operate over a speed range of 20 to 3,600 PPM (4-20 mA output). During installation, the Milli-Speed is set to the normal running RPM (100% = 17 mA output) by simple magnetic calibration. A 20 mA output signal occurs when speed is 123% higher than the calibrated normal running RPM. A 4 mA output signal is produced when speed falls below 10% of the calibrated speed.

## SPECIFICATIONS

Supply -	17 - 30 VDC
Load -	500 Ohm (typical)
Speed Range -	20 - 3,600 PPM (pulses per minute)
Sensing Range -	Ferrous target - 11/32" (9 mm) maximum Non-ferrous target - 7/32" (6 mm) maximum
Operating Temperature -	-13°F (-25°C) to 158°F (70°C)
Enclosure -	Nylon
Calibration -	Magnetic
Output Set Points - (Linear from 4-20 mA*)	1. Zero Speed 4 mA 2. Calibrated Speed 17 mA 3. Over Speed 20 mA
Output Accuracy -	+/- 0.2 mA
Response Time -	<1 second (typical)
Overall Resolution -	0.3% (22 microamps)
LED Indicator -	Blue LED indicates input pulses when a target is detected. Green LED acts as a calibration aid.
Cable -	6 ft. (2 m) - 2 conductor (loop powered)
Protection -	IP67 dust and water tight (fully encapsulated)
Approvals -	CSA Class II Division 1 Groups E, F and G (USA & Canada)

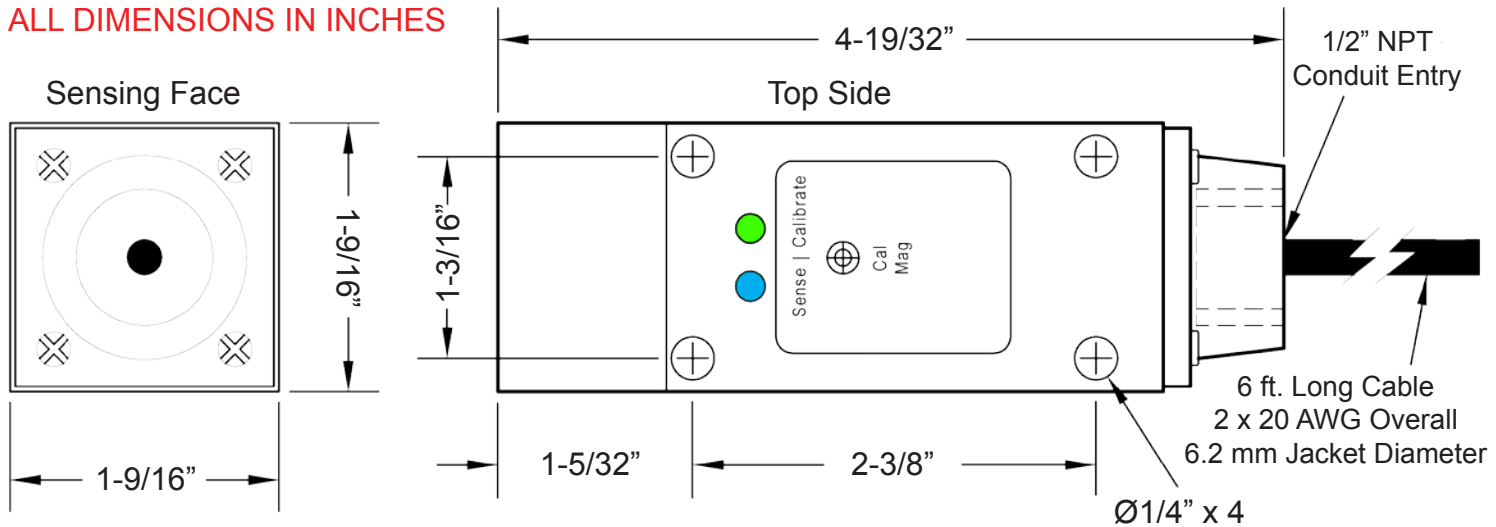
\* For more details on linear output, see page 9 - Sensor Output.

## NOTE

Zero speed is registered whenever the speed is less than 10%.  
Over speed is registered whenever the speed is more than 123%.

## DIMENSIONS

ALL DIMENSIONS IN INCHES



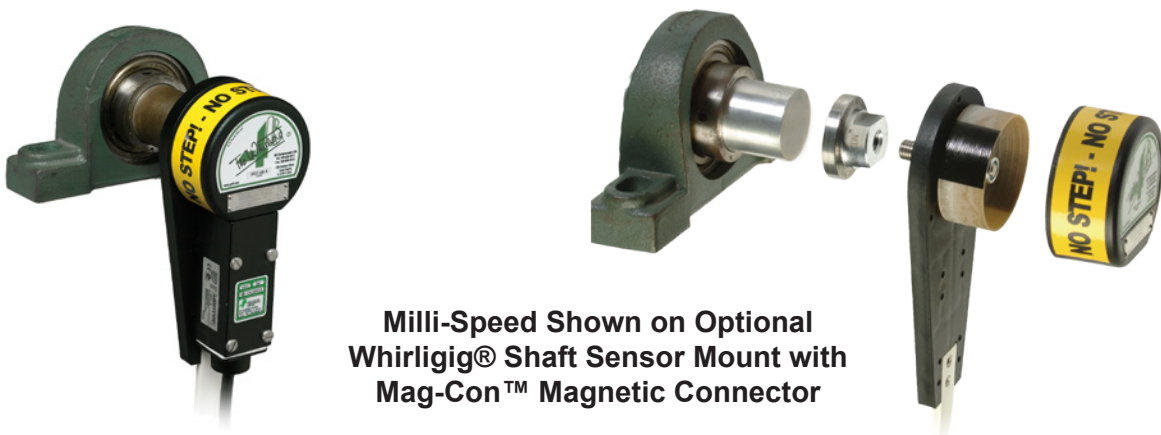
## INSTALLATION

The Milli-Speed should be wired as shown in the connections diagrams on page 8. The inductive sensing device, located in the front of the Milli-Speed enclosure is designed to detect a metal target on a shaft. The target can be a bolt head or similar. Ideally, the target should be a ferrous metal but non-ferrous metal will detect at a shorter range. Maximum range for a ferrous material is  $11/32$  inches (9 mm) and for non-ferrous metal is  $7/32$  inches (6 mm), assuming a  $3/4$  inch (19 mm) diameter target. Smaller targets may be used but operating distance will be reduced. The Milli-Speed should be mounted adjacent to the target, ensuring that the distance to the target does not exceed the stated maximum. Typical mounting methods are shown in figure 1 (page 8). When mounted against a solid steel shaft, the target or bolt head should protrude from the shaft about  $3/8$  inch (10 mm). Otherwise the sensor will not be able to distinguish the target from the shaft and the blue LED will stay on permanently (instead of flashing) and it would not be possible to calibrate the unit.

### ! WARNING

O.S.H.A. requires that all exposed rotating shafts are provided with a full guard. Therefore, this device and its target must be equipped with a guard.

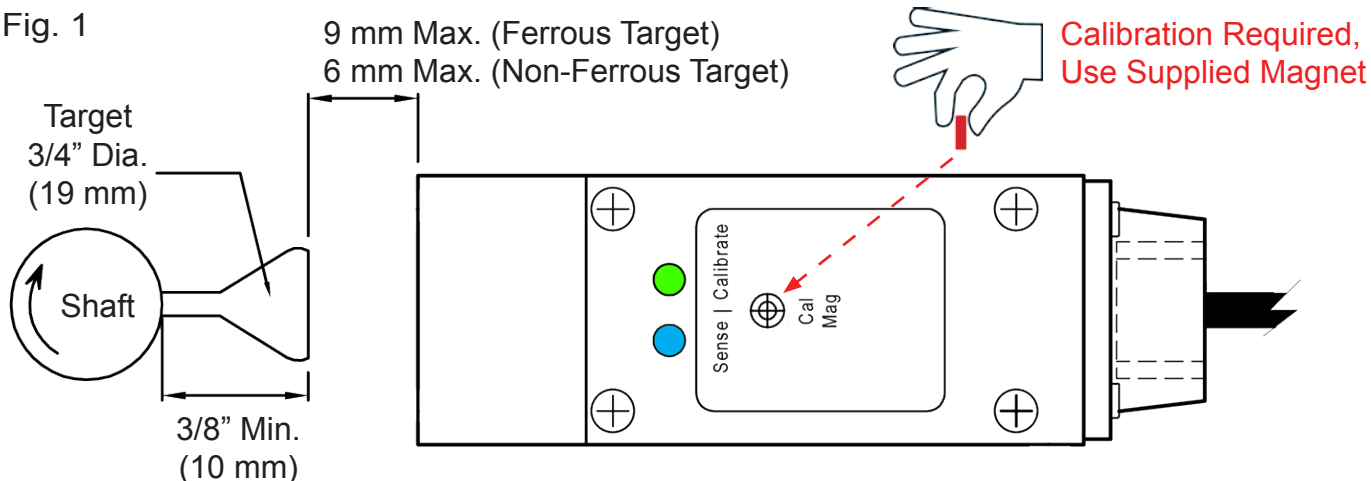
Fasten the Milli-Speed to a suitable mounting bracket, such as 4B's Whirligig® universal shaft sensor mount, with the nose of the switch within the sensing range of the target, as shown below -



**Milli-Speed Shown on Optional  
Whirligig® Shaft Sensor Mount with  
Mag-Con™ Magnetic Connector**



Fig. 1



## STANDARD WIRING DIAGRAM

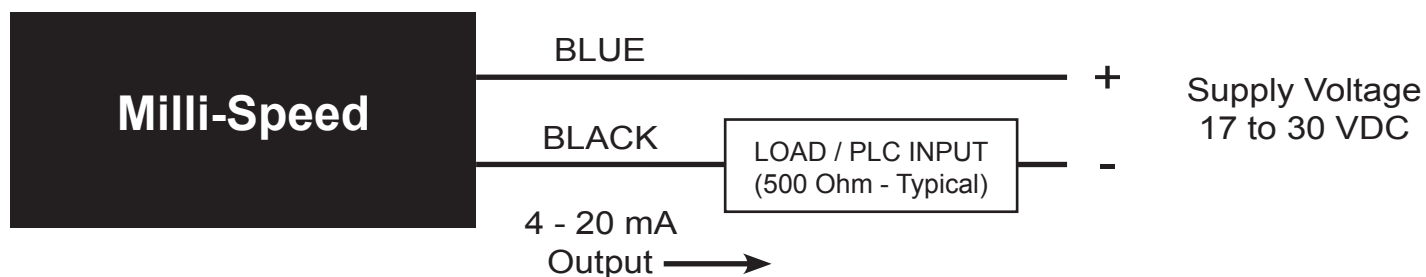
All wiring must be in accordance with local and national electrical codes and should be undertaken by an experienced and qualified electrician.

Always use dust/liquid tight flexible metal conduit with approved fittings to protect the sensor cables. Use rigid metal conduit to protect the cables from the sensors to the control unit. Conduit systems can channel water due to ingress and condensation directly to sensors and sensor connections which over time will adversely affect the performance of the system. As such, the installation of low point conduit drains is recommended for all sensors.

Wiring connections are shown in figure 2. Supply polarity to the Milli-Speed is not important and the load can be connected to either wire.

Cable length can be extended to virtually any distance required. The sensor is well protected against electrical interference, but if long cable runs are used in very noisy environments, the cabling should be segregated from any high current carrying conductors.

Fig. 2



## NOTE

Supply polarity to the Milli-Speed is not important and the load can be connected to either wire.



# SENSOR CALIBRATION

## INITIAL SENSOR CALIBRATION -

1. Check that the Milli-Speed is correctly installed (see standard wiring diagram).
2. Check that the distance between target, stud or bolt head and sensing face of unit is within the minimum distance specified.
3. With the belt tight and without introducing any product into the machine, start up machine. Allow machine time to attain normal running speed. The blue sense LED should be blinking, if not see fault table at the bottom of the page.
4. Place the magnet (supplied with unit) on "CAL Mag" point located on the top side of the sensor. Remove the magnet when the green "CALIBRATE" LED turns on.
5. Calibration will start when the magnet has been removed. When the calibration cycle is complete, the green LED will turn off and the current output will go to 17 mA.

CALIBRATE Point Symbol






## SENSOR OUTPUT

At the calibrated speed, the output will be set to 17 mA (100%). If the speed input increases to equal 123% of the calibrated speed, the output will be 20 mA and will not rise above this.

An input rate of less than 10% of the calibrated speed is treated as zero speed (4 mA). Once the speed reaches 10% of calibrated speed, the output will change from 0% (4 mA) to 10% (5.3 mA). The output will then continue linearly up to the maximum rate of 123% (20 mA).

## WARNING

In belt slip applications, the machinery must shutdown with no more than 20% belt slip to prevent damage to the belt. On a fixed motor speed application where the Milli-Speed is calibrated for normal running speed (100%), 80% of the calibrated speed is 14.4 mA.

 	<h3> WARNING</h3> <p>Rotating parts can crush, cut and entangle.</p> <p>Do NOT operate with guard removed.</p> <p>Lockout power before removing guard or servicing.</p>
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## TESTING AND COMMISSIONING

1. Check that the unit is correctly installed (see standard wiring diagram).
2. Check that the distance between the target, stud or bolt head and sensing face of Milli-Speed is within the minimum distance specified.
3. Start up machine, and allow it to reach normal running speed.
4. 4B's *SpeedMaster™* calibration and testing device can be used to accurately test the alarm and shutdown features of the Milli-Speed. A metal putty knife or a small piece of metal can be used to simulate a stop motion situation by placing the metal between the sensing face of the Milli-Speed and the target. After the initial start up delay, the machine should shutdown.

### ***SPEEDMASTER™***



Patents -  
US8947073  
MX321802  
EP26223568

The *SpeedMaster™* with Pulse Pilot is the only device that accurately tests the calibration of a speed switch, and allows testing of the alarm and shutdown features of the sensor while installed on the machine shaft.

The *SpeedMaster™* operates in two modes. Input mode is used to measure the pulse rate at normal speed. Output mode will allow the user to input pulses to the sensor for testing purposes.

The Pulse Pilot fits between the gap between the sensor and the target. The Pulse Pilot will have no effect on the operation of the speed switch until it is connected to the *SpeedMaster™* and set to "output" mode.

### **⚠ WARNING**

If the system does not immediately shutdown as expected or alarm as required, then remove the machine from service until the problem has been diagnosed and corrected.

## TROUBLESHOOTING GUIDE

FAULT	REMEDY
Blue LED does not illuminate	Check the power supply and verify it is the correct value. Slide a screwdriver blade across the face of the sensor, the input LED should flicker. If not, contact 4B.  If the input LED does flicker, move the front face of the sensor closer to the target and check the target size as specified under "INSTALLATION".
Blue LED Stays on Permanently	The sensor is too close to the target. Either increase the gap between the target and the shaft, or between the target and the sensor face.
Output Range (Scale) Incorrect	Sensor previously calibrated for another speed range used on a different piece of equipment. Recalibrate the sensor for the range of the new equipment.

# PRODUCT WARRANTY

## 1. EXCLUSIVE WRITTEN LIMITED WARRANTY

ALL PRODUCTS SOLD ARE WARRANTED BY THE COMPANY (4B COMPONENTS LIMITED, (4B) BRAIME ELEVATOR COMPONENTS LIMITED, AND (4B) S.E.T.E.M. Srl) HEREIN AFTER REFERRED TO AS 4B TO THE ORIGINAL PURCHASER AGAINST DEFECTS IN WORKMANSHIP OR MATERIALS UNDER NORMAL USE FOR ONE (1) YEAR AFTER DATE OF PURCHASE FROM 4B. ANY PRODUCT DETERMINED BY 4B AT ITS SOLE DISCRETION TO BE DEFECTIVE IN MATERIAL OR WORKMANSHIP AND RETURNED TO A 4B BRANCH OR AUTHORIZED SERVICE LOCATION, AS 4B DESIGNATES, SHIPPING COSTS PREPAID, WILL BE, AS THE EXCLUSIVE REMEDY, REPAIRED OR REPLACED AT 4B'S OPTION.

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## 3. NO WARRANTY "BY SAMPLE OR EXAMPLE"

ALTHOUGH 4B HAS USED REASONABLE EFFORTS TO ACCURATELY ILLUSTRATE AND DESCRIBE THE PRODUCTS IN ITS CATALOGS, LITERATURE, AND WEBSITES, SUCH ILLUSTRATIONS AND DESCRIPTIONS ARE FOR THE SOLE PURPOSE OF PRODUCT IDENTIFICATION AND DO NOT EXPRESS OR IMPLY A WARRANTY AFFIRMATION OF FACT, OF ANY KIND OR A WARRANTY OR AFFIRMATION OF FACT THAT THE PRODUCTS WILL CONFORM TO THEIR RESPECTIVE ILLUSTRATIONS OR DESCRIPTIONS. 4B EXPRESSLY DISCLAIMS ANY WARRANTY OR AFFIRMATION OF FACT, EXPRESSED OR IMPLIED, OTHER THAN AS SET FORTH IN THE EXCLUSIVE WRITTEN LIMITED WARRANTY STATEMENT ABOVE, INCLUDING, WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

## 4. LIMITATION OF DAMAGES

ANY LIABILITY FOR CONSEQUENTIAL, INCIDENTAL, SPECIAL, EXEMPLARY, OR PUNITIVE DAMAGES, OR FOR LOSS OF PROFIT WHETHER DIRECT OR INDIRECT, IS EXPRESSLY DISCLAIMED.

With subsidiaries in North America, Europe, Asia, Africa and Australia along with a worldwide network of distributors, 4B can provide practical solutions for all your applications no matter the location.



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