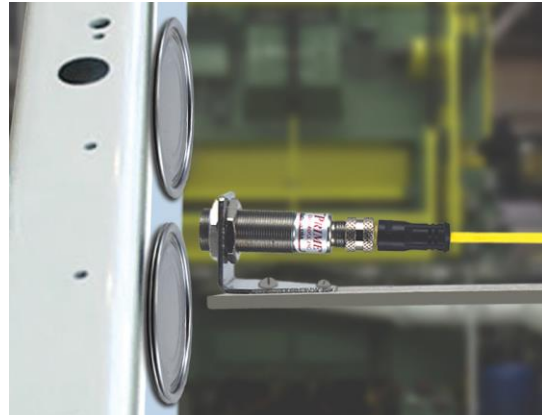


FLUXIMITY

OPERATING INSTRUCTIONS

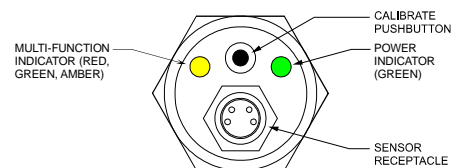
MODEL DS73 or DS74 DOUBLE SHEET CONTROLLER MODEL PN18 Sensor Probe

The **Fluximity** detector is a unique double metal detection system that utilizes an external magnet as the operating signal to measure metal thickness. A typical application is to use the magnetic field of a magnetic conveyor that transports metal blanks from process to process. In the absence of an existing magnetic source, a magnet can be positioned such that the blank interrupts the field between the magnet and Fluximity sensor located approximately 12mm away to monitor the strength.



CONTROLLER

There are four Fluximity controllers (DS71 –DS74). Only Models DS73 and DS74 Double Sheet Controllers are explained in this instruction sheet. The Fluximity system includes a microcontroller-based control module in an 18mm threaded aluminum housing. The Controller is connected to a PN18 magnetic detection sensor through an 8mm receptacle on the face of the Controller (see diagram). A five-pin 12mm connector at the rear end provides connections for power, ground, remote calibrate input, single output and no-double output. The Model **DS73** provides current **sourcing inputs and outputs** while the **DS74** provides current **sinking inputs and outputs**; otherwise, the two units are functionally identical. Status and setup controls on the face include a green power indicator, a multi-function/multi-color LED indicator and a pushbutton switch.



The DS73/DS74 requires 10 to 24 DC volts at 40mA for power. Model DS74 controllers require additional current equal to the anticipated output PnP load currents. The load current should not exceed 100mA.

SENSOR PROBE

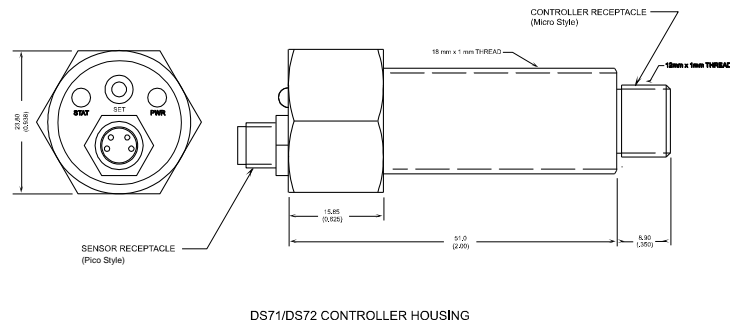
The Model PN18 operates with the DS73/DS74 controller. The PN18 probe is a passive receiver sensor. It requires an operating signal from an external magnetic source. Ferrous metal from .002 to .100" is detectable with the PN18, if the external magnetic field strength is sufficient to allow the probe to detect a difference in field strength between single and double metal blank conditions.

INSTALLATION

Installation of the individual components of the DS73/DS74 system is covered in the following paragraphs:

DS73/DS74 Control Module Installation

The DS73/DS74 Controller module is designed to mount with a simple bracket, where convenient, between the probe and a higher-level controller such as a PLC. Avoid mounting locations with excessive heat and vibration. The control and probe separation should not exceed the length of the Model CBL110-2 (2 meters) or CBL110-5 (5 meter) adapter cables. Any 18mm proximity probe mounting bracket can be used to install the controller such as Prime's model BR18SR 18mm right angle bracket. Mount the controller so the control face with the LED indicators and pushbutton are visible and accessible. To connect the DS73/DS74 into a control system, use Prime Model CBL113-2 two-meter cable/connector or CBL113-5 (5M).



Probe Installation

Mount the probe so that the metal passes between the probe face and the magnetic source (typically a magnetic conveyor). We recommend the initial probe gap to conveyor belt should be 12mm (.5") or less. **Do not** hard mount the probe bracket at this time. With no metal present the probe must detect at least 100 Gauss from the magnetic conveyor. It is wise to leave the mounting loose until a suitable gap is determined using the **Gap Setting Guide** below.

The Models DS73 and DS74 with the Model PN18 Single probe Double Sheet Detector can operate without the probe touching the target metal. It uses the residual magnetic field that attracts the metal to the conveyor. The magnet acts like a transmitter in a dual probe detector. The Magnetic field will permeate through the metal blank. The thickness of a non-metallic belt will not adversely affect the magnetic strength as long as the blank

is held closely to the belt surface. The unit must be calibrated after the gap is established. If the gap is too large, the unit will not calibrate. Use the **Gap Setting Guide** to determine the maximum gap.

We recommend you always locate the sensor to achieve maximum coverage of the target metal blank when calibrating. Calibration at a location where the maximum field is not blocked may cause false doubles. During operation the metal may move to a point where more flux is covered. This is especially true when the shape of the blank varies. Typically, the blank should cover the magnet to the PN18 for approximately 50 mm (2"). If the target is smaller than 50mm, then locate it where the maximum coverage is located using the meter mode. Calibrate at that position.

Electrical Wiring

The connection between the probe and the controller requires a Prime Controls adapter cable model CBL110-2 (2 meter) or CBL110-5 (5 meter). The CBL110 cables are not straight through pin-to-pin cables. Use only CBL110 cables when connecting the PN18 probe to the DS73/DS74 controller. The CBL110 cable has a connector at both ends and does not require external wiring. Probe and control separation should be within the 2 or 5 meter cable lengths.

Power to the controller, the remote calibrate input, and the outputs connect through an industrial standard male, five-pin, 12mm connector. Use Prime Controls specified Model CBL113-2 (2 meter), CBL113-5 (5 meter), or CBL113-10 (10 meter) cable.

The pin-out is as follows:

Pin 1 -	Power	Brown wire on standard cable
Pin 2 -	Single Output	White wire on standard cable
Pin 3 -	Common	Blue wire on standard cable
Pin 4 -	No-double Output	Black wire on standard cable
Pin 5 -	Calibrate Input	Gray wire on standard cable

Route the cables away from any high-power wiring and machinery to maintain noise immunity. Make sure the Pin 3 Common (blue) is uninterrupted to the common of the source power supply.

Operation

When power is applied, the green power LED indicator is continuously ON. This is the LED indicator that is clockwise from the pushbutton switch.

When initially powered up, the DS73/DS74 controller displays the firmware version number by flashing the **multi-function/multi-color** LED indicator, first **red** then **green** (See FIRMWARE VERSION later in this document on page 10). This is the indicator counterclockwise from the switch. The controller then checks for a valid probe. If a fault is detected, the multi-function indicator will flash red or amber at a rate of 10Hz until the fault is cleared. If no fault is detected the controller goes into normal sensing operation.

Normal indicator colors are covered on page 4. If the magnetic field signal is strong the multi-function indicator is off. The DS73/DS74 is capable of sensing three metal present conditions. They are *Nothing Present*, *Single Present* and *Double Present*. In order to detect all three conditions, the gap between the probe and magnet must be positioned within an appropriate sensing range. That window can be found in the **Gap Setting Guide**. To operate properly, the probe gap must be separated within this range. Follow the **Gap Setting Guide** setup procedure on the following page.

MULTI-COLOR INDICATOR and OUTPUT INTERPRETATION

As metal passes the sensor the LED multi-function indicator and the two outputs respond as shown in the chart below:

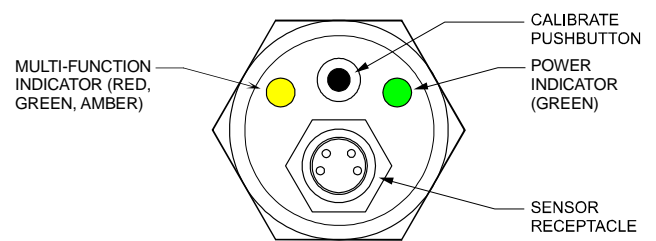
Probe Detects	Single Output	No-Double Output	LED
No Metal	OFF	ON	OFF
Single Thickness	ON	ON	Green
Double Thickness	OFF	OFF	Red

The DS73/DS74 controller constantly monitors the current draw of the attached probe. If the measured current goes out of specification for whatever reason, the multi-function indicator flashes red at a 10 Hz rate until the problem is corrected or the power is removed.

The output logic is designed for fail-safe operation. If the controller loses power or an output line is disconnected, the unit reports a double by default.

PUSHBUTTON OPERATION

A built-in calibrate pushbutton is located on the face of the DS73/DS74 controller. Optionally, the function of the calibrate pushbutton may be wired remotely through the main control cable at pin 5 of the 12mm connector. The built-in pushbutton and the externally wired input perform the same function within the DS73/DS74. The small pushbutton mounts flush with the face of the unit to ensure no inadvertent bumping can cause a calibration mistake. The calibration contact closure from either source is used to control the operational modes of the controller as follows:



1. From gauge mode, pressing and releasing once within 3 seconds, initiates calibration on a single thickness of metal.
2. From error mode, pressing the pushbutton once retries calibration.
3. From gauge mode, pressing the pushbutton twice within 0.7 seconds, initiates two-sample calibration mode and records the first point. A third tap records the second calibration point, installs the new calibration and exits calibration mode.

4. From gauge mode, pressing and holding the pushbutton for at least three seconds, initiates meter mode.
5. From meter mode, pressing the pushbutton once exits meter mode.

Gap Setting Guide

Ensure the DS7x controller is not powered.

Hold the probe face several inches from the conveyor surface and power up the DS71 controller. After displaying the firmware version code, the LED indicator on the controller rapidly flashes yellow.

Very slowly move the probe face toward the conveyor until the yellow indicator stops flashing. This marks the farthest distance the probe should be mounted from the conveyor.

Assemble mounting hardware to position the probe at the determined distance from the conveyor surface.

Reposition the probe one full turn of the mounting nuts closer to the conveyor and lock into place.

Power the DS71 controller down and back up. If the controller displays the yellow indicator flashing rapidly, adjust the probe another full turn of the nut closer to the conveyor surface. Repeat this step until the unit no longer displays the flashing yellow LED at startup

To deactivate the Meter Mode, press and release the pushbutton once. The multi-function indicator reverts to the setting from the previous calibration. If this is the first time these settings are from the factory and do not apply to your installation. Calibration for this installation should follow.

CALIBRATION

The DS73/DS74 Controller offers two modes of calibration, one-sample mode and two-sample mode. Both are invoked through the pushbutton on the face of the unit, or a remote pushbutton wired through connector pin 5.

One-sample mode sets the gauge threshold at 125% of the signal present at the time the pushbutton switch is pressed. The two-sample mode sets the gauge threshold halfway between the readings from the two-sample calibrations.

Calibration information is stored in non-volatile memory and is restored at power-up.

One-sample Calibration (*The **Nominal Signal Window** Has Been Located and Fixed*)

1. The **Nominal Signal Window** procedure, on page 5, has been performed and fixed.
2. Place a single thickness of the metal to be sensed on the magnetic conveyor in front of the probe face.
3. Press the calibration pushbutton once.

If successful, the multi-function LED indicator turns off momentarily, and then flashes amber 4 times in succession at a 5 Hz rate then turns solid green.

If calibration is not successful, the indicator flashes amber at a 10 Hz rate for 15 seconds or until the pushbutton is pressed again. The previous calibration values are re-installed if 15 seconds elapses with no press of the pushbutton.

The detector has a standby calibration feature that permits calibration while the metal is moving. Press the pushbutton once with no metal between the magnet field and probe. The indicator will flash amber at a 2.5 Hz rate until metal is moves in front of the probe. The controller will sense the effect the metal has on the magnetic field. It delays the measurement for half (.5) second to allow full coverage of the metal over the background magnetic field. If successful, the indicator flashes green 4 times and remains solid if metal remain present or off if no metal is present.

Two-sample calibration (*The **Nominal Signal Window** Has Been Located and Fixed*)

Two-sample calibration may be used to tightly set the gauge tolerances. Two-sample calibration places the gauge threshold at the midpoint between the two recorded conditions. Whereas the one-sample calibration always discriminates on a >25% change in signal relative to the sample point. The separation of sample points in the two-sample mode may be varied according to the user's needs.

When calibrating in two-sample mode, the order of sampling the thicker and thinner material makes no difference. The controller sorts out the order and sets the threshold the same either way.

The calibration procedure for Two Sample procedure follows:

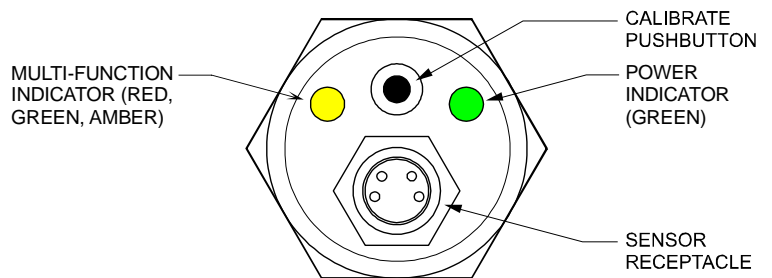
1. The **Nominal Signal Window** procedure, on page 5, has been performed and fixed.
2. Place the first material sample centered in front of the probe face.
3. Tap the pushbutton twice in succession within 1.0 second. The first sample is measured, and the indicator will flash amber at a 2.5 Hz rate for up to 25 seconds.
4. Within 25 seconds, place the second material sample centered in front of the probe face.

5. Tap the pushbutton once more. The second sample is measured, the new threshold installed, and the indicator flashes amber four times at a 5 Hz rate and then reverts to following the outputs.
6. If 25 seconds elapses before the press of the calibration pushbutton, the controller aborts calibration and re-installs the previous calibration values.
7. If the thickness of the two samples is too close for reliable gauging, the indicator flashes amber at a 10 Hz rate for up to 15 seconds or until the pushbutton is pressed again. After 15 seconds, it returns to the previous calibration settings.

METER MODE

The following is for general informational purposes. This mode of operation may be used for diagnosis and setup purposes. It may be used if desired, though the usefulness is highest when working with the guidance of a trained field service technician or installer.

The DS73/DS74 Controller provides a feature for determining the magnetic source strength detected by the sensor. Mount the sensor face pointing at the magnetic source (conveyor). The separation will depend on the strength of the background magnet. We suggest approximately 12mm to 24 mm (0.5 to 1 inch) to start. After power is applied activate the “meter” mode by pressing the calibration pushbutton switch for at least **three (3)** seconds. When the switch is released, the multi-function indicator begins flashing at a rate inversely proportional to the strength of the detected magnetic signal (Faster blink is farther from the magnet).



If the sensor is in a fault mode (blinking yellow LED) it must be cleared before the pushbutton will operate. To do so move the probe towards the magnet until the LED stops blinking. Once this happens the switch will operate normally.

Note: The pushbutton, as referred to in this text, can be the pushbutton on the face of the controller or a remote pushbutton connected to the remote calibrate input signal (connector pin 5).

The meter mode of operation has two elements. The first is the frequency of flashing. The LED will flash faster as the sensed magnetic field weakens up to some maximum which is still discernable as flashing. The LED flashing will slow as the field increases. The second element is that the LED will change color. This color change is dependent on the currently active calibration. The color will be **GREEN** when in the single sheet sensing range. When it is RED it is in the double detection range. When it is YELLOW it is in the no target sensing range. These color changes correspond to the current calibration points.

One of the following conditions will occur when in the meter mode:

<i>Weak or no magnetic field</i>	Flashing LED color is RED.
<i>Magnet field is acceptable</i>	Flashing LED color is GREEN.
<i>Magnetic field is too strong</i>	Flashing LED color is AMBER.

In order for the detector to work it must sense sufficient magnetic strength to penetrate (saturate) an inspected single metal blank and have additional magnetic flux for a double blank thickness to block the signal. The Fluximity detector operates best if the magnetic strength is >100 gauss. Gauss (G) is a unit of measurement for magnetic field strength or flux density.

For example: approx. 1 gauss from earth's magnetic north aligns a compass needle in its direction. When the flux is measured at 100G or greater the indicator will begin to flash **green** at a rate of approximately **1 Hz** or 1 flash per second. This indicates the signal is strong enough to detect double metal. For weak flux, under 100 Gauss, the indicator flashes **amber** slowly (<25 Hz) and **then red** as the magnetism is weaker. The **red** flashes rapidly or at maximum rate (**25 HZ**) if no flux is detected.

FIRMWARE VERSION

The format of the firmware version number is of the form 1.2, comprising a single digit integer part and a single digit fractional part. When first powered up, the controller displays the version number by flashing the integer digit value in red and the fractional digit value in green. To determine the version number, count the number of red flashes and then the number of green flashes immediately after power-up. For example, a single flash of red followed by a single flash of green indicates a version number of 1.1.

TROUBLESHOOTING HINTS

NORMAL: When power (10 to 24 volts DC) is applied, the POWER LED should be ON solidly green.

PROBLEM: If the POWER LED remains off with power applied, check the cable connections and the integrity of the cable.

PROBLEM: It is important to remember that when powering up the DS73/DS74, metal should not be present on the magnetic surface and in front of the probe face. The controller reads the probe signal at power-up to determine the minimum signal level of the probe.

The flash pattern and color of the multi-function LED on the DS73/DS74 can be helpful in the diagnosis of problems with your installation. Check the following:

Immediately After Power-up

1. **NORMAL:** The multicolor LED flashes red then green at a 2.5 Hz rate to indicate firmware version then turns off.
2. **PROBLEM:** The LED flashes green then red at a 2.5 Hz rate to indicate firmware version number and then begins flashing red rapidly (10 Hz). This can indicate a) there is metal present, b) the probe is disconnected, or c) the cable to the probe has an open, or d) the probe is faulty.

During One-Sample Calibration

1. **NORMAL:** The LED constantly flashes amber at a 2.5 Hz rate. This is normal if no metal is present in front of the probe face. It is in a standby mode waiting on metal.
2. **PROBLEM:** Persistence of the above pattern with metal present can indicate a) the metal is non-ferrous, b) the metal is too thin for the probe, or c) the probe is faulty.

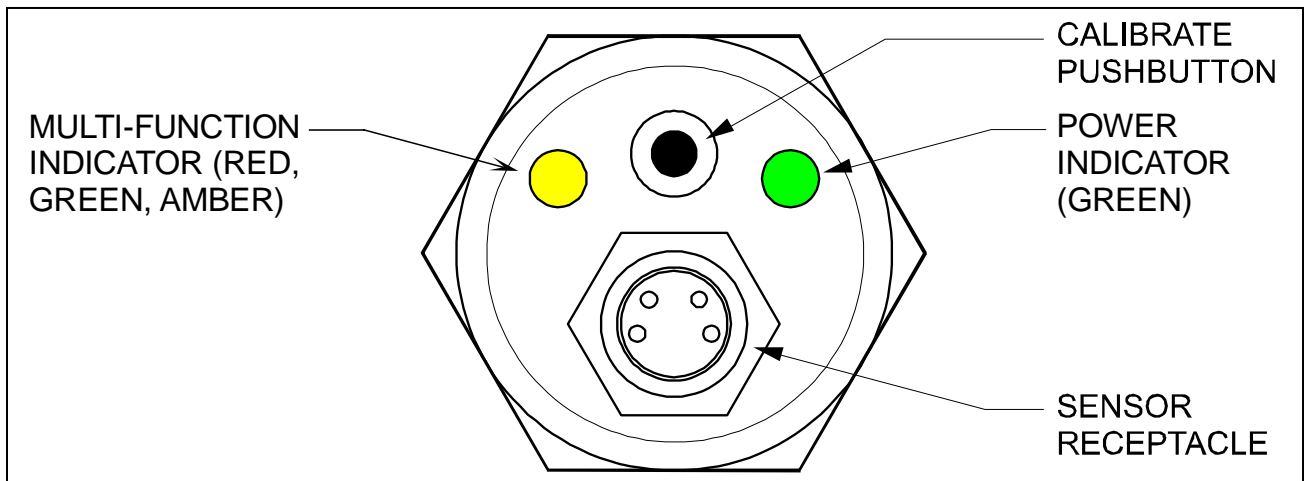
During Two-Sample Calibration

1. **NORMAL:** After the pushbutton switch is pressed twice in less than 0.7 seconds, the LED flashes amber at a 2.5 Hz rate. This is normal; the controller is waiting for the second thickness of metal to be placed against the probe and the pushbutton to be pressed once again.
2. **PROBLEM:** After the third press of the pushbutton (to record the second thickness), the LED flashes amber at a rapid (10 Hz) rate. This indicates the two samples were so close in thickness that the difference cannot be reliably discriminated.

While Gauging

1. **PROBLEM:** The LED flashes red rapidly (10 Hz). The probe is either faulty or disconnected. Check the cabling and probe.
2. The LED indicates the expected state of the outputs as follows:

LED State	Single Output (pin2)	No-Double Output (pin4)
OFF	OFF DS73 – low DS74 – high	ON DS73 high DS74 low
GREEN	ON DS73 – high DS74 – low	ON DS73 – high DS74 – low
RED	OFF DS73 – low DS74 – high	OFF DS73 – low DS74 – high



SPECIFICATIONS

Power

Type:	DC
V+ Connection:	12 mm Connector, Pin 1
Common	12 mm Connector, Pin 3
Voltage:	10 to 24 volts
DS73 Max Current:	40 milliamps + output loads
DS74 Max Current:	40 milliamps
Protection:	Reverse polarity protected. Transient Voltage Suppress @ 30 Volts

Logic Input Electrical Specifications

DS73 Remote Calibrate Input

Connection:	12 mm Connector, Pin 5
Active Level:	High
Input Impedance:	10K to Ground
Switching Threshold:	Nominally 6.6 volts
ESD protection:	Transient Voltage Suppressor @ 30 volts

DS74 Remote Calibrate Input

Connection:	12 mm Connector, Pin 5
Active Level:	Low
Pullup:	10K to V+ - 1 diode junction voltage
Switching Threshold:	Guaranteed low: 1 volt or less Guaranteed high: 4.5 volts or more
ESD protection:	Transient Voltage Suppressor @ 30 volts

Logic Output Electrical Specifications

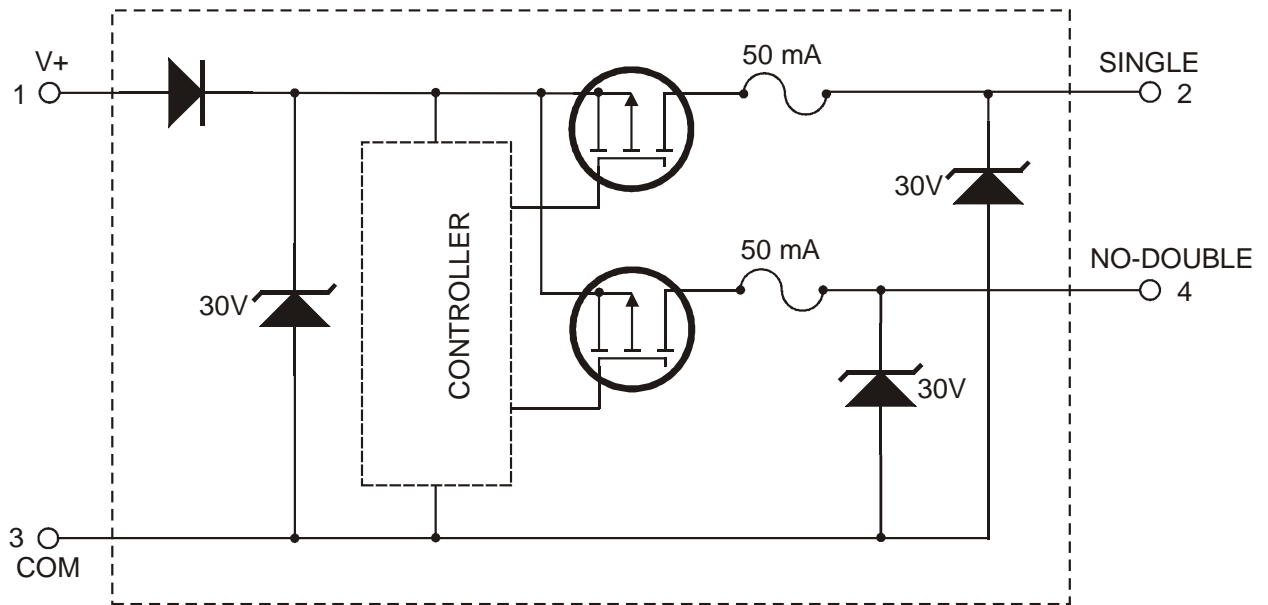
DS73 Sourcing Outputs

Connection:	12 mm Connector, Pin 4
Max. source current:	50mA, fuse limited
Output Voltage High:	Supply Voltage less 1 volt
Over-current protection:	Self-resetting thermal fuse
ESD protection:	Transient Voltage Suppressor @ 30 Volts

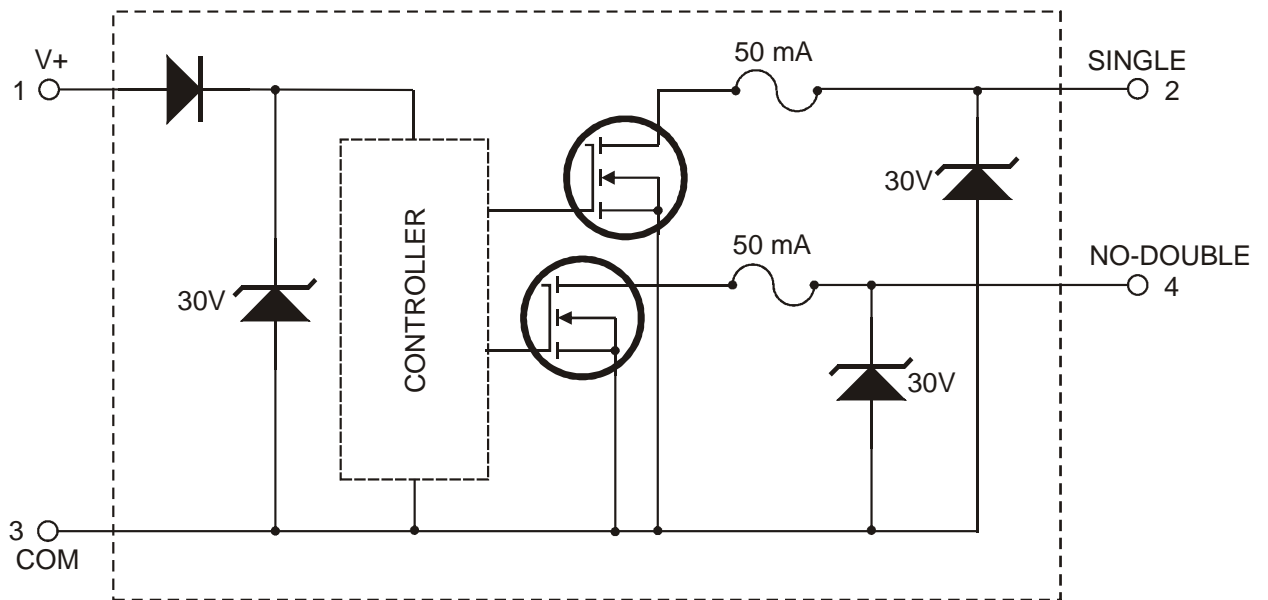
DS74 Sinking Outputs

Open Drain	
Connection:	12 mm Connector, Pin 2
Max. applied voltage:	30 Volts, TVS limited
Max. current, momentary:	40 Amps
Max. current, sustained:	50mA, fuse limited
Max. off state leakage @ 30 V:	25uA
Over-current protection:	Self-resetting thermal fuse.
ESD protection:	Transient Voltage Suppressor @ 30 Volts

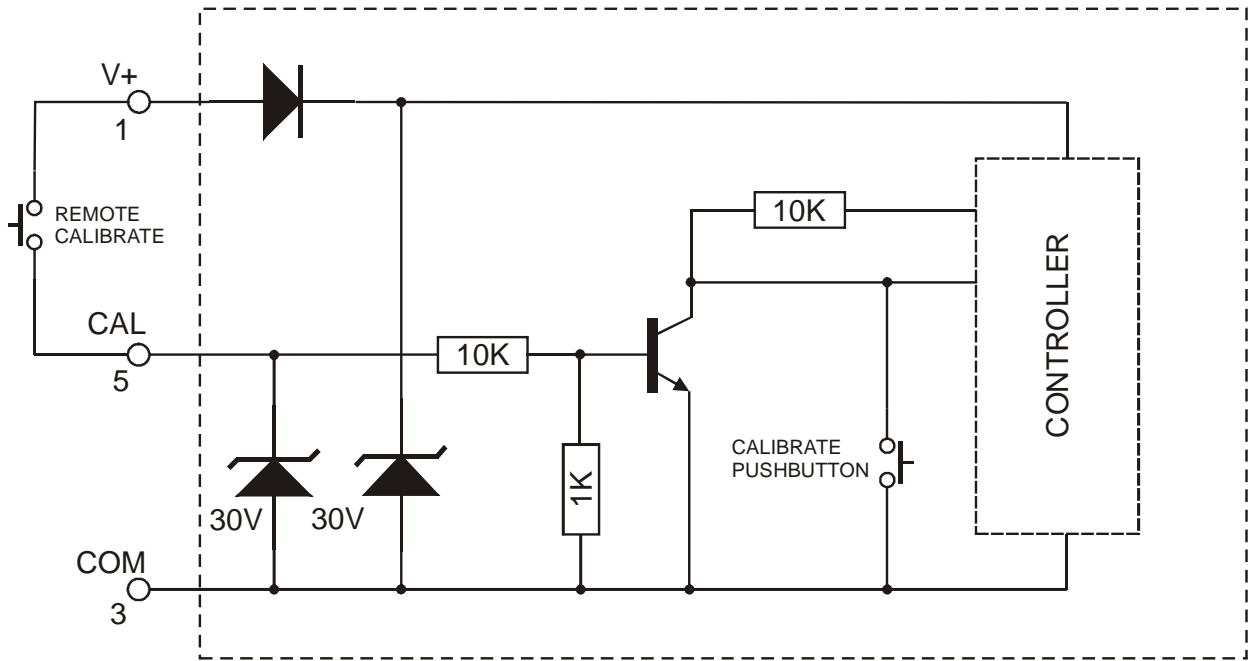
DS73 DRIVE CIRCUITRY



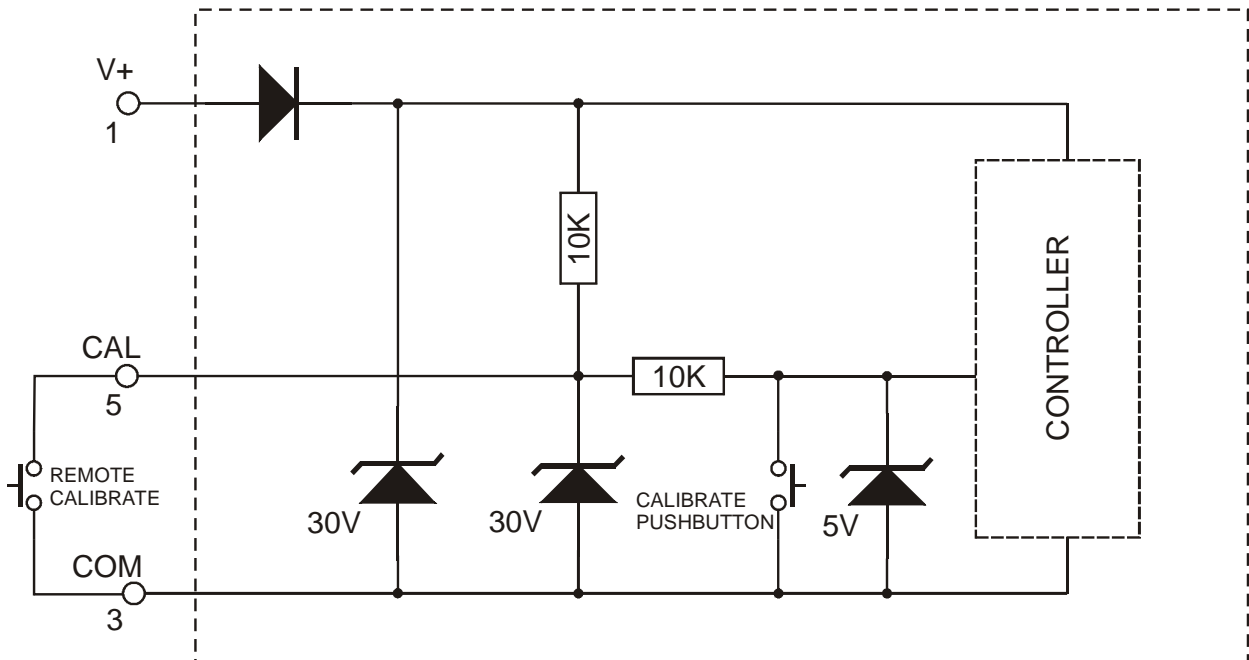
DS74 DRIVE CIRCUITRY



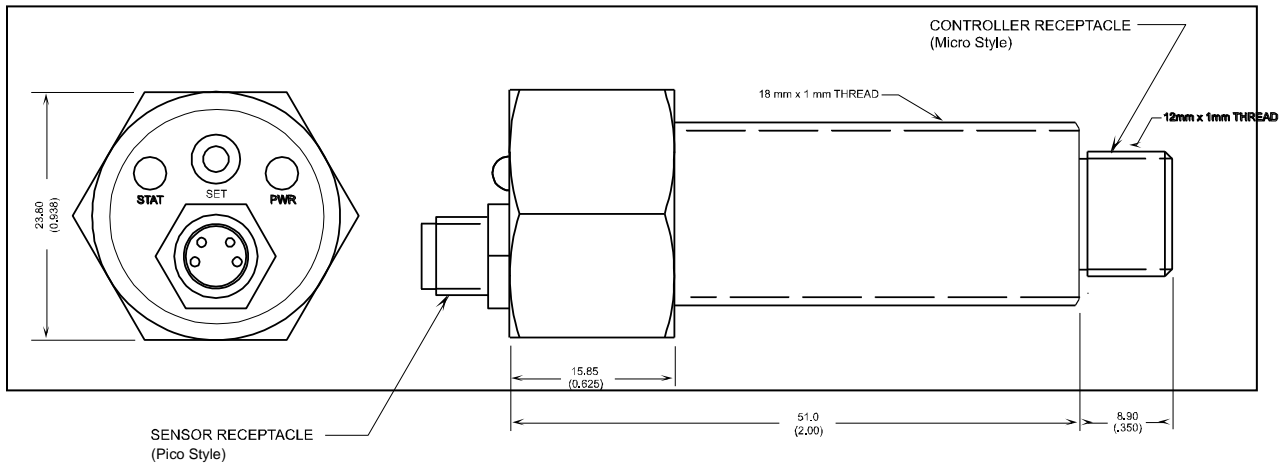
DS73 REMOTE CALIBRATE INPUT CIRCUITRY



DS74 REMOTE CALIBRATE INPUT CIRCUITRY



CONTROLLER DIMENSIONS



DS71/DS72 CONTROLLER HOUSING

LIMITATION AND EXCLUSION OF WARRANTIES

All goods purchased from PRIME CONTROLS, INC. shall be free from defects in materials, design and workmanship under normal conditions of use for one year from the date of shipment. THIS WARRANTY IS THE SOLE WARRANTY AND IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED, WARRANTY OF MERCHANTABILITY OF FITNESS FOR A PARTICULAR PURPOSE. THE LIABILITY OF PRIME CONTROLS TO ANY PURCHASER SHALL BE LIMITED EXCLUSIVELY TO THE COST OF REPLACEMENT OR REPAIR OF DEFECTIVE PARTS, AND SHALL NOT INCLUDE LIABILITY FOR ANY DIRECT, CONSEQUENTIAL OR INCIDENTAL DAMAGES WHATSOEVER, WHETHER FORESEEN OR UNFORESEEN, INCLUDING BUT NOT LIMITED TO LOST PROFITS, LOST SALES, OR INJURY TO PERSONS OR PROPERTY