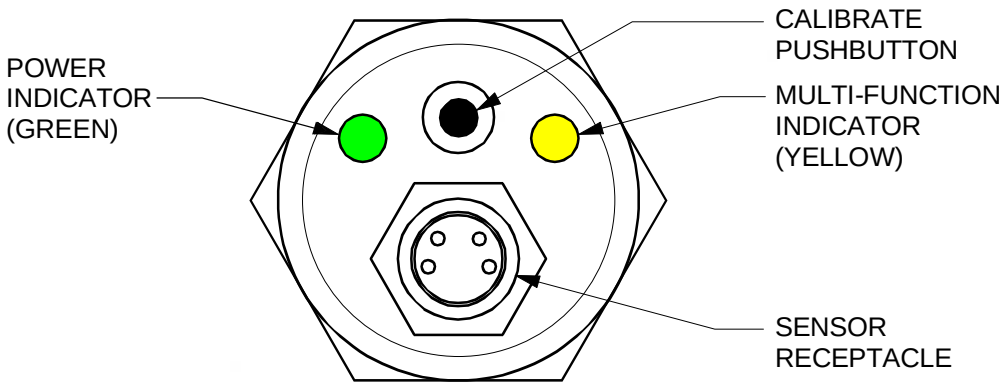
# OPERATING INSTRUCTIONS

PRIME® CONTROLS, INC.
METAL SENSING SOLUTIONS

## MODEL **DS60** DOUBLE SHEET CONTROLLER




The Prime Controls Model DS60 Double Sheet Controller comprises a microcontroller based control module in an 18 mm threaded aluminum housing that can be connected to a family of permanent magnet sensors through a 12 mm receptacle at the face end. A four-pin connector at the rear end provides connections for power, ground, sourcing output, and sinking output. Status and setup controls on the face include a green power indicator, a yellow multi-function indicator and a pushbutton switch.

The DS60 requires a dc power source in the voltage range of 12 to 24 volts at 100 mA. The pin-out is as follows:

| | | | |
|---|---|---|---|
| Pin 1 | - | Power | Brown wire on standard cable |
| Pin 2 | - | Sinking Output | White wire on standard cable |
| Pin 3 | - | Common | Blue wire on standard cable |
| Pin 4 | - | Sourcing Output | Black wire on standard cable |

When power is applied, the green indicator is solidly ON.

During normal sensing operation, the yellow indicator tracks the state of the sinking and sourcing outputs. When the indicator is ON, the sinking output is low (sinking current) and the sourcing output is high (sourcing current). In meter mode, the yellow indicator flashes at a rate proportional to the strength of the signal from the attached sensor. During calibration, the yellow indicator flashes at various rates to indicate the status of the process as described later in this document.

The small calibrate pushbutton mounts flush with the face of the unit to insure no inadvertent activations that can cause loss of calibration.

September 3,2003

## PROBES

The DS60 operates with a several different Prime magnetic probes including Models PM4, PM10, and PM15. All probes are potted and completely sealed. The probes do not respond to small amounts of fine metal filings, oil or dirt.

| Probe Model | Min thickness | Max thickness | Probe Diameter |
|---|---|---|---|
| PM4 | .04 mm (.0015”) | .40 mm (.015”) | 18 mm (0.70”) |
| PM10 | .10 mm (.004”) | 1.0 mm (.040”) | 30 mm (1.18”) |
| PM15 | .15 mm (.006”) | 1.5 mm (.060”) | 36 mm (1.42”) |

## INSTALLATION

Installation of the individual components of the DS 60 system is covered in the following paragraphs:

### DS60 Control Module

The control 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.

### Probes

The probe must be mounted so that the sheet is in contact with the probe face as it passes. The face of the probe is made of magnetic material and will last for many years of operation.

The Model DS60 Double Sheet Detector can operate with no contact between the sheet material and the probe if the gap is kept very small and is held constant. A constant gap is very important since a small change in gap causes significant change in the sensor signal. If the system is to be operated with a gap between the probe and the sheet material, the unit must be calibrated after the gap is established. If the gap is too large, the unit will not calibrate.

### Electrical Wiring

The connection between the probe and the DS60 Controller requires a Prime Controls adapter cable model CBL110-X where X indicates length.

Power to the controller and the outputs from the controller connect through an industry standard male, four-pin “Micro” style connector. For this connection use Prime Controls cable CBL104-3.

## METER MODE

The DS60 Controller provides a feature for monitoring the sensitivity to the sheet(s). To invoke “meter” mode, press and hold the pushbutton switch for three or more seconds. When the switch is released, the yellow indicator begins flashing at a rate proportional to the strength of the sensor signal. For minimum or no signal, the flash rate is approximately 1 Hz. For maximum signal, the flash rate is approximately 25 Hz.

Press and release the pushbutton to exit meter mode. The yellow indicator reverts to following the outputs.

The gauging function of the controller remains active during meter mode. As the sensor signal moves above and below the calibration threshold, the outputs switch accordingly, independent of the state of the yellow indicator.

## YELLOW INDICATOR INTERPRETATION

The yellow indicator provides information about the state of the controller. During normal gauging, the state of the yellow indicator follows the outputs directly. When the outputs are ON (sourcing output high, sinking output low), the yellow indicator is ON, and vice versa.

In meter mode, the yellow indicator flashes at a rate proportional to the strength of the signal from the attached sensor. For minimum or no signal, the flash rate is approximately 1 Hz. For maximum signal, the flash rate is approximately 25 Hz.

During one-sample calibration, the yellow indicator turns off momentarily, and then if calibration is successful, the indicator flashes 4 times in succession at a 5 Hz rate then reverts to following the state of the outputs. If calibration is not successful (the sensor signal is too weak), the yellow indicator flashes at a 10 Hz rate for 15 seconds or until the pushbutton is pressed again. If 15 seconds elapse with no repress, the indicator reverts to tracking the outputs.

When two-sample calibration is invoked, the yellow indicator begins flashing indefinitely at a 2.5 Hz rate until the pushbutton is pressed for recording of the second calibration point. After the pushbutton is pressed for recording the second point, the indicator flashes 4 times in succession at a 5 Hz rate then reverts to following the state of the outputs.

## PUSHBUTTON OPERATION

The calibration pushbutton allows control of the operational mode of the DS60 controller as follows:

1. From gauge mode, tap and release within 0.7 seconds, calibrates on current conditions or bad calibration, enters error reporting mode.
2. From error mode, tap the pushbutton once to retry calibration.
3. From gauge mode, tap the pushbutton twice within 0.7 seconds, enters 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, hold the pushbutton in for at least three seconds, the controller enters meter mode.
5. From meter mode, tap the pushbutton once to exit meter mode.

## CALIBRATION

The DS60 Controller offers two modes of calibration or “teach”, a one-sample mode and a two-sample mode. Both are invoked through the pushbutton on the face of the unit.

The one-sample mode simply sets the gauge threshold at 125% of the signal present at the time the pushbutton switch is pressed.

The latest calibration information is always stored in non-volatile memory and is restored at power-up.

### One-sample Calibration

1. Mount the sensor and place the material to be sensed against the face of the probe.
2. Tap the calibration pushbutton.

If the calibration is successful, the yellow indicator flashes 4 times at a 5 Hz rate and then reverts to following the output. If calibration is successful, the new calibration value is stored in non-volatile memory. The outputs turn ON for double and OFF for single.

If the sensor signal is too weak or too strong, the calibration will fail. The controller indicates the failure by flashing the yellow indicator at a 10 Hz rate for 15 seconds or until the pushbutton is pressed again. If the pushbutton is not pressed within 15 seconds, the controller aborts calibration and re-installs the previous calibration parameters.

**Two-sample calibration**

Two-sample calibration may be used for two purposes: for looser or tighter control of the positioning of the gauge threshold and and/or to reverse the operational logic of the outputs. Two-sample calibration places the gauge threshold at the midpoint between the two recorded samples. Whereas the single-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 vary according to the user's needs.

Inverting the gauge logic works as follows:

Outputs ON with Thinner Material or Single

1. Place the thicker material or double sample against the probe face.
2. Tap the pushbutton twice in succession within 0.7 seconds. The first sample is taken and the yellow indicator begins flashing indefinitely at a 2.5 Hz rate.
3. Place the thinner material or single sample against the probe face.
4. Tap the pushbutton once. The second sample is taken, the new threshold installed, and the yellow indicator flashes four times at a 5 Hz rate and then reverts to following the outputs.

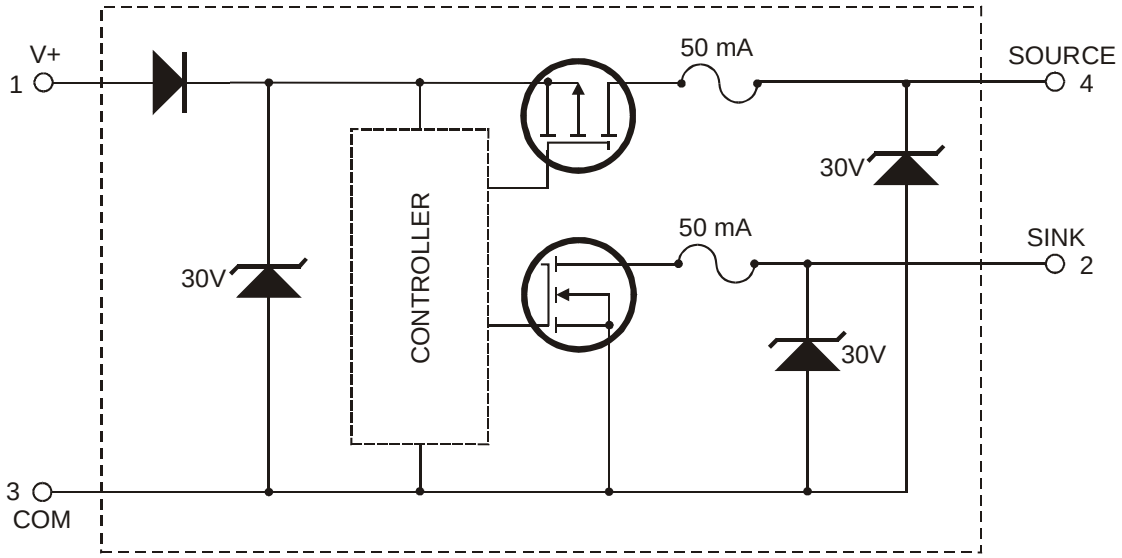
After this calibration, the outputs turn ON for a single and OFF for a double. Note that for double detection this mode reports a double when power is lost to the sensor.

Outputs ON with Thicker Material or Double

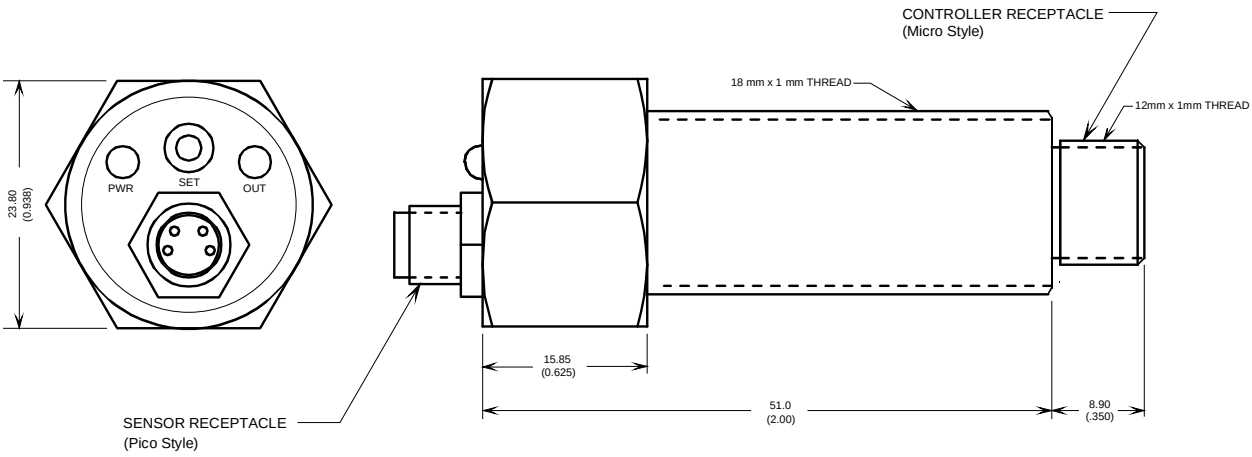
1. Place the thinner material or single sample against the probe face.
2. Tap the pushbutton twice in succession within 0.7 seconds. The first sample is taken and the yellow indicator begins flashing indefinitely at a 2.5 Hz rate.
3. Place the thicker material or double sample against the probe face.
4. Tap the pushbutton once. The second sample is taken, the new threshold installed, and the yellow indicator flashes four times at a 5 Hz rate and then reverts to following the outputs.

The outputs turn ON for a double and OFF for a single.

## DS60 DRIVE CIRCUITRY




## CONTROLLER DIMENSIONS




DS60 CONTROLLER HOUSING

## SPECIFICATIONS

### Power

| | |
|---|---|
| Type: | DC |
| V+ Connection: | 12 mm Connector, Pin 1 |
| Common | 12 mm Connector, Pin 3 |
| Voltage: | 12 to 24 volts |
| Max Current: | 50 milliamps + sourcing output load |
| Protection: | Reverse polarity protected. |

### Logic Output Electrical Specifications

Sinking Output

Open Drain

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

Sourcing Output

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

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