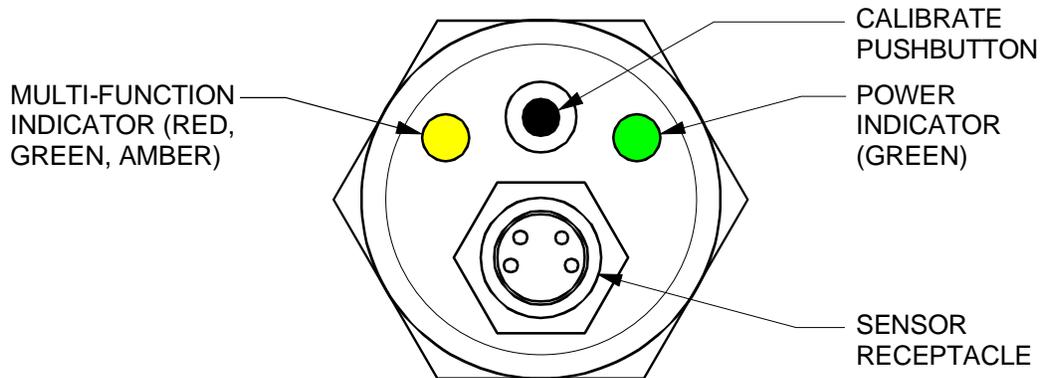# OPERATING INSTRUCTIONS

MODEL **DS60A** DOUBLE SHEET CONTROLLER

The Prime Controls Model DS60A 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 multi-color multi-function indicator and a pushbutton switch.

The DS60A 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	-	Sourcing Output	White wire on standard cable
Pin 3	-	Common	Blue wire on standard cable
Pin 4	-	Sinking Output	Black wire on standard cable

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

During normal sensing operation, the multi-color indicator tracks the state of the sinking and sourcing outputs. When the outputs are off, the indicator is green. When the outputs are on, i.e. the sinking output is low (sinking current) and the sourcing output is high (sourcing current), the indicator is red. In meter mode, the multi-function indicator flashes at a rate proportional to the strength of the signal from the attached sensor. It flashes green if the signal is in the nominal range and red when double thick material is sensed. During calibration, the multi-function indicator flashes different colors 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.

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PROBES

The DS60A operates with 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 60A system is covered in the following paragraphs:

DS60A 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 DS60A 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 DS60A 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 DS60A Controller provides a feature for monitoring the sensitivity to the target materials. To invoke "meter" mode, press and hold the pushbutton switch for three or more seconds. When the switch is released, the multi-function 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. The color of the indicator is green if the signal is below the current calibration threshold and red if above the threshold.

Press and release the pushbutton to exit meter mode. The 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 as indicated by the color of the indicator.

MULTI-FUNCTION INDICATOR INTERPRETATION

The multi-function indicator provides information about the state of the controller. During normal gauging, the state of the indicator follows the outputs directly. When the outputs are ON (sourcing output high, sinking output low), the indicator is red, and when the outputs are OFF, the indicator is green.

In meter mode, the 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. The color of the indicator is green if the signal is below the current calibration threshold and red if above the threshold.

During one-sample calibration, the indicator turns off momentarily, and then if calibration is successful, the indicator flashes amber 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 indicator flashes red 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 indicator begins flashing amber 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 amber 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 DS60A controller as follows:

1. From gauge mode, tap and release within 0.7 seconds to calibrate on current conditions. If bad calibration (e.g. no metal against the probe face), unit 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 to enter two-sample calibration mode and record the first point. LED flashes amber until a third tap records the second calibration point. If good calibration, LED flashes amber 4 times and returns to gauge mode. If bad calibration (e.g. no difference in thickness between first and second samples), unit enters error reporting mode.

4. From error mode, tap the pushbutton once to restart calibration.

5. From gauge mode, hold the pushbutton in for at least three seconds, the controller enters meter mode.

6. From meter mode, tap the pushbutton once to exit meter mode.

CALIBRATION

The DS60A 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 indicator flashes amber 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 indicator red 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 (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 indicator flashes amber 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 indicator flashes amber 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 (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 indicator flashes amber 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 indicator flashes amber 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.

DS60A DRIVE CIRCUITRY
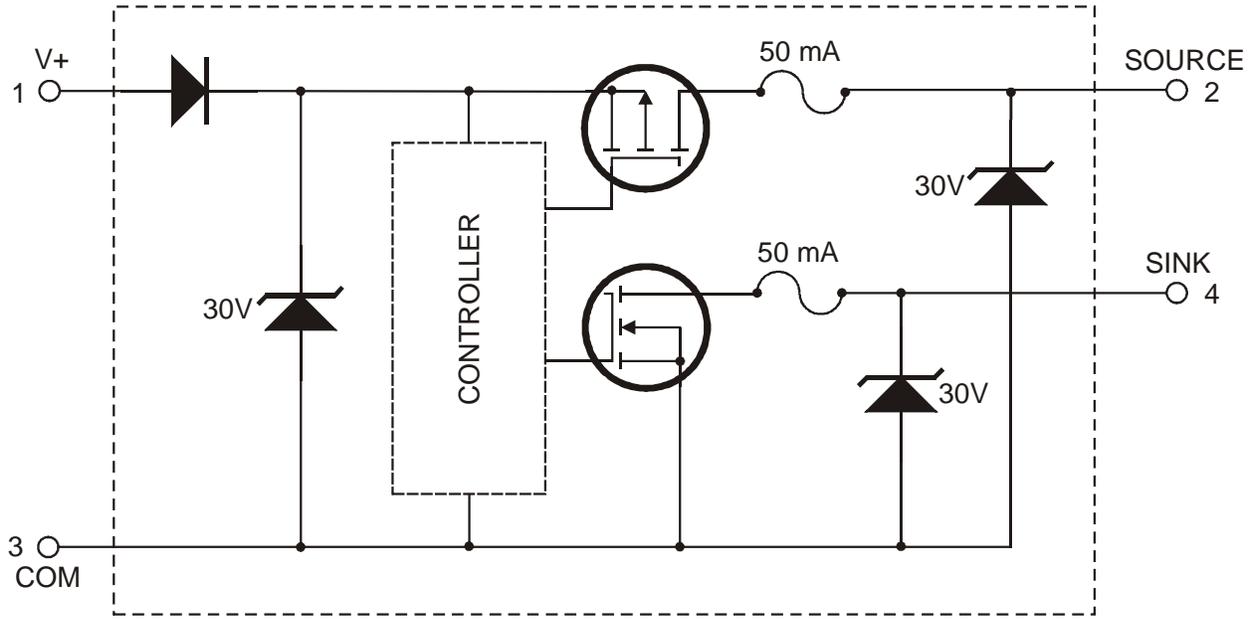
CONTROLLER DIMENSIONS
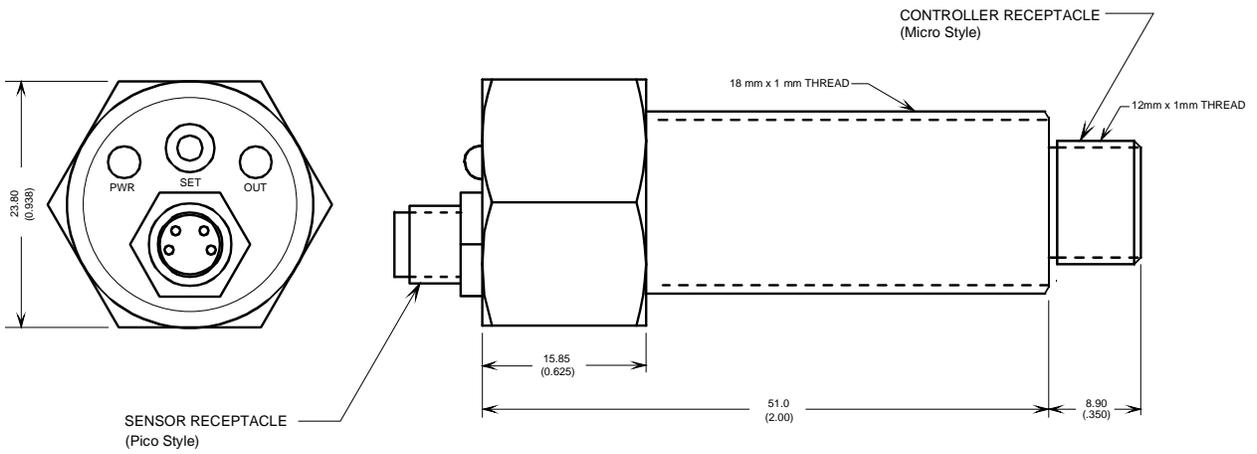
DS60 CONTROLLER HOUSING

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SPECIFICATIONS

Power

Type:	DC
V+ Connection:	12 mm Connector, Pin 1
Common	12 mm Connector, Pin 3
Voltage:	12 to 24 volts
Max Current:	25 milliamps + sourcing output load
Protection:	Reverse polarity protected.

Logic Output Electrical Specifications

<u>Sinking Output</u>

Open Drain

Connection:	12 mm Connector, Pin 4
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 50 mA fuse.
ESD protection:	Transient Voltage Suppressor @ 30 Volts

<u>Sourcing Output</u>

Connection:	12 mm Connector, Pin 2
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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