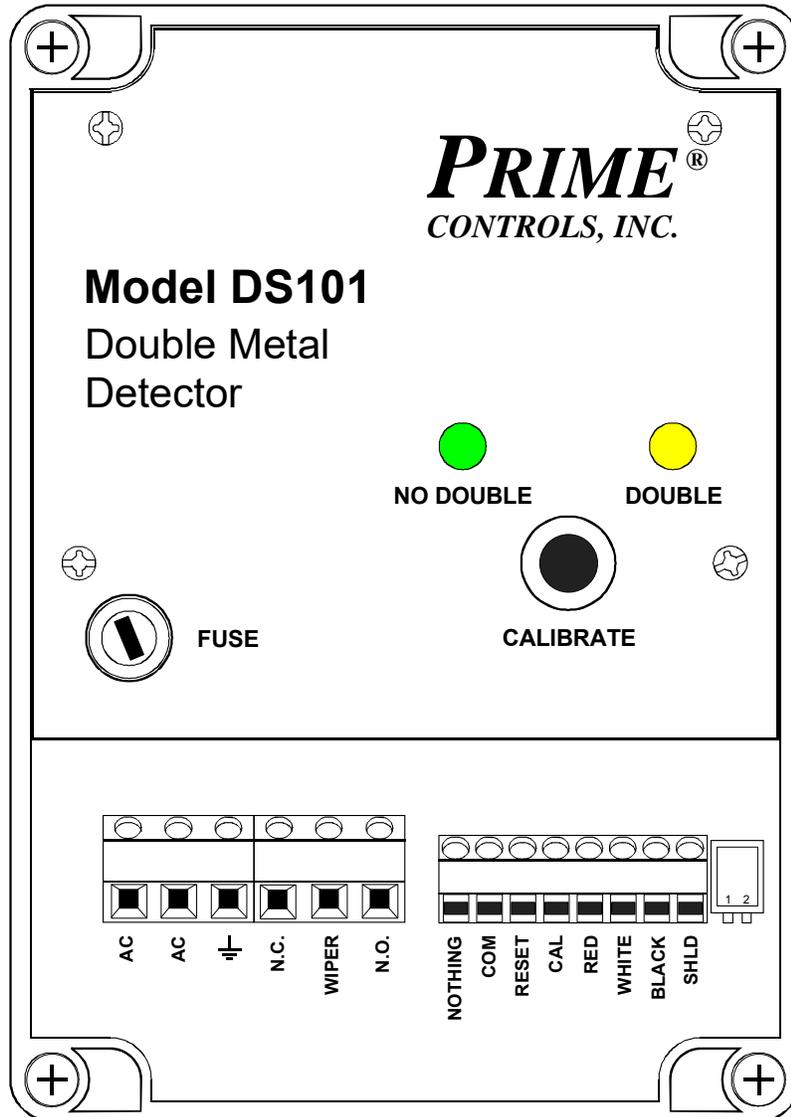


# OPERATING INSTRUCTIONS

## Model DS101 DOUBLE SHEET DETECTOR



### DESCRIPTION

The Model DS101 Double Metal Sheet Detector comprises a control module in a polycarbonate housing with a single probe to form a system that detects the thickness of ferrous (magnetically attracted) metals passing the face of the probe. The detector system may be used on automatic sheet feeders where double or overlapped sheet material may jam or damage the receiving machine. A double feed produces an output to stop the machine or signal the operator.

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## Control Module

The control module allows fast and easy setup and for diagnosis of system errors or problems. Calibration is achieved through the simple press of a push-button switch. Faults are reported through different flash patterns on the green and yellow "no double" and "double" indicators.

When the unit first powers up, the two indicators flash alternately as the unit determines which model of probe is attached. If the probe is not recognized, the flash pattern changes with the DOUBLE indicator on solid and the NO DOUBLE indicator flashing. When probe assessment has completed successfully, the indicators stop flashing

Other features of the control module include:

- 95 to 130 or 200 to 250 volt operation selected through internal jumpers.
- Form C relay output providing normally open or normally closed contacts.
- LED indicators report the gauge states of NO DOUBLE and DOUBLE.
- Automatic setup of system gain and operating parameters.
- Simple push-button calibration.
- Non-volatile memory that retains all calibration parameters even when power is removed.
- Latching relay output that is cleared by asserting the RESET input.
- Probe fault detection and reporting via the two front panel indicators.
- External Calibrate terminals for convenient placement of the calibrate switch
- Metal present output to verify the sheet has fed properly

## Probes

The DS101 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")

**CAUTION: Protect the probes from exposure to magnetic fields. Probes should not be allowed to contact other probes, magnets, or other sources of magnetic fields. Failure to prevent exposure may result in permanent damage to the probe.**

## INSTALLATION

Installation of the individual components of the Double Metal Sheet Detector system is covered in the following paragraphs:

### DS101 Control Module

The control module is designed to be mounted either in the open on a machine member or on the back panel of an electrical enclosure using the four mounting holes at the corners of the enclosure. The footprint is 4.75 inches (120 mm) wide by 6.70 inches (170 mm) high with mounting hole locations on a rectangle 3.575 inches (91 mm) in the horizontal and 6.25 inches (159 mm) in the vertical (see drawing at end of this document). *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 DS101 Double Sheet Detector can be made to 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 may fail to calibrate and will indicate the failure through simultaneous flashing of the yellow and green indicators.

### Electrical Wiring

All wiring for the DS101 connects to terminal blocks at the bottom of the control circuit board within the enclosure as described in the following paragraphs.

1. Connect 100 to 130 VAC (50-60 Hz. @15watts) to the terminals labeled AC on the left of terminal block. Connect earth ground to the terminal marked with the ground symbol.
2. For 200 to 260 volt operation remove the DS101 front panel (four screws) and remove suitcase jumpers **A** and **C** immediately in front of the gray transformer block. Place one of the suitcase jumpers in position **B**. Discard the second jumper. Replace the front panel. The factory setting for these jumpers is for 100 to 130 volt operation. *Do not power the Model DS100 with 200 to 260 VAC until jumpers have been changed.*

**Refer to pictures below:**



3. Connections to the control circuit of the machine are made through the form C output relay. This relay is powered in the NO DOUBLE condition. If power is lost to the control the relay is not energized and the DOUBLE contact is closed.
4. Always use shielded cable from the probe to the control module (Belden 8771 or equivalent). The probe is connected to terminals on the rightmost terminal block labeled Red, White, Black & Shield. Connect the shield leads (drain wires) from the probe cables to the terminals labeled SHLD. If a splice is made between the control and probe leave the probe unshielded no more than 20 to 30 mm.
5. The output relay may be operated in a "follower" mode or "memory" (latch or sealed) mode depending upon the wiring of the RESET input. The mode connections and definitions are described below.
  - a) To operate the output in the "follower" mode, jumper RESET and COM. together on the terminal block. When a DOUBLE condition occurs, the relay drops out and the DOUBLE indicator comes on. When the double metal condition is removed, the relay returns to the normally energized condition, the yellow DOUBLE indicator goes out and the green NO DOUBLE indicator turns on. Automatic reset is normally selected to control the operation when the fault condition is automatically removed or the DS101 is wired into the stop circuit of a machine with a manual restart circuit.
  - b) To operate the output in a "latch" mode, wire the RESET and its associated COM terminal to the normally open contact of a switch, relay, or controller output. In this mode, when a fault condition occurs, the relay drops out and the DOUBLE indicator comes on. After the fault condition is corrected, the RESET contact must be momentarily activated to bring the relay back to the NO DOUBLE state.

## **INPUTS AND CONTROLS**

The primary control input to the DS101 is the calibration push-button switch on the front panel. Use of this switch is described below under CALIBRATION.

The DS101 has two logic inputs labeled CAL and RESET. The CAL input parallels the function of the calibrate push-button on the front panel allowing the calibration function to be performed through a remotely located switch wired to this input. The RESET input controls the latching of the relays as described in item 5 of the Electrical Wiring section above.

The two logic inputs have associated with them two jumper plugs located immediately behind its associated terminal. The function of these jumpers is described below under CONFIGURATION SWITCHES AND JUMPERS.

Both the CAL and RESET inputs are ON when pulled low (zero volts) independent of the jumper settings.

A two position DIP switch to the right of the terminal blocks controls the selection of the calibration mode and the system response time as described below under CONFIGURATION SWITCHES AND JUMPERS.

## OUTPUTS

The DS101 outputs include a form C relay for reporting OVER conditions and a dc logic output for reporting no material in front of the probe.

The logic output is labeled the NOTHING output since it provides an indication that nothing is present in front of the probe. The intent of this output is to signal that a sheet did not feed. This output provides a dc sourcing signal that switches between zero volts and 22 volts, delivering up to 100 mA.

The NOTHING output is ON (sourcing at 22 volts) when material is present in front of the probe.

## INDICATORS

The function of the indicators and controls on the DS101 are described in the following paragraphs:

During *normal gauge operation*, the yellow DOUBLE indicator is ON whenever the received signal is closer to the calibrated value for double thickness than to the calibrated value for single thickness. The green NO DOUBLE indicator is ON whenever the received signal is closer to the calibrated single thickness value than to the calibrated double thickness value.

Through various flashing patterns, these indicators also provide information regarding system mode (calibrate vs operate), firmware version number, and error conditions. Reading firmware version is described later in this document. All other flash patterns can be interpreted as follows:

*Alternate* flashing of yellow and green indicates busy such as during initialization after power-up.

*Simultaneous* flashing of yellow and green indicates failed calibration. The reasons are various such as calibration sample too thick, sample too thin, too little difference between double and single, or too much air gap between metal and probe.

*Green flashing, yellow off* - awaiting single sample for calibration.

*Yellow flashing, green off* - awaiting push-button press for calibration on double.

*Green flashing, yellow on* - probe error. Probe not connected, probe wire broken, or probe is defective.

## CONFIGURATION SWITCHES AND JUMPERS

A two position switch is located on the main control circuit board at the right of the terminal blocks. In units with version 1.3 or later firmware, the right switch determines the response time of the system as detailed below. The right switch is not used on units with version 1.2 or earlier firmware. The switch on the left selects one or two “hit” calibration as described below in the CALIBRATION section of this document.

Left Switch:	UP	selects calibrate on single.
	DOWN	selects calibrate on single and double
Right Switch:	UP	selects standard (12 millisecond) response time.
	DOWN	selects high speed (2 millisecond) response time.

*NOTE: These switches are read only at power up. If a switch setting is changed, be sure to power the unit down and back up again.*

Each of the logic inputs (CAL and RESET) has associated with it a two position jumper plug located immediately behind its associated connector. These jumpers allow the inputs to be driven by a sinking (NPN) or sourcing (PNP) device. When the jumper plug is installed on the pins closest to the connector, the input is set up for a sourcing driver. When installed on the two pins farthest from the connector (factory setting), the input is set up for a sinking driver, or dry contact between the input and COM. Both inputs are active low.

## CALIBRATION

The detector may be calibrated via the push-button switch on the front panel or remotely through a switch connected between the CAL and COM terminals of the right terminal block.

The DS101 offers two modes of calibration: 1) calibrate on single nominal thickness, and 2) calibrate on single and double thickness. Normally where double thickness discrimination is required, the DS101 can be calibrated on a single thickness of the material to be monitored (one press of the push button). If finer changes in thickness are to be discriminated, the DS101 may be calibrated on two different thicknesses of the same material. The discrimination threshold is set halfway between the two calibration points.

### Calibration on Single Only (Single Hit)

Calibration on single is selected when the left configuration switch is UP. See section on CONFIGURATION SWITCHES AND JUMPERS above.

Place a single sheet of metal to be gauged against the probe face and press the CALIBRATE push-button. During calibration on the single thickness, the green (NO DOUBLE) indicator flashes and the yellow (DOUBLE) indicator is off. If the calibration on the single is successful,

the green indicator stops flashing and remains solidly on until the material thickness at the probe face changes.

If the calibration is not successful, both indicators flash simultaneously. Make sure that the sheet is solidly against the probe and not moving when calibrating or that the sheet thickness does not exceed the probe specification. (See probe specifications on page 2). If everything seems to check out, re-try the calibration. Alternatively try calibrating on single and double as described below. If difficulties persist, call Prime Controls for technical assistance.

### **Calibration on Single and Double (Two Hit)**

Calibration on single AND double is selected when the left configuration switch is DOWN.

Place a single thickness of material against the probe face and press the CALIBRATE push-button. During calibration on the single thickness, the green (NO DOUBLE) indicator flashes and the yellow (DOUBLE) indicator is off. When calibration on the single thickness is complete and the unit is ready for the double thickness, the green indicator turns off and the yellow indicator flashes. Place a sample of thicker material or two samples of the single material against the probe face and press the CALIBRATE push-button again. If calibration is successful, the yellow indicator stops flashing and remains solidly on and the green indicator is off.

If the calibration is not successful, both indicators flash simultaneously. The causes for unsuccessful calibration can be many including too little difference in thickness between the thin and thick material, poor probe contact, non-ferrous material, wrong probe model for the material, etc.

### **FIRMWARE VERSION**

From time to time, as improvements are made to Prime products, the firmware controlling the units is revised. When setting a unit up or troubleshooting it may be necessary to determine the version number for the firmware installed in your unit. The version numbers begin with 1.0 and are incremented either by tenths (1.1, 1.2, etc.) for small revisions or by the integer digit (1.0, 2.0, etc.) for more significant revisions.

To determine the version of the firmware running in your unit, simply hold the calibration push button in as power is applied to the unit. The revision number is displayed as one second flashes of the NO DOUBLE LED for the integer digit followed by one second flashes of the DOUBLE LED for the fractional digit. Count the number of flashes on each LED to determine the revision number. Thus one flash of the NO DOUBLE LED followed by two flashes of the DOUBLE LED indicates version 1.2 of the firmware.

## **SPECIFICATIONS**

### **Enclosure**

Material: Polycarbonate  
Color: Light gray body, clear cover  
Dimensions: 6.70 in. high x 4.75 in. wide x 2.17 in. deep  
(170 mm x 121 mm x 55 mm)  
Seal: Nema 4x  
Mounting Holes: 0.175 in. diameter on 6.25 in. x 3.58 in rectangle  
4.45 mm diameter on 159 mm x 91 mm rectangle

### **Power requirements**

95 to 130 volts, 50/60 Hz at 50 mA (Suitcase jumpers A and C installed).  
190 to 250 volts, 50/60 Hz at 25 mA (Suitcase jumper B installed).

### **Logic Input Electrical Specifications**

CAL, RESET: 30 Volts maximum  
Upper switch threshold - 6.9 volts  
Lower switch threshold - 3.3 volts

When the internal jumper is installed for pull up to accommodate sinking drivers, the input is pulled to +15 volts through 4700 ohms. When the jumper is installed for pull down to accommodate sourcing drivers, the input is pulled to common through 4700 ohms.

### **Logic Output Electrical Specifications**

NOTHING: PNP sourcing, 100mA max., 0 volts low, 22 volts high.

### **Output relay specifications**

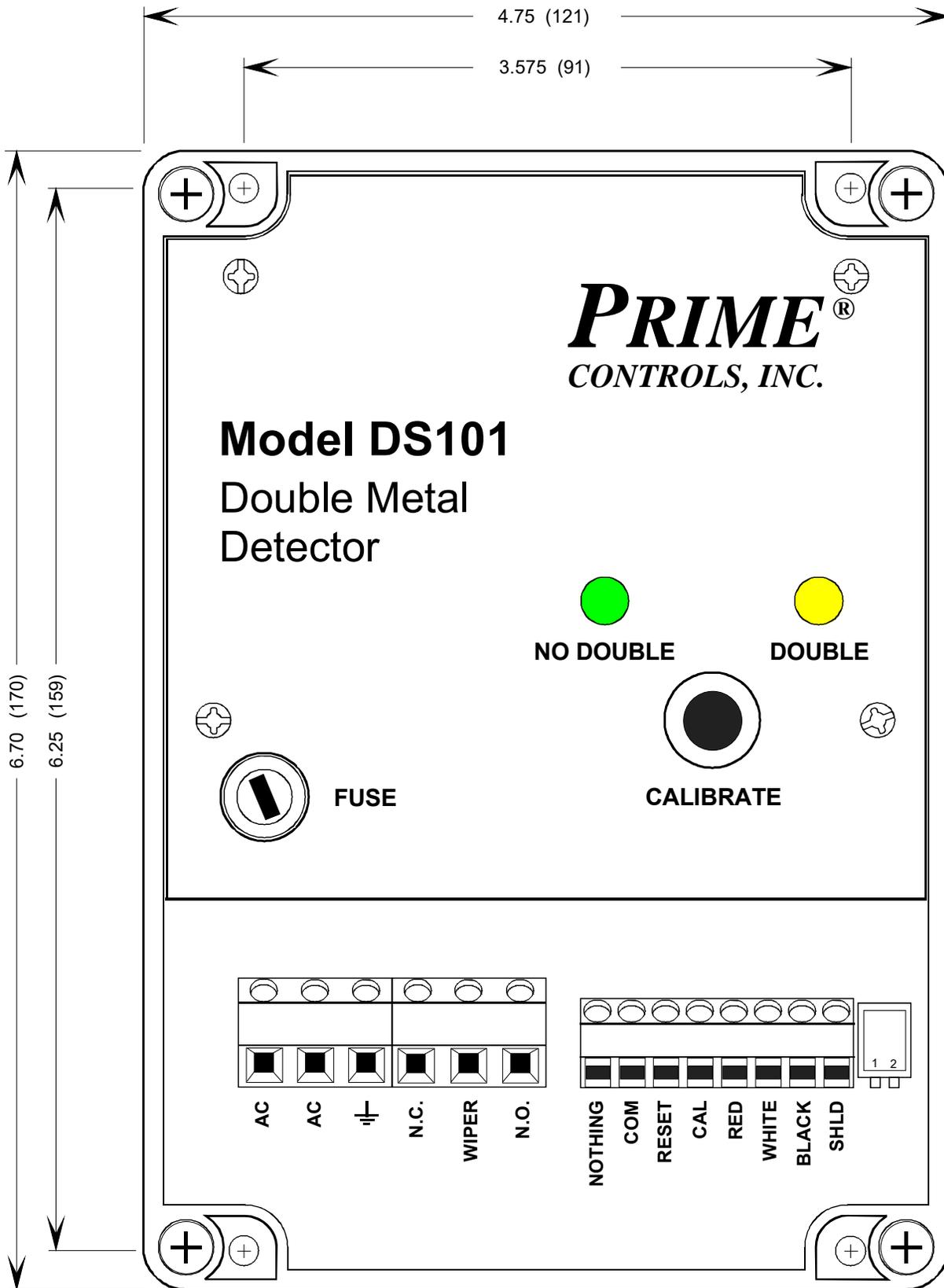
Maximum switched voltage: 380VAC  
Maximum switched current: 14 amps N.O., 5 amps N.C, AC resistive; 8 amps DC  
Maximum switched power: 200W DC, 2,000 VA AC.  
Minimum required contact load: 12V, 100 mA  
Expected mechanical life: 20 million operations  
Expected electrical life: 100,000 operations at 8 amps, 240VAC  
50,000 operations at 14 amps N.O., 5 amps N.C.,  
120VAC resistive  
30,000 operations at 7.2FLA, 45LRA, 120VAC  
10,000 operations at 5FLA, 30 LRA, 240VAC

## **TROUBLESHOOTING**

Should trouble develop, proceed as follows:

1. Check AC input power to the control module
2. Check the fuse, accessible at the front panel behind the clear plastic cover.
3. When power is applied, if the green and yellow indicators show a response to the metal condition in front of the probe and the output relay does not switch, check that the RESET jumper is installed (if you want the relay to follow the sheet condition). The jumper is installed between RESET and COM. on the terminal strip. If the unit is reset by an external machine START button, check wiring across the RESET and COM terminals or the START button contacts.
4. When power is applied, if the DOUBLE indicator is on solidly while the NO DOUBLE indicator is flashing, check for a missing, disconnected, open, or shorted probe.
5. If both indicators flash in unison, the system is indicating an invalid calibration. The potential causes are many. Among them, an attempt to calibrate both double and single on the same thickness material, a shorted receiver probe, probe gap too large, incorrect probes for the material being gauged. If the problem is not resolved, call the factory for assistance.

For further information or service assistance, contact Prime Controls, Inc., 4551 Gateway Circle, Dayton, Ohio 45440-1711. Phone: (937) 435-8659, Fax: (937) 435-2091. Mention model number and serial number.



## **LIMITATION AND EXCLUSION OF WARRANTIES**

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