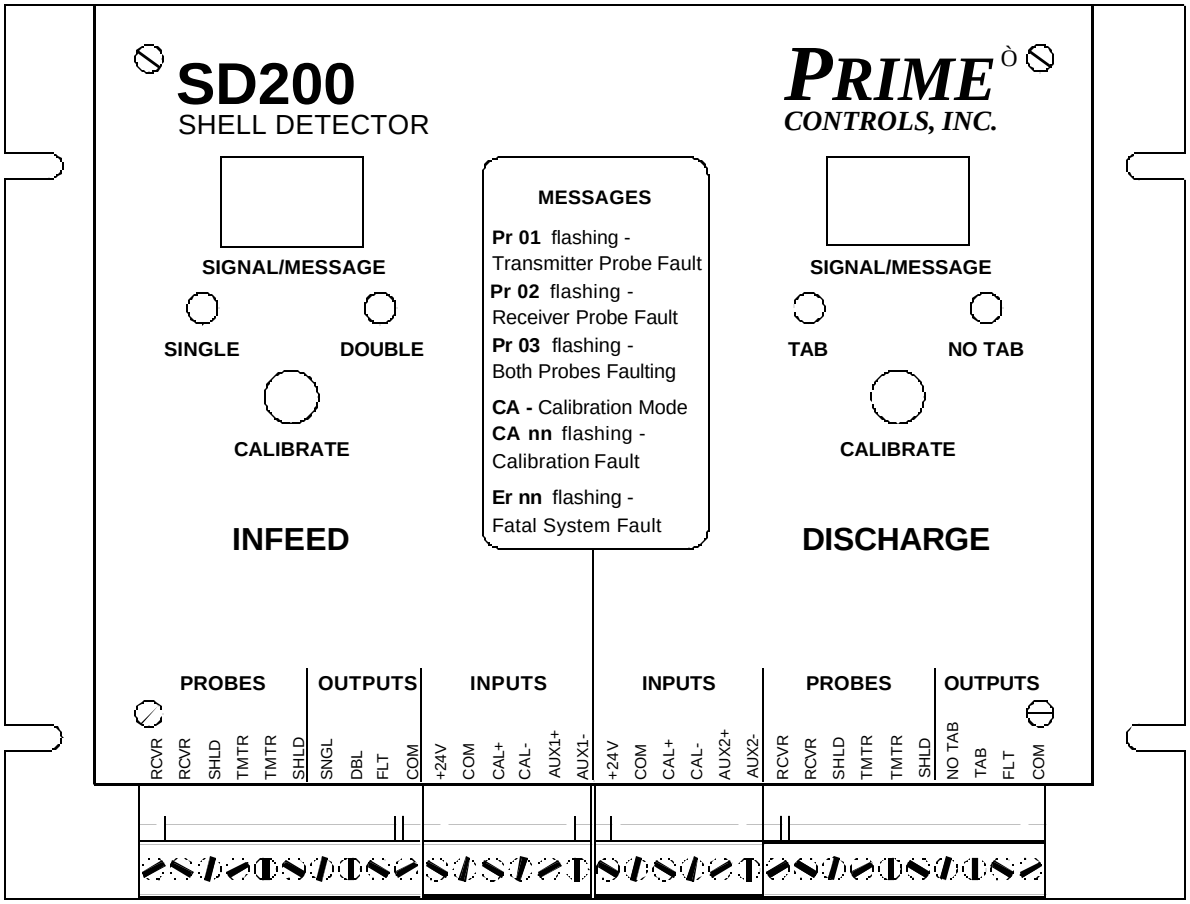
OPERATING INSTRUCTIONS

MODEL **SD200** SHELL DETECTOR



DESCRIPTION

The Model SD200 Shell Detector for conversion press applications is a rugged but sensitive dual channel instrument designed specifically to detect and report missing blanks or double blanks at the infeed to a conversion press and to detect and report ends that exit the press without tabs.

A complete system for one lane of a press comprises a control module housed in an aluminum enclosure and four probes. One transmitting and receiving probe pair senses doubles at the press input while the second transmitting and receiving pair senses the presence or absence of tabs at the press output.

Control Module

The control module allows for fast and easy setup and for quick diagnosis of system errors or problems. Setup is achieved through the simple press of a push-button switch or an external contact closure. Faults are reported on two digit displays on the control module and through FAULT outputs that may be connected to a PLC or system controller.

The DOUBLE, SINGLE, NO TAB, TAB and FLT outputs may be jumper selected as sinking or sourcing drivers. A four position DIP switch behind the front panel allows the installer to select a number of operational options as described in the installation section of this document.

The AUX inputs provide a means to switch between two different setups, such as sensing steel shells and sensing aluminum shells, without removing the front panel and changing the DIP switch settings.

When the unit first powers up, the two digit displays indicate the operational mode of the unit, i.e. whether set up for sensing **Al**uminum, **St**eel, or **A**luminum on **S**teel by displaying the characters "**Al**", "**St**" or "**AS**" for a period of approximately four seconds. Which mode comes up is determined by the setup of the unit through the internal DIP switch and the setting of the **SU** parameter selection through the calibration pushbuttons. See setup later in this document.

Calibrate Pushbutton Operation

The push-button switches on the front panel of the control module serve to initiate the calibration process and to make adjustments for system setup. The pushbuttons may be used to select the aluminum-on-steel setup option (**SU**) and to adjust the gage tolerances (**tL**).

To initiate calibration, simply press the appropriate pushbutton and release it within 3 seconds.

To view the current value of a parameter, press the pushbutton and hold it for more than 3 seconds until the appropriate parameter identifier (**SU** or **tL**) appears on the digital display. After the parameter identifier appears, release the pushbutton and the current value of the parameter displays for 5 seconds. To retain the current value of the parameter, simply allow the 5 second display interval to elapse. The display reverts to displaying the gauge signal.

To change the value of a parameter, press the pushbutton and hold it for more than 3 seconds until the appropriate parameter identifier appears on the digital display. After the parameter identifier appears, release the pushbutton and the current value of the parameter displays. Press the pushbutton while the parameter is displaying and the value increments, first slowly then more rapidly. For more precise control of the value adjustment, simply tap the pushbutton repeatedly until the desired value is displayed. All parameters roll back to their minimum values after reaching the maximum value. To retain the adjusted value of the parameter, simply allow the 5 second display interval to elapse. The display reverts to displaying signal strength.

Probes

The SD200 may be used with any of the new two wire probes or with older model three wire probes including AV, AY, AZ, AZA, and CB probes. When used with older 3 wire probes, the white wire in the probe cable is not used and must remain disconnected.

OPERATION

Operation of the SD200 Shell Detector involves only two processes, calibration and fault interpretation. These processes are described below.

Calibration

Calibration requires the following steps:

1. Stop the press in the dwell portion of the cycle with a single end between the infeed probes and a good tabbed end between the discharge probes.

2. Observe that no error conditions are being reported on either display of the SD200 control module.

3. Press the CALIBRATE pushbutton on the infeed side of the SD200 control module and observe the SINGLE and DOUBLE LEDs flashing alternately and "CA" flashing on the numeric display. If the calibration is successful, the display flashing stops in less than three seconds and a number between 48 and 52 is displayed. If the display continues to flash "CA", retry the calibration by pressing the CALIBRATE pushbutton a second time.

   If after the second calibration attempt the flashing continues beyond 5 seconds, check for proper gap setting, proper material selection (steel or aluminum), and for appropriate sample between the probes.

   If the calibration problem is not resolved and the calibration switch pressed again within 30 seconds, calibration mode is aborted and the previous calibration values are reinstated.

4. Press the CALIBRATE pushbutton on the discharge side of the SD200 control module and observe the TAB and NO TAB LEDs flashing alternately and "CA" flashing on the numeric display. If the calibration is successful, the display flashing stops in a few seconds and a number between 28 and 33 is displayed. If the display continues to flash "CA", retry the calibration by pressing the CALIBRATE pushbutton a second time.

   If after the second calibration attempt the flashing continues beyond 5 seconds, check for proper gap setting, proper material selection (steel vs aluminum), and for appropriate sample between the probes.

   If the calibration problem is not resolved and the calibration switch pressed again within 30 seconds, calibration mode is aborted and the previous calibration values are reinstated.

If both channels calibrate successfully, calibration is complete. The calibration process may also be initiated through an external switch or signal controlling the CAL+ and CAL- inputs to the SD200. Activation of this input performs the same function as pressing the CALIBRATE push-button switch for the corresponding channel.

Fault Interpretation

The SD200 monitors the probe connections on a continuous basis and reports what it detects to be disconnected or malfunctioning probes. The probe faults are reported as follows:

Alternately flashing "PR" and "01" - transmitter probe disconnected or failing.

Alternately flashing "PR" and "02" - receiver probe disconnected or failing.

Alternately flashing "PR" and "03" - both probes disconnected or failing

The SD200 performs extensive self diagnostics at power up and more limited diagnostics while running. Most fatal faults, if not involving the display subsystem, are reported on the numeric displays through the alternate flashing of "Er" and "nn" where "nn" is a two digit number indicating the source of the fault. These faults are not field repairable and require the change out of the control module.

“Er” and “05” can be triggered by attempting calibration on a channel that is displaying a probe error. The error can be cleared by powering the unit down and back up. If an Er 05 persists, a repair may be required.

Any detected fault causes the FLT outputs to be turned OFF until the fault is cleared.

INSTALLATION

Installation comprises four basic steps: 1) Installing the probes, 2) Mounting the control module, 3) Wiring the unit, and 4) Setting system options. Each of these steps is further expanded below.

Installing the Probes

1. Mount the double detecting infeed probes, one above and one below the centerline of the track carrying the ends into the press. The probes must be positioned such that they are *centered on the can end during the dwell* portion of the press cycle. In the vertical, the track should run midway through a gap of approximately 5/8 inch between the probes.

2. Mount the tab detecting discharge probes, one above and one below the centerline of the tabs as they are carried on the track from the press. The probes must be positioned such that they are *centered on the tab ring during the dwell* portion of the press cycle. In the vertical, the track should run midway through a gap of approximately 5/8 inch between the probes.

3. Run the probe cabling through conduit back to the cabinet housing the control module. *Do not run the sensor cables through conduit carrying high level or noisy signals.*

Mounting the Control Module

Mount the control module on the back panel of an industrial enclosure. The footprint is 8.25 inches (210 mm) by 6.25 inches (159 mm) with mounting slot locations on a rectangle 7.625 inches (194 mm) in the horizontal and 4.0 inches (102 mm) in the vertical. Insure that the mounting screws make good electrical contact between the module housing and the control enclosure back panel. See drawing at the end of this document.

Wiring the Control Module

1. Connect 24 volt dc power between one set of the +24V and COM terminals of the control module. Two +24V terminals and two COM terminals are supplied for convenience of connecting jumpers to the CAL and AUX inputs. The two +24V terminals are internally connected. The supply must be capable of delivering 0.2 amps continuously with at startup surge of 0.3 amps.

2. Connect the infeed transmitter probe wires to the two TMTR terminals on the INFEED side of the control module and the infeed receiving probe wires to the two RCVR terminals on the INFEED side of the control module. The probe connections are not polarized Connect the shield wires to the terminal labeled SHLD.

   Though both the transmitting and receiving probes are identical, it is preferred practice to choose the transmitting probe as the one that will remain farthest from the track as it moves and stretches.

On retrofit installations where older three wire probes are installed, cut back and do not connect the third (white) wire. If in doubt about which wires to use, measure the resistance between the wires in pairs, and then use the pair that produces the highest resistance reading (typically 24 ohms).

3. Connect the discharge transmitter probe wires to the TMTR terminals on the DISCHARGE side of the control module and the discharge receiving probe wires to the two RCVR terminals on the DISCHARGE side of the control module. Connect the shield wires to the terminals labeled SHLD.

   The precautions regarding choice of transmitter probe are the same for the discharge side as for the infeed. See above.

4. Connect the SNGL, DBL, NO TAB, TAB, and FLT outputs to the system controller and/or interlocking circuitry as required. These outputs may be sinking or sourcing as determined by the placement of jumpers on the SD200 circuit board. See the figure at the end of this document.

   The FLT outputs are always ON for no fault and are slaved together. Thus a fault on either channel will turn OFF both FLT outputs. The active states of the other outputs may be affected by the setting of the compatibility DIP switch as described later in this document.

5. If calibration is to be activated remotely, connect the CAL+ and CAL- inputs appropriately. Connect a *sinking* driver or contact to the CAL- terminal and connect CAL+ to the 24 volt power source. Connect a *sourcing* driver to the CAL+ terminal and connect CAL- to COM.

6. If the application may involve switching between steel and aluminum blanks, either AUX input may be wired to provide external control of the sensing mode of the SD200. Connect a *sinking* driver or contact to the AUX- terminal and connect the AUX+ terminal to the 24 volt supply. Connect a s*ourcing* driver to the AUX+ terminal and connect the AUX- terminal to COM.

Setting System Options

To set any of these options, disconnect power and remove the front panel of the control module by removing the four screws at the corners of the module. Removing the panel allows access to a four position DIP switch and a set of six jumpers.

The DIP switch, located at the upper left hand corner of the circuit board, may be set as follows:

Switch	OFF	ON
DIP 1	Sense aluminum ends	Sense steel ends
DIP 2	Display signal strength	Display relative metal thickness
DIP 3	Select fail-safe mode	Select compatibility mode
DIP 4	Fixed thresholds	Adjustable thresholds

NOTE: The DIP switches are read only upon power-up of the unit. After changing a switch setting, power the unit down and back up again to activate the change.

Selecting Aluminum on Aluminum

Set up the SD200 for monitoring aluminum tabs on aluminum shells by simply setting the topmost DIP switch to the OFF (left) position and powering the unit OFF and back ON.

Selecting Aluminum on Steel Setup

Set up the SD200 for monitoring aluminum tabs on steel ends as follows:

1) Set DIP switch 1 (topmost) to ON. This selects steel shell.
2) Press and hold either calibrate pushbutton for at least 3 seconds until **SU** appears on the display.
3) Release the pushbutton and the display changes to **00** or **01**. If **01** displays then the unit is already set for aluminum on steel. Go to step 5.
4) When **00** displays, press the calibrate pushbutton once and the display changes to **01**.
5) Wait 5 seconds until the display again shows signal value. Aluminum on steel setup is complete.

Selecting Steel on Steel Setup

Set up the SD200 for monitoring steel tabs on steel ends as follows:

1) Set DIP switch 1 (topmost switch) to ON. This selects steel shell.
2) Press and hold either calibrate pushbutton for at least 3 seconds until **SU** appears on the display.
3) Release the pushbutton and the display changes to **00** or **01**. If **00** displays then the unit is already set for steel on steel. Go to step 5.
4) When **01** displays, press the calibrate pushbutton once and the display changes to **00**.
5) Wait 5 seconds until the display again shows signal value. Steel on steel setup is complete.

Adjusting the Tolerance

Adjust the double shell tolerance as follows:

1) Set the fourth (bottom) DIP switch to ON (right). Power the unit down and back up.
2) Press and hold the channel 1 calibrate pushbutton for at least 3 seconds until either **SU** or **tL** appears on the display. If **tL** appears go to step 4.
3) If **SU** appears, continue to hold the pushbutton until **tL** appears.
4) Release the pushbutton and observe the current value of the threshold (in percent).
5) If the current value is ok (typically 35), wait 5 seconds and the display reverts to displaying the gauge value and retains the current tolerance.
6) To change the value, press and hold or tap the calibration pushbutton until the desired value is displayed. After the value reaches 90, it rolls over to 10 and increases.
7) When the desired value is on the display, wait 5 seconds and the display reverts to displaying the gauge value and retains the last displayed tolerance value.

Adjust the missing tab tolerance as follows:

1) Insure the fourth (bottom) DIP switch to ON (right). If necessary, change the switch position and power the unit down and back up.
2) Press and hold the channel 2 calibrate pushbutton for at least 3 seconds until either **SU** or **tL** appears on the display. If **tL** appears go to step 4.
3) If **SU** appears, continue to hold the pushbutton until **tL** appears.
4) Release the pushbutton and observe the current value of the threshold (in percent).
5) If the current value is ok (typically 15), wait 5 seconds and the display reverts to displaying the gauge value and retains the current tolerance.
6) To change the value, press and hold or tap the calibration pushbutton until the desired value is displayed. After the value reaches 80, it rolls over to 10 and increases.

7) When the desired value is on the display, wait 5 seconds and the display reverts to displaying the gauge value and retains the last displayed tolerance value.

The range of values available for the SD200 adjustable parameters are as follows:

Parameter ID	Function	Range of Values
SU	setup select	**00** for steel on steel and **01** for aluminum on steel
tL	double tolerance	0% to 90% for double (default is 35%)
tL	tab tolerance	0% to 80% for tab (default is 15%)

Sinking or Sourcing Outputs

Output driver sinking or sourcing modes are selected through the jumper settings as shown on the INTERNAL SETTINGS illustration at the end of this document. Sourcing output is selected when the jumpers are installed on the two pins closest to the connector edge of the circuit board.

Sensing Aluminum Shells or Steel Shells

When no signal is applied to either of the AUX inputs, DIP switch 1 determines the sensing mode as aluminum when OFF and steel when ON. However, if either AUX input is active, DIP switch 1 has the reverse effect.

Display Direction

The numeric displays may be set to readout in proportion to received signal (high for empty gap, low for doubles and tabs) or in proportion to metal thickness (low for gap and high for doubles and tabs) between the probes. See the chart above.

Compatibility with Earlier Double Sensing Units

When DIP switch 3 is ON, the sourcing outputs of the SD200 provide the same logic levels as the outputs of older double sheet units such as the DS33 and DS35, allowing for quick and easy retrofit installations. When DIP switch 3 is OFF, the output states are defined to provide maximum protection against loss of connection between the shell detector and the controlling PLC. The loss of connection is sensed as the fault condition.

The table below defines the output states for all combinations of DIP switch 3 and the possible sensing states. Also, see the output signal drawings at the end of this document.

		OUTPUT STATES			
Switch	In Gap	SNGL	DBL	NOTAB	TAB
OFF	missing	OFF	ON	ON	OFF
OFF	single	ON	ON	OFF	OFF
OFF	double/tab	ON	OFF	ON	ON
ON	missing	ON	OFF	ON	OFF
ON	single	OFF	OFF	OFF	OFF
ON	double/tab	OFF	ON	ON	ON

Special Functions

The SD200 offers two sets of optically isolated inputs that provide added control over the unit. These are the remote calibration input terminals labeled CAL+ and CAL- and the sensing mode inputs labeled AUX1+, AUX1-, AUX2+ and AUX2-.

Remote Calibration

The remote calibration inputs, when activated, perform the same function as the CALIBRATE push-button switches on the front panel of the control module.

Selecting Sensing Mode

The AUX inputs work in conjunction with DIP switch 1 to determine the sensing mode (sensing steel or aluminum shells) of the SD200. Activating either the AUX1 or the AUX2 input reverses the effect of DIP switch 1.

If DIP switch 1 is OFF and neither AUX input is active, aluminum sensing is selected. With DIP switch 1 OFF and either AUX input active, steel sensing is selected. If DIP switch 1 is ON and neither AUX input is active, steel sensing is selected. When DIP switch 1 is ON and either AUX input is active, aluminum sensing is selected.

As the SD200 changes modes from sensing aluminum to sensing steel, the characters "St" (steel tab on steel shell) or “AS” (aluminum tab on steel shell) appear on the two digit displays for a period of approximately 4 seconds indicating the switch to steel shell sensing mode. Likewise, when switching from steel sensing mode to aluminum sensing mode, the characters "Al" appear on the two digit displays indicating the switch to aluminum shell sensing mode.

Determining 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 are of the form 01.00 and are incremented either by tenths (1.01, 1.02, etc.) for small revisions or by the integer digit (1.00, 2.00, etc.) for more significant revisions.

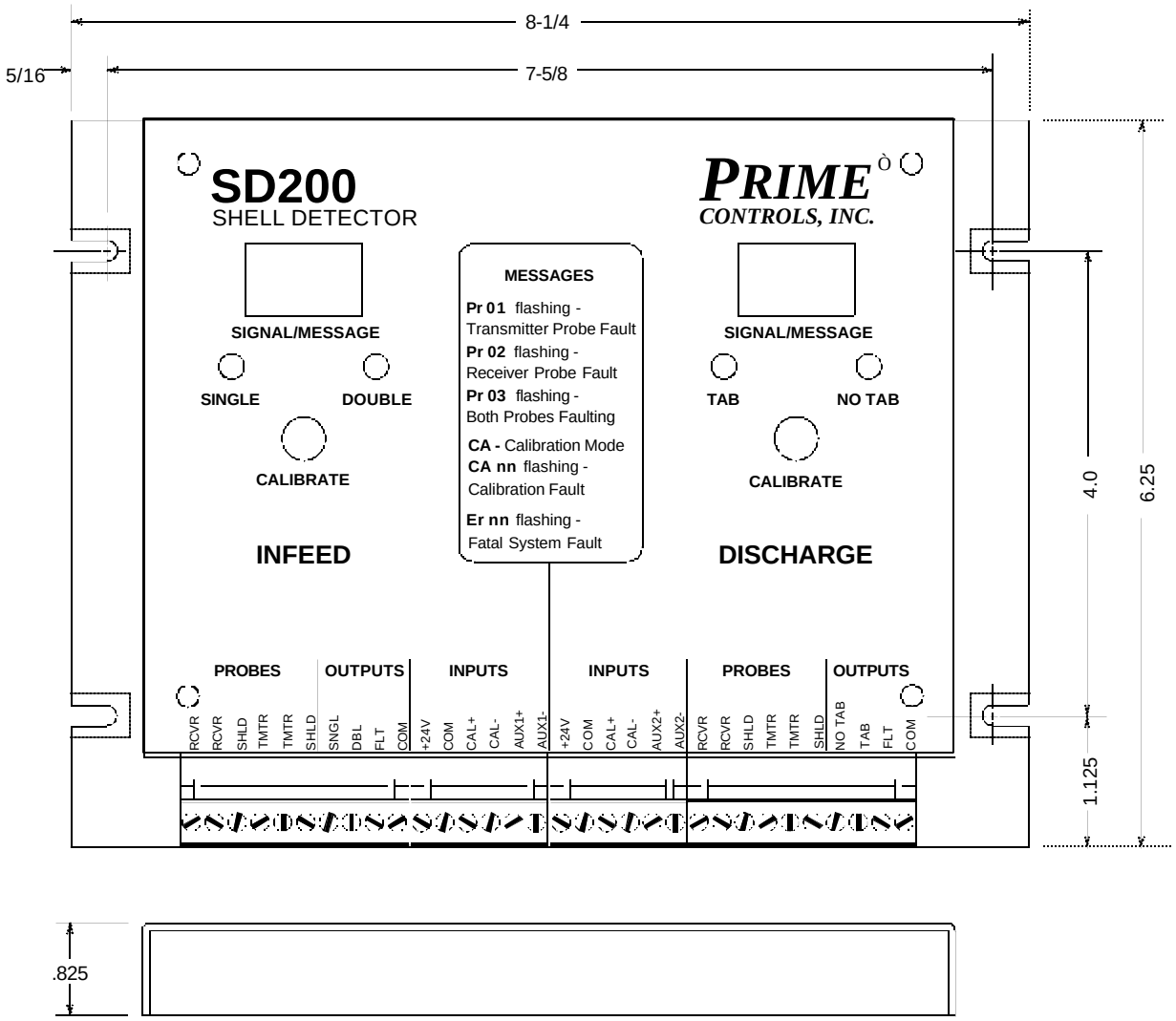
To determine the version of the firmware running in your unit, simply hold one calibration pushbutton in as power is applied to the unit. The revision number is displayed across both digital displays with the whole number digits (first two) on the left display (e.g. 02) and the fractional digits on the right display (e.g. .20).

NOTE: Systems with firmware Version 1.17 or earlier do not display version numbers by this technique. The firmware version for all units is printed on the ROM memory label within the unit.

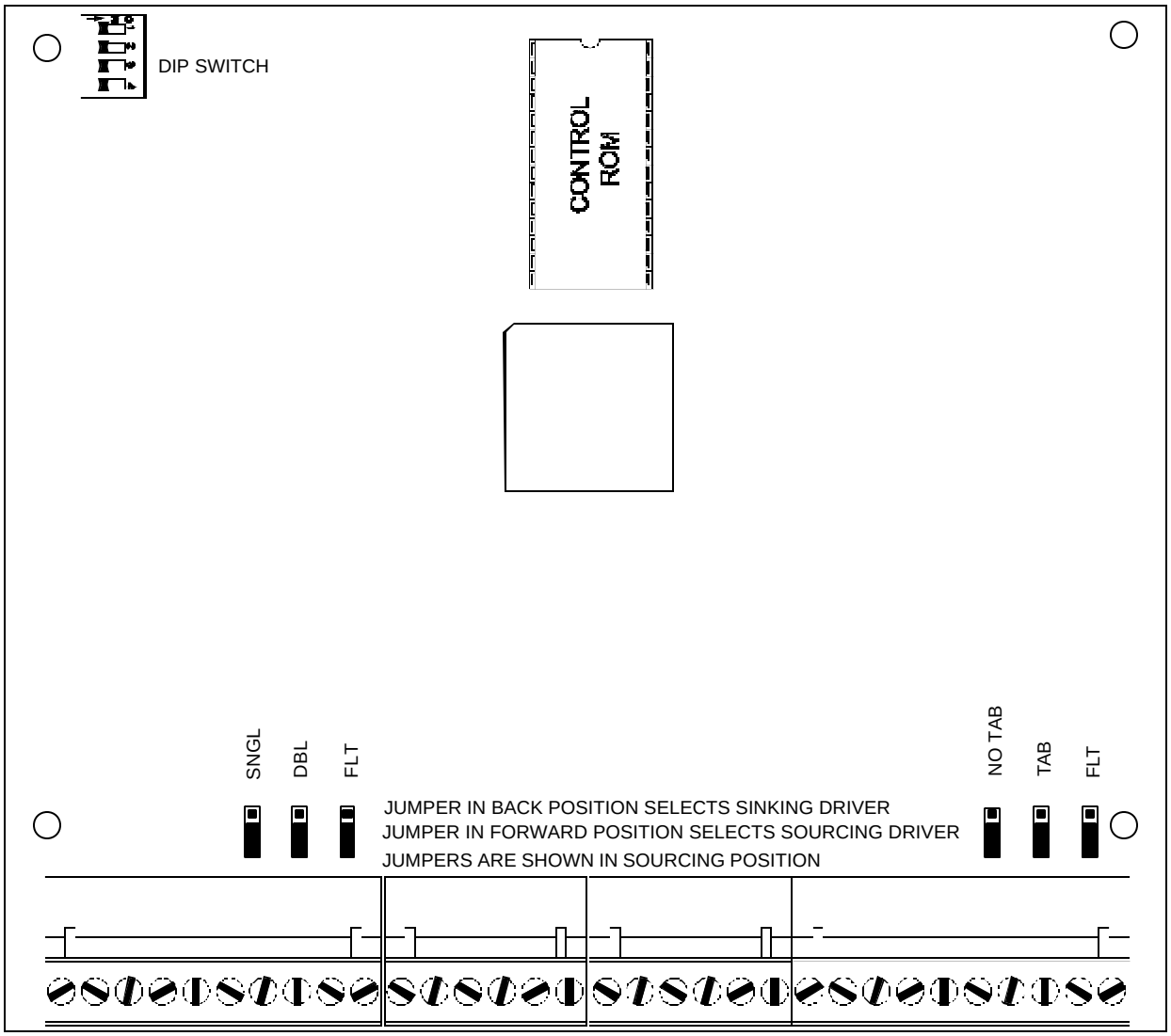
Document Applicability

This document applies to SD200 units running firmware Versions 2.20 to 3.00 and 4.00 or higher. If your system is running any other firmware version, the setup for aluminum tabs on steel shells and the tolerance adjust features do not apply.

All units in the field can be upgraded to include these features for a modest upgrade fee. Contact Prime Controls, Inc.


8-1/4
5/16
7-5/8
SD200
SHELL DETECTOR
PRIME
CONTROLS, INC.
SIGNAL/MESSAGE
SINGLE
DOUBLE
CALIBRATE
INFEED
MESSAGES
Pr 01 flashing - Transmitter Probe Fault
Pr 02 flashing - Receiver Probe Fault
Pr 03 flashing - Both Probes Faulting
CA - Calibration Mode
CA nn flashing - Calibration Fault
Er nn flashing - Fatal System Fault
SIGNAL/MESSAGE
TAB
NO TAB
CALIBRATE
DISCHARGE
PROBES
OUTPUTS
INPUTS
INPUTS
PROBES
OUTPUTS
RCVR RCVR SHLD TMTR TMTR SHLD SNGL DBL FLT COM
+24V COM CAL+ CAL- AUX1+ AUX1-
+24V COM CAL+ CAL- AUX2+ AUX2-
RCVR RCVR SHLD TMTR TMTR SHLD NO TAB TAB FLT COM
4.0
6.25
1.125
.825

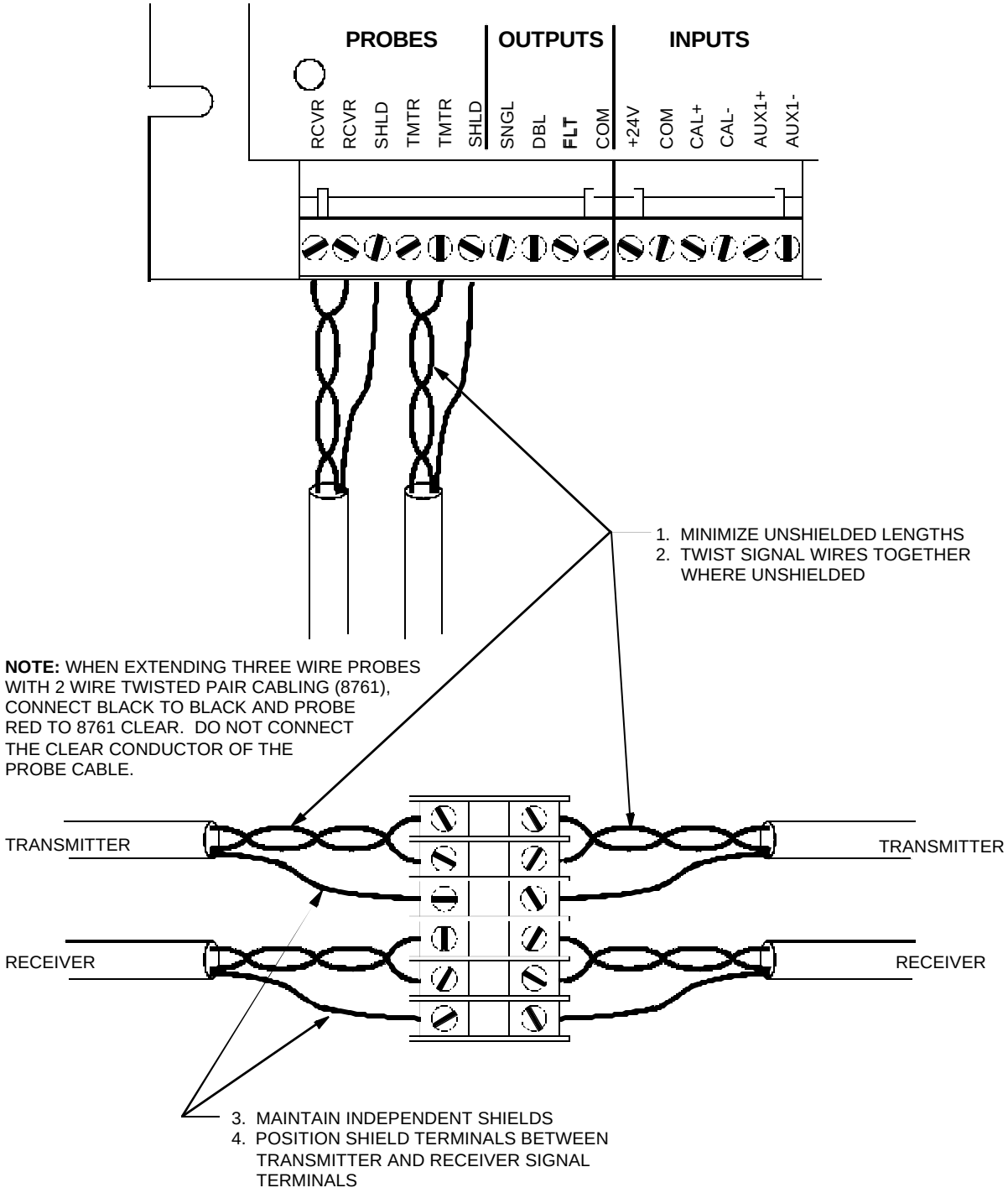
	OFF	ON
SW 1	SENSE ALUMINUM ENDS	SENSE STEEL ENDS
SW 2	DISPLAY SIGNAL STRENGTH	DISPLAY RELATIVE THICKNESS
SW 3	SELECT FAIL SAFE MODE	SELECT COMPATIBILITY MODE
SW 4	35% DOUBLE THRESHOLD	20% DOUBLE THRESHOLD (Version 1.18 or later firmware only)



INTERNAL SETTINGS

SD200 AND SD202 WIRING RECOMMENDATIONS

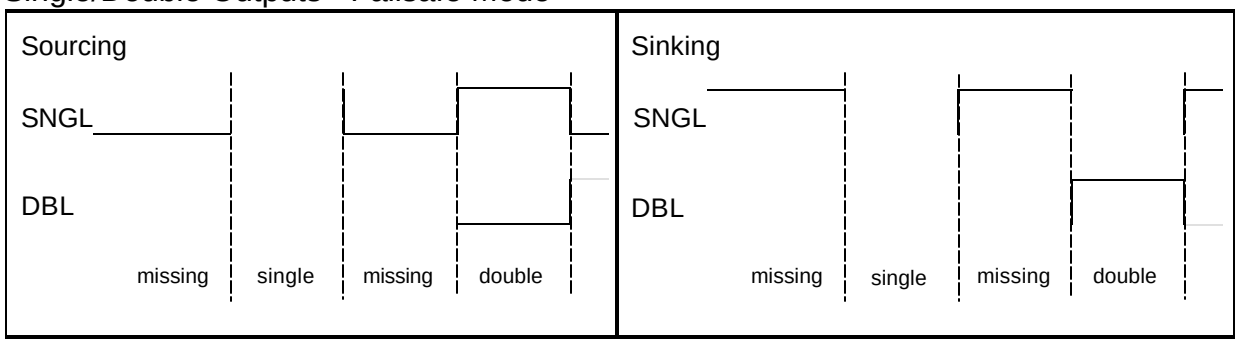
FOR MAXIMUM NOISE IMMUNITY, SPLICE OR TERMINATE CABLES ONLY WHEN ABSOLUTELY NECESSARY. WHERE EXTENSION IS NECESSARY, USE BELDEN 8761 OR EQUIVALENT SHIELDED TWISTED PAIR CABLE. THE SD200 AND SD202 ARE DESIGNED TO PROVIDE HIGH COMMON MODE NOISE REJECTION. COMMON MODE REJECTION IS REALIZED MOST EFFECTIVELY WITH TWISTED PAIR CABLING.



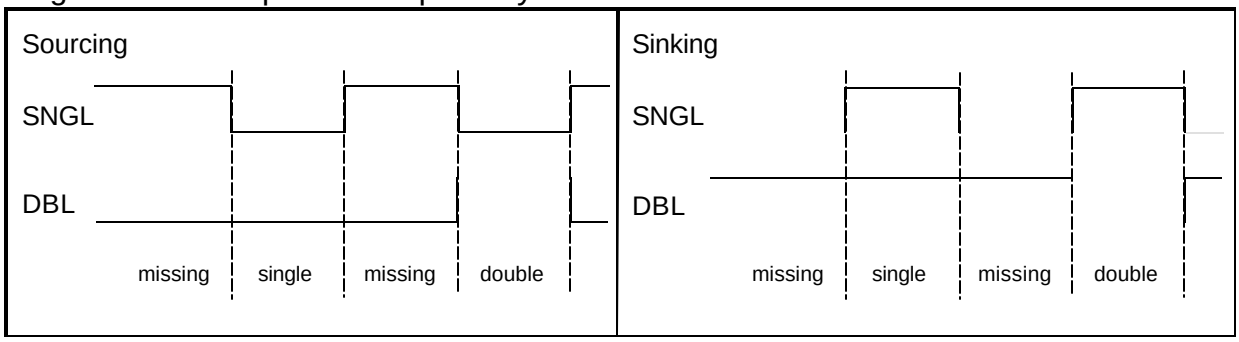
Output Signals

CHANNEL 1 - INFEED

Single/Double Outputs - Failsafe Mode

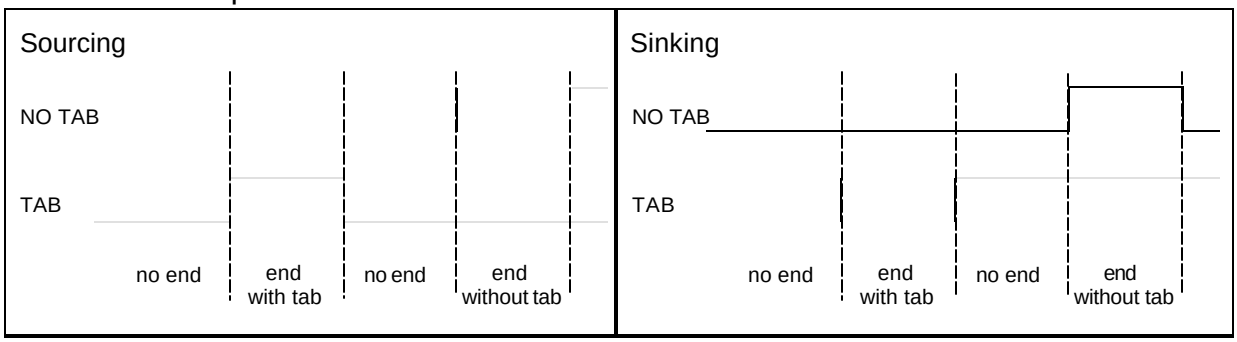


Single/Double Outputs - Compatibility Mode

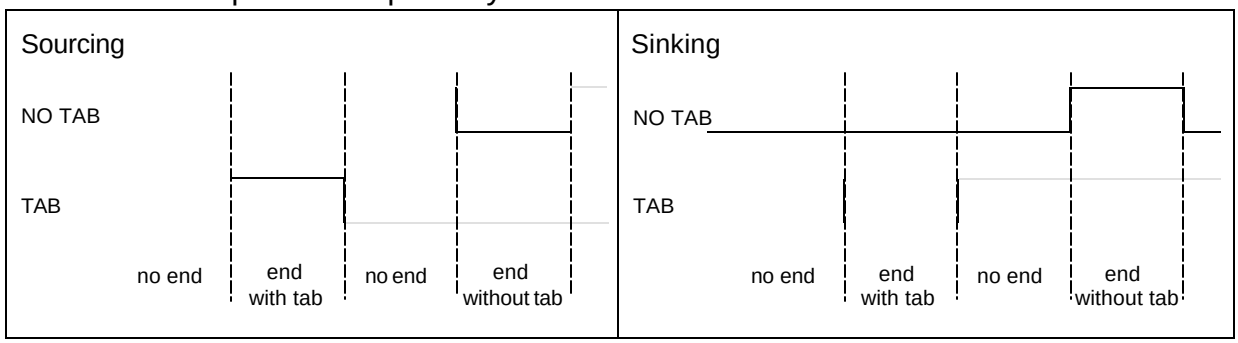


CHANNEL 2 - DISCHARGE

No Tab/Tab Outputs - Failsafe Mode



No Tab/Tab Outputs - Compatibility Mode



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