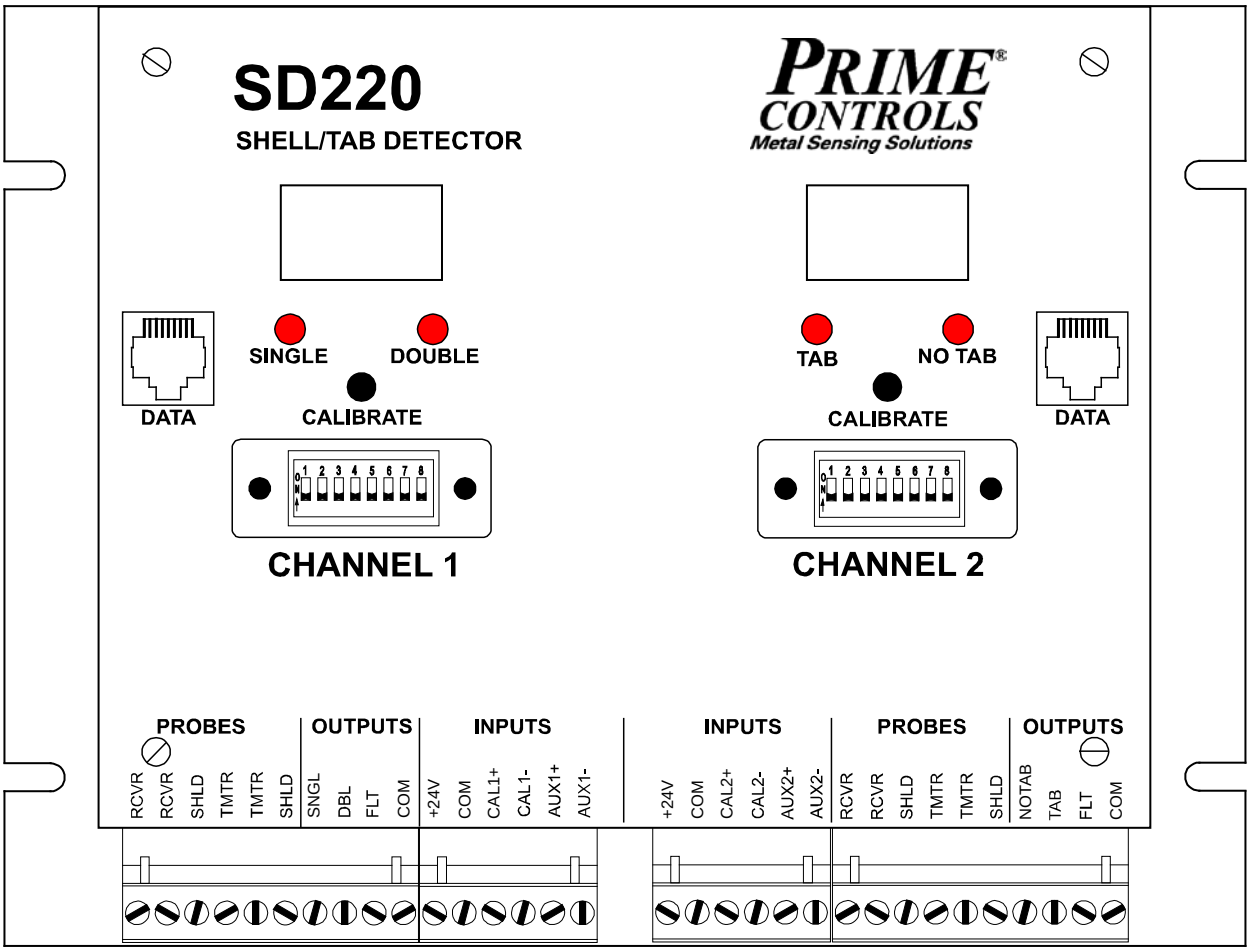
OPERATING INSTRUCTIONS

MODEL **SD220** SHELL/TAB DETECTOR



DESCRIPTION

The Model SD220 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.

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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 digital 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 switch selected as sinking or sourcing drivers. An eight position DIP switch, accessible on 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 recalibrating or changing the DIP switch settings.

When the unit first powers up, if probes are properly connected, the digital 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 two seconds. Which mode comes up is determined by the setup of the unit through the DIP switches and the state of the AUX input. 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 adjust the gauge tolerances (**tL**) and set the display option to invert the digital display (**do**).

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 (**tL** or **do**) 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 SD220 may be used with any P15 or P70 series 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 SD220 Shell/Tab Detector involves only two processes, calibration and fault message 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 SD220 control module.

3. Press and release the CALIBRATE pushbutton on channel 1 of the SD220 control module and observe the SINGLE and DOUBLE LEDs flashing alternately and "**CAL**" on the digital display. If the calibration is successful, the LED flashing stops in less than three seconds and the digital display shows a number between 48 and 52.

   If the display flashes alternately "**CAL**" and "**Lo**", the calibration was unsuccessful due to insufficient signal at the receiving probe. This can be an indication that the probes are too far apart or that the unit is not set to the appropriate frequency for the material being sensed, e.g. frequency set to aluminum when steel ends are present. If the display flashes alternately "**CAL**" and "**Hi**", the receiver signal is too strong indicating nothing between the probes.

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

4. Press the CALIBRATE pushbutton on channel 2 of the SD220 control module and observe the TAB and NO TAB LEDs flashing alternately and "**CAL**" on the digital display. If the calibration is successful, the LED flashing stops in less than 3 seconds and a number between 28 and 33 is displayed.

   If the display begins to alternately flash "**CAL**" and "**Lo**", the calibration was unsuccessful due to insufficient signal at the receiving probe. This can be an indication that the probes are too far apart or that the unit is not set to the appropriate frequency for the material being sensed e.g. frequency set to aluminum when steel ends are present.

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 SD220. Activation of this input performs the same function as pressing the CALIBRATE push-button switch for the corresponding channel.

Fault Message Interpretation

The SD220 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 "**1**" - transmitter probe disconnected or failing.

Alternately flashing "**PR**" and "**2**" - receiver probe disconnected or failing.

Alternately flashing "**PR**" and "**3**" - both probes disconnected or failing

During calibration:

Alternately flashing "**CAL**" and "**Lo**" indicates a low signal at the receiving probe.

Alternately flashing "**CAL**" and "**Hi**" indicates the signal at the receiver is too strong, likely no end between the probes.

The SD220 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 digital displays through the alternate flashing of "**Err**" and "**nnn**" where "**nnn**" is a one to three digit number indicating the source of the fault. These faults are not field repairable and require the change-out of the control module.

Any detected fault causes the FLT output 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 (16mm) between the probes.

2. Positioning of the tab detecting probes is more critical than the positioning of the infeed probes. For most tabbed ends, the optimum position for the probes is above and below the ring of the tab, not centered on the rivet. Centering on the rivet only works on some older tab designs where the tab formed a ring around the rivet. If positioning of the tab sensing probes is uncertain, contact Prime Controls for help.

   Mount the tab detecting probes, one above and one below the tabbed ends 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 (16mm) 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 both sets of the +24V and COM terminals of the control module. The left and right side modules are electrically independent and must be powered independently. The two +24V terminals are NOT internally connected. The supply must be capable of delivering 0.250 amps continuously with a startup surge of 0.5 amps for 2 milliseconds.

2. Connect the double detecting transmitter probe wires to the two TMTR terminals on the channel 1 side of the control module and the double detecting receiving probe wires to the two RCVR terminals on the channel 1 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.

   Note: Prime Controls assures compatibility with PN: CBL101-XX cables and the cabling pre-attached to certain probes. Other types of cabling, and also, cable lengths above 30 meters (approx 100 ft) are not advised.

   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 tab detecting transmitter probe wires to the TMTR terminals on the channel 2 side of the control module and the tab detecting receiving probe wires to the two RCVR terminals on the channel 2 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 setting of SW 5. See switch settings later in this document.

   The FLT outputs are always ON for no fault. 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, the AUX inputs may be wired to provide external control of the sensing mode of the SD220. 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 Switch Options

To access the DIP switches in the middle of the front panel, swing the hinged plastic window to the side. The left-most switch is SW1, the right-most is SW8. The switches are on when in the up position.

Channel 1 Switch Options

Switch	OFF	ON
SW1	Sense aluminum ends	Sense steel ends
SW2	On-press sensing	Off-press sensing (high speed)
SW3	Select fail-safe mode	Select compatibility mode
SW4	Fixed thresholds	Adjustable thresholds
SW5	Sourcing outputs	Sinking outputs
SW6	No overlap allowed	Overlap allowed if SW2 ON
SW7	Not used	
SW8	Not used	

Channel 2 Switch Options

Switch	OFF	ON
SW1	Sense aluminum ends	Sense steel ends
SW2	Sense aluminum tabs	Sense steel tabs
SW3	Select fail-safe mode	Select compatibility mode
SW4	Fixed thresholds	Adjustable thresholds
SW5	Sourcing outputs	Sinking outputs
SW6	Enable tab profiling	Disable tab profiling
SW7	Not used	
SW8	Not used	

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

Sensing Aluminum Ends

When sensing aluminum shells, insure that SW1 is off for both channels.

Sensing Steel Ends

When sensing steel shells, insure that SW1 is on for both channels.

Sensing Aluminum Tabs on Aluminum Ends

When sensing aluminum tabs on aluminum ends, insure SW1 and SW2 are off for both channels.

Sensing Aluminum Tabs on Steel Ends

When sensing aluminum tabs on steel ends, set SW1 on and SW2 off for channel 1. Set SW1 on and SW2 off for channel 2.

Sensing Steel Tabs on Steel Ends

When sensing steel tabs on steel ends, set SW1 on and SW2 off for channel 1 and set both SW1 and SW2 on for channel 2.

Set Sinking or Sourcing Outputs

The setting of SW5 determines whether the output drivers are sinking or sourcing. SW5 off selects sourcing, SW5 on selects sinking.

Set Outputs for Failsafe or Compatibility

When SW3 is on, the sourcing outputs of the SD220 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 SW3 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 SW3 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

Enable or Disable Tab Profiling

The SD220 uses two different methods for determining the absence or presence of tabs. The most basic method is simple thresholding of the sensor signals. As the shape of the beverage ends and tabs evolved and the speed of presses increased, it became necessary to implement a redundant test that recognizes the profile of a tab as it moves through the machine. This feature, however, is not compatible with larger and steel ends or with machines that have stainless steel belts. The stainless steel belts can change the sensor signal sufficiently to interfere with the tab profiling algorithm and cause the system to report self check errors. Profiling is most effective in the detection of aluminum tabs on aluminum ends on high speed presses. SW6 enables and disables tab profiling.

Setting Options Through the Front Panel

Adjusting the Tolerance

Adjust the double shell tolerance as follows:

1) Insure that SW4 is on. If necessary, change the switch position and power the unit down and back up..
2) Press and hold the channel 1 calibrate pushbutton for at least 3 seconds until **tL** appears on the display.

3) Release the pushbutton and observe the current value of the threshold (in percent).
4) 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.
5) 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.
6) 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 that SW4 is on. 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 **tL** appears on the display.
3) Release the pushbutton and observe the current value of the threshold (in percent).
4) 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.
5) 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.
6) 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.

Set Display Direction

By default, the digital display values follow the strength of the receiver signal, increasing for stronger signal and decreasing for weaker signal. In this mode, the signal increases for thinner materials between the probes and decreases for thicker materials. The display may be inverted so that the values are proportional to material thickness rather than signal strength. To invert the display:

1) Press and hold the calibrate pushbutton until **do** appears on the display.
2) Release the pushbutton and the display changes to **0** or **1**.
3) At this point, with each press of the pushbutton the display toggles between **0** and **1**. The **0** selects normal display mode, **1** selects inverted mode..
4) When the desired value is on the display, wait 5 seconds and the display reverts to displaying the signal value in the selected mode.

The range of values available for the SD220 adjustable parameters are as follows:

Parameter Value Ranges

ID	Function	Range of Values
tL	double tolerance	10% to 90% for double (default is 35%)
tL	tab tolerance	10% to 90% for tab (default is 15%)
do	display direction	**0** for signal strength (default), **1** relative thickness
oL	overlap percentage	0% to 90% for off-press sensing only (SW2 On)

Special Functions

The SD220 offers two sets of optically isolated inputs on each channel that provide added control over the unit. These are the remote calibration input terminals labeled CAL+ and CAL- and the sensing mode inputs labeled AUX+, AUX-.

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Remote Calibration

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

Quick Calibration Changeover

The AUX input works in conjunction with SW1 (both channels) and SW2 (channel 2 only) to select the target tab and shell material combinations as presented in the table below.

When the AUX input is activated or deactivated, the SD220 changes to accommodate the new material combination and displays, for approximately 2 seconds, a two-character abbreviation indicating the selected targeted materials. The display interpretation is as follows:

Al – aluminum tab on aluminum shell
St – steel tab on steel shell
AS- aluminum tab on steel shell

The two-character indication also displays at power-up indicating the current selection.

Channel 1 Material Selection

SW1	AUX	Shell Material
OFF	OFF	Aluminum
OFF	ON	Steel
ON	OFF	Steel
ON	ON	Aluminum

Channel 2 Material Selection

SW1	SW2	AUX	Material Combination
OFF	OFF	OFF	Aluminum tab on aluminum end
OFF	OFF	ON	Aluminum tab on steel end
OFF	ON	OFF	Aluminum tab on aluminum end
OFF	ON	ON	Steel tab on steel end
ON	OFF	OFF	Aluminum tab on steel end
ON	OFF	ON	Aluminum tab on aluminum end
ON	ON	OFF	Steel tab on steel end
ON	ON	ON	Aluminum tab on aluminum end

If quick calibration changeover is to be activated remotely, connect the AUX+ and AUX- inputs appropriately. Connect *sinking* drivers or contacts to the AUX- terminal and connect AUX+ to the 24 volt power source. Connect *sourcing* drivers to the AUX+ terminal and connect AUX- to COM.

Determining Firmware Version

From time to time, as improvements are made to Prime Controls 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 1.00 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, hold the calibration pushbutton in as power is applied to the unit. The revision number is displayed directly on the digital display.

The two channels of the SD220 are independent and may be running different versions of firmware. Each must be checked separately.

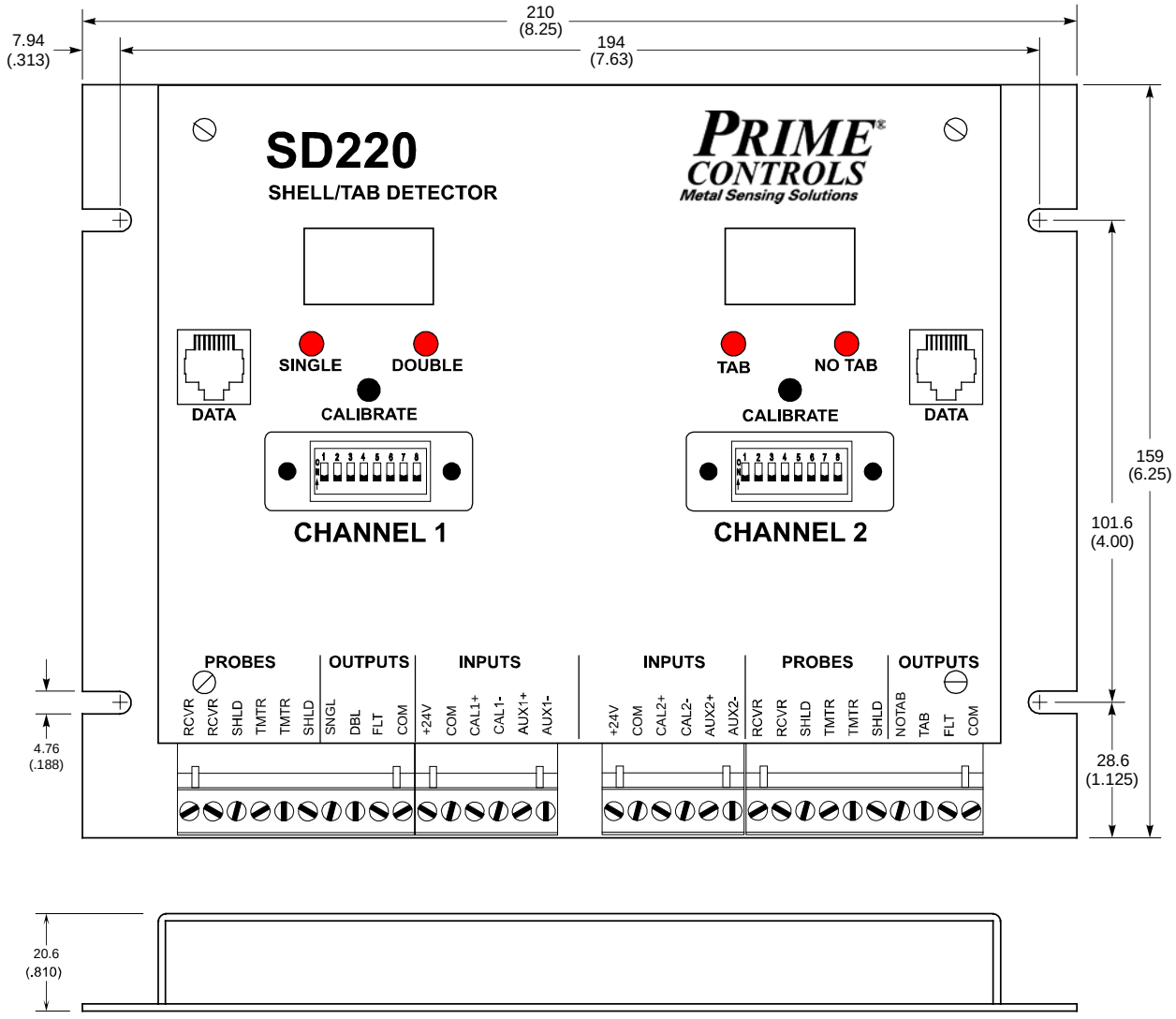
DOCUMENT APPLICABILITY

This document applies to SD220 units running firmware Version 1.01 through 1.11

ELECTRICAL SPECIFICATIONS

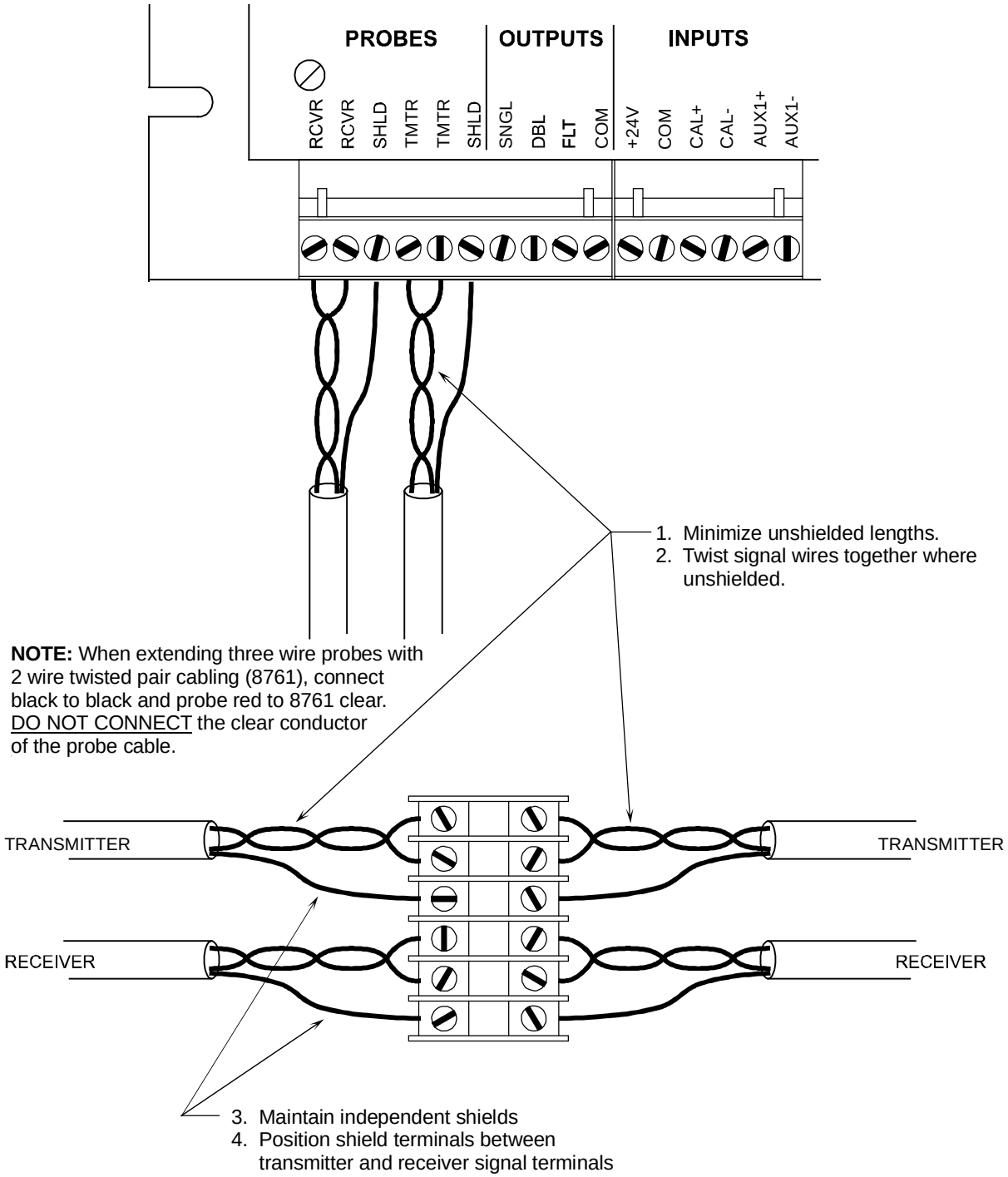
Supply Voltage:	24 volts DC plus or minus 10%
Supply Current per Channel:	130 mA plus sourcing output load
Inrush Current at Startup:	500 mA for 3 milliseconds per channel
AUX and CAL Max Input Voltage:	30V
AUX and CAL input impedance:	3300 ohms
Sourcing Outputs:	On voltage: Supply Voltage – 1.0 volt Off voltage: 0 volts Max current: 50 mA
Sinking Outputs:	On voltage: 0 volts Off voltage: Load pullup dependent Max current: 50 mA
Output Overload Protection:	Self-resetting thermal fuse
Input and Output Transient Protection:	30 volt transient absorber.
Probe Cabling:	Prime Controls PN: CBL101-XX, Belden 8761, or exact equivalent.

SD220 CONTROL MODULE DIMENSIONS



SD220 WIRING RECOMMENDATIONS

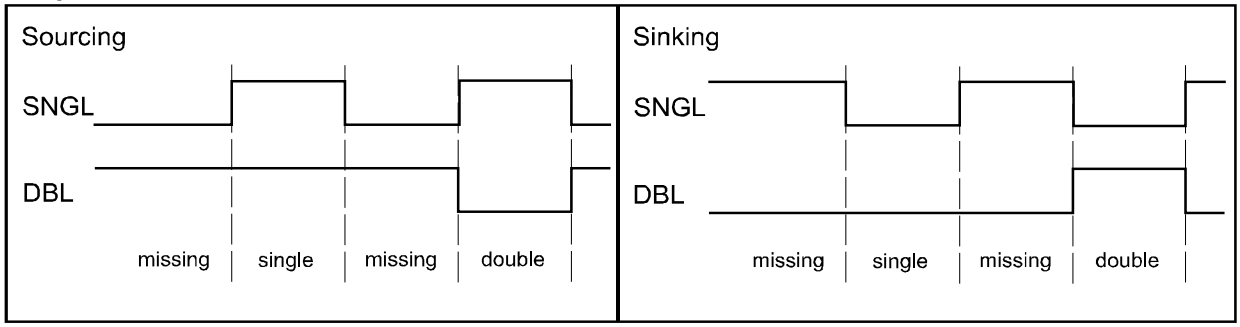
For maximum noise immunity, splice or terminate cables only when absolutely necessary. Where extension is necessary, use Belden 8761 or equivalent shielded twisted pair cable. The SD22x family of products is designed to provide high common mode noise rejection. Common mode rejection is realized most effectively with twisted pair cabling. Total cable lengths greater than 30 M (approx. 100 ft.) are not advised. Use of excessively long cables, or cables not specified by Prime Controls, may cause issues within the receiver and/or probe detection circuits of the controller.



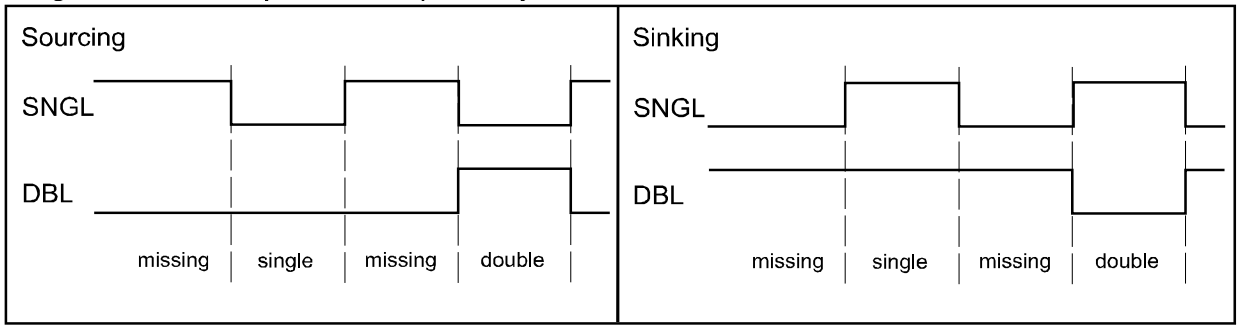
SD220 OUTPUT SIGNALS

CHANNEL 1 - INFEED

Single/Double Outputs - Failsafe Mode

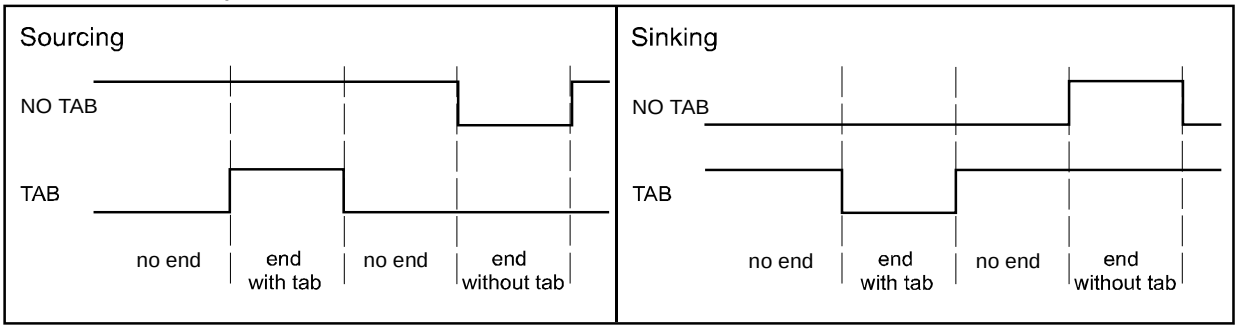


Single/Double Outputs - Compatibility Mode

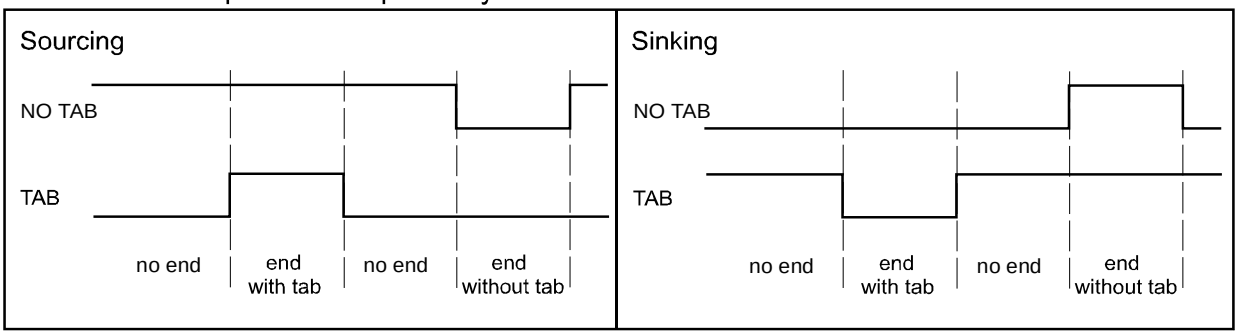


CHANNEL 2 - DISCHARGE

No Tab/Tab Outputs - Failsafe Mode



No Tab/Tab Outputs - Compatibility Mode



SUMMARY OF DIFFERENCES BETWEEN SD200 AND SD220

FEATURE	SD200	SD220
Wiring		
Power connection	+24V and COM to left or right channel	+24V and COM to both channels
Fault signal	Fault signals are slaved internally	Fault signals must be monitored independently
AUX input frequency change	AUX inputs are slaved internally	Both AUX inputs must be driven externally
Configuration		
DIP switch access	Remove cover	Window on front panel
Number of configuration switches	Four for both channels	Eight for each channel
Sink/Source select	Jumpers beneath cover	Switch Select
Al tab on steel end sensing	SU parameter set through front panel	Switch Select
Profiling enable/disable	Pd parameter set through front panel	Switch Select
Display inversion	Switch select	Parameter selected
Data Collection		
Serial port	Not available	Serial port on each channel

SD200 TO SD220 MIGRATION

Replacement of installed SD200 units by SD220s requires the following wiring changes:

1. +24V and COM must be connected to both channels of the SD220.
2. SD200 faults for either channel are reported on both fault outputs. The fault signals on the two channels of the SD220 are totally independent.
3. If your installation uses the AUX input to quickly change between calibrations on different shell materials, it is necessary with the SD220 to activate the AUX input on both channels independently. The AUX inputs are not slaved together as in the SD200.

Configuration of the SD220 has been simplified as compared to the SD200. It is no longer necessary to remove the cover to change options. These changes include:

1. The DIP switches, now eight per channel instead of four per unit, are accessible through a window on the front panel.
2. Where the SD200 requires jumper changes under the front panel to select sinking or sourcing outputs, the selection on the SD220 is made through the setting of DIP switch 5. Set SW5 off for sourcing and on for sinking.

The method of setting some options has changed. The list below shows which settings remain the same and which have changed:

CHANNEL 1 Configuration Switches

1. SW1 – (no change) – configures the unit for aluminum or steel ends.
2. SW2 – (change) – no longer inverts display, must *be off on SD220*.
3. SW3 – (no change) – selects output failsafe or compatibility mode.
4. SW4 – (no change) – selects fixed thresholds or adjustable thresholds.
5. SW5 – (new) – selects sourcing or sinking outputs.
6. SW6 – (new) – allows or disallows overlap – not used on SD220
7. SW7 – not used
8. SW8 – not used

CHANNEL 2 Configuration Switches

1. SW1 – (no change) – configures the unit for aluminum or steel ends.
2. SW2 – (change) – selects tab material, off for aluminum, on for steel
3. SW3 – (no change) – selects output failsafe or compatibility mode.
4. SW4 – (no change) – selects fixed thresholds or adjustable thresholds.
5. SW5 – (new) – selects sourcing or sinking outputs.
6. SW6 – (new) – enables or disables tab profiling.
7. SW7 – not used
8. SW8 – not used

Setup parameter **SU** not available on SD220; use SW2.

Setup parameter **Pd** not available on SD220; use SW6.

SW2 no longer inverts the display as on the SD220; use setup parameter **do** (display option) on the SD220

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