Vital Proximity Detection System Technical Reference Manual

Morley Bridge
Port Allen Canal
Brusly, Louisiana

Installation - January 2013

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*** Warnings and Cautions ***

The following technical Reference Manual is provided for reference only. Consult authorized signal staff for approved signal practice for the Morley Bridge.

The VPD circuit board should be handled with care to prevent electro-static discharge (ESD) damage during the installation and wiring of the signal system.

The VPD has no field serviceable parts, circuit board should be returned to J&A Industries for repair. Attempting to repair the circuit board will void warranty.

Most of the parts contained in the Morley Bridge VPD System are custom fabricated, lead times for delivery of some parts can exceed 4-6 weeks. Spares should be kept on-site to prevent train or service delays.

A typical installation schematic for the sensor and circuit board wiring is provided in this Technical Reference Manual. On-site official signal circuit plans should be used for the troubleshooting of the signal circuit.

The circuit board should be protected from excessive heat. Proper ventilation is required to keep the circuit board from failing at excessive heat levels.

Morley Bridge - Port Allen Canal

Moveable Span Bridge
Proximity Sensor Signal Detection

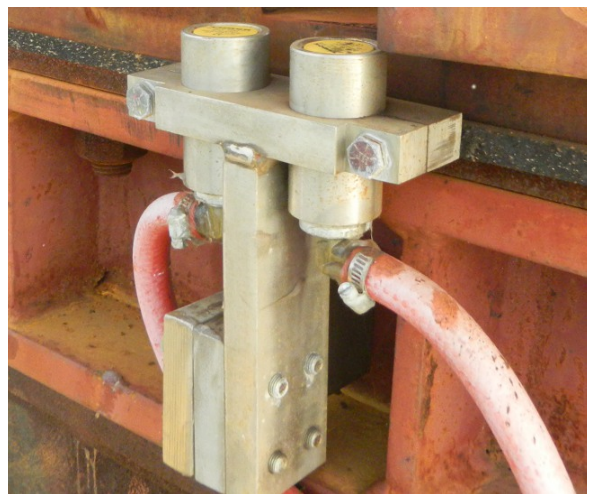
Operation Description:

The Proximity Sensor detection system is made up of 2 major components: inductive proximity sensors and Vital Proximity Detection (VPD) circuit board. The proximity sensors perform the position detection of the bridge structure to an exact predetermined distance.

The VPD circuit board provides the validation of the proximity sensor inputs for signal indication, checking for shorts, line resistance and proximity sensor failure. Both of these components have been designed to provide a state-of-the-art moveable span bridge detection system.

Proximity Sensor:

The proximity sensor is an inductive component containing two basic elements; an oscillator and a coil. The oscillator creates a frequency that is emitted from the coil and out through the sensor face. If a metal object enters this radiated field, eddy currents are induced on the metal targets' surface. As the target plate moves closer to the sensor, the eddy current increases, causing greater load on the oscillator. Control output is triggered when the oscillator load reaches a predetermined level which is related to the predetermined distance.



The proximity sensor is permanently encased in a stainless steel sleeve to provide additional protection and secured in the bracket using locking fasteners. (Refer to appendix for proximity sensor technical data)

Circuit Board:

The VPD circuit board performs the logic function with input from the proximity sensors and provides vital isolated +12 V output to the signal relays. Each output is driven by two switching power supplies, powered from each of the two microprocessors, providing redundant operation. Each microprocessor must also drive the power supplies at a specific frequency or if one would "hang up" no output would be allowed to be active. The circuit board also provides an external alarm output sent out to a signal relay if any error is detected by the circuit board. (Refer to appendix for VPD circuit board technical data)

Operation Description: (continued)

The Morley Bridge Vital Proximity Detection signal system utilizes two (2) VPD circuit boards that monitor eight (8) proximity sensors that check the miter rail seating position. As the bridge opens and closes, proximity sensors provide input to the VPD circuit board. The input and output circuits of the VPD unit will switch on or off dependent upon bridge position and display through the LEDs located on each circuit board. Each proximity sensor must detect the seated rail position or the relay outputs will not indicate.

Two (2) additional VPD circuit boards monitor eight (8) proximity sensors that confirm span lock position. As the two (2) bridge span locks located on each bridge end close into the locked position, proximity sensors provide position input to the VPD circuit board. As the bridge span locks open the open position indication is also provided. The input and output circuits of the VPD unit will switch on or off dependent upon lock position and display through the LEDs located on the circuit board. Each proximity sensor must detect the bridge span lock in a closed position or open (unlocked) position in order to have the relay output and associated indication.

During normal operation the following LED indications (see Table 1. Page 6) located on the circuit board will appear as depicted in the following table (refer to Figure 1 for location of the LED indication lights): This table is shown as typical for each of the four circuit boards used on the Morley Bridge.

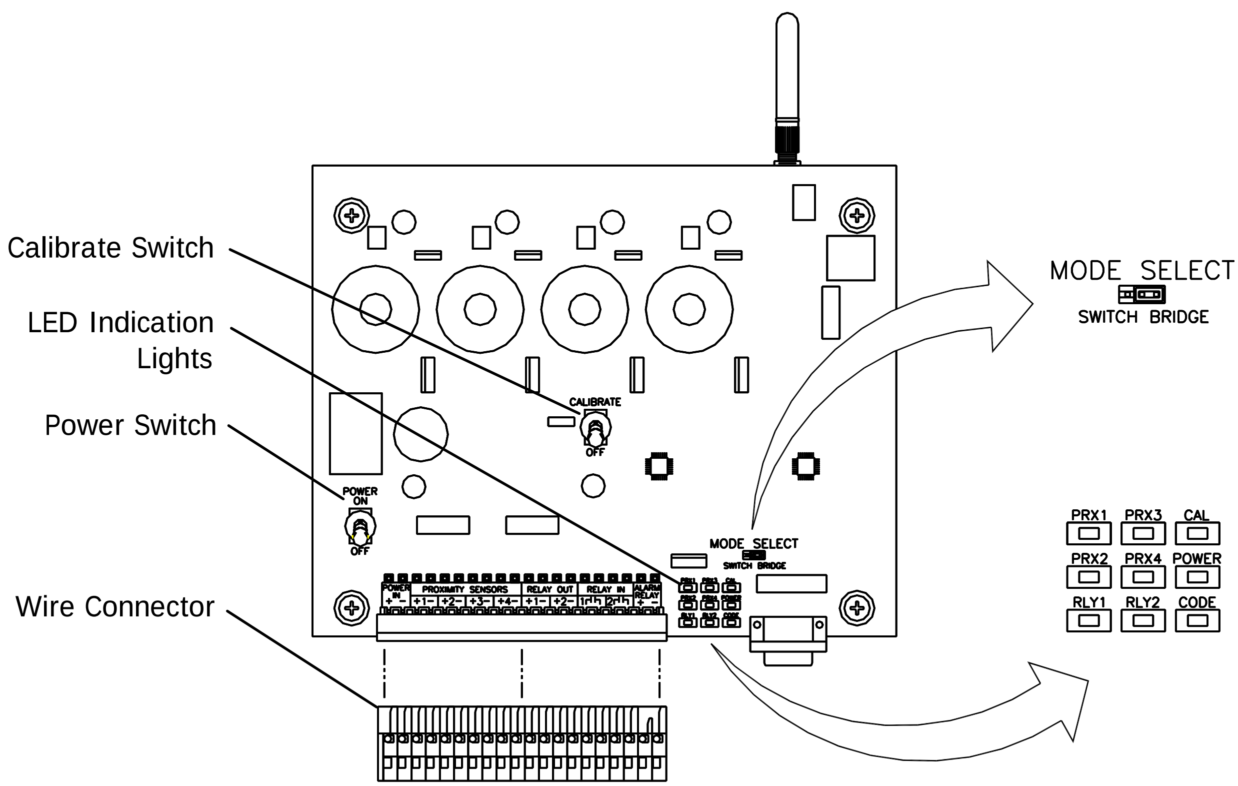


Figure 1. VPD Circuit Board Layout

Operation Description: (continued)

Table 1. Circuit Board LED Indications

Circuit Board LED Indication Label	Circuit Board # / Bridge Sensor Location		Bridge In Closed Position LED	Bridge In Open Position LED
PRX 1	Bd. #1 / NE Lift Rail Prox 1		ON	OFF
	Bd. #2 / E Span Lock Closed Prox 1			
	Bd. #3 / NW Lift Rail Prox 1			
	Bd. #4 / W Span Lock Closed Prox 1			
PRX 2	Bd. #1 / NE Lift Rail Prox 2		ON	OFF
	Bd. #2 / E Span Lock Closed Prox 2			
	Bd. #3 / NW Lift Rail Prox 2			
	Bd. #4 / W Span Lock Closed Prox 2			
RLY 1	Bd. #1 / NE Lift Rail Relay		ON	OFF
	Bd. #2 / East Span Lock Closed Relay			
	Bd. #3 / NW Lift Rail Relay			
	Bd. #4 / West Span Lock Closed Relay			
PRX 3	Bd. #1 / SE Lift Rail Prox 1		ON	OFF
	Bd. #2 / E Span Lock Open Prox 1		OFF	ON
	Bd. #3 / SW Lift Rail Prox 1		ON	OFF
	Bd. #4 / W Span Lock Open Prox 1		OFF	ON
PRX 4	Bd. #1 / SE Lift Rail Prox 2		ON	OFF
	Bd. #2 / E Span Lock Open Prox 2		OFF	ON
	Bd. #3 / SW Lift Rail Prox 2		ON	OFF
	Bd. #4 / W Span Lock Open Prox 2		OFF	ON
RLY 2	Bd. #1 / SE Lift Rail Relay		ON	OFF
	Bd. #2 / East Span Lock Open Relay		OFF	ON
	Bd. #3 / SW Lift Rail Relay		ON	OFF
	Bd. #4 / West Span Lock Open Relay		OFF	ON
CODE	VPD Circuit Board		OFF	OFF

Operation Description: (continued)

Remote Status Unit (RSU):

The Remote Status Unit (RSU) (see Figure 2) provides the maintainer with an instrument to determine proximity sensor and signal relay on/off status during the operation, adjustment, and setup of the VPD system. The handheld unit also provides the user with circuit board status while allowing sensor adjustment by a single individual. The RSU operates on a 9-volt battery located in the base of the unit and should be checked regularly to ensure that the unit is providing the strongest signal.

To begin using the Remote Status Unit handheld, turn on the power switch located on the lower portion of the unit. The LED on the handheld switch will light to show power “ON”. Ensure that the “CALIBRATE” mode switch is turned to the “on” position on the VPD circuit board (refer to Figure 1) only on the circuit board requiring calibration. A corresponding “CAL” LED on the circuit board will illuminate to indicate an “ON” status. The RSU will go through a normal startup sequence where each LED on the unit illuminates to confirm operation. The red “VALID SIGNAL” LED must be illuminated on the RSU to confirm proper reception from the VPD circuit board’s RF transmitter. The LED lights on the RSU handheld unit will flash occasionally to correspond with the circuit boards intermittent broadcasting of the VPD status. A loss of signal strength or operability of the handheld unit will usually indicate battery replacement is required.

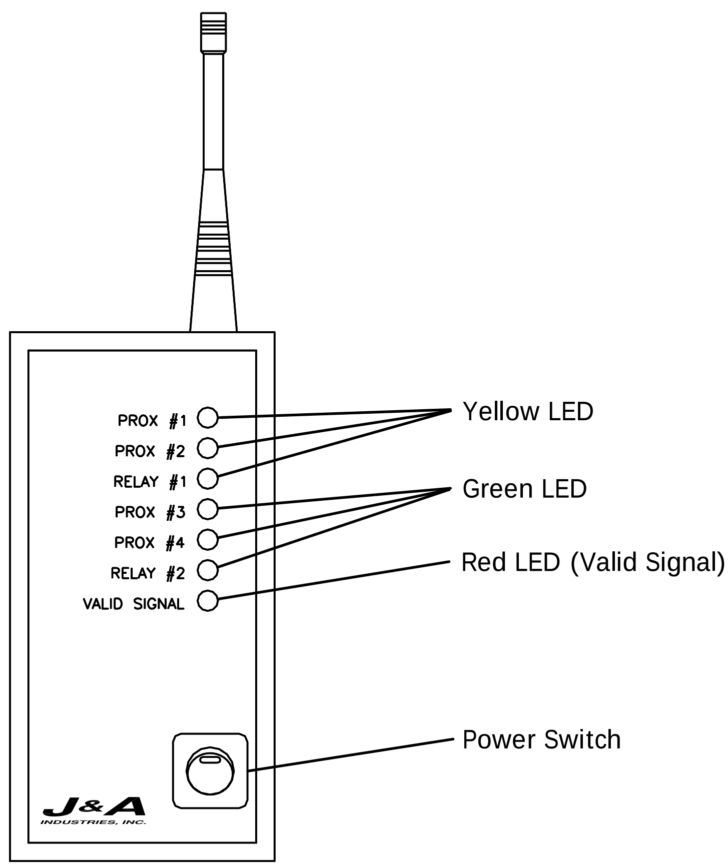


Figure 2. Remote Status Unit

Troubleshooting Information

Remote Status Unit (RSU): (continued)

Remote Antenna:
A remote antenna is also provided to enhance signal strength to the Remote Status Unit. The antenna can be temporarily mounted outside of the signal house or equipment case to improve RSU signal reception.

If in place, remove short antenna that extends outside of the circuit board enclosure. Attach the coax connector of the remote antenna to the antenna output coax on the top right corner of the circuit board. Move antenna to a location where it will enhance reception by the RSU handheld unit while in operation.

It is very important to remove the remote antenna after completion of circuit board calibration to prevent lightning damage in the event of electrical storms.

Failure Indications:

If a proximity sensor or circuit board failure occurs, a red LED indicates an error code output on the VPD circuit board (see Figure 1, page 5) will flash on and off to indicate the error type as depicted on the following table. This VPD system feature is designed to aid the signal maintainer with most of the common troubleshooting issues.

Generally, turning the power off for 15 seconds and then on again or cycling the bridge will reset the VPD and re-energize the outputs to return to normal operation, provided the improper input which caused the failure no longer exists. If a required input is still incorrect or the circuit board has detected a failure after resetting, the VPD will simply go into failure mode again.

If one or more of the proximity sensors is out of detection range the signal relay will not pick and will require the signal maintainer to inspect the sensor and move it back into proper adjustment. Comparing the proximity sensor and relay LEDs on the VPD circuit board or using the handheld RSU will aid with the troubleshooting. Refer to the Sensor Adjustment Procedure (see page 10) to return sensor to proper adjustment range.

When the circuit board indicates an error, it is advisable to first compare the VPD circuit board indicator LEDs using the Error Codes. There are two main possibilities for error types; sensor or circuit board related errors. The circuit board LED lights will flash short and long on / off sequence that repeats after a short pause. Troubleshooting charts for both the sensors and circuit board are located on pages 12 and 13.

Simply note operational lighting sequences (on/off) of the red circuit board error code LED with the following table:

Table 2. Circuit Board Error Indications Codes

Dash Sequence			Description	Location	Cause
• • • —	3 short – 1 long		Sensor 1 Error	(See Page 6)	Most probable: Sensor disconnected, connected reverse polarity, or failed. Input opened or shorted. Other causes: Bad component in analog channel 1 on circuit board
• • — •	2 short – 1 long – 1 short		Sensor 2 Error	(See Page 6)	Most probable: Sensor disconnected, connected reverse polarity, or failed. Input opened or shorted. Other causes: Bad component in analog channel 2 on circuit board.
• — • •	1 short – 1 long – 2 short		Sensor 3 Error	(See Page 6)	Most probable: Sensor disconnected, connected reverse polarity, or failed. Input opened or shorted. Other causes: Bad component in analog channel 3 on circuit board.
— • • •	1 long – 3 short		Sensor 4 Error	(See Page 6)	Most probable: Sensor disconnected, connected reverse polarity, or failed. Other causes: Bad component in analog channel 3 on circuit board
— — • •	2 long – 2 short		MODE Error	Circuit board jumper	Mode Select jumper not installed
— — • • •	2 long – 3 short		SYNC Error	Circuit board dual processor communication	CPUs not communicating – Most probable: R26 (0 ohm) open, missing, or bumped out of tolerance Other causes: CPU2 not running, open or shorted and/or clock lines Improper jumper placed on P1
— — •	2 long – 1 short		RES Error	Circuit board resistor pairs	Most Probable: Analog channel 1 – 4 resistor pairs are out of balance. Other causes: U1/U2 analog inputs are bad.
• • • • •	1 Short		SHIM Error (Switch Mode)	Circuit Board MODE Select jumper in	Most probable: Mode Select jumper is set for SWITCH mode instead of BRIDGE mode Other causes: U1/U2 analog input bad
— — • • • •	2 long – 4 short		INPUT TEST Error	Circuit Board	Most probable: Analog channel 1 – 4 problem Other causes: U1/U2 analog bad
— — — —	1 Long		Power Supply Error	Circuit Board	Most probable: Bad power supply Other causes: Bad component in the power supply feedback circuit
			Relay Error	Signal Relay	Most probable: Bad signal relay or relay feedback is disconnected from circuit board Other causes: Bad component in the relay feedback circuit

Sensor Adjustment Procedures

Proximity sensors provide indications at each of the miter lift rails of the lift bridge span, directly detecting the miter lift rail target at each location. The proximity sensor mounting brackets are located on the miter rail base plate on the fixed span bridge ends. When the lift span lowers onto the bridge fixed span rail seat, the sensor performs span detection.

The span lock proximity sensors detect the span lock bar that travels into the fixed span lock receiver. It determines the lock bar position is in proper location. The sensor mounting brackets are located on the span lock casting located beneath the span surface.

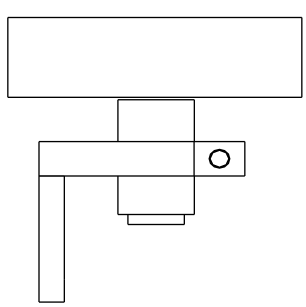
Adjustment Procedures:

The Lift Rail Sensor Bracket has two adjustments: The sensor attached in the bracket can be raised or lowered. The bracket cannot be raised or lowered. Target and bracket alignment side-to-side alignment can be performed be loosening the mounting bolts and moving target side to side into alternate mounting positions.

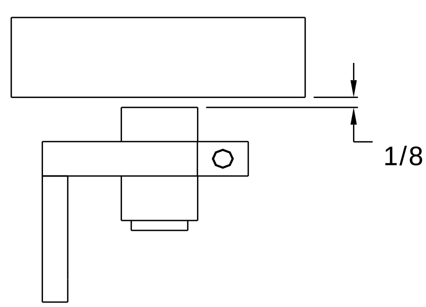
The Span Lock Sensor Bracket has three adjustments: The proximity sensor in the bracket can be raised and lowered. The bracket can be moved along the designed mounting slots. The target can be mounted in any combination of tapped mounting holes in the plate attached to the span lock bar.

It is important to ensure that the bridge span is fully seated in the miter rail pockets before making any of the following adjustments or that shims are in the rail pockets to provide proper spacing for sensor off detection position.

The proximity sensor can be adjusted up or down within the bracket to obtain the standard bridge seat fail dimension, typically 1/4 to 3/8 inch. The typical sensor “ON” distance is 10mm, (0.3937”) or approximately 3/8”. If you want the indication to turn “OFF” when the bridge moves away from the proximity sensor 1/4” then adjustment of the sensor would require setting the sensor 1/8” away from the target. Other variables on proximity sensor detection distances may include temperature or material being detected.



Proximity Sensor adjusted
to turn off at 3/8 inch



Proximity Sensor adjusted
to turn off at 1/4 inch

Adjustment Procedures: (continued)

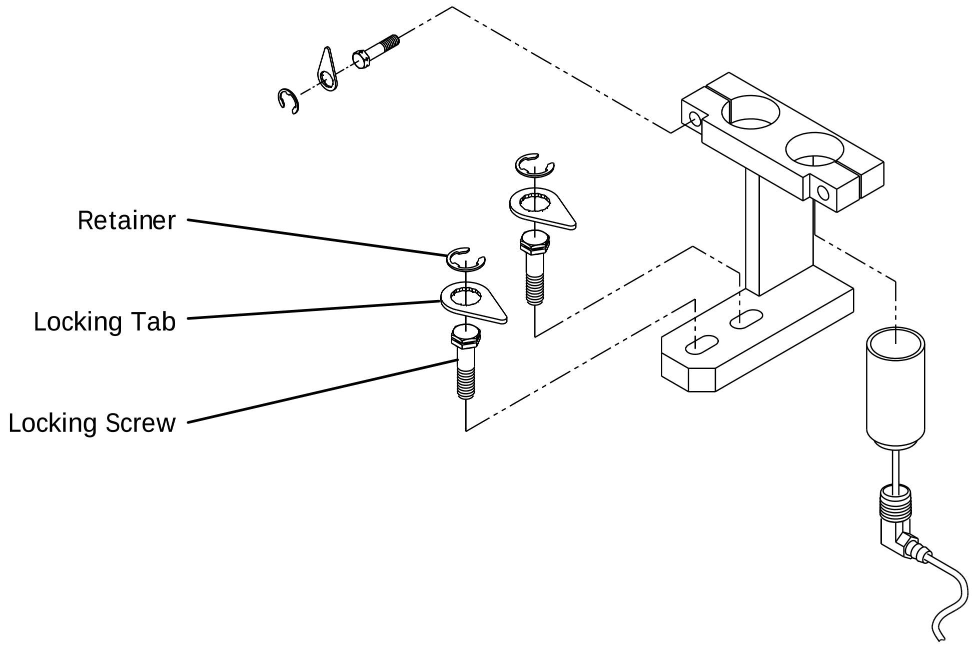


Figure 3. Lift Rail Bracket Sensor Adjustment

1. Ensure that the calibrate mode switch, located near the center of the Vital Proximity Detection (VPD) circuit board has been turned on (see Figure 1, Page 5). A red indicator LED on the circuit board will illuminate to confirm an "on" position.

2. Turn on the handheld Remote Status Unit (RSU) and wait for the unit to fully cycle through the startup procedure. The "Valid Signal" LED light on the handheld RSU will be on only if the VPD circuit board calibrate switch has been turned on.

It is normal for the RSU LED indicator lights to flicker on the handheld unit as the circuit board broadcasts information to the handheld unit. If signal distance or strength deteriorates, replace the 9-volt battery located in the base of the RSU. When not in use ensure that both the handheld RSU and the calibrate switch located on the VPD circuit board are turned off.

3. Remove the retainer clip from the head of the locking screw located on the front of the sensor mounting bracket. Carefully remove the locking tab from the locking screw. The locking screw head should now be accessible. Using a wrench or socket loosen the screw just enough to free the sleeved proximity sensor from the bracket.

4. Slide the proximity sensor either up or down to desired position using the handheld RSU to determine when the sensor turns either on or off.

Adjustment Procedures: (continued)

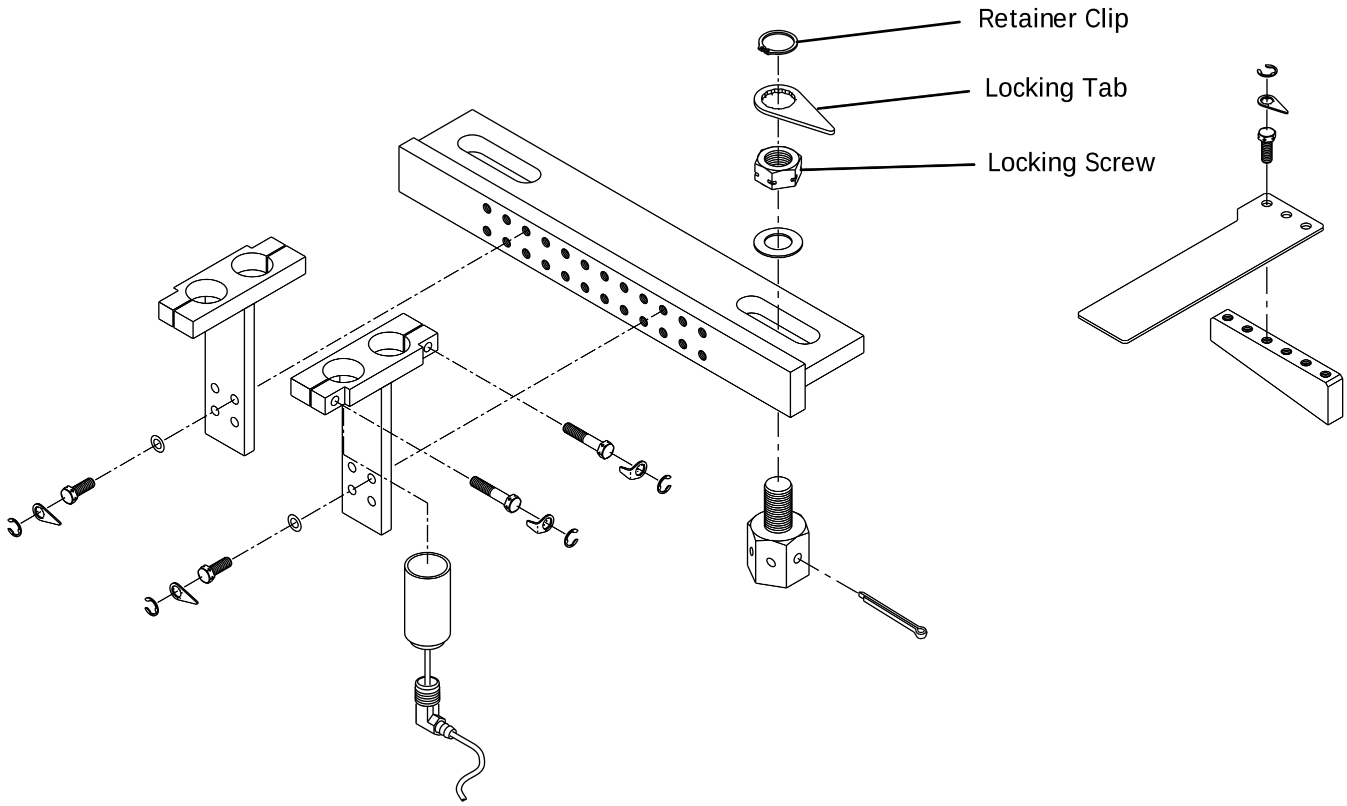
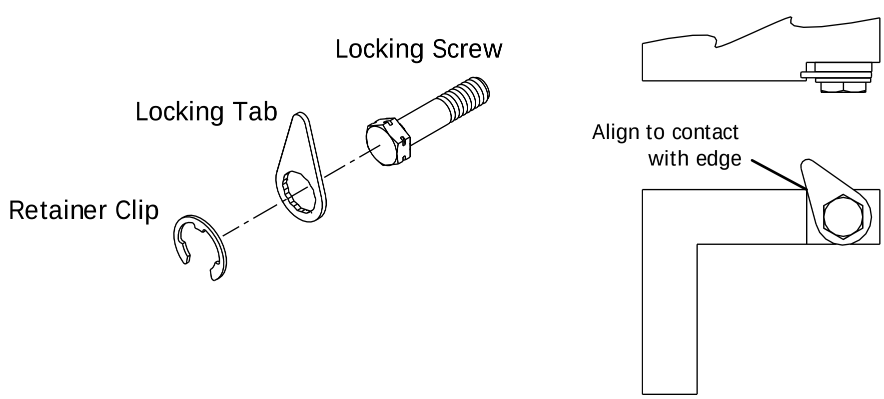


Figure 4. Span Lock Bracket Sensor Adjustment

5. While keeping proximity sensor in the desired position, firmly tighten the locking screw or nut, (depending on which bracket or sensor is needing adjustment) replace the locking tab so that the retainer makes contact with base bracket to prevent the retainer from moving counterclockwise as shown in the below diagram, and securely add retainer clip.

6. Turn off the RSU handheld switch and the calibrate mode switch on the VPD circuit board and double check bracket for tightness.



VPD Circuit Board Replacement

Use caution whenever handling the VPD circuit board to prevent damage from electrostatic discharge (ESD)

There are no replacement components for the Vital Proximity Detection circuit board. If there are indicated failures shown on the error code LEDs or any other indication of circuit board malfunction as described in the troubleshooting section of this manual, the circuit board assembly should be replaced. Tampering or attempting to replace components on the VPD circuit board will void the factory warranty.

Use caution to prevent ESD damage to the components on the VPD circuit board, especially during installation. Touch a metal chassis or other metal object before handling the circuit board to mitigate any damage from static buildup and, whenever possible, handle circuit board by the edges. Keeping the VPD unit in the original plastic shipping bag during handling will also aid in any accidental damage until installation occurs.

To begin the removal of the circuit board from its enclosure, turn off the power switch on the circuit board. Remove the orange Wago wiring harness connector from the circuit board then remove the four mounting screws from each corner of the circuit board.

Carefully pull the circuit board assembly from the junction box enclosure. Place the damaged or failed circuit board into the replacement board's plastic shipping bag for return to J&A Industries and install new circuit board. Ensure that the new circuit board power switch is in the off position before reinstalling the orange Wago connector. Ensure that the orange Wago connector has been fully seated before turning on power to the new board.

Review the circuit board troubleshooting diagram to evaluate any additional issues or call J&A Industries for additional assistance. J&A Industries will be able to evaluate the circuit board and forward a replacement backup.

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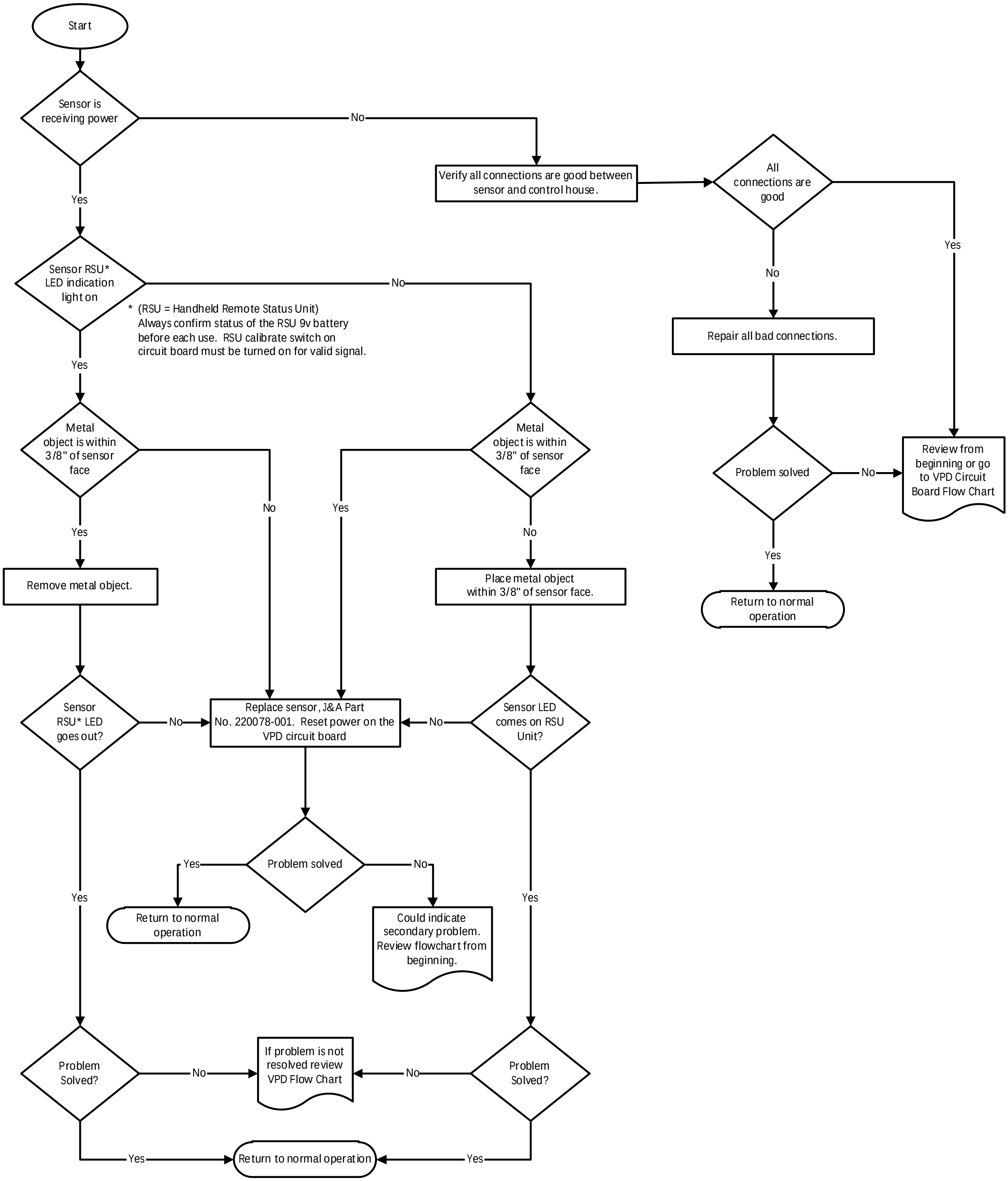
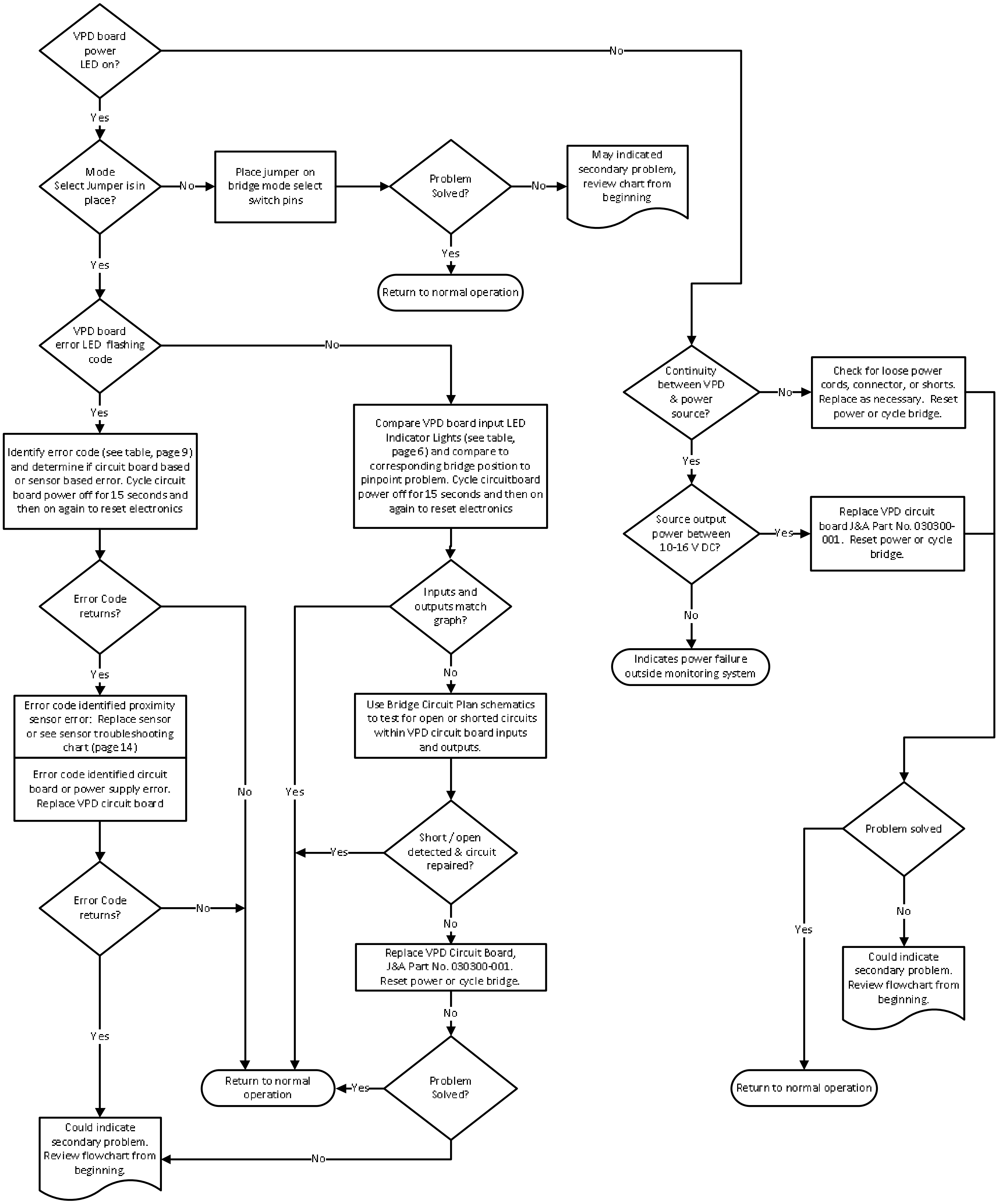
Sensor Troubleshooting Diagram



Circuit Board Troubleshooting Diagram



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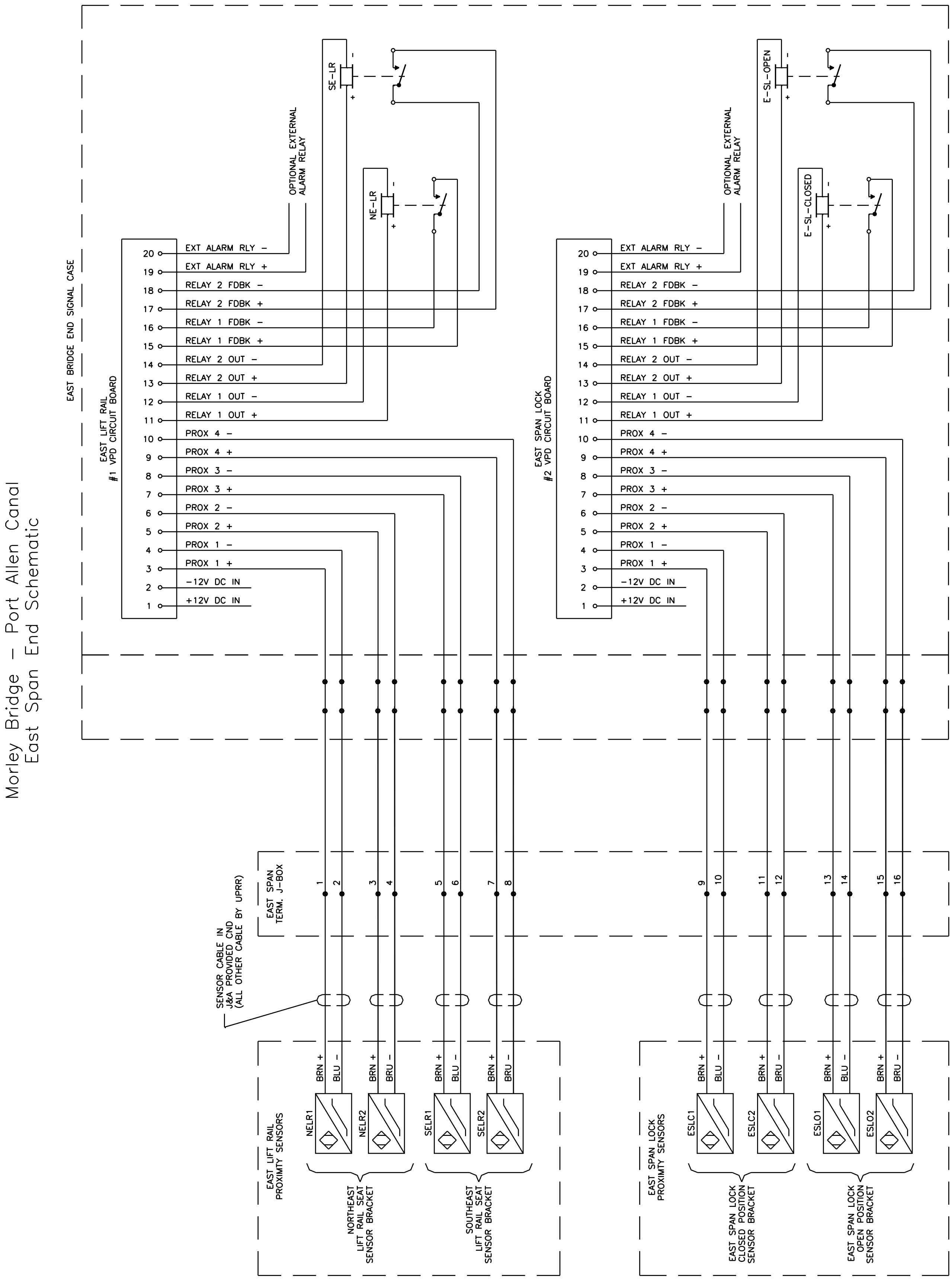

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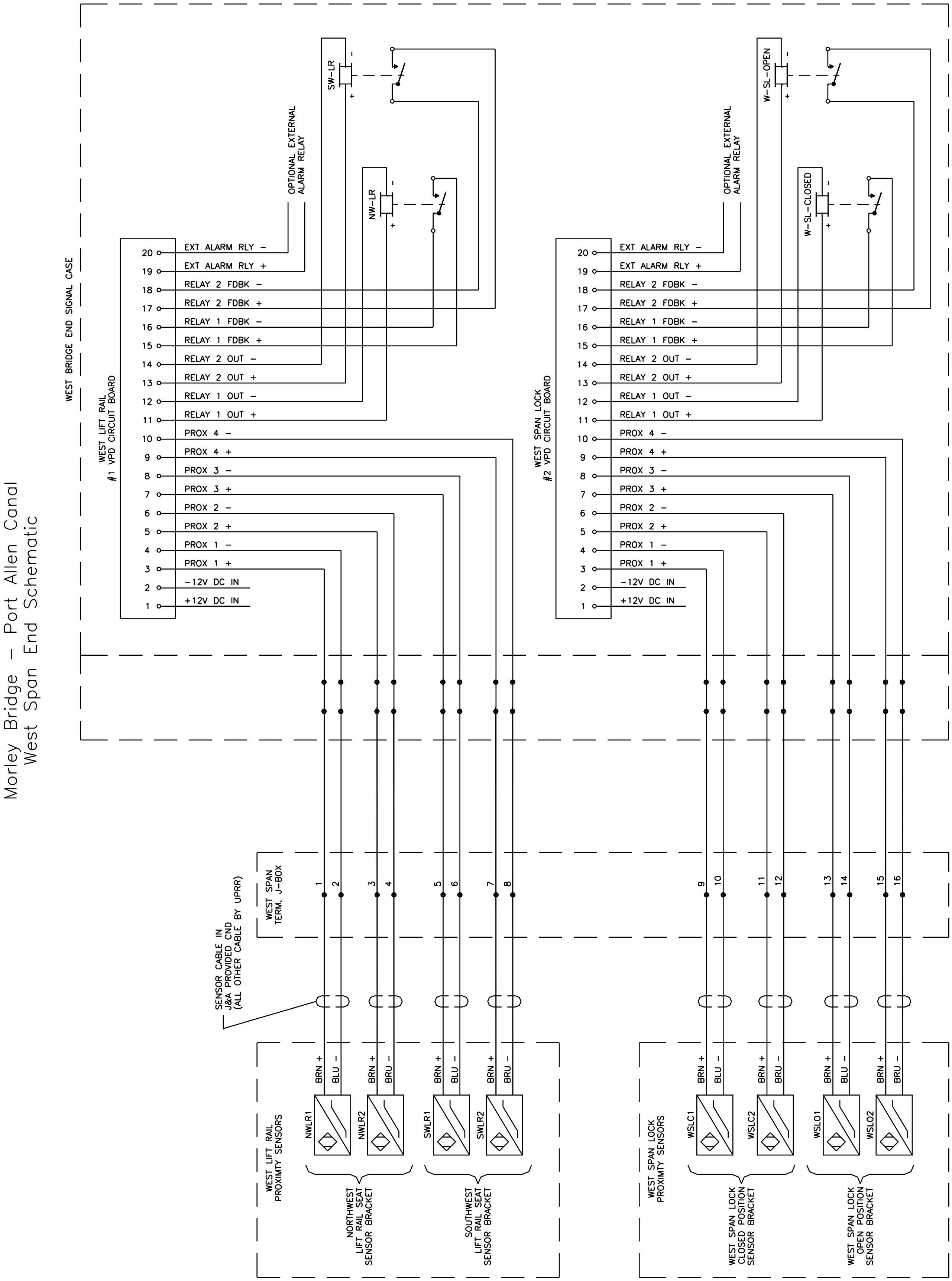

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