SP6R-X
LEVEL CONTROLLER
INSTALLATION INSTRUCTIONS

User Manual

Manufactured by: SJE Inc.
Technical support: +1-800-746-6287
techsupport@sjeinc.com

www.csicontrols.com www.primexcontrols.com www.sjerhombus.com

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⚠ WARNINGS

Failure to read and understand the information provided in this manual may result in personal injury or death, damage to the product or product failure. Please read each section in its entirety and be sure you understand the information provided in the section and related sections before attempting any of the procedures or operations given.

Failure to follow these precautions could result in serious injury or death. Keep these instructions with warranty after installation. This product must be installed in accordance with National Electrical Code, ANSI/NFPA 70 so as to prevent moisture from entering or accumulating within the controller housing.

⚠WARNING

ELECTRICAL SHOCK HAZARD
A qualified service person must install and service this product according to applicable codes and electrical schematics. Disconnect power prior to servicing any equipment with the SP6R-X controller.

- Do not connect power to this equipment if it has been damaged or has any missing parts.
- The SP6R-X contains no serviceable parts; do not attempt to repair this equipment.
- Do not install in areas with: excessive or conductive dust, corrosive or flammable gas, moisture or rain, excessive heat, regular impact shocks, or excessive vibration.

⚠WARNING

EXPLOSION OR FIRE HAZARD
Do not use this product with flammable liquids. Do not install in hazardous locations as defined by National Electrical Code, ANSI/NFPA 70.

Warning: Users must read this manual and understand controller operation before changing any settings. Entering incorrect settings may result in damage to equipment.

If the SP6R-X controller was shipped pre-installed in a control panel, some default values may have been changed at the factory in order to properly test the control panel operation. The user must adjust the settings to the requirements of their particular installation

The user should always keep a record of the settings before making changes, in case there is a need to revert to previous settings. The user should also record all settings changed for use in programming a new controller in case a replacement is ever needed.

Always thoroughly test controller operation in the installed configuration to verify user settings.

INTRODUCTION & SPECIFICATIONS

Thank you for your purchase of the SP6R-X controller. This manual explains the features and operations of the SP6R-X controller which was designed to monitor a 4-20mA input signal. The controller features six programmable relay outputs that can be used for control and alarm puposes. The input range is fully configurable. A rotary selector knob is included along with back and escape pushbuttons for intuitive menu navigation and quick setting adjustments. A simulation mode allows the user to easily test the setpoints and relay operation.

GENERAL
Six configurable relay outputs
Normally-Open or Normally-Closed operation
Configurable units
Operates using 4-20mA level transmitter
Scalable 4-20mA output
Relay ouput status indicator on display
Rotary selector for menu navigation
2.7” blue OLED 64 x 256 pixel display

ELECTRICAL SPECIFICATIONS
Power

- 24 VDC (19-28 VDC, 325 mA max)
- Optional battery backup

Dedicated I/Os

- 6 relay outputs (120 VAC, 3A Max.)
- 1 analog input (4-20mA, 14 bit resolution, non-isolated)
- 1 analog output (4-20mA, 12 bit resolution, non-isolated, fully scalable)

Serial Communication Port

- RS-485 3-Wire (half duplex)
- Modbus RTU
- 9600 baud, 1 stop bit, no parity
- Designed for complete compatibility with the SJE Panel Link™ Gateway.

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DIMENSIONS
7.2 x 5.7 x 2.5 inches (18.3 x 14.5 x 6.4 cm)

SYSTEM

- Individual on and off setpoints for each relay output
- Level Simulation mode
- Configurable relay operation in case of level transmitter failure
- The bar graph range is user adjustable

ENVIRONMENT
Operational temperature -4ºF to 158ºF (-20ºC to 70ºC)
Storage temperature -4ºF to 185ºF (-20ºC to 85ºC)
Relative Humidity (RH) 5% to 95% (non-condensing)

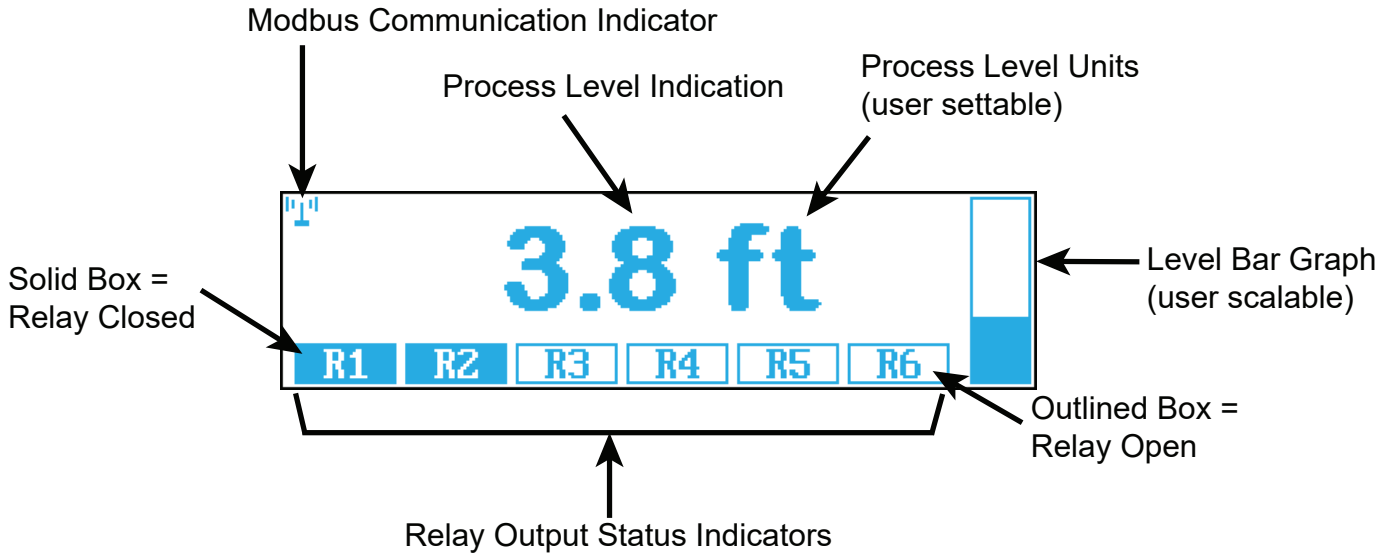
Not outdoor rated—use only indoors or inside an outdoor rated enclosure

An SP6R-X-N4X is avaliable which includes an SP6R-X controller mounted within a NEMA 4X enclosure with a pre-wired power supply and terminal blocks.

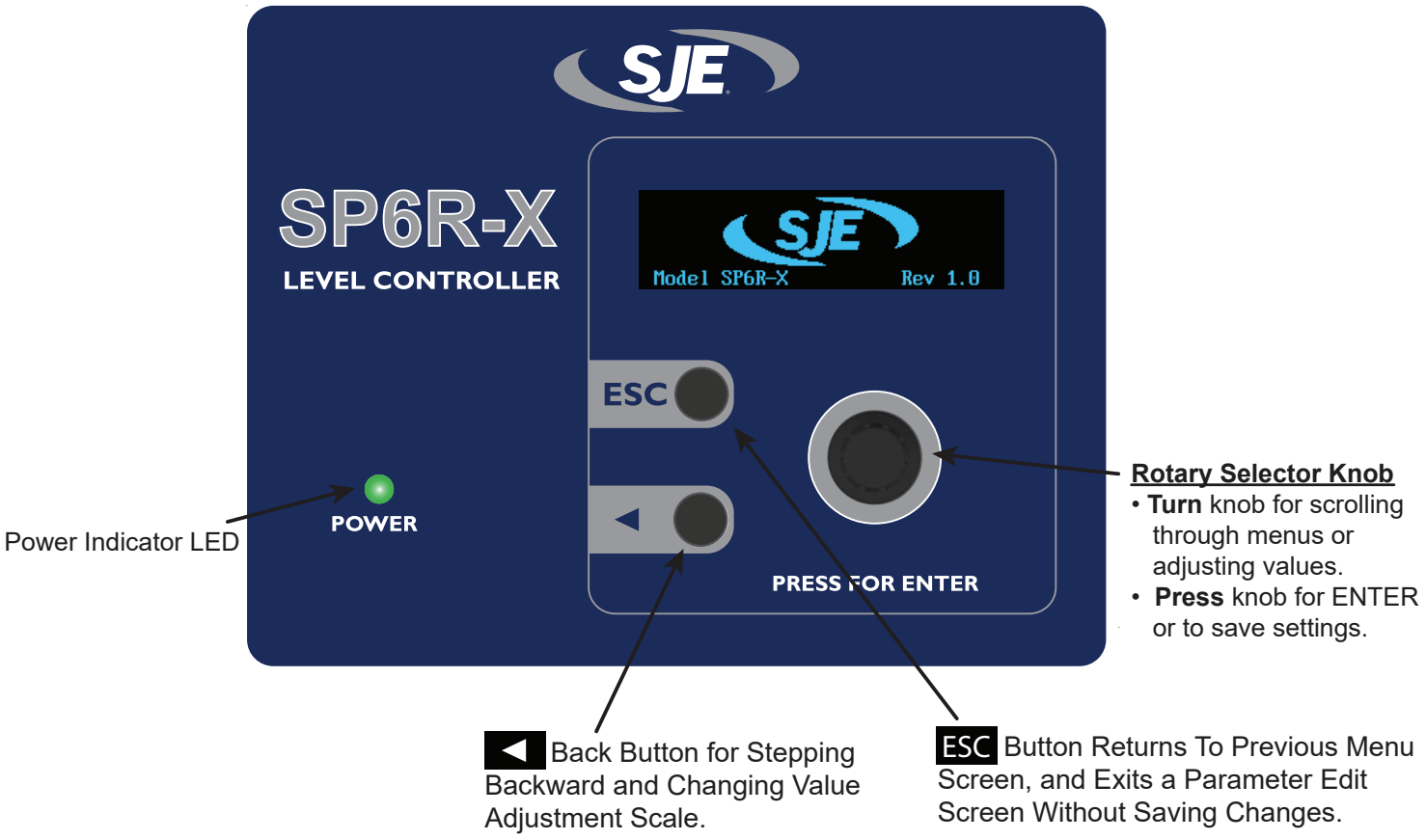
PROGRAMMING

MAIN SCREEN

The main screen gives the operator an overview of the system status including any active alarms.

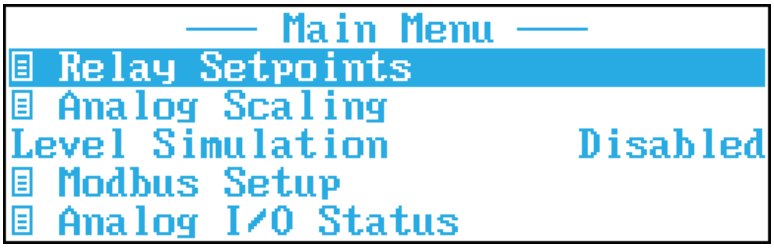


USER INTERFACE



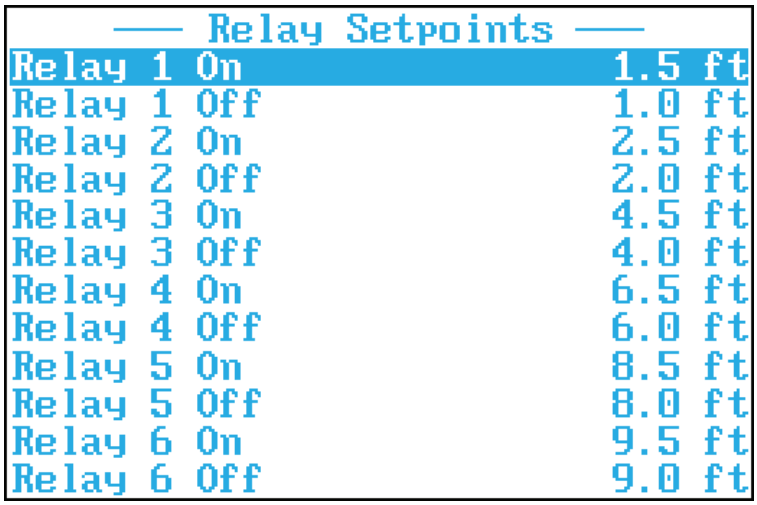
MAIN MENU

While in the Main Display screen, press the ENTER button to view the Main Menu.



RELAY SETPOINTS

These are the Relay Setpoints that can be adjusted.



An edit screen can be brought up by pressing the selection knob when the desired setpoint is highlighted.

To adjust the value simply scroll the knob to the desired value and click the knob to save the setting. The adjustment scale will default to tenths. The adjustment scale can be set to tenths, ones, tens and hundreds as shown on previous page. Depending on the specific adjustment, hundreds may not be an option.

To adjust the scale, click the ◄ button until the desired increment is highlighted.

Ones will be adjusted

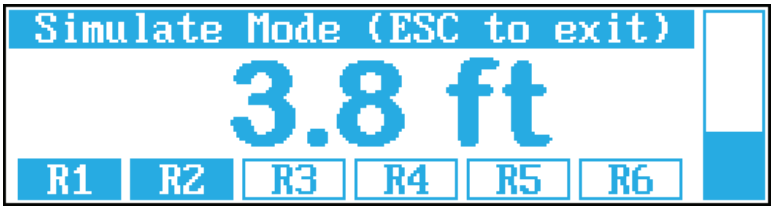
Tens will be adjusted

Hundreds will be adjusted

The default scale is feet. This can be changed using the Analog Scaling menu.
To ignore any changes and return to the previous screen, press the ESC button or press and hold the ◄ button.

LEVEL SIMULATION

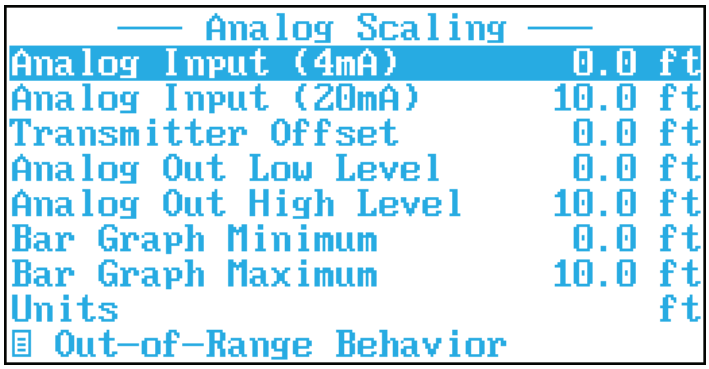
When Enabled**, Level Simulation** is used to temporarily use the selector wheel to simulate input level changes. This can be helpful for troubleshooting a system to ensure the controller is functioning correctly without actually having various level scenarios available.



Rotate the selector knob to make fine adjustments. To make coarse adjustments, press and hold the ◄ button while rotating the selector knob.

ANALOG SCALING MENU

The Analog Scaling menu contains the following 8 settings.



ANALOG INPUT (4mA)
Set this to the displayed level reading when the signal value is equal to 4 mA.
Allowable range: 0-999.9.

ANALOG INPUT (20mA)
Set this to the displayed level reading when the signal value is equal to 20 mA.
Allowable range: 0-999.9.

TRANSMITTER OFFSET
Use the Transmitter Offset to add a constant amount to the measured level input. For example, in the case where a 20.0-ft range submersible level transmitter was mounted one foot above the bottom of the tank, the Transmitter Offset setting would be “001.0 ft”. This would add 1.0 ft to whatever the input reading would be, so that all displayed levels were with respect to the bottom of the tank, not merely the bottom of the level sensor. In the example given, a 20mA input would be displayed as 21.0 ft. All level setpoints are referenced to the displayed level, which includes any Transmitter Offset.
Allowable range: -999.9 – to 999.9.

ANALOG OUT LOW LEVEL
This setting defines the displayed level reading that corresponds with 4.0 mA on the analog output. This can be set below or above the Analog Out High Level setting.

ANALOG OUT HIGH LEVEL
This setting defines the displayed level reading that corresponds with 20.0 mA on the analog output. This can be set above or below the Anlog Out Low Level setting.

> ***Example:*** *If you want the 4-20mA output to be scaled such that it ouputs 4mA at a 5.0-ft level reading, and 20 mA at a 10.0-ft level reading, you would set the Analog Out Low Level setting to 5.0 ft, and the Anolog Out High Level setting to 10.0 ft.*

BAR GRAPH MINIMUM
Set this value to the displayed level reading that should correspond with the bottom of the bar graph.

BAR GRAPH MAXIMUM
Set this value to the displayed level reading that should correspond with the top of the bar graph.

LEVEL UNITS

This setting defines what units label is applied to the level input reading and all level settings. The available settings are:

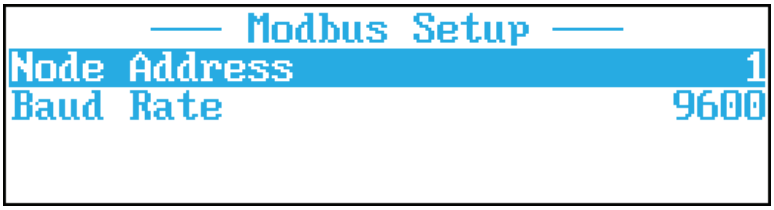
ft = Feet
in = Inches
m = Meters
cm = Centimeters
PSI = Pounds Per Square Inch
bar = Bar
kPa = Kilopascals
% = Percentage
°C = Degrees Celsius
°F = Degrees Fahrenheit
GPM = Gallons Per Minute
m^3/hr = Cubic Meters Per Hour
V = Volts
A = Amps
mA = Milliamps
(none)= Blank, no units will be displayed

OUT-OF-RANGE BEHAVIOR

These settings for relay outputs 1-6 control the operation of each relay when the analog input is out of its allowable range (below 3.75 mA or above 20.25 mA). By default, the relay outputs are off (open) when the analog input is out of range. Within the allowable range, the relays operate according to the relay setpoints.

MODBUS SETUP MENU

The Modbus Setup menu contains the following two settings:



NODE ADDRESS
This is the Modbus address of the SP6R-X.

BAUD RATE
The Modbus communication baud rate can be set to the following:
1200, 2400, 4800, 9600, 19.2K, 38.4K

ANALOG I/O STATUS SCREEN

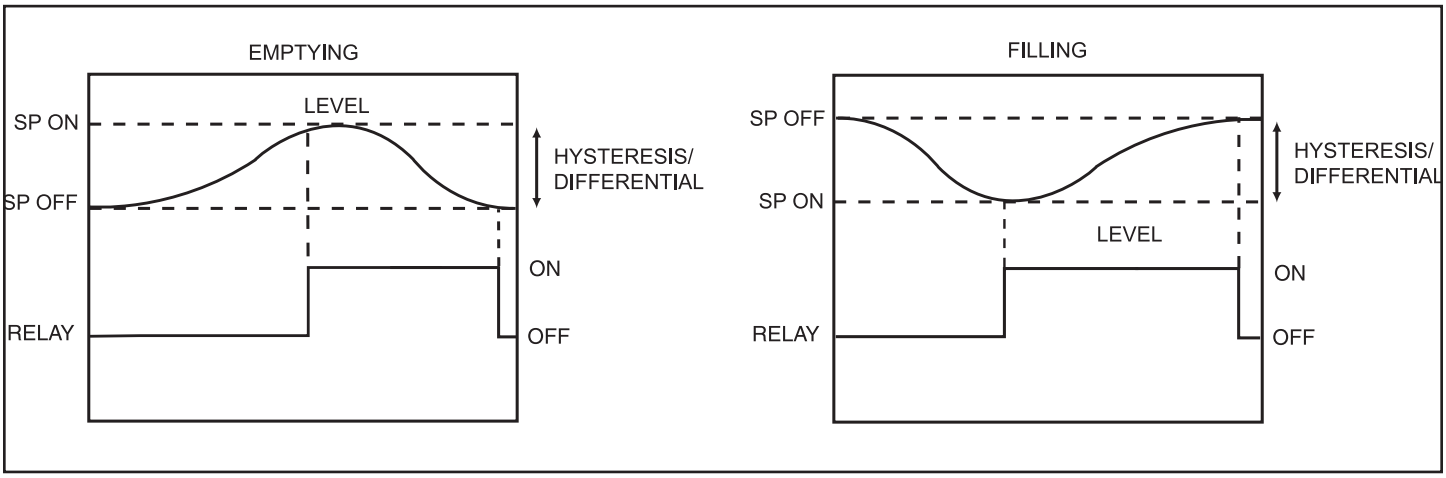
ANALOG I/O STATUS

This screen shows the current in mA of the analog input (A Input) and analog output (A Output). This can be used for troubleshooting to make sure the 4-20 mA signals are behaving as expected.

OPERATION

The adjustable ON and OFF function allows for an individual hysteresis or differential setting of each setpoint. For an emptying application, the ON setpoint must be greater than the OFF setpoint. For a filling application, the ON setpoint must be less than the OFF setpoint *(See below)*.

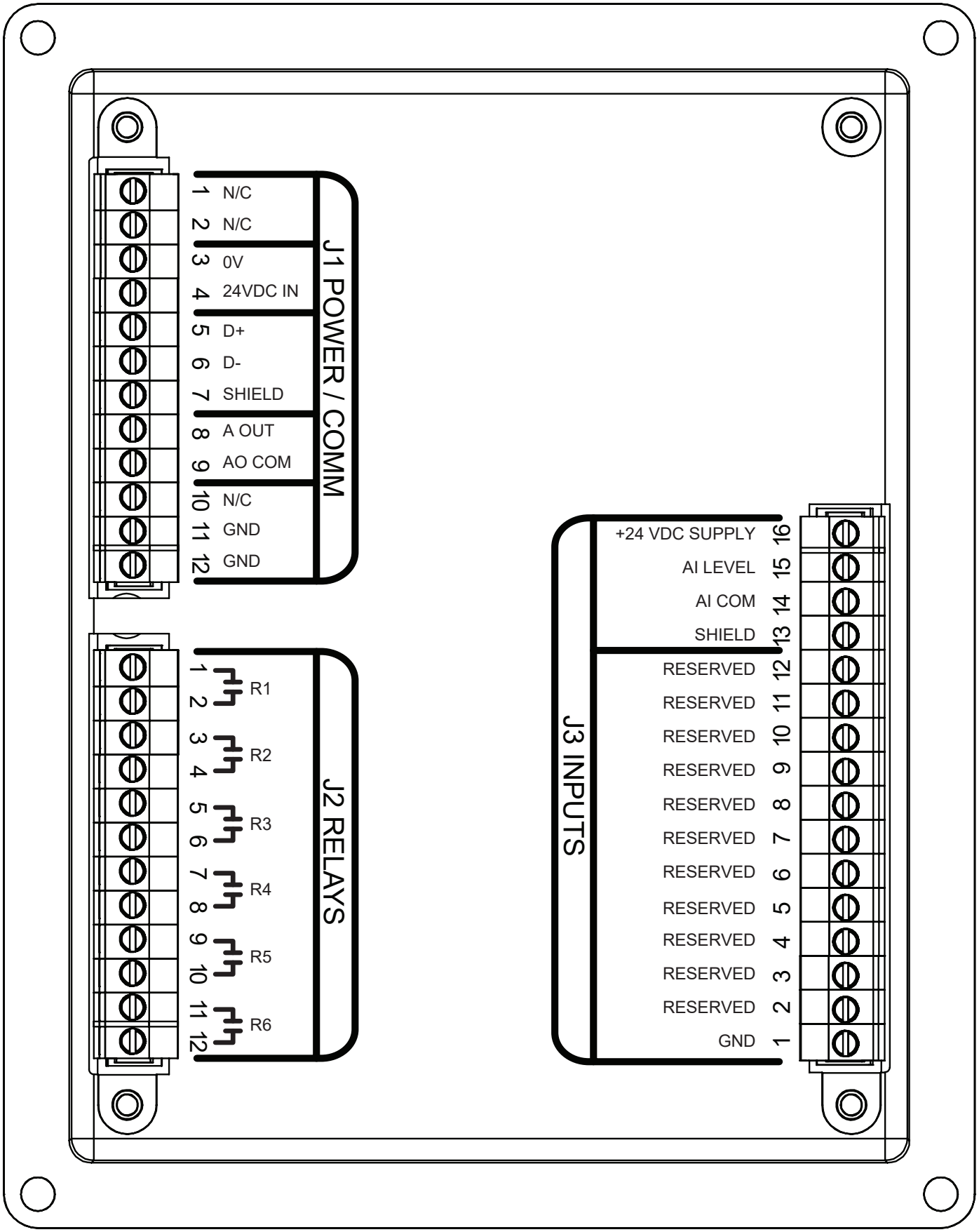
NOTE: For proper operation of the SP6R-X controller, the ON and OFF setpoints must not be set to the same value.



SP6R-X POWER UP SCREEN (VERSION)

On power up, the screen will display the version of the program. Always have the version number ready when contacting the factory for service.

I/O TERMINAL CONFIGURATION



SP6R-X I/O TABLE

J1 POWER AND COMMUNICATIONS		
PIN	**NAME**	**DESCRIPTION**
1	N/C	- NO CONNECTION -
2	N/C	- NO CONNECTION -
3	0V	RETURN FOR +24 VDC SUPPLY
4	+24 VDC	19 - 28 VDC SUPPLY
5	D+	MODBUS (RS-485 NON-INVERTING)
6	D-	MODBUS (RS-485 INVERTING)
7	SHIELD	
8	A OUT	4-20 mA LOOP, POWER SUPPLIED
9	AO COM	4-20 mA LOOP RETURN
10	N/C	- NO CONNECTION -
11	GND	PROTECTIVE EARTH GROUND
12	GND	PROTECTIVE EARTH GROUND

J2 RELAY OUTPUTS		
PIN	**NAME**	**DESCRIPTION**
1	R1	PROGRAMMABLE RELAY #1
2		
3	R2	PROGRAMMABLE RELAY #2
4		
5	R3	PROGRAMMABLE RELAY #3
6		
7	R4	PROGRAMMABLE RELAY #4
8		
9	R5	PROGRAMMABLE RELAY #5
10		
11	R6	PROGRAMMABLE RELAY #6
12		

J3 DIGITAL INPUTS		
PIN	**NAME**	**DESCRIPTION**
1	GND	
2	RESERVED	
3	RESERVED	
4	RESERVED	
5	RESERVED	
6	RESERVED	
7	RESERVED	
8	RESERVED	
9	RESERVED	
10	RESERVED	
11	RESERVED	
12	RESERVED	
13	SHIELD	
14	AI COM	4 - 20 mA LOOP RETURN
15	A INPUT	4 - 20 mA LOOP INPUT
16	+24 VDC OUT	LEVEL TRANSMITTER SUPPLY

Note:
Pins J1-3, J1-7, J1-11, J1-12, J3-1, J3-13 and J3-14 are all internally connected, and should be wired to Protective Earth Ground at terminal J1-11 or J1-12.

Use Copper Conductors, rated 60°C (140°F)

Apply Torque Value of 4.5 In-lbs to Field Wiring Terminals.

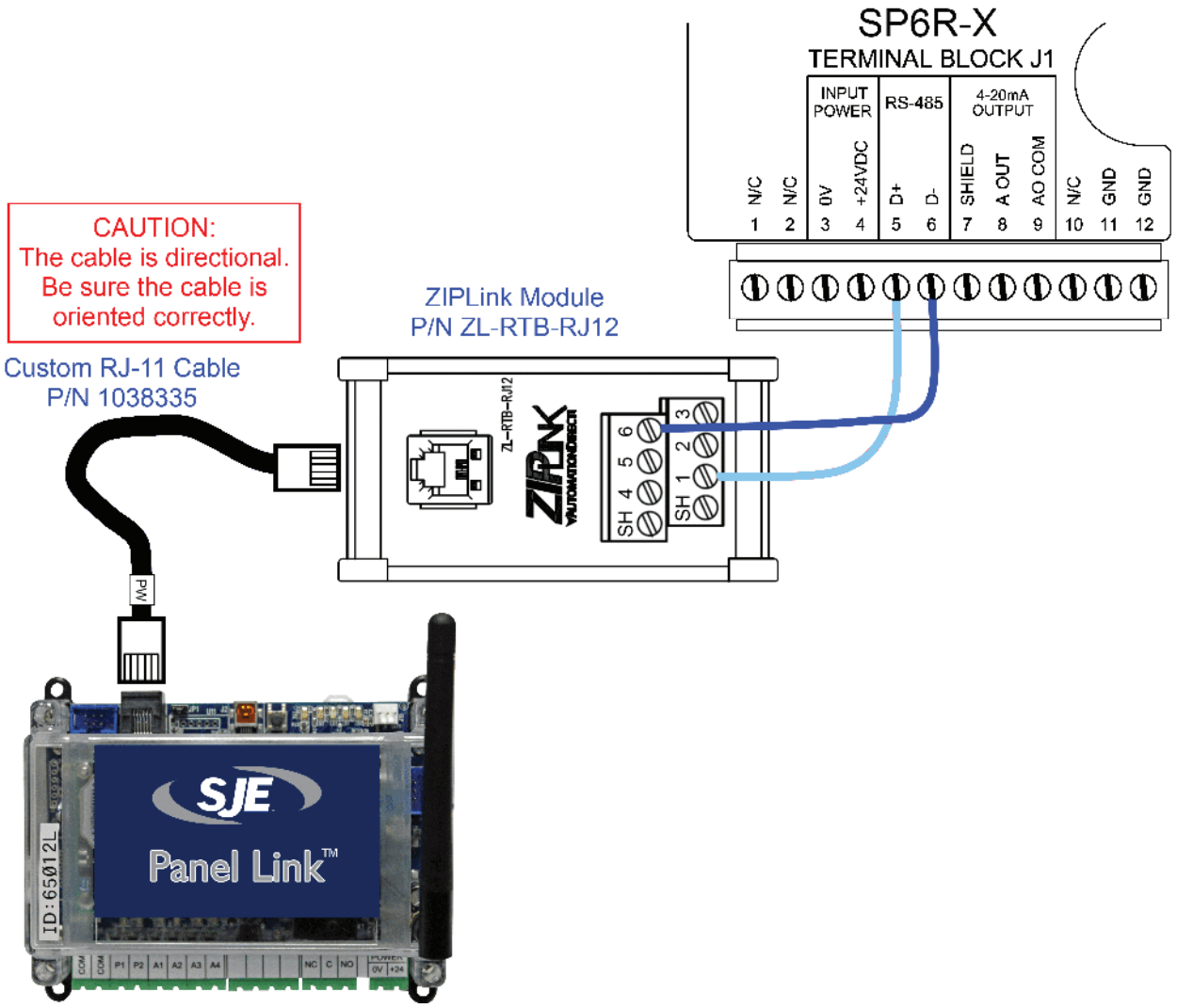
MODBUS COMMUNICATION

The SP6R-X is equipped with Modbus RTU support using the D+ and D- RS-485 terminals. The Modbus registers and communications specifications are designed to work with an SJE Panel Link™ Gateway right out of the box.

- Baud Rate: 9600 baud
- Data Bits: 8 bits
- Stop Bits: 1 bit
- Parity: None
- Node Address: 1
- Modbus Function Codes Supported:
  - Read Holding Registers (0x03)
  - Write Single Register (0x06)
  - Write Multiple Registers (0x10)

Anytime the SP6R-X receives a valid Modbus request, a “Modbus Communication Active” icon (“⊥”) will appear on the Main Screen for 60 seconds. If the Modbus master device is sending a Modbus request more often than once every 60 seconds, the icon will effectively be displayed continuously.

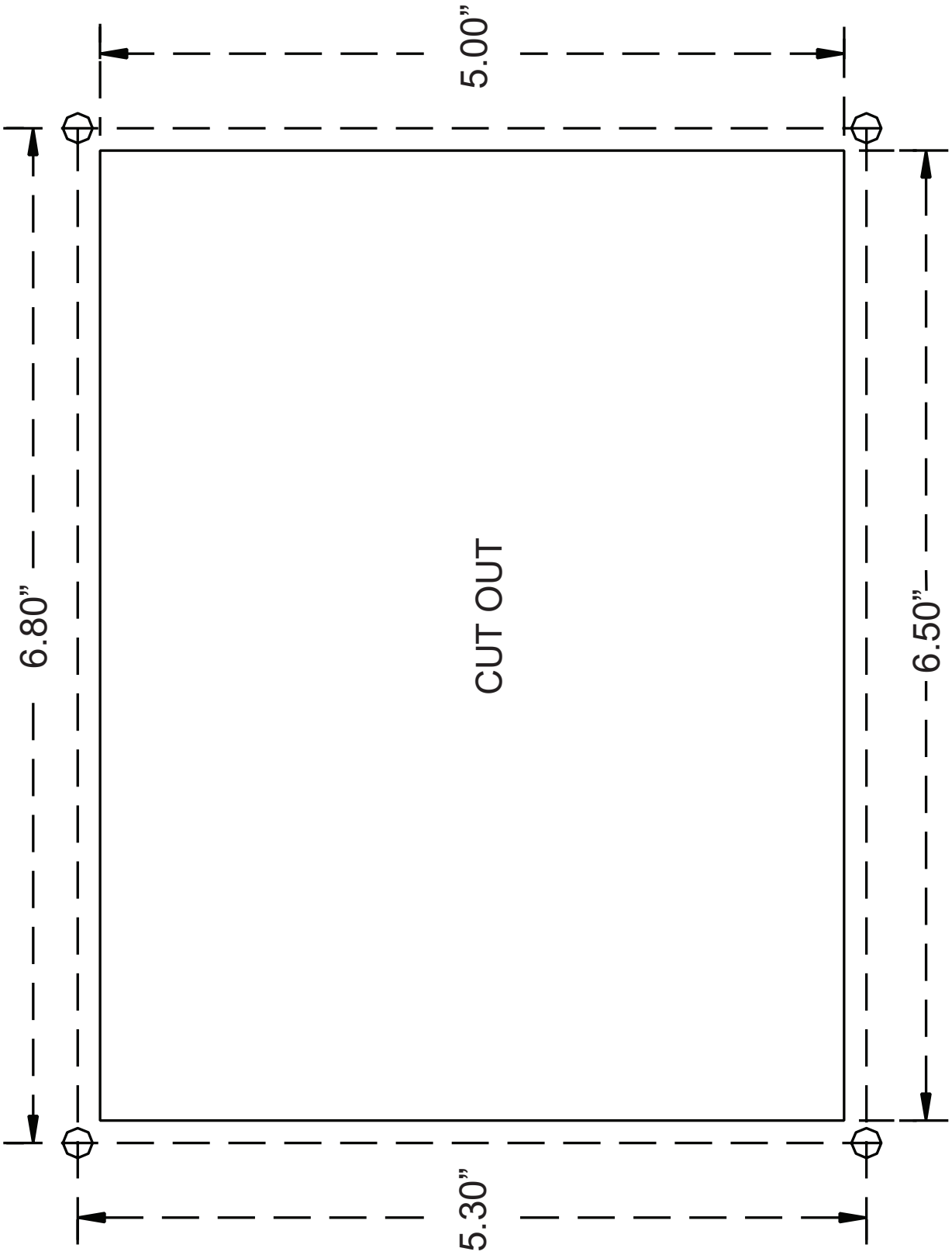
To connect the SP6R-X and the SJE Panel Link™ Gateway, follow the connection diagram below.



The following is a list of all accessible Modbus registers.

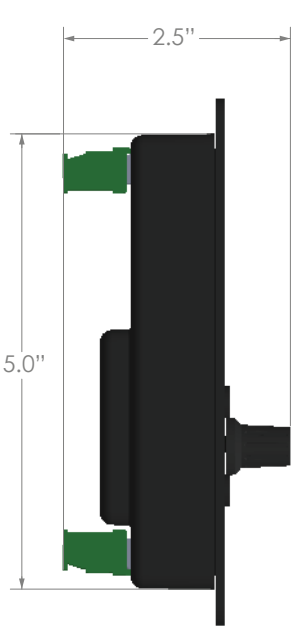
Access Type	Holding Register Number	Holding Register Address	Bit	Description	Unit of Measure (Other Notes)
Read	2005	42006		Input Level Reading	Tenths of Units
Read	2006	42007		Input mA	Hundredths of mA
Read	2007	42008		Output mA	
Read/Write	2008	42009		Units	0=ft, 1=in, 2=m, 3=cm, 4=psi, 5=bar, 6=kPa, 7=%, 8=°C, 9=°F, 10=GPM, 11=m³/hr, 12=V, 13=A, 14=mA, 15=none
Read/Write	2009	42010		R1 Out-of-Range Behavior	0=Relay Open, 1=Relay Closed
Read/Write	2010	42011		R2 Out-of-Range Behavior	
Read/Write	2011	42012		R3 Out-of-Range Behavior	
Read/Write	2012	42013		R4 Out-of-Range Behavior	
Read/Write	2013	42014		R5 Out-of-Range Behavior	
Read/Write	2014	42015		R6 Out-of-Range Behavior	
Read	2023	42024	0	Relay 1 Status	0=Relay Open, 1=Relay Closed
			1	Relay 2 Status	
			2	Relay 3 Status	
			3	Relay 4 Status	
			4	Relay 5 Status	
			5	Relay 6 Status	
			6-15	--not used--	
Read/Write	2025	42026		Analog Input (4mA)	Tenths of Units
Read/Write	2026	42027		Analog Input (20mA)	
Read/Write	2027	42028		Transmitter Offset	
Read/Write	2028	42029		Bar Graph Maximum	
Read/Write	2029	42030		Bar Graph Maximum	
Read/Write	2031	42032		Relay 1 On Setpoint	
Read/Write	2032	42033		Relay 1 Off Setpoint	
Read/Write	2033	42034		Relay 2 On Setpoint	
Read/Write	2034	42035		Relay 2 Off Setpoint	
Read/Write	2035	42036		Relay 3 On Setpoint	
Read/Write	2036	42037		Relay 3 Off Setpoint	
Read/Write	2037	42038		Relay 4 On Setpoint	
Read/Write	2038	42039		Relay 4 Off Setpoint	
Read/Write	2039	42040		Relay 5 On Setpoint	
Read/Write	2040	42041		Relay 5 Off Setpoint	
Read/Write	2041	42042		Relay 6 On Setpoint	
Read/Write	2042	42043		Relay 6 Off Setpoint	

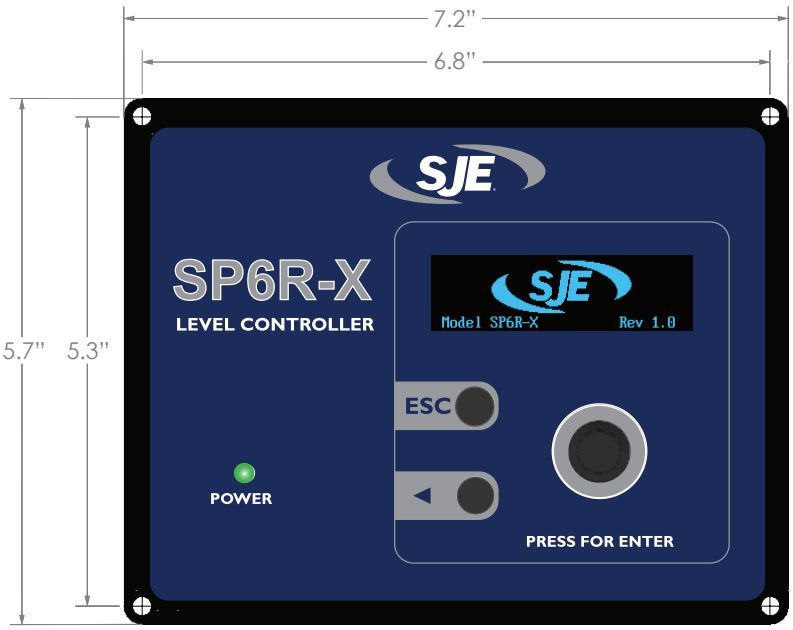
MOUNTING DIMENSIONS

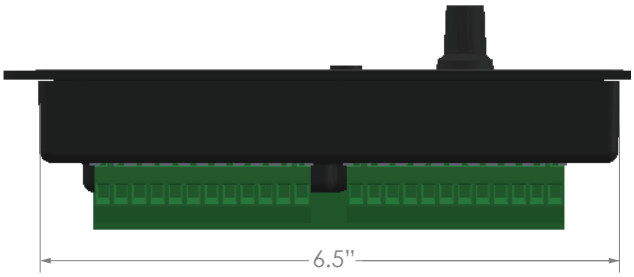


Not to scale. Do not use as a template.

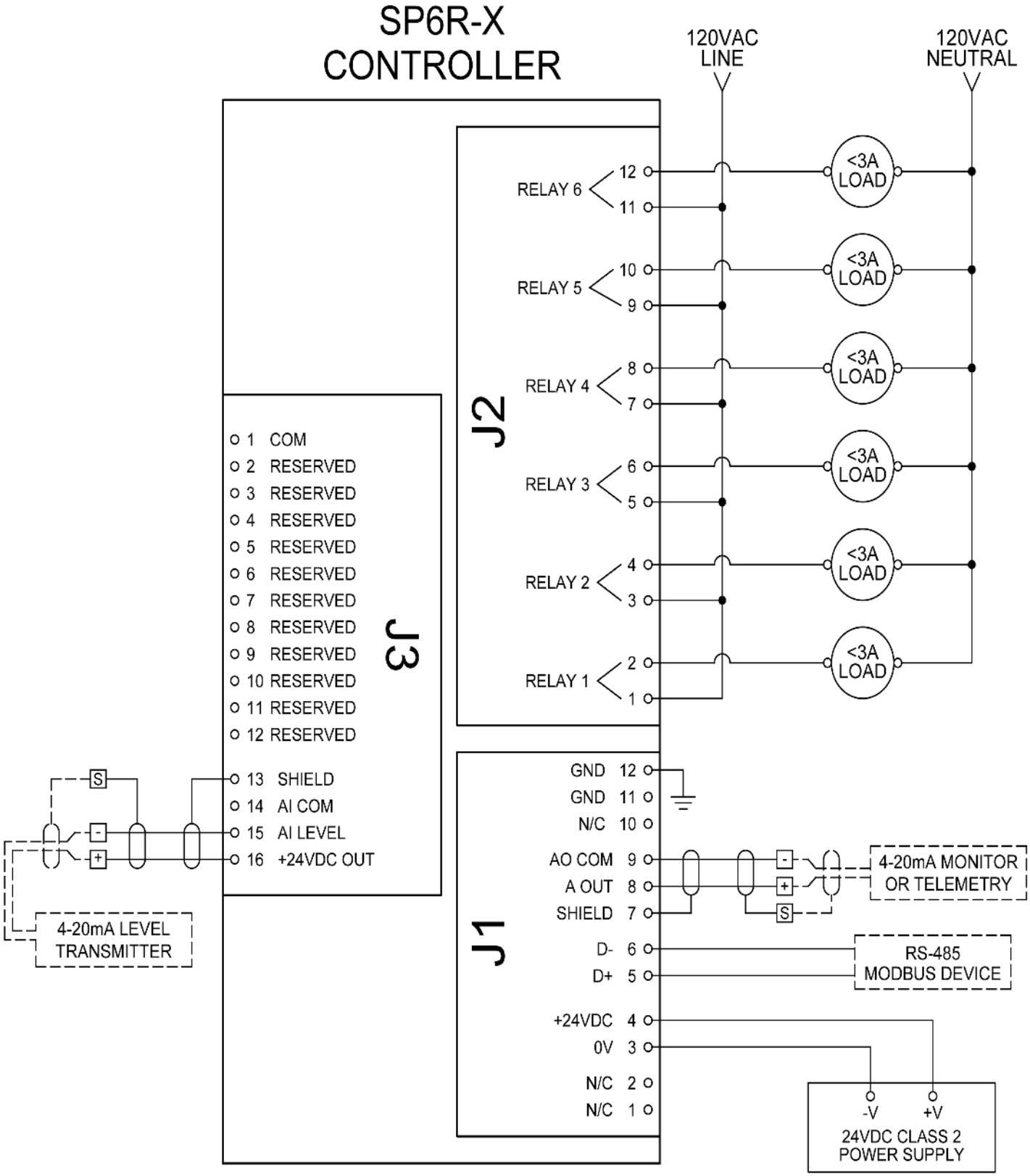
CONTROLLER DIMENSIONS







ELECTRICAL WIRING DIAGRAM



SP6R-X CONTROLLER SETPOINTS LIST

STATION NAME:	
START UP DATE:	
CONTROLLER REV:	

		MIN	MAX	DEFAULT VALUE	USER SETTING
RELAY SETPOINTS					
	Relay 1 On	0	999.9	**1.5**	
	Relay 1 Off	0	999.9	**1.0**	
	Relay 2 On	0	999.9	**2.5**	
	Relay 2 Off	0	999.9	**2.0**	
	Relay 3 On	0	999.9	**4.5**	
	Relay 3 Off	0	999.9	**4.0**	
	Relay 4 On	0	999.9	**6.5**	
	Relay 4 Off	0	999.9	**6.0**	
	Relay 5 On	0	999.9	**8.5**	
	Relay 5 Off	0	999.9	**8.0**	
	Relay 6 On	0	999.9	**9.5**	
	Relay 6 Off	0	999.9	**9.0**	
ANALOG SCALING SETTINGS					
	Analog Input (4mA)	0	999.9	**0.0**	
	Analog Input (20mA)	0	999.9	**10.0**	
	Transmitter Offset	-999.9	999.9	**0.0**	
	Analog Out Low Level	0	999.9	**0.0**	
	Analog Out High Level	0	999.9	**10.0**	
	Bar Graph Minimum	0	999.9	**0.0**	
	Bar Graph Maximum	0	999.9	**10.0**	
	Units	List		**ft**	
OUT-OF-RANGE BEHAVIOR SETTINGS					
	Relay 1	List		**Off**	
	Relay 2	List		**Off**	
	Relay 3	List		**Off**	
	Relay 4	List		**Off**	
	Relay 5	List		**Off**	
	Relay 6	List		**Off**	
MODBUS SETUP					
	Node Address	1	247	**1**	
	Baud Rate	List		**9600**	

Manufactured by: SJE Inc.
Technical support: +1-800-746-6287
techsupport@sjeinc.com

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