SPS Modbus
Operations Manual
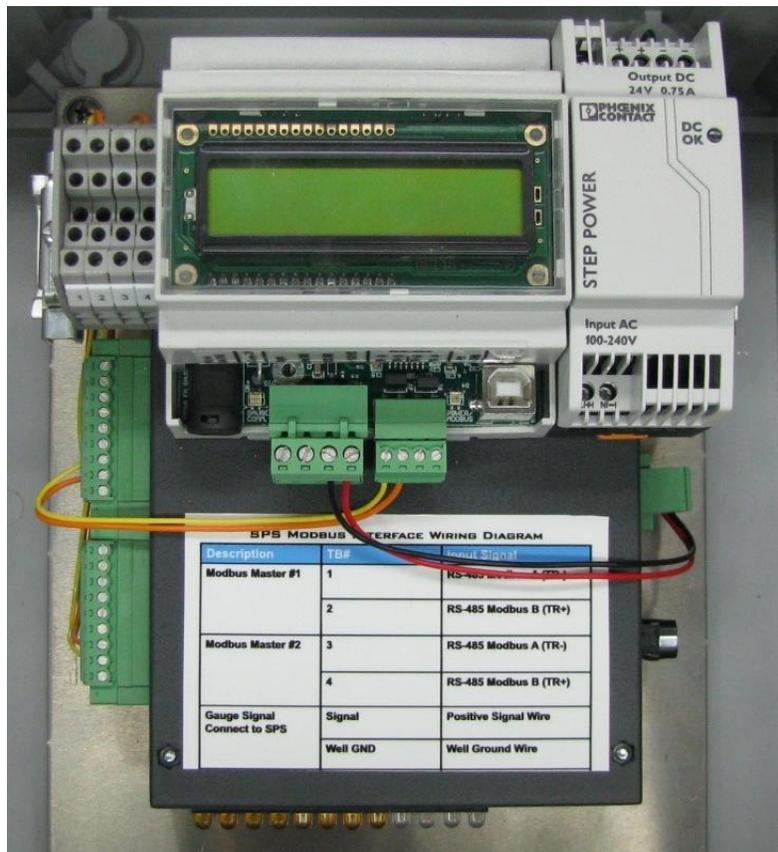
Sercel-GRC Corp.

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Any questions concerning the content of this manual, equipment operation, field maintenance, maintenance assistance and operation or maintenance training courses should be directed to:

1.0 SPS Modbus System Overview

Specifications

GRC P/N: 90D3115
Voltage Input: 100-240 VAC
Polling Interface: Dual RS-485 Isolated ModBus
PC Interface: Isolated USB Virtual COM Port for Configuration
Supported Baud Rates: 1200, 2400, 4800, 9600, and 19200 bps
Display: 16x2 Backlit LCD
Gauge Power Out: 40 to 80 VDC Out (~80mA Current Limited)
Gauge Power Fuse: 100mA Fast Acting, GRC P/N 043-0042-00

Default/Factory Settings

Baud Rate   9600 bps
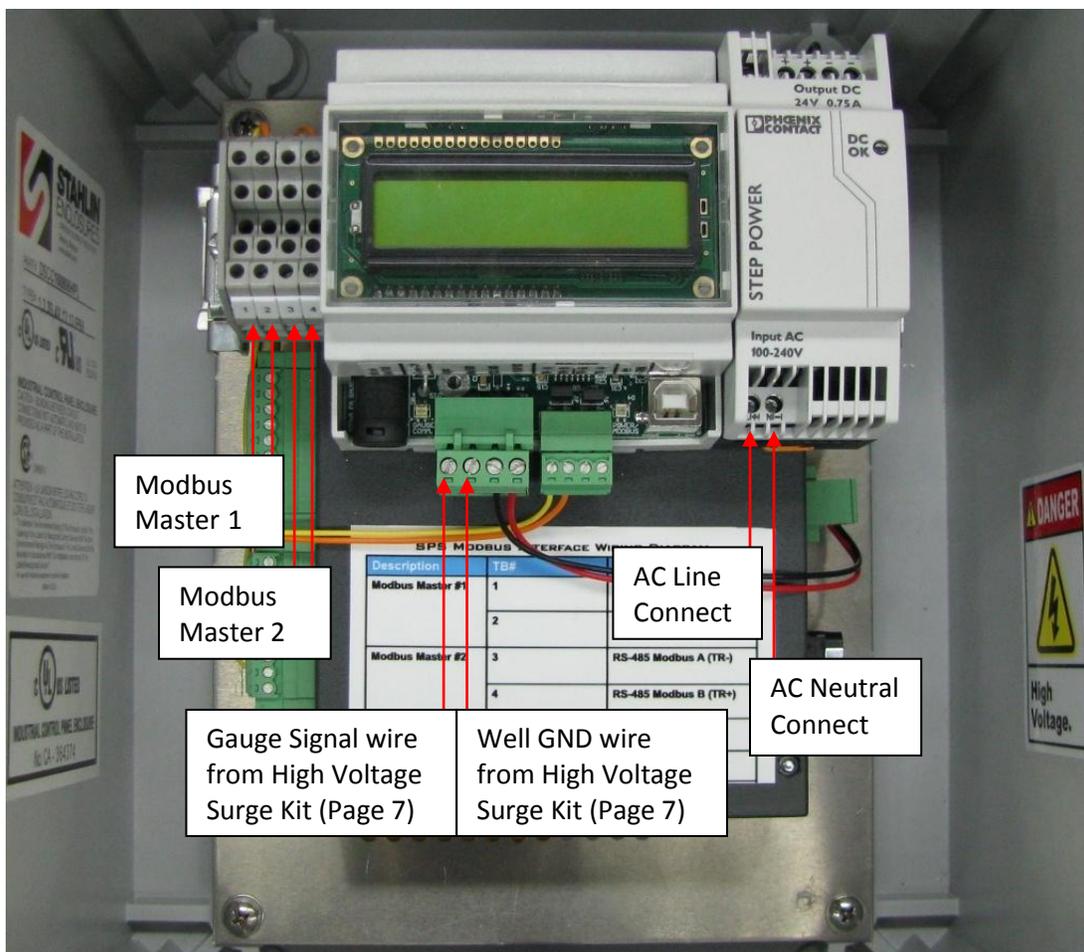ModBus ID   1

2.0 SPS Modbus System Connections

Figure 1. SPS System Connections.

Power Input	Connect power to AC Power Supply input. L(+) Line input N(-) Neutral input
Modbus Input Master #1	TB 1 RS-485 A (TR-) TB 2 RS-485 B (TR+)
Modbus Input Master #2	TB 3 RS-485 A (TR-) TB 4 RS-485 B (TR+)
Gauge Signal Input	Connect positive gauge output to Signal on SPS controller Connect gauge ground to Well GND on SPS Controller
USB PC Connection	SPS controller configuration port. USB connection not available while Modbus port is active.

Figure 1. SPS System Connections.

3.0 Modbus Register Map

The default Modbus register map is configured to the settings in the table. Any register can be customized as required. Contact Sercel GRC for Modbus configuration options.

TAG	UNITS	DESCRIPTION	COMMENTS	RANGE[1]
40129	Serial Number	Serial Number High	Long Integer Tool Serial Number	0 ↔ 4294967295
40131	Seconds * 10	Packet Time Stamp High	1234 is 123.4s	0.0s ↔ 429496729.5s
40133	Count Value	Packet Count High	1234 is 1234 packets	0 ↔ 4294967295
40135 (32 BIT)	Psia * 10	Intake Pressure	1234 is 123.4psia	0.0psia ↔ 429496729.5psia
40137	°F * 10	Intake Temperature	1234 is 123.4°F	0.0°F ↔ 6553.5°F
40138 (32 Bit)	Psia * 10	Discharge Pressure	1234 is 123.4psia	0.0psia ↔ 429496729.5psia
40141	°F * 10	Winding Temperature	1234 is 123.4°F	0.0°F ↔ 6553.5°F
40142	Gs * 100	Vibration X	123 is 1.23gs	0.00g ↔ 655.35g
40145	Volts * 10	Line Voltage	123 is 12.3V	0.0V ↔ 6553.5V
40146	Gs * 100	Vibration Y	123 is 1.23gs	0.00g ↔ 655.35g
40147	mA * 1000	Leakage Current	123 is 0.123mA	0.000mA ↔ 65.535mA

Figure 2. Gauge data register map.

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[1] Sensor values may not actually span the entire Range shown. Range is shown for decoding purposes only.

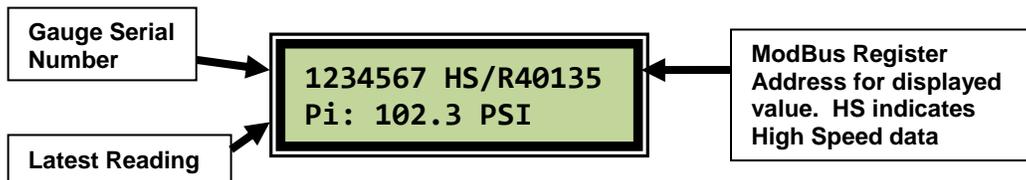| TYPE	REGISTER	HEX ADR	DESCRIPTION	
Coil 0x Registers				
FLASH	**Applicable Modbus Functions:**			
	1: Read Coil Status	5: Force Single Coil	15: Force Multiple Coils	
	0	0000	SPS ID	Revision
	1	0001	Modbus Address	Modbus Baud Index
	2	0002	SPS Holding Register Base Address	
	3	0003	OEM Holding Register Base Address	
	4	0004	OEM Gauge Serial Number Length/Order	
	5	0005	OEM Packet Time Length/Order/Precision	
	6	0006	OEM Packet Count Order/Length	
	7	0007	OEM Intake Pressure Length/Order/Unit/Precision	
	8	0008	OEM Intake Temperature Length/Order/Unit/Precision	
	9	0009	OEM Discharge Pressure Length/Order/Unit/Precision	
	10	000A	OEM Discharge Temperature Length/Order/Unit/Precision	
	11	000B	OEM Motor Temperature Length/Order/Unit/Precision	
	12	000C	OEM Vibration X Length/Order/Unit/Precision	
	13	000D	OEM Flow Length/Order/Unit/Precision	
	14	000E	OEM Conductivity Length/Order/Unit/Precision	
	15	000F	OEM Voltage Length/Order/Unit/Precision	
	16	0010	OEM Vibration Y Length/Order/Unit/Precision	
	17	0011	OEM Leakage Current Length/Order/Unit/Precision	
	18	0012	OEM Spare Length/Order/Unit/Precision	
Holding 4x Registers				
EEPROM	**Applicable Modbus Functions:**			
	3: Read Holding Register		16: Preset Multiple Holding Registers	
	6: Preset Holding Register			
	40001	0000	Control	Power On Volt Setting
	40002	0001	Max Slow Baud	Min Slow Baud
	40003	0002	DC-DC Regulator Tolerance	
	40004	0003	Line Voltage Tolerance	
	40005	0004	No Tool Amp	
	40006	0005	Low Amp	
	40007	0006	High Amp	
	40008	0007	DC-DC Warm Time	Power Off Time
	40009	0008	Amps Timeout	Volts Timeout
	40010	0009	Amps Stable Time	Sync Bits Measure
	40011	000A	Signal Wait Time	Signal Measure Time
	40012	000B	Timer0 Stable Count	
	40013	000C	Sync Wait	Max Packet Errors
	40014	000D	Leakage Current Zero: Reserved	
	40015	000E	LCD Configuration	
	40016	000F	Reserved	

Figure 3. OEM Modbus Registers.

4.0 SPS-1500 LCD

On power-up the SPS-1500 displays these screens in sequence:

1. Firmware Version/Date Screen
2. ModBus Information
3. Startup Surface Imbalance

Then the screen cycles through the analyzing steps to acquire the tool, which takes 3-5 minutes. Once the tool is acquired the LCD automatically scrolls through both gauge readings and diagnostic screens. The display is updated once per second, and the screen advances every 3 seconds by default.

The displayed data includes the gauge serial number, the latest sensor reading and ModBus register address where that data can be polled from. All enabled parameters on the tool will be displayed. The screens operate in a circular loop displaying tool parameters, then diagnostic screens, and back to tool parameters.

Gauge Serial Number		ModBus Register Address for displayed value. HS indicates High Speed data
Latest Reading	**1234567 HS/R40135** **Pi: 102.3 PSI**	

4.1 Status & Diagnostic Screens

There are 8 diagnostic screens that display the status and other useful information about the SPS-1500. They are fully customizable with Memory Tools or other ModBus editing software – you may enable or disable screens and also control the scrolling time of the screens. Section 4.4 of this manual shows how to change the LCD settings.

Firmware Version/Date

Displays the loaded firmware version and date. By default this screen is only shown once on power up.

```
 GRC SPS-1500
L 1.0a 15-JUN-11
```

Tool Information

Top line: Gauge serial number and gauge type.
Bottom line: Tool baud rate

```
1234567 ESP+
ToolBaud: 5.000
```

Modbus Information

Displays the device Modbus baud-rate and slave address/id.

```
Baudrate: 9600
Slave ID: 1
```

Startup Surface Imbalance

Displays the DC voltage measured on the gauge signal line with the gauge signal disconnected. This

```
StartupImbalance
Vdc = -2.4 V
```

voltage will be negative, and will give you an idea of the phase imbalance level at the surface. Ideally this voltage will be 0.

Upon startup, the SPS-1500 will take a one-shot measurement of the RMS negative voltage on the signal line with the output of the SPS disconnected. This number can give you a rough idea of the phase imbalance downhole and is equivalent to connecting a multimeter to the SPS signal line with the power off. To read the current surface imbalance you need to restart the SPS-1500.

Tool Communication Settings

Displays the tool communication settings, described below:

```
AAn:ON   AVlt:ON
ABd:ON   BdL:3-6
```

- **AAn**: Auto Analyze ON/OFF
- **AVlt**: Auto Volt ON/OFF
- **ABd**: Auto Baud ON/OFF
- **BdL**: Tool baud low-high limits

Signal Levels

```
Min_A^m  Now_A^m  Max_A^m
18.2   28.3   28.5
```

Displays the minimum, current and maximum line current (in mA). The minimum/average/maximum is not calculated over all time, but just for the current data packet.

Line Voltage

Displays the minimum, current and maximum line voltage measured at the surface.

```
MinV   NowV   MaxV
55.2   55.7   55.9
```

Packet Count and Run Time

Displays the data packet number and elapsed time since the last power on (displayed as elapsed days, hours, minutes).

```
RcvDat 435
RunTm:001d18h25m
```

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Modbus Multiplexer LED Indicators

The LED indicators on the Modbus Multiplexor show power, communication packets, Modbus communication and packet/connection errors. If the red LED is on there is a connection problem. Switch the TR+ and TR- wires from the Modbus master. This should clear the error automatically after a few successful data packets are transmitted. To verify the connection is correct check the XMIT and RECV LED's, both should be flashing. P1 is connected to the SPS-1500 surface readout. P2 and P3 connect to Modbus Master #1 and Modbus Master #2 respectively. A communication problem between the master device and the slave device would also cause an error. The default baud rate for the SPS is set to 9600 and the default Modbus address is 1. Verify these settings are correct in the Modbus master slave device settings.
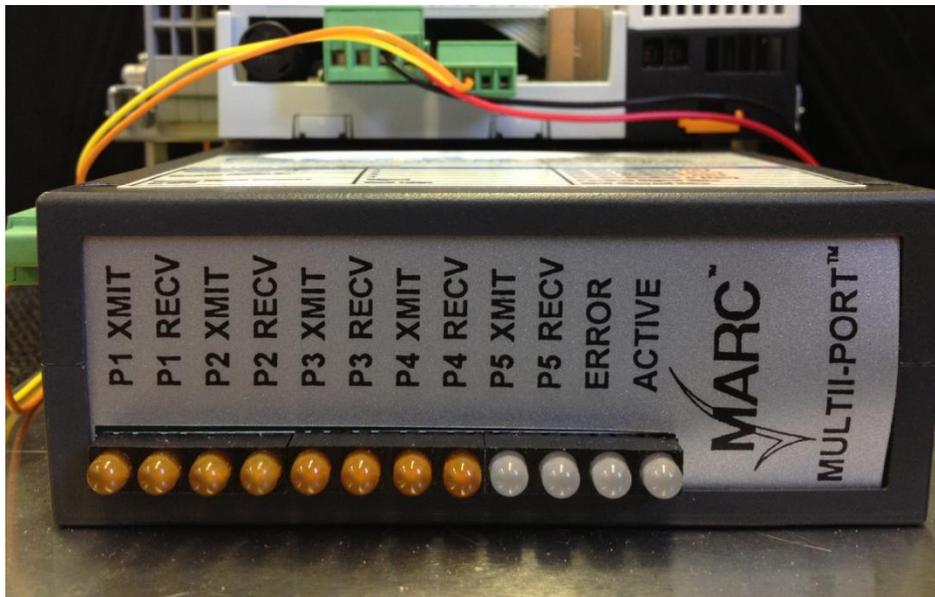

Figure 4. Modbus Multiplexor LED's.

5.0 High Voltage Surge Kit Connection Details

Gauge Signal: connect to SPS "Signal"

Gauge Ground: connect to SPS "Well GND"

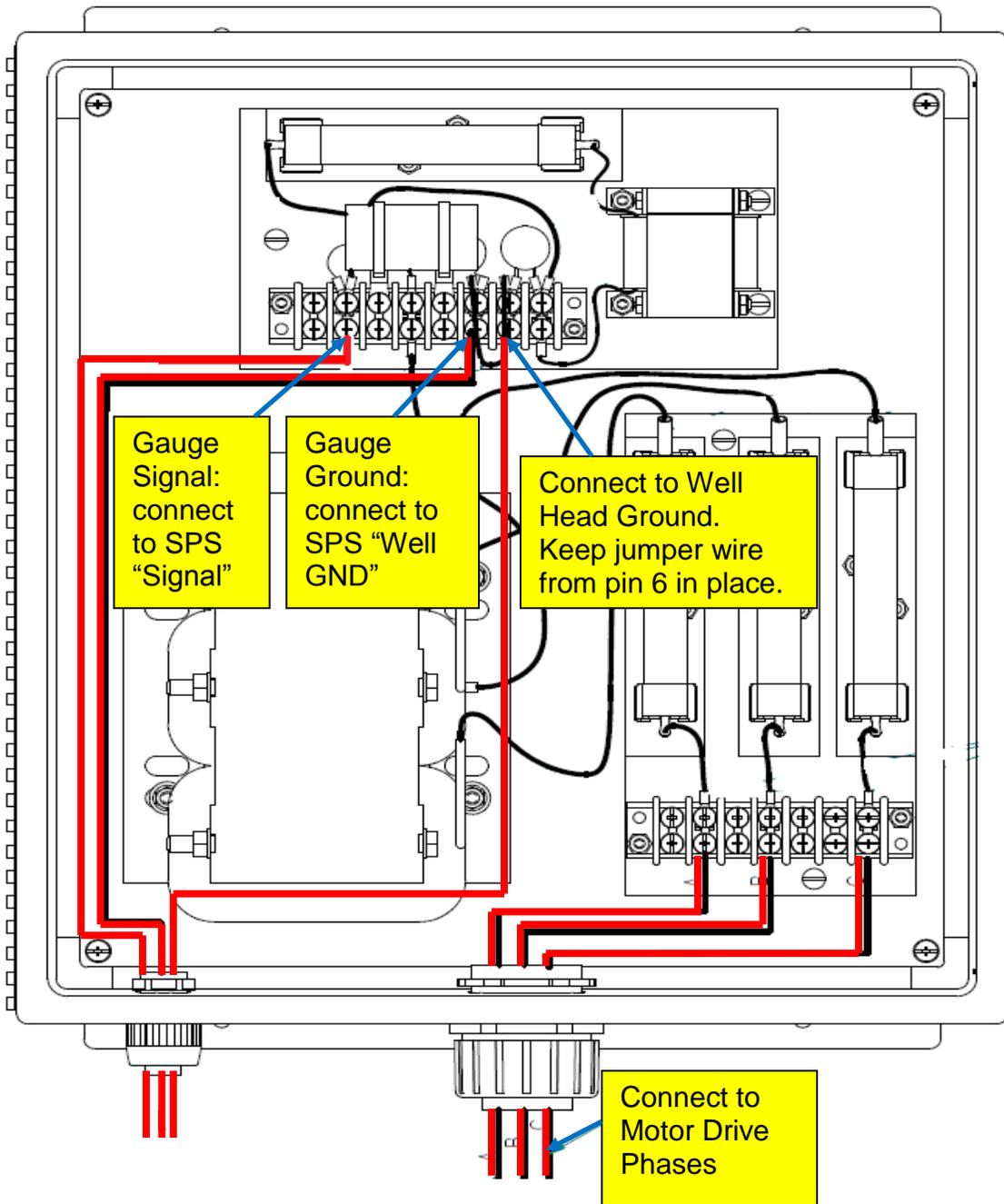**Connect to Well Head Ground. Keep jumper wire from pin 6 in place.**

Connect to Motor Drive Phases

Figure 5. High Voltage Surge Kit Connection.