



**SPONSLER**

## Sponsler SP714-S2i Pulse Amplifier

## Installation & Parts



# TABLE OF CONTENTS

| INTRODUCTION                              | INSTALLATION                  |
|---|-------------------------------|
| Safety Procedures..... 3                  | Installation Overview ..... 7 |
| General Information ..... 3               | Wiring ..... 7                |
| Dimensions ..... 4                        | Settings ..... 11             |
| Specifications ..... 4                    | Diagnostics..... 11           |
| Regulatory Compliance Tag Markings..... 6 | Maintenance..... 11           |

## NOTICE

This manual provides warnings and procedures that are intended to inform the owner and/or operator of the hazards present when using the Liquid Controls Meter on LP-Gas and other products. The reading of these warnings and the avoidance of such hazards is strictly in the hands of the owner-operators of the equipment. Neglect of that responsibility is not within the control of the manufacturer.

### Publication Updates and Translations

The most current English versions of all Liquid Controls publications are available on our web site, [www.lcmeter.com](http://www.lcmeter.com). It is the responsibility of the local distributor to provide the most current version of LC manuals, instructions, and specification sheets in the required language of the country, or the language of the end user to which the products are shipping. If there are questions about the language of any LC manuals, instructions, or specification sheets, please contact your local distributor.

# SAFETY PROCEDURES AND GENERAL INFORMATION

## Be Prepared

### ⚠ WARNING

- Before using this product, read and understand the instructions.
- All work must be performed by qualified personnel trained in the proper application, installation, and maintenance of equipment and/or systems in accordance with all applicable codes and ordinances.
- When handling electronic components and boards, always use proper Electrostatic Discharge (ESD) equipment and follow the proper procedures
- Make sure that all necessary safety precautions have been taken.
- Provide for proper ventilation, temperature control, fire prevention, evacuation, and fire management.
- Provide easy access to the appropriate fire extinguishers for your product.
- Consult with your local fire department, state, and local codes to ensure adequate preparation.
- Read this manual as well as all the literature provided in your owner's packet.
- Save these instructions for future reference.
- Failure to follow the instructions set forth in this publication could result in property damage, personal injury, or death from fire and/or explosion, or other hazards that may be associated with this type of equipment.

## Observe National and Local Codes

### ⚠ WARNING

**North America** - Installations must be in full accordance with the National Electrical Code (US) or the Canadian Electrical Code respectively to maintain the hazardous location ratings on the product.

**Outside of North America** - Installations must be in full accordance with EN 60079-14 to maintain the hazardous location ratings on the product. Use Ex d certified cable glands only. For ambient temperatures above 70°C, use field wiring rated 20°C above the maximum ambient temperature.

**WARNING: Explosion Hazard -**

Substitution of components may impair suitability for hazardous area applications.

**WARNING: Explosion Hazard -**

When in hazardous locations, turn power OFF before replacing or wiring modules.

**WARNING: Explosion Hazard -**

Do NOT disconnect equipment unless power has been switched OFF or the area is known to be Non-Hazardous.

## General Information

The SP714-S2i is a meter-mounted pulse amplifier that amplifies and conditions low amplitude signals, typically produced by the magnetic pickup coil of a Sponsler turbine flowmeter. The SP714-S2i transforms the low power input signal from the pickup coil into square-wave output signals with enough energy to travel a greater distance and be detected reliably by the electronic device, such as a flow computer or an electronic register.

### SP714-S2i and Sponsler Turbine Flowmeter Shipped as Assembly

*In order to maintain IECEx compliance, the SP714-S2i is connected to the turbine flowmeter boss. The turbine meter and SP714-S2i assembly is pressure tested at the factory, then shipped as an assembly.*

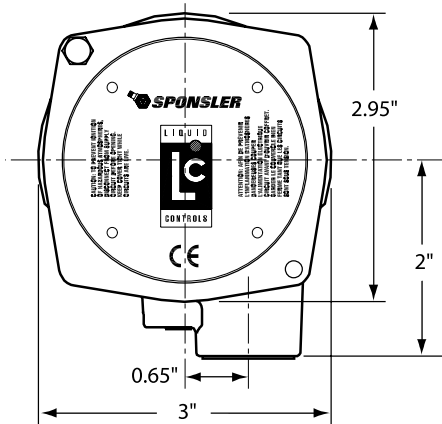
The SP714-S2i includes an input signal sensitivity adjustment (R1) that permits the SP714-S2i to discriminate between an input signal and noise by increasing or decreasing the input signal amplitude necessary to be processed as a valid signal. This, in conjunction with being directly mounted onto the turbine flow meter, allows the SP714-S2i to operate effectively in noisy environments.

The SP714-S2i also includes diagnostic tools. The diagnostic test oscillator (SW2) enables the operator to verify the amplifiers operation without a signal source. The green LED (D1) indicates the power supply status. The red LED (D2) indicates the signal frequency status.

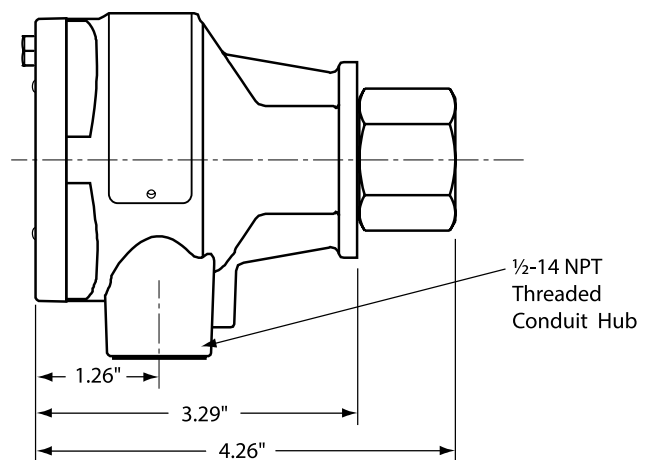
# DIMENSIONS AND SPECIFICATIONS

## Dimensions

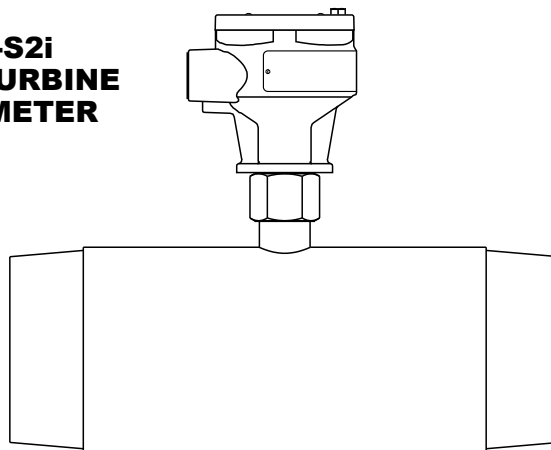
**FRONT**



**SIDE**



**SP714-S2i  
AND TURBINE  
FLOWMETER**



## Specifications

### Weight

- 1.2 lbs (0.54 kg)

### Materials of Construction

#### Housing

- Aluminum Alloy ADC12
- Powder Coat: Corro-Coat PE 74-141 Polyester

#### Adapter (to turbine meter boss)

- Stainless Steel

### Cable Entry

- 1/2"-14 NPT

### Temperature Range

#### Operating

- -40 to 176 °F (-40 to 80 °C)

#### Storage

- -76 to 257 °F (-60 to 125 °C)

### Input Voltage

- 6-28 VDC; 83 mA maximum @ 24 VDC
- Protected against polarity reversal

### Signal Input

#### Frequency

- 2 kHz maximum *over operating temperature in all modes*

#### Amplitude

- 10 mV p-p minimum sine or square wave

#### Impedance

- 50 KΩ

#### Sensitivity Field

- Adjustable by potentiometer (R1)

### Output Signal Characteristics

*See following page.*

## Output Signal Characteristics

| Standard Configuration (2-wire Current Mode)*   |                |            | MINIMUM | MAXIMUM | UNITS |
|---|----------------|------------|---------|---------|-------|
| DC power supply voltage: <b>12 V</b><br>Total System Resistance: <b>130 <math>\Omega</math> <math>\pm</math> 25 <math>\Omega</math></b> | Output Voltage | Logic HIGH | 9       |         | VDC   |
|   |                | Logic LOW  |         | 5       | VDC   |
|   | Output Current | Logic HIGH |         | 12      | mA DC |
|   |                | Logic LOW  |         | 83      | mA DC |
| DC power supply voltage: <b>24 V</b><br>Total System Resistance: <b>250 to 400 <math>\Omega</math></b>                                  | Output Voltage | Logic HIGH | 18      |         | VDC   |
|   |                | Logic LOW  |         | 5       | VDC   |
|   | Output Current | Logic HIGH |         | 15      | mA DC |
|   |                | Logic LOW  |         | 83      | mA DC |
| DC power supply voltage: <b>28 V</b><br>Total System Resistance: <b>360 <math>\Omega</math> <math>\pm</math> 60 <math>\Omega</math></b> | Output Voltage | Logic HIGH | 21      |         | VDC   |
|   |                | Logic LOW  |         | 5       | VDC   |
|   | Output Current | Logic HIGH |         | 15      | mA DC |
|   |                | Logic LOW  |         | 83      | mA DC |

\*Depends on power supply voltage and total system resistance (Load impedance + signal cable resistance)

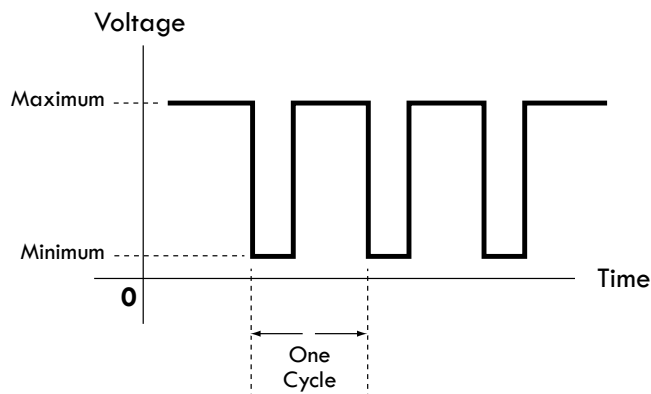
| TTL Sourcing (3-wire)   |                |            | MINIMUM     | MAXIMUM | UNITS |
|---|----------------|------------|-------------|---------|-------|
| DC power supply voltage: Vcc: <b>4 – 28 VDC</b><br>Total System Resistance: <b>500 <math>\Omega</math> minimum @ 28 VDC</b> | Output Voltage | Logic HIGH | Vcc – 1*    |         | VDC   |
|   |                | Logic LOW  |             | 0.25    | VDC   |
|   | Output Current | Logic HIGH | ~8 to 60    |         | mA DC |
|   |                | Logic LOW  |             | 8       | mA DC |
| DC power supply voltage: Vcc: <b>4 – 28 VDC</b><br>Total System Resistance: <b>10 k<math>\Omega</math> (Example)</b>        | Output Voltage | Logic HIGH | Vcc – 0.60* |         | VDC   |
|   |                | Logic LOW  |             | 0.25    | VDC   |
|   | Output Current | Logic HIGH | ~8 to 11    |         | mA DC |
|   |                | Logic LOW  |             | 8       | mA DC |

\*Depends on DC power supply voltage value

| Open Collector (3-wire)   |                |            | MINIMUM    | MAXIMUM | UNITS |
|---|----------------|------------|------------|---------|-------|
| DC power supply voltage: Vcc: <b>4 – 28 VDC</b><br>Total System Resistance: <b>500 <math>\Omega</math> minimum @ 28 VDC</b> | Output Voltage | Logic HIGH | Vcc – 0.5* |         | VDC   |
|   |                | Logic LOW  |            | 0.5     | VDC   |
|   | Output Current | Logic HIGH |            | 7       | mA DC |
|   |                | Logic LOW  |            | 8 to 60 | mA DC |
| DC power supply voltage: Vcc: <b>4 – 28 VDC</b><br>Total System Resistance: <b>10 k<math>\Omega</math> (Example)</b>        | Output Voltage | Logic HIGH | Vcc – 1*   |         | VDC   |
|   |                | Logic LOW  |            | 0.5     | VDC   |
|   | Output Current | Logic HIGH |            | 7       | mA DC |
|   |                | Logic LOW  |            | 8 to 11 | mA DC |

\*Depends on external DC power supply voltage value

### TYPICAL SIGNAL OUTPUT WAVEFORM



# REGULATORY COMPLIANCE TAG


LIQUID CONTROLS    LAKE BLUFF, IL USA

MODEL \_\_\_\_\_ SERIAL NO. \_\_\_\_\_

○ YEAR OF MFR. \_\_\_\_\_ VDC +10x/-15x, 1.5 W MAX.

SINGLE ENTRY  
0.500-14 NPT

IP66

 II 2 G    Ex d IIB T6 Gb  
IECEx DNV 11.0012X

WARNING: DO NOT OPEN  
WHILE ENERGIZED



Explosive Atmospheres symbol

**IECEX DNV 11.0012X**

This equipment has been found to comply with the Certification Scheme for Explosive Atmospheres of INTERNATIONAL ELECTROTECHNICAL COMMISSION (IECEX). Evaluation was made in 2013 by Det Norske Veritas (DNV) to IECEx scheme with a certificate number IECEx DNV 11.0012X, where X represents the following Special Conditions for Safe Use: 1) Only Ex d certified cable glands are to be used; and 2) For ambient temperatures above 70 °C, use field wiring suitable for 20°C above maximum ambient temperature.

**II**  
Suitable for use in surface (not mine) installations.

**2 G**  
High level of protection is provided against flammable gases, vapors, or liquids, which may exist during normal operation.

**Ex d**  
Explosion protection is provided by a flameproof enclosure.

**IIB**  
Gas group, which includes ethylene, propane, and methane.

**T6:**  
Temperature class for surface temperature limitations. T6 is ≤ 85°C

**Gb**  
Equipment group per IEC 60079-0:2007.

**-40°C ≤ Tamb ≤ 80°C**  
Safe limits of ambient temperature.

**IP66**  
Ingress protection: dust tight and protected against powerful water jetting.

*Consult factory for current compliance status.*

## Installation Overview

In order to maintain IECEx compliance, the SP714-S2i is shipped as part of an assembly with a Sponsler turbine flowmeter. A complete installation of the flowmeter and pulse amplifier assembly includes the physical installation of the flowmeter and the electrical installation of the SP714-S2i. Guidelines for the physical installation of the flowmeter can be found in the Sponsler turbine flowmeter manual. Instructions for the electronic installation of the SP714-S2i are included in this manual.

### Installation overview for the SP714-S2i:

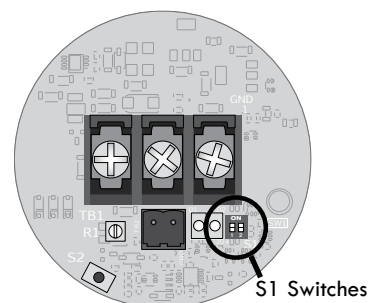
1. Install Sponsler turbine flowmeter (with SP714-S2i) into system piping. *Sponsler Turbine Flowmeter Installation Manual*
2. Wire the SP714-S2i to a pulse acquisition device and set the S1 switches to the preferred output signal characteristics. *Page 7*
3. Perform field test and adjust the input signal sensitivity (if necessary). *Page 11*

### WIRING THE OUTPUT SIGNAL CONFIGURATIONS

The SP714-S2i can be set to one of three configurations: 2-wire Standard, 3-wire TTL Sourcing, and 3-wire Open Collector. The 2-wire Standard configuration translates the output signal from the turbine flowmeter's pickup coil into a current value. 2-wire connections are effective transmitting the signal over long distances. The 3-wire TTL Sourcing configuration translates the output signal from the turbine flowmeter's pickup coil into a voltage value. The output of the 3-wire TTL Sourcing configuration is driven either positive or negative internally. The 3-wire Open Collector configuration translates the output signal from the turbine flowmeter's pickup coil into a voltage value. The output is driven by an "Open Collector" transistor.

Each configuration requires a specific positioning of the two S1 switches, specific wiring connections (to the power supply and the pulse acquisition device), and a resistor(s) spliced into the +V leg from the power supply (optional for the 3-wire TTL Sourcing configuration).

The best configuration for your application is determined by the specifications of the pulse acquisition device (typically a flow computer or electronic register) receiving the SP714-S2i signal and the electrical characteristics of the application.



### Materials required: not supplied with SP714-S2i

- 18 AWG stranded wire in shielded cable, UL Listed *For ambient temperatures above 70°C, use field wiring suitable for 20°C above maximum ambient temperature.*
- ½-14 NPT cable glands *Use Ex d certified cable glands only.*
- Connectors for pulse acquisition device or DC power supply *See "Observe National and Local Codes" on this page.*
- PTFE tape or pipe sealant

### Observe National and Local Codes

*Use the proper cable glands, conduit connectors, cables, conduit, and installation procedures when wiring the SP714-S2i. Installations must be in full accordance with national and local codes to maintain the hazardous location ratings on the product.*

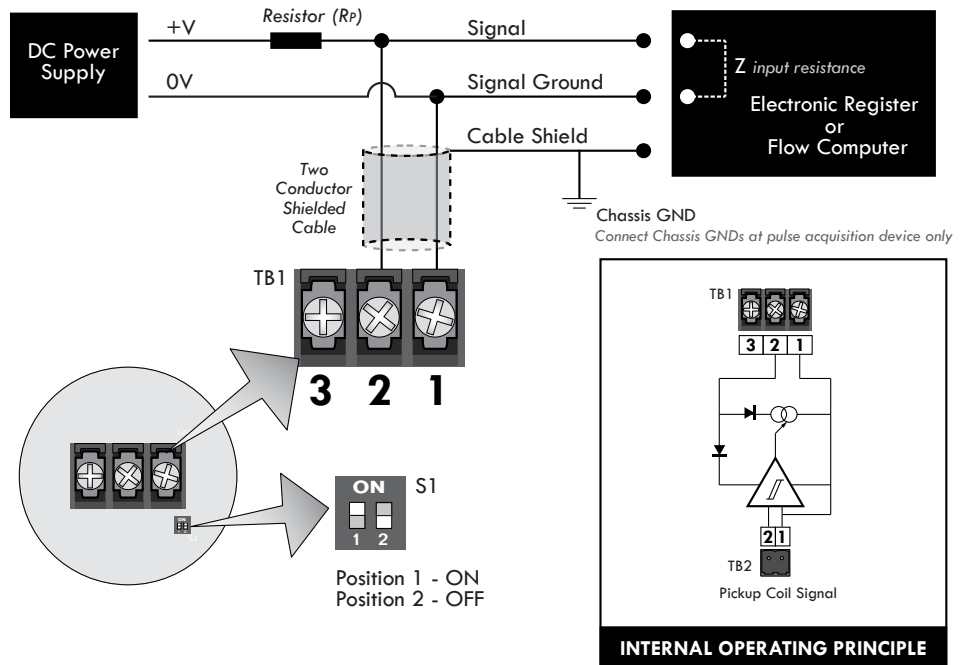
# 2-WIRE STANDARD WIRING

## 2-WIRE STANDARD

The 2-wire Standard configuration translates the output signal from the turbine flowmeter's pickup coil into a current value. The 2-wire Standard configuration produces an output signal using a resistor to convert the electrical current variations into voltages. In this configuration, the power supply travels on the signal wire. 2-wire connections are effective transmitting the signal over long distances.

### To connect the SP714-S2i for 2-wire Standard:

1. Remove the SP714-S2i housing cover.
2. Pull the SP714-S2i board from the housing for access to the TB1 terminal block and the S1 switches.
3. Attach proper cable glands and/or conduit connectors to the SP714-S2i, the pulse acquisition device, and DC power supply.
4. Run the wires (through proper conduit) between the SP714-S2i, the pulse acquisition device, and DC power supply.
5. Set the first S1 switch to the ON position and the second S1 switch to the OFF position.
6. Splice the resistor onto the +V leg from the DC power supply. *The value of the resistor can be determined using the information below.*
7. Wire the SP714-S2i to the pulse acquisition device and DC power supply as indicated in the schematic.
8. If necessary, adjust the input signal sensitivity (R1), activate the diagnostic test oscillator (SW2), and/or check the diagnostic operational LEDs (D1 & D2). See page 11.
9. Coil the wires underneath the CPU board and place the board inside the housing, ensuring the wires are not pinched, and replace the housing cover.



**Maximum Cable Length:** 380 m (1200')

**Minimum Wire Gauge:** 0.75 mm<sup>2</sup> (18 AWG)

| SP714-S2i Connections      |               |                  |
|----------------------------|---------------|------------------|
| Pulse Acquisition Device   | Signal        | Signal Ground    |
| Sponsler IT 400            | TB2 (1)       | TB2 (2)          |
| LectroCount LCR-II/LCR 600 | J8 (33)       | J8 (37)          |
| Topotech MultiLoad         | TB2B (V+ any) | TB2B (V COM any) |

### ⚠ CAUTION ⚠

If the total system resistance in a 2-wire standard configuration exceeds the recommended value, the preamplifier may function irregularly as a result of insufficient supply voltage to the terminals.

### Resistor Value - 2-wire Standard

- Maximum cable wire resistance must be less than 30 Ω  $R_{CABLE} = R_{W1} + R_{W2}$  (both wires in cable)
- Total system resistance with +24 VDC power supply must be between 250 and 400 Ω  $R_{SYSTEM} = R_{CABLE} + R_p$
- Maximum System Current  $I_{MAX} = 90 \text{ mA}$   $I_{MAX} = \frac{V_{DC}}{R_{SYSTEM}}$
- Resistor ( $R_p$ ) Power Dissipation  $P_{RD} = \frac{(V_{DC})^2}{R_p}$

### Recommended Resistor Value ( $R_p$ )

**24 VDC Power Supply:**  $R_p = 330 \text{ Ω}$ , 2 W

**12 VDC Power Supply:**  $R_p = 150 \text{ Ω}$ , 2 W

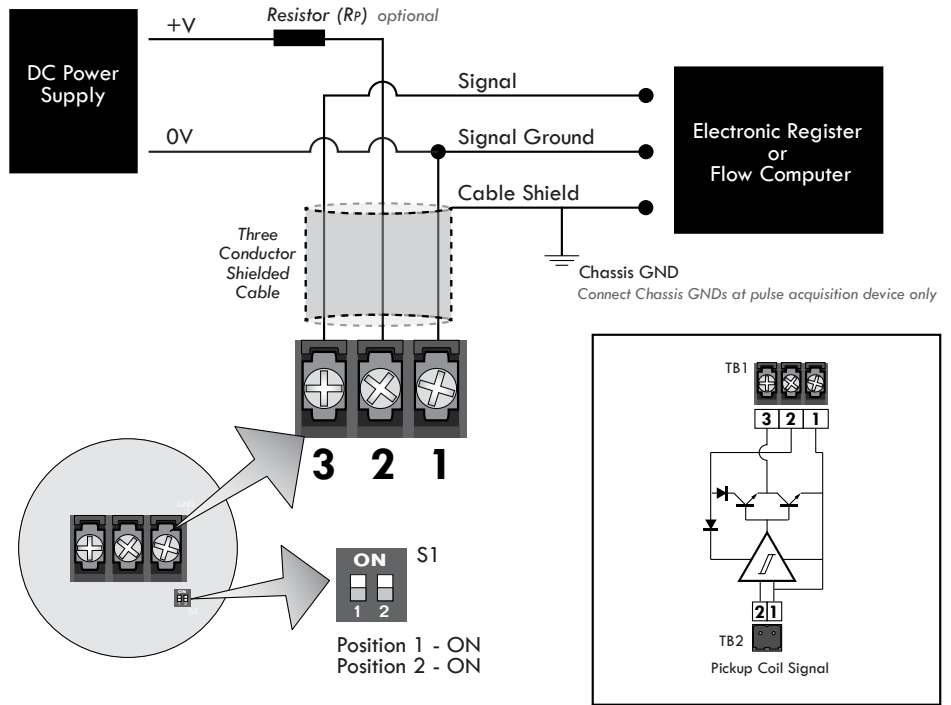


## 3-WIRE TTL SOURCING

The 3-wire TTL Sourcing configuration translates the output signal from the turbine flowmeter's pickup coil into a voltage value. The output of the 3-wire TTL Sourcing configuration is driven either positive or negative internally. Note that the name "TTL" is misleading because the output switches from 0V to +Vs, not 0V to +5V as the TTL standard indicates. In the SP714-S2i, "TTL" indicates that the output is driven in both the positive and zero volt cases. A pull-up or pull-down resistor is optional in the 3-wire TTL Sourcing configuration; however, a resistor can be installed to prevent damage from faults.

### To connect the SP714-S2i for 3-Wire TTL Sourcing:

1. Remove the SP714-S2i housing cover.
2. Pull the SP714-S2i board from the housing for access to the TB1 terminal block and the S1 switches.
3. Attach proper cable glands and/or conduit connectors to the SP714-S2i, the pulse acquisition device, and DC power supply.
4. Run the wires (through proper conduit) between the SP714-S2i, the pulse acquisition device, and DC power supply.
5. Set the first S1 switch to the ON position and the second S1 switch to the ON position.
6. Splice the resistor onto the +V leg from the DC power supply. **This step is optional.** The value of the resistor can be determined using the information below.
7. Wire the SP714-S2i to the pulse acquisition device and DC power supply as indicated in the schematic.
8. If necessary, adjust the input signal sensitivity (R1), activate the diagnostic test oscillator (SW2), and/or check the diagnostic operational LEDs (D1 & D2). See page 11.
9. Coil the wires underneath the CPU board and place the board inside the housing, ensuring the wires are not pinched, and replace the housing cover.



| SP714-S2i Connections      |               |                  |
|----------------------------|---------------|------------------|
| Pulse Acquisition Device   | Signal        | Signal Ground    |
| Sponsler IT 400            | TB2 (1)       | TB2 (2)          |
| LectroCount LCR-II/LCR 600 | J8 (33)       | J8 (37)          |
| Topotech MultiLoad         | TB2B (V+ any) | TB2B (V COM any) |

Maximum Cable Length: 1000 m (3280')  
Minimum Wire Gauge: 0.75 mm<sup>2</sup> (18 AWG)

### Resistor Value - 3-wire TTL Sourcing

- Limit total system current to 50 mA  $I_{MAX} = \frac{V_{DC}}{R_P}$
- For 24 VDC operation pulse acquisition device impedance must be at least 1200  $\Omega$
- For 5 VDC operation pulse acquisition device impedance must be at least 250  $\Omega$
- Resistor ( $R_P$ ) Power Dissipation  $P = \frac{(V)^2}{R_P}$

#### Recommended Resistor Value ( $R_P$ )

24 VDC Power Supply:  $R_P = 680 \Omega$ , 1 W  
12 VDC Power Supply:  $R_P = 330 \Omega$ , 1 W  
5 VDC Power Supply:  $R_P = 12 \Omega$ , 2.5 W

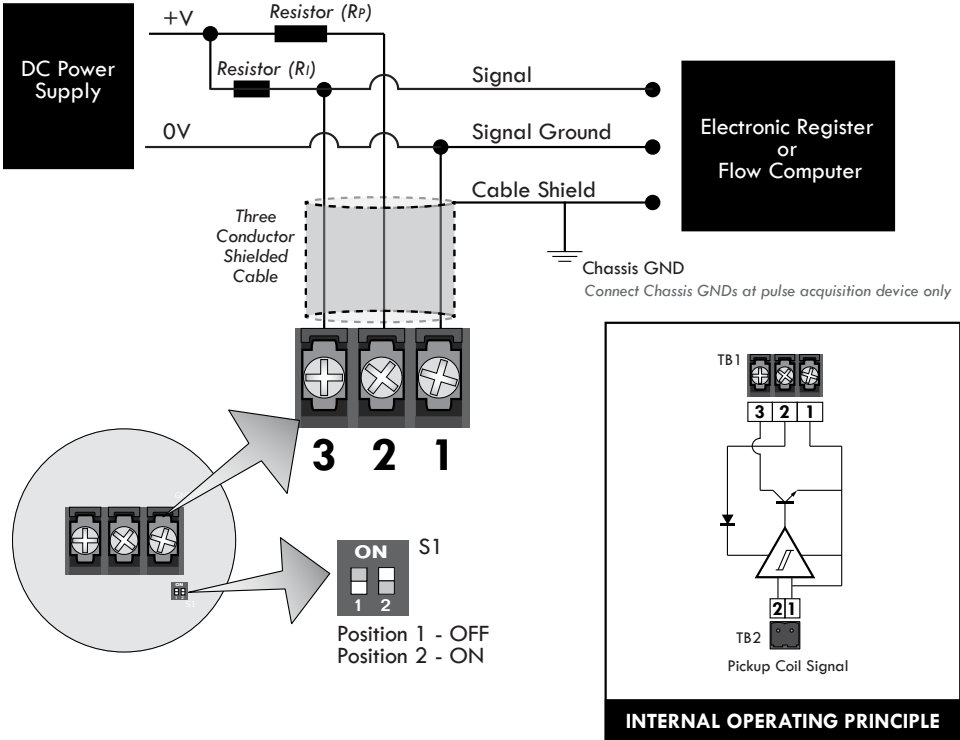
# 3-WIRE OPEN COLLECTOR WIRING

## 3-WIRE OPEN COLLECTOR

The 3-wire Open Collector configuration translates the output signal from the turbine flowmeter’s pickup coil into a voltage value. The output is driven by an “Open Collector” transistor. A resistor is required to “pull-up” the voltage when the transistor is ‘off’.

### To connect the SP714-S2i for Open Collector 3-Wire:

1. Remove the SP714-S2i housing cover.
2. Pull the SP714-S2i board from the housing for access to the TB1 terminal block and the S1 switches.
3. Attach proper cable glands and/or conduit connectors to the SP714-S2i, the pulse acquisition device, and DC power supply.
4. Run the wires (through proper conduit) between the SP714-S2i, the pulse acquisition device, and DC power supply.
5. Set the first S1 switch to the OFF position and the second S1 switch to the ON position.
6. Splice the resistors between the +V leg from the DC power supply and the signal input leg to the pulse acquisition device. *The value of the resistor can be determined using the information below.*
7. Wire the SP714-S2i to the pulse acquisition device and DC power supply as indicated in the schematic.
8. If necessary, adjust the input signal sensitivity (R1), activate the diagnostic test oscillator (SW2), and/or check the diagnostic operational LEDs (D1 & D2). See page 11.
9. Coil the wires underneath the CPU board and place the board inside the housing, ensuring the wires are not pinched, and replace the housing cover.



| SP714-S2i Connections      |               |                  |
|----------------------------|---------------|------------------|
| Pulse Acquisition Device   | Signal        | Signal Ground    |
| Sponsler IT 400            | TB2 (1)       | TB2 (2)          |
| LectroCount LCR-II/LCR 600 | J8 (33)       | J8 (37)          |
| Topotech MultiLoad         | TB2B (V+ any) | TB2B (V COM any) |

Maximum Cable Length: 1000 m (3280')  
Minimum Wire Gauge: 0.75 mm<sup>2</sup> (18 AWG)

Resistor Value - 3-wire TTL Sourcing

- Limit total system current to 50 mA  $I = \frac{V_{DC}}{R_P}$
- Resistor (R<sub>i</sub>) Power Dissipation  $P = \frac{(V_{DC})^2}{R_i}$
- Resistor (R<sub>p</sub>) Power Dissipation  $P = \frac{(V_{DC})^2}{R_p}$

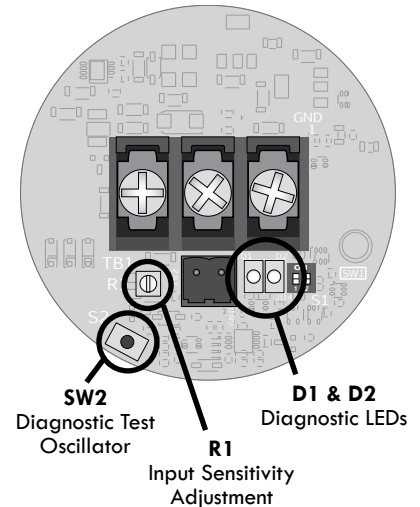
**Recommended Resistor Value (R<sub>p</sub>)**  
**24 VDC Power Supply:** R<sub>i</sub> = 1200 Ω, 1 W  
R<sub>p</sub> = 680 Ω, 1 W  
**12 VDC Power Supply:** R<sub>i</sub> = 560 Ω, 0.5 W  
R<sub>p</sub> = 330 Ω, 1 W  
**5 VDC Power Supply:** R<sub>i</sub> = 270 Ω, 0.25 W  
R<sub>p</sub> = 25 Ω, 1 W

## Input Signal Sensitivity Adjustment (R1)

The R1 Input Signal Sensitivity Adjustment is a valuable tool that, in addition to SP714-S2i being directly mounted to the turbine meter, allows effective operation in noisy environments. The R1 is a potentiometer that sets the amplitude of the input signal (from the pickup coil) that the SP714-S2i will accept as a valid pulse.

Adjusting R1 allows the SP714-S2i to differentiate between the input signal and any noise in the system. Turning the R1 clockwise decreases the amplitude of the input signal required for a valid pulse, and turning the R1 counterclockwise increases the required amplitude.

The detection level of the R1 potentiometer is set at approximately 17 mV rms at the factory. A red varnish is applied to the potentiometer screw to seal the factory setting.



## Diagnostic Test Oscillator (SW2)

The SW2 Diagnostic Test Oscillator verifies that the SP714-S2i is operational. To activate the test, press the SW2 push button. A 10 Hz signal will be introduced into the SP714-S2i signal output pins (TB1). For best results, use the SW2 Diagnostic Test Oscillator without the presence of the pickup coil signal.

### Do Not Use the SW2 During Operation

*If an input signal from the pickup coil is present, the 10 Hz signal from the SW2 can disrupt the SP714-S2i output signal and an error will be detected by the pulse acquisition device.*

## Diagnostic Operational LEDs (D1 & D2)

There are two Diagnostic Operational LEDs (D1 and D2) on the SP714-S2i PC board that indicate the current operational status of the preamplifier. The green LED (D1) indicates the power supply status. When the green LED is on, the power supply is sufficient. When the LED is dim or flashing, the preamplifier does not have sufficient power.

The red LED (D2) indicates the status of the signal traveling through the preamplifier. The red LED flashes at the same rate as the frequency as the signal passing through the SP714-S2i. If the LED is not flashing, no signal is passing through the amplifier. If the signal frequency is above 40 Hz, the light will flash very quickly and the LED will appear to be constantly illuminated. If the input into the SP714-S2i stops on a positive portion of the signal pulse, the LED will be illuminated constantly.

*The D1 and D2 LEDs are inoperable in the 2-wire Standard configuration.*

## Maintenance - CPU Board Replacement

The CPU board (PN 85025) is the only SP714-S2i part available for purchase. If you are replacing the 85025 CPU board, the wiring harness, which connects the pickup coil and to the SP714-S2i CPU board, must be unplugged from the old CPU board and plugged into the replacement board, then wired appropriately.

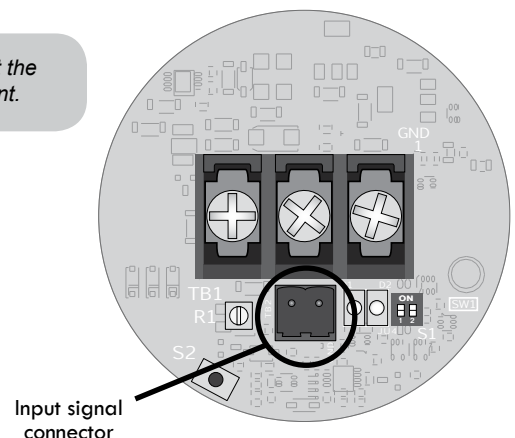


Wiring Harness

### To replace the 85025 CPU board:

1. Remove the SP714-S2i housing cover.
2. Pull the CPU board from the housing, disconnect the wires to the power supply and the pulse acquisition device, and unplug the wiring harness.
3. Plug the wiring harness into the replacement CPU board, wire the replacement CPU board to the power supply and the pulse acquisition device, set the board into the housing, and replace the housing cover. *See pages 7-10 for detailed instructions.*

*Polarity of the connector at the pickup coil is not important.*



# **LIQUID CONTROLS GROUP**

**CORKEN • FAURE HERMAN • LIQUID CONTROLS • SAMPI • SPONSLER • TOPTECH SYSTEMS**

## **LIQUID CONTROLS**

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