Data Flow Systems, Inc.

Installation and Operation Manual

R P T 0 0 1

This document was last updated July 27, 2020.

Contents

Product Overview

The Rail Pressure Transducer (RPT001) is a DIN rail mounted product that incorporates patented level sensing and fault detection techniques to provide a highly reliable well level indication via 4-20mA output. The level transducer is integrated into the RPT001 product – offering an alternative to hanging or submerging an expensive instrument inside the well. The RPT001 is designed to measure well level depths from 0 to 33 feet.

The RPT001 also features a digital output for fault indication, making it ideal for use with automatic pump controllers and monitoring via SCADA Systems. A complete RPT001 installation requires product sold separately (see Appendix A for details).

Hardware Specifications

Part Number	DFS-00546-008-01
Model Name	Rail Pressure Transducer - RPT001
Dimensions	5.25” (L) x 3.35” (W) x 1.2” (H)
Material	Acrylonitrile Butadiene Styrene (ABS)
Supported Tube Diameter	1/8” ID
Power Supply Requirements	7 - 24 VDC, 50mA
Temperature Rating	-10ºC to 60ºC
Digital Output Rating	240VAC/30VDC, 3A, NO, Mechanical
Analog Output Rating	4-20mA @ 250Ω
Transducer Pressure Rating	0 - 14.5 PSI
Transducer Measurement Accuracy	1% of full scale

Features

- Snap-on DIN rail mount design that allows for easy installation and removal
- Push spring terminal block
- Status LEDs indicate device operating status
- Digital output provided by relay closure for fault alarms (opens on fault)
- 4-20mA analog output for level output (14.5PSI / 33.45ft)
- 1/8” barb fittings for hose connections between the air pump and well
- Internal check valve monitors flow and checks for faults with the air pump

Application Information & Description

The RPT001 is mounted inside a panel and connected inline with a small diaphram air pump by two barbed fittings that connect to the tubing and provide air flow throughout the system. The air pump produces a known amount of pressure as pulses of air into the well, which will create a back pressure representing the height of water above the tube. The RPT001 measures this back pressure and converts this into a 4-20mA analog signal that can be measured by an automatic pump controller (such as Data Flow Systems's TCU800). The pump controller will then interpret this 4-20mA analog value as the well water level in feet, utilizing this value for configured automated procedures and reporting.

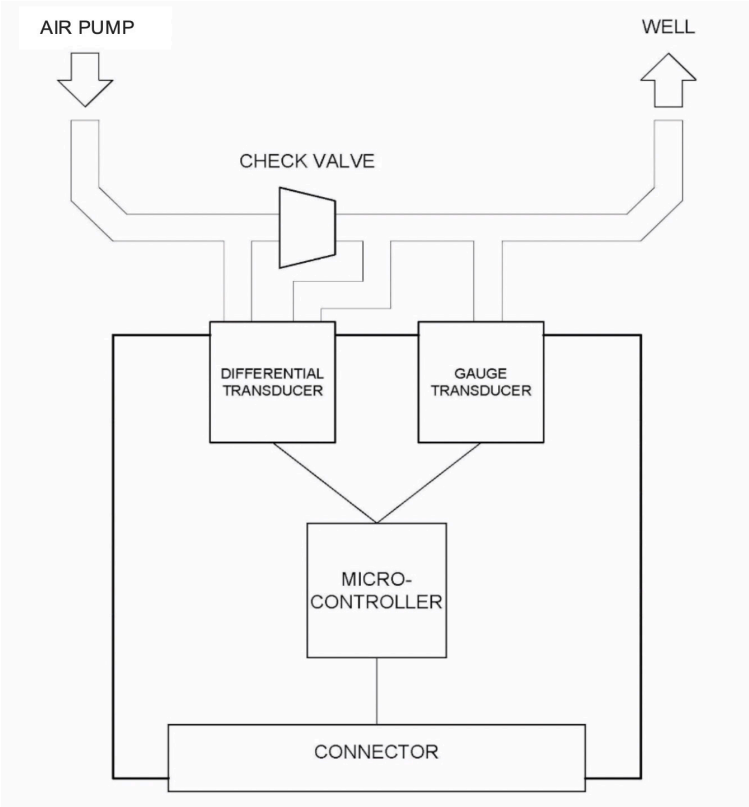
The analog output of the RPT001 follows the industrial 4-20mA standard, where 4mA represents 0% of the measured value and 20mA represents 100%. The measured value in this system is the back pressure produced by the water level in the well. The RPT001's pressure transducer is rated to accurately measure pressures between 0-14.5 PSI. This means that the analog output will output 4mA when measuring 0 PSI and output 20mA when measuring 14.5 PSI.

In order to interpret this 4-20mA analog output as feet of water in the well, you can use the following conversion:

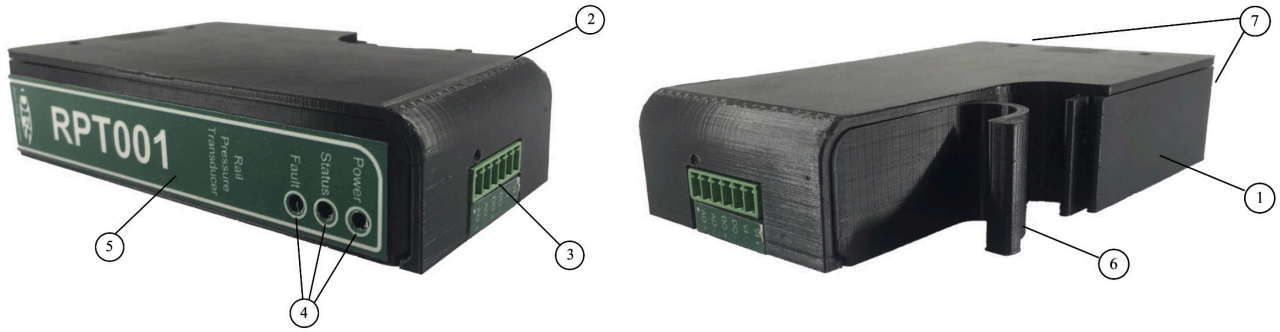
$$Well\ Level\,(ft) = \frac{Pressure\,(PSI)}{0.4335}$$

Additionally, the RPT001's digital output will open when the unit detects a failure in the air pump diaphram. This can be used to determine if the air pump is adequately providing enough pressure to measure the full depth of the well. The operating state of the unit is indicated by the three LEDs on the front face of the RPT001. Refer to Appendix D: Troubleshooting for LED operating descriptions.

Internal Block Diagram



Mechanical Assembly



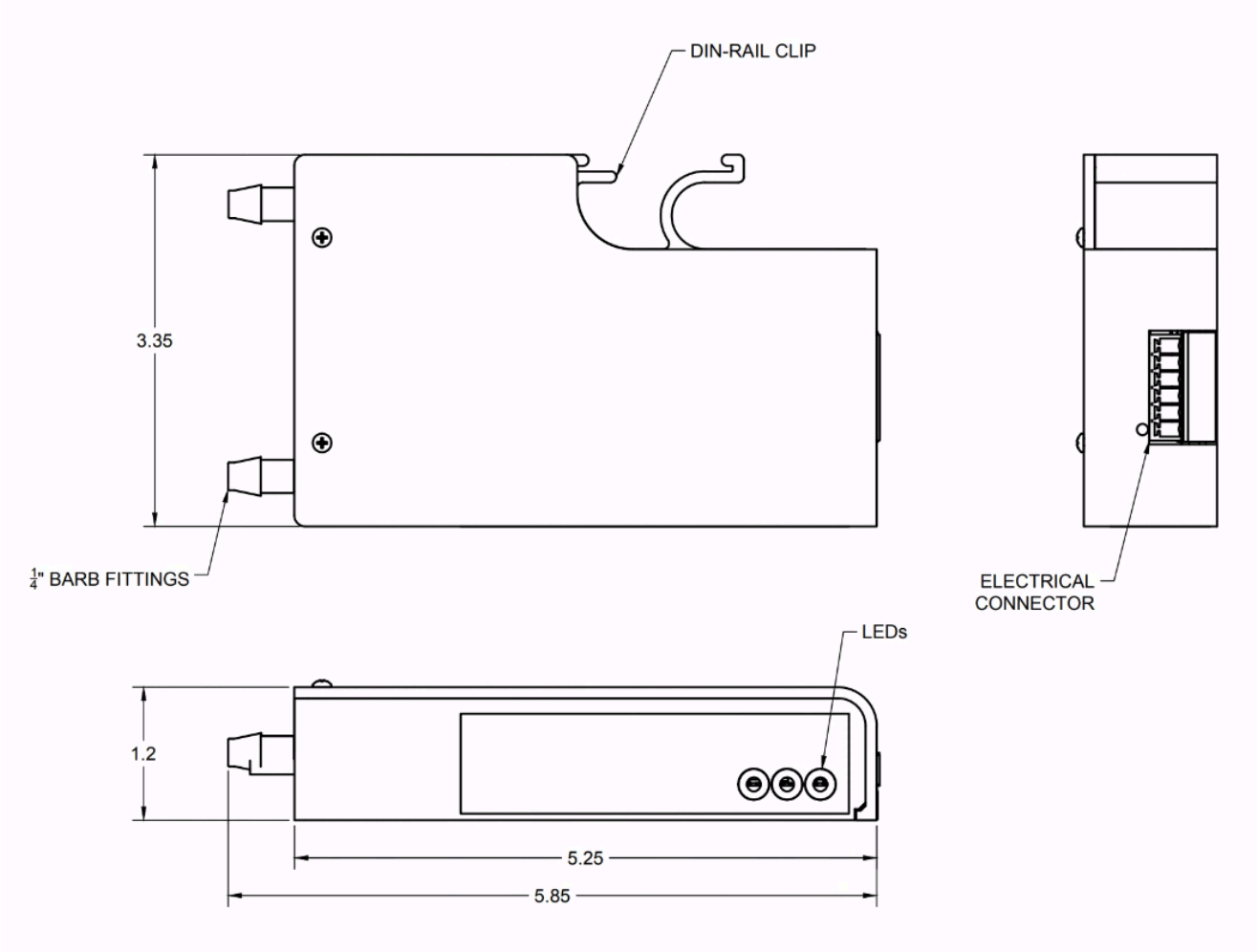
Part Number	Description
1	RPT001 Enclosure Base
2	RPT001 Enclosure Lid
3	6-Pin Terminal Block
4	Status LEDs (Power, Status, Fault)
5	RPT001 Label
6	DIN Rail Mounting Bracket
7	1/8” Barb Fittings

Pinouts

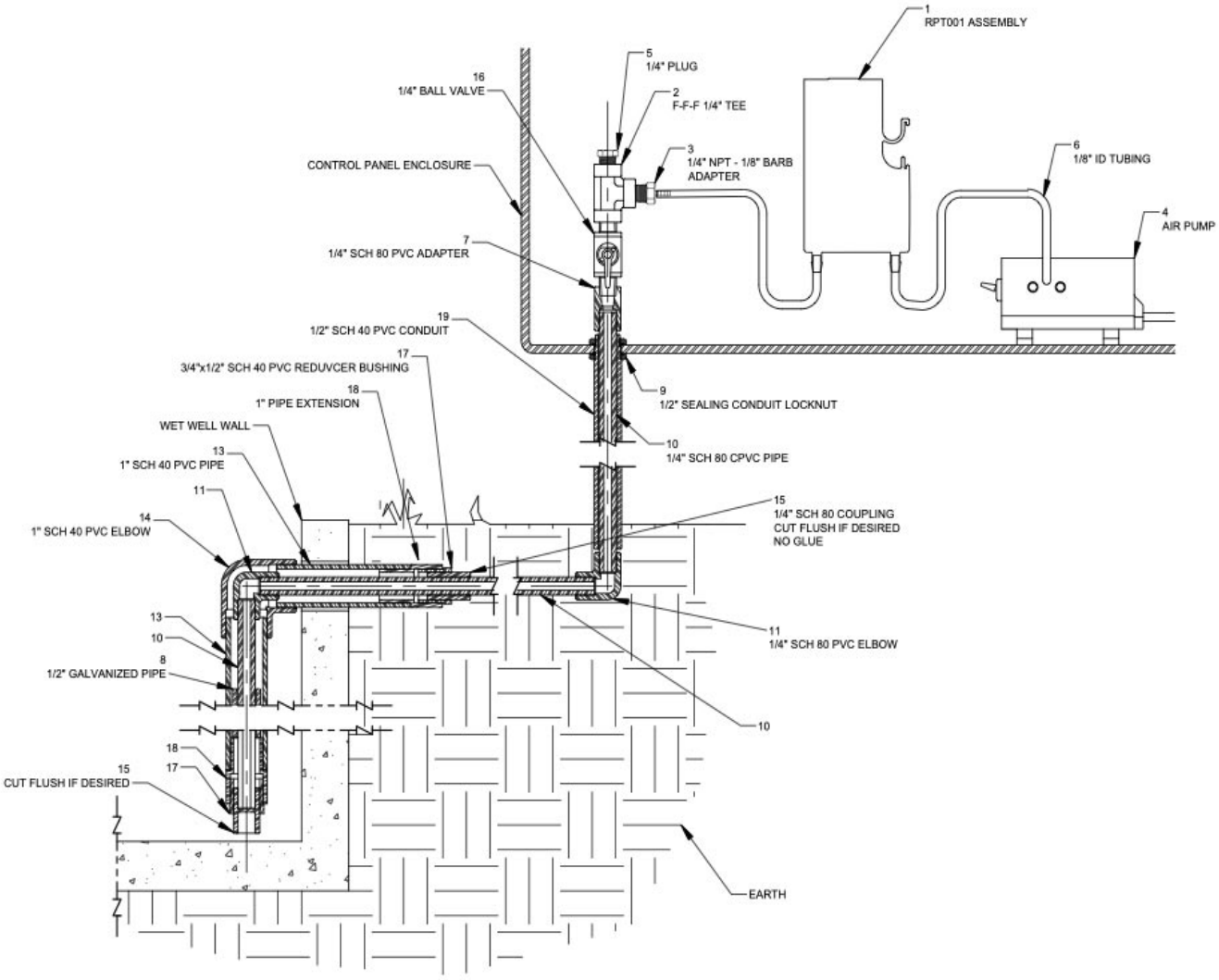
PIN #	Name	Description	Electrical Rating
P1-1	AO+	Analog output 4-20mA source	0-40VDC, 20mA
P1-2	AO- *	Analog output 4-20mA return	0-40VDC, 20mA
P1-3	DO+	Fault relay Normally Open (NO)	240VAC/30VDC, 3A
P1-4	DO-	Fault relay Common (COM)	240VAC/30VDC, 3A
P1-5	VI- *	Input voltage return	7-24VDC, 50mA
P1-6	VI+	Input voltage supply	7-24VDC, 50mA

* VI- and AO- are internally connected.

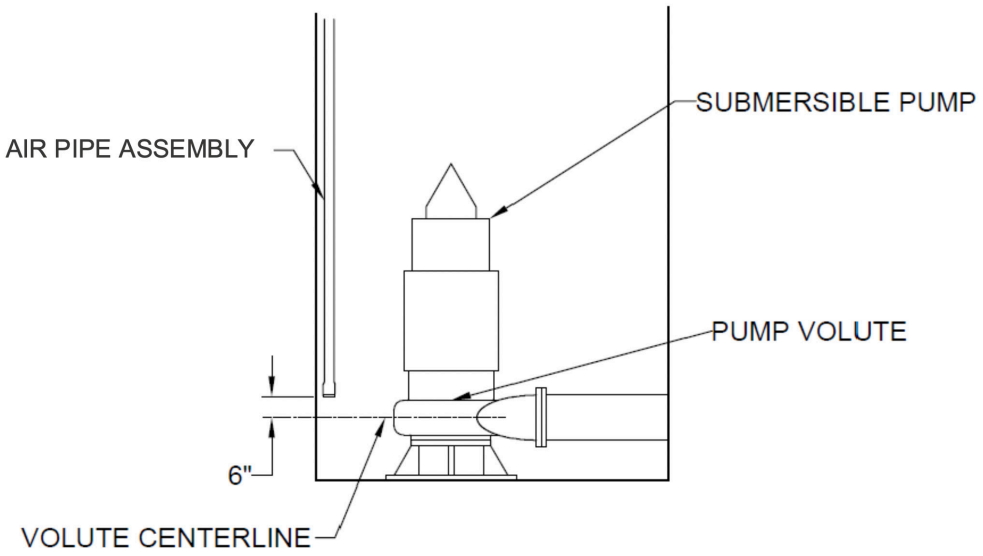
Mechanical Dimensions



Suggested Installation Diagram



*End of sensor tube must be 6” above the suction inlet pipe for non-submersible pump installations.



Reccomended Placement of Air Tube

The diagram above depicts routing of the air pipe assembly inside wet-well. The end of the air pipe is positioned 6 inches above the pump volute center line. This positioning is critical to the product's non-clogging, self-cleaning features.

When installation is complete, plug the pump into an electrical outlet, but do not turn it on until the transducer has been wired. Wire the RPT to the TCU (P2-22; Analog1+) as shown in Step 1 of the installation sequence.

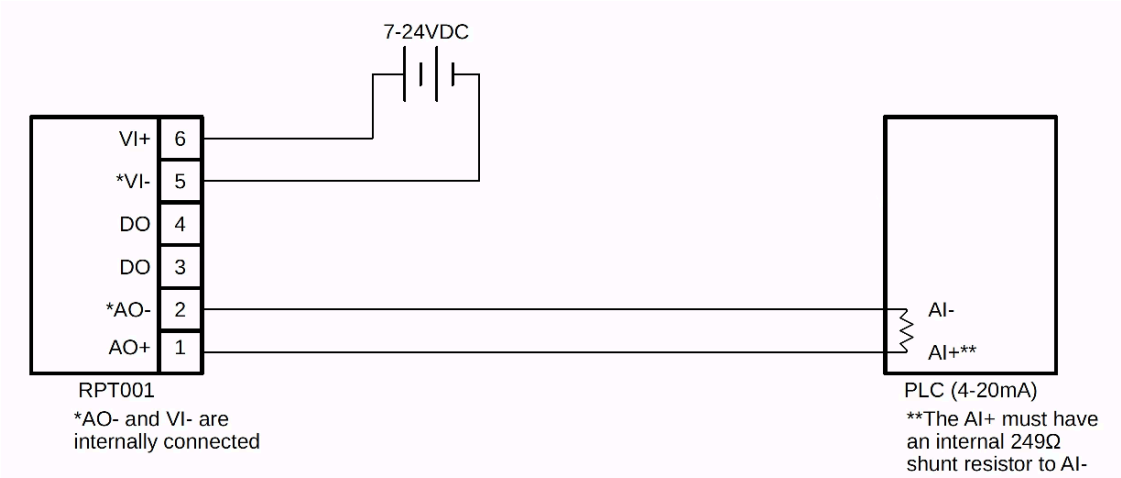
Optional Right-Angle Mounting Adapter

Appendix

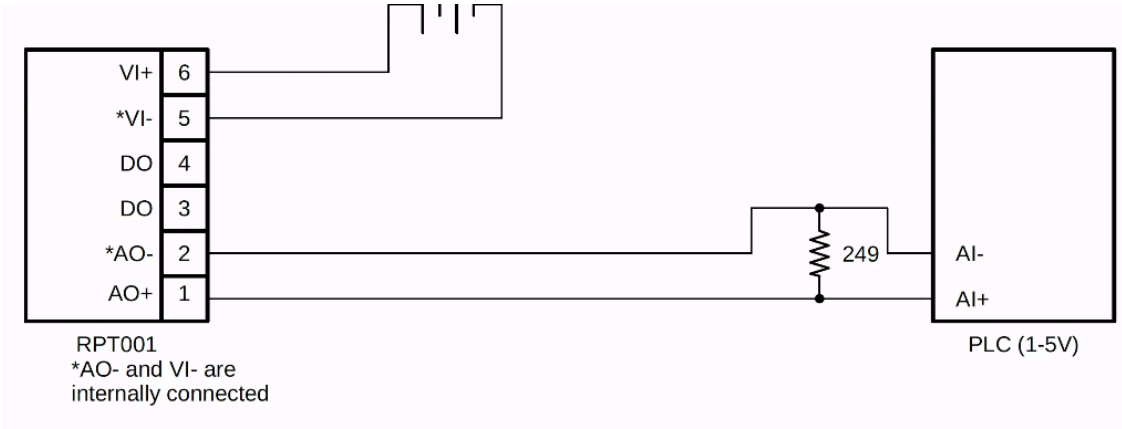
A: Part Numbers / Part Lists

Assembly	Parts List	Ordering Number
RPT001	(1) RPT001 unit with mating connector	DFS-00546-008-01
RPT001 Small Parts Kit	(1) RPT001 unit with mating connector (2) Fitting, locknut, sealing, 1/2” NPT F (6) Elbow, 1/4” sockets, scheuld 80, PVC, 90 degree (6) Coupling, 1/4” sockets, schedule 80, PVC, gray (2) Adapter, 1/4” socket x NTPF, schedule 80, PVC (3) Coupling, 1” sockets, schedule 40, PVC, white (1) Elbow, 1”, schedule 40, PVC, white, 90 degree (1) Valve, PVC, for TCU360 (2) Bushing, PVC, schedule 40, 3/4” x 1/2”, non hexhead (2) Pipe extension, 1”, schedule 40, PVC, slip x intern (1) Tee, SS, 1/4”, FemXFemXFem (1) Tubing, Clear, 1/8” ID, 1/4” OD, Flexible (1) Plug, 1/4” NPTM, Brass, External Hex Drive (1) Adapter, 1/4” NPTM, 1/8” Barb, Brass (1) Air Pump, 115 VAC (Part #022-0526) (1) Glue, Christy’s Red Hot Blue, 4oz can (12) Q-Tip cotton swab, 6”, industrial	DFS-00546-008-02
RPT001 Full Parts Kit	(1) RPT001 unit with mating connector (2) Fitting, locknut, sealing, 1/2” NPT F (6) Elbow, 1/4” sockets, scheuld 80, PVC, 90 degree (6) Coupling, 1/4” sockets, schedule 80, PVC, gray (2) Adapter, 1/4” socket x NTPF, schedule 80, PVC (3) Coupling, 1” sockets, schedule 40, PVC, white (1) Elbow, 1”, schedule 40, PVC, white, 90 degree (1) Valve, PVC, for TCU360 (2) Bushing, PVC, schedule 40, 3/4” x 1/2”, non hexhead (2) Pipe extension, 1”, schedule 40, PVC, slip x intern (1) Tee, SS, 1/4”, FemXFemXFem (1) Tubing, Clear, 1/8” ID, 1/4” OD, Flexible (1) Pipe, Conduit, 1/2”, PVC, SCH 40, Gray (1) Plug, 1/4” NPTM, Brass, External Hex Drive (1) Adapter, 1/4” NPTM, 1/8” Barb, Brass (1) Air Pump, 115 VAC (Part #022-0526) (1) Glue, Christy’s Red Hot Blue, 4oz can (12) Q-Tip cotton swab, 6”, industrial (2) Pipe, 1/4”, schedule 80, CPVC, 20’ (2) Pipe, 1” x 20’, schedule 40, PVC, belled end, white	DFS-00546-008-03

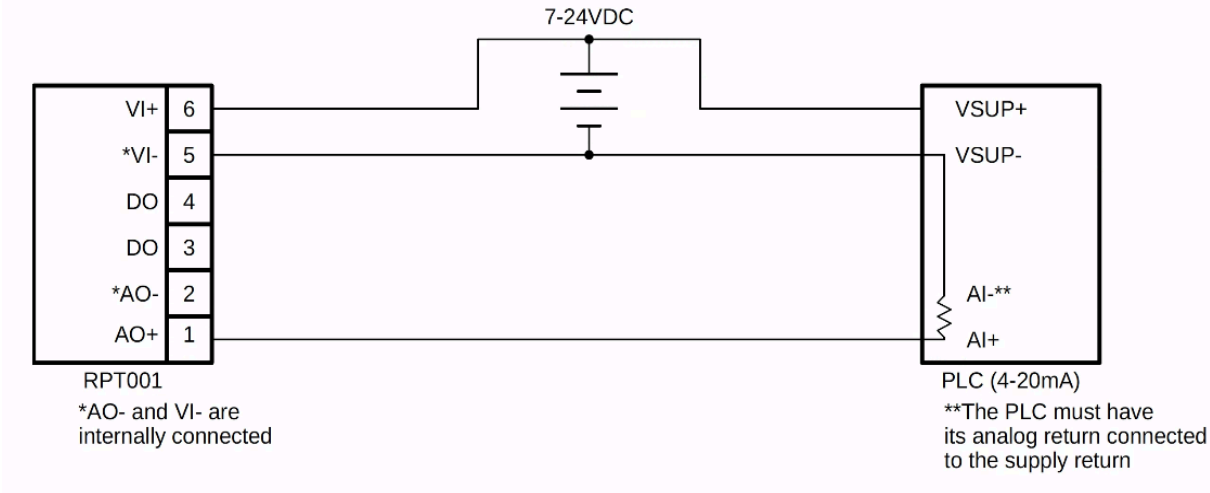
B: Basic Wiring



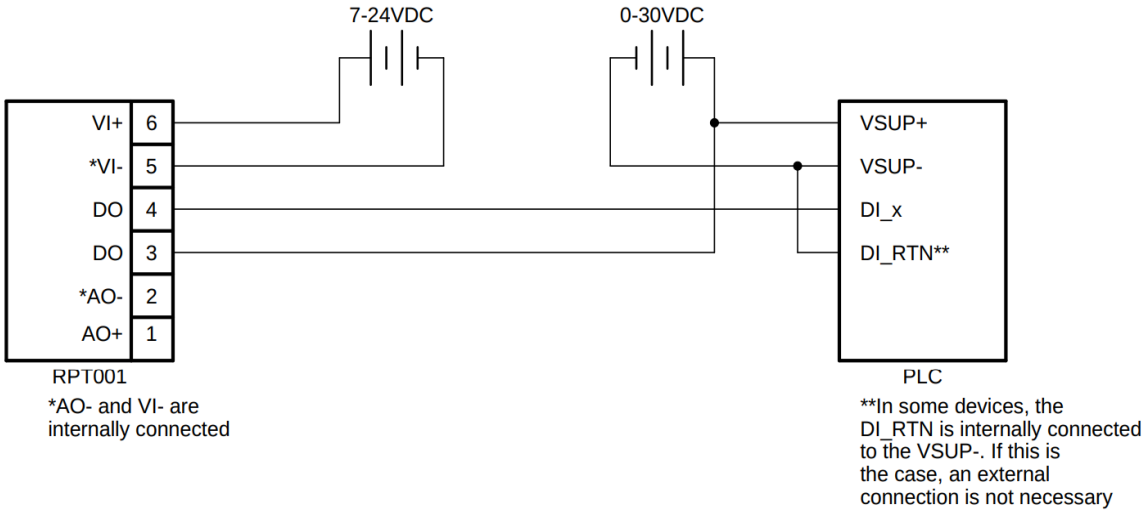
Typical Connection to 4-20mA PLC



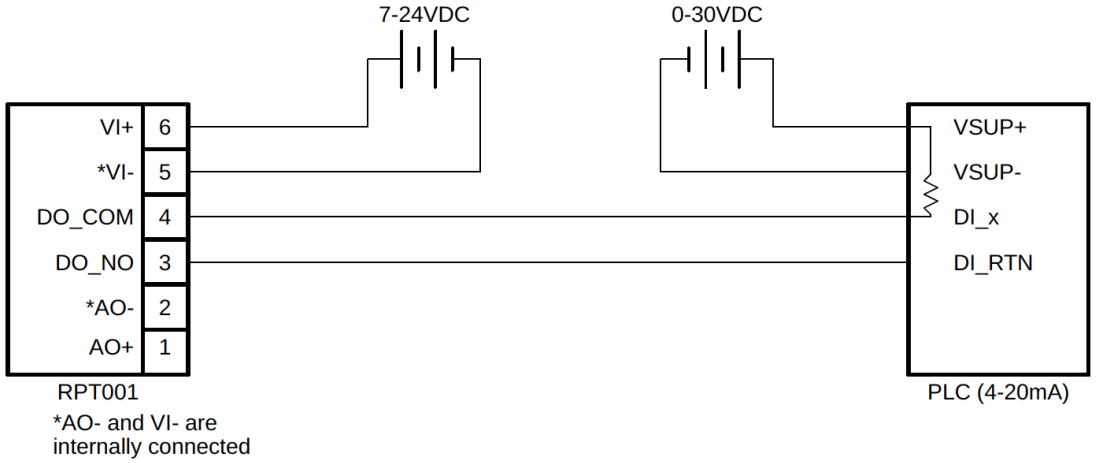
Typical Connection to 0-5V PLC (external shunt)



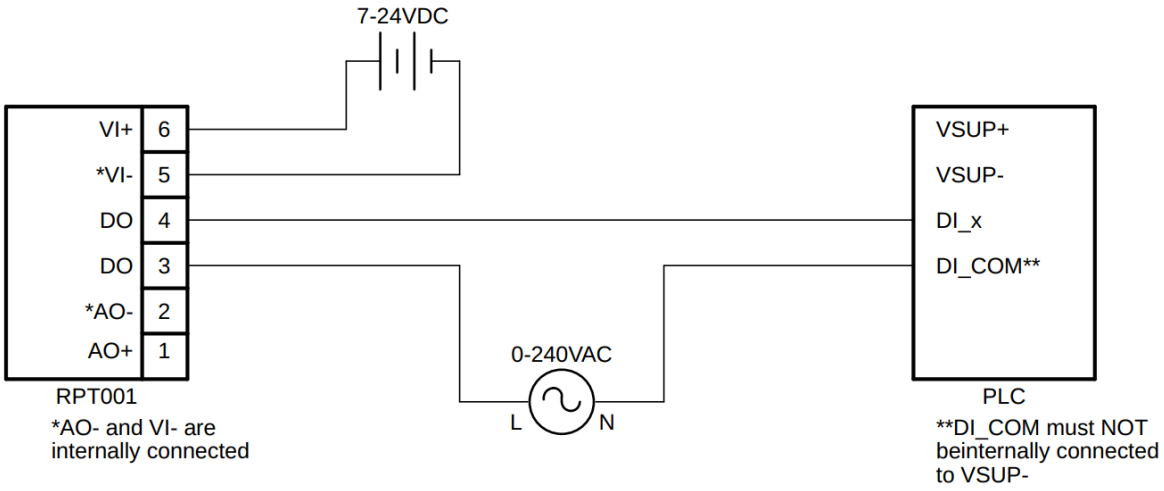
Simplified Connections for Shared Supply



Fault Relay Connection (externally biased input)



Fault Relay Connection (internally biased input)



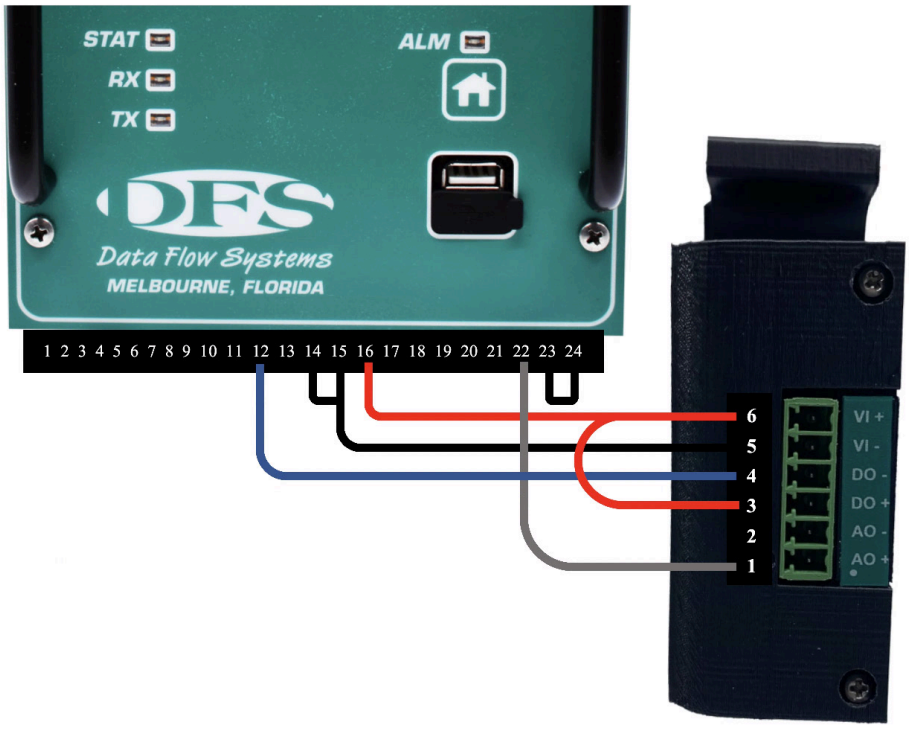
Fault Relay Connection (AC input)

C: TCU001/TCU800 Wiring

1. Begin by mounting the RPT001 on the DIN rail. Place the top of the mounting bracket onto the DIN rail at an angle and apply pressure to push in the bracket. At the same time, slip the bottom of the bracket over the rail and release pressure to securely mount it.

2. Connect the following pins:

P1-6 (VI+)	Connect to the positive terminal of the power supply.
P1-5 (VI-)	Connect to the negative terminal of the power supply.
P1-4 (DO-)	Connect to a voltage source within the listed relay specifications.
P1-3 (DO+)	Connect to a digital input pin on the Telemetry Control Unit (TCU).
P1-2 (AO-)	Connect to the return pin of the analog input on the Telemetry Control Unit (TCU).
P1-1 (AO+)	Connect to an analog input pin on the Telemetry Control Unit (TCU).



The logic of the digital output is inverted. If the RPT001 does not indicate a fault, then the relay will be closed, but if a fault does occur, then the relay will open.

3. On the base of the enclosure there are two arrows indicating flow through the device. Connect the tube from the air pump to the barb fitting that indicates air flow into the device.

4. Connect the tube from the well to the barb fitting that indicates air flow leaving the device.

When connecting the tubing to the barb fittings, make sure that the tube is pushed completely over the barb in order to seal and prevent leaks in the system.

Configuration

For appropriate use of the RPT001 with a pump controller, enter the following configuration values:

- Transducer Type - 4-20mA
- Transducer Low - 0.0 ft
- Transducer High - 33.4 ft (TCU001); 33.45 ft (TCU800)

The TCU800 configuration values allow more precise floating point values than the TCU001.

The transducer type is necessary since the analog output is 4-20mA. However, the transducer low and high values can be changed only to compensate an offset. Some well installations place the tube 1.0 ft above the bottom of the well, which would then add an offset to the configuration values resulting in a low of 1.0 ft and high of 34.45 ft.

Digital Output

The digital output of the RPT001 is provided as a relay contact closure. The system closes the relay on startup and keeps the closure as long as the air pump is operating within its required specifications. If the air pump is no longer operating within specifications, the relay will open and break the digital output circuit.

An example of using the digital output involves connecting a voltage source to P1-3 (DO+) and connecting P1-4 (DO-) on the RPT001 to the AUX_IN digital monitor input on the TCU. These connections will provide the ability to monitor the fault status based on the digital input and provide the possibility of switching to a standby air pump. The digital output provides the means to articulate if a fault has occurred, but how this is interpreted and handled can be configured in many different ways.

D: Troubleshooting

The RPT001 includes self-monitoring capabilities and includes current operating status via the LED indicators on the side of the device.

Power Status LED

- Off - The recommended voltage supply is not provided to the device and is currently not operating.
- On - The device is currently in operation and receiving the recommended voltage supply.

Fault Status LED

- Off - There is no active fault and the air pump is operating within specifications.
- On - There is an active fault and the air pump is unable to produce the required pressure for accurate measurements.

Device Status LED

The device status LED serves the purpose of interpreting the current state of the device to the operator. This status is indicated by the number of on/off sequences, or pulses, of the LED within a 2 second window. Multiple statuses can be indicated by sequenced pulses starting from the lowest number to the highest. The device will cycle through the statuses until they are cleared.

Pulse Count	Meaning
1	Heartbeat of the device which indicates no active faults.
2	Analog output fault generated by the device. This indicates a wire break in the analog output connection or a high impedance load.
3	Pressure transducer fault generated by the device. The pressure transducer is no longer operating within specifications.
4	Differential pressure transducer fault generated by the device. The differential pressure transducers is no longer operating with specifications.
5	Over pressure fault generated by the device. The measured well level indicates a pressure greater than the max specification of 14.5 PSI.

Data Flow Systems, Inc.
605 N. John Rodes Blvd
Melbourne, Florida 32934
(321) 259-5009
www.dataflowsys.com