

Wireless Signal Replication with Plunger Arrival Sensors

Background

Every natural gas well produces a combination of oil and gas. Over time the gas pressure underground decreases and the fluid in the well begins to weigh down production. To decrease the fluid load a plunger is placed in the production tubing and the well is closed. The gas pressure gradually builds, pushing the plunger up and all the fluid out of the well. With the plunger at the top and the fluid out of the way the well is opened and gas flows more freely. This process is called artificial lift and increases a well's productivity significantly.

For artificial lift to be economical it must be automated. That means oil and gas automation companies must use a sensor to detect when the plunger lands in the lubricator at the top of the well head and report the event to a Programmable Logic Controller or Remote Terminal Unit. There are several plunger arrival sensors on the market such as TripMate from OKC Products and ESO from Time Products.

Problem

Plunger arrival sensors output a short pulse (as short as 1 second) when the plunger arrives in the lubricator. The automation system must not miss the pulse less the well stays shut in when it could be producing gas.

Solution

FreeWave Technologies' provides the benefits of wireless with peace of mind that goes with the most reliable radios in harsh environments. The I/O radios used in wireless signal replication (a.k.a. wire replacement) provide a wireless link with any automation equipment in the field. Wireless signal replication can replace a wired solution without any changes to the PLC or RTU.

Follow these directions when automating a plunger arrival sensor with momentary outputs.

Radio Network Configuration

The minimum and maximum packet sizes determine the size of data packets in the frequency-hopping spread spectrum protocol. Settings the min/max packet sizes to 9 and 9 creates an update rate of both ends of the link just 6 updates per second. This means that the shortest pulse that can be reliably detected at both ends of the link is $1/3^{\text{rd}}$ of a second.

Set Min/Max Packet Sizes to 2/2

Set the minimum and maximum packet size of the wireless signal replication network to 2 and 2. This provides the fastest hopping speed at 12 updates per second at both ends of the link. This equates to a pulse of $1/6^{\text{th}}$ of a second to be reliably reproduced at both ends of the link.

I/O Radio Settings: FGRIO-S, FGR2-IOS, FGR2-IO-IOE, I2-IOS

The TripMate plunger arrival sensor momentarily grounds its output when it detects the plunger. To correctly detect the pulse on the digital input of the I/O slave radio a pull-up resistor for that digital input channel must be enabled.

Set DI1 or DI2 Resistor Pull to "Pullup"

Connect the TripMate according to figure 1 below and set the DI1 Pullup or DI2 Pullup setting to "Pullup" (choose appropriate channel).

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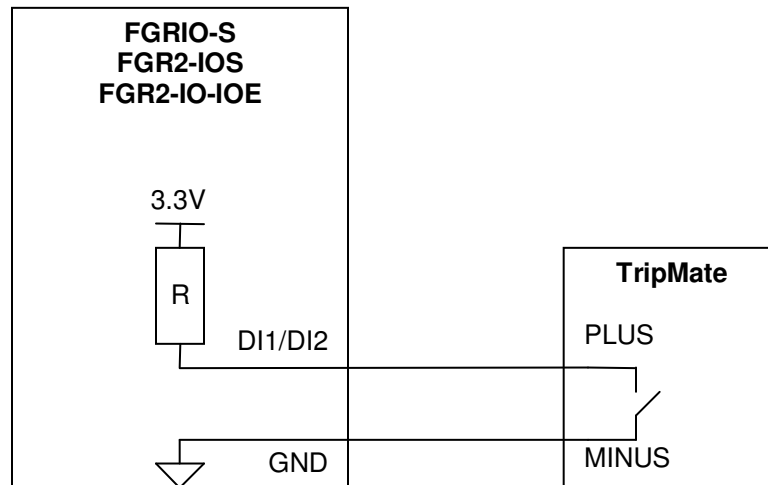


Figure 1. Connection diagram for TripMate plunger arrival sensor

PLC/RTU Settings

The PLC or RTU must sample the status at least as fast as the shortest pulse. Testing has shown that the shortest TripMate pulse is 2 seconds. If the PLC or RTU polls its input at any slower setting, then it is likely it will miss the pulse.

Set PLC/RTU DI Polling Rate to 2 seconds

Set the PLC/RTU polling rate for its digital input to 2 seconds or shorter. This way it will always detect a pulse that is 2 seconds or longer.