

Using ETC Products with Edge Processing

System Level Design Tips

Prepared By: Mark Scantlebury

Date: May 26, 2020



Overview

Many oil and gas producers are looking to move to edge processing for their monitoring and control applications. While one of the main objectives can be to reduce the overall system cost, it is important to not forget that:

- Control should be provided by a microcontroller-based system with real time operating system as opposed to relying on a microprocessor running Linux.
- Edge processors are often certified as Class I Zone 2/Div 2 while plunger lift well heads can be classified as Class I Zone 0/1/Div 1.

ETC Background

ETC is an embedded electronics company that specializes in low power, wide temperature range, hazardous locations approved controls and sensors for the oilfield. Most of our current products are related to plunger lift. ETC can be a partner in delivering components of an edge processing solution, especially when it comes to plunger lift.

Plunger Arrival Monitoring

Simply monitoring plunger arrivals is unlikely to be very valuable on its own. This may have some value if the edge processor is also monitoring the pressure sensors and controlling the sales valve, effectively becoming the plunger lift controller.

NOTE: The Cyclops acts as a dry contact. This means that when the plunger arrives, the SIG pin is pulled to ground, completing the circuit and drawing current. To detect this, the controller must have an internal pull up resistor. If the input on the controller is looking for a change in voltage, then an external pull up must be used. For more detail, please refer to the Cyclops Manual.

The Cyclops IS is dual certified:

Class I Division 1, Group C, D T4

Ex ia IIB T4

Class I Zone 0, AEx ia IIB T4

Class I Division 2, Group A,B, C, D T4

Class I Zone 2 Group IIC T4

The Cyclops ExP is certified:

Class I Division 1, Group C, D

Ex d IIB T4

Class I Zone 1, AEx d IIB T4

Installation in Zone 0/1

If the well head is considered Zone 0/1, then a Cyclops IS can be used. If the control system is in a less hazardous Zone, then an IS barrier should be used.

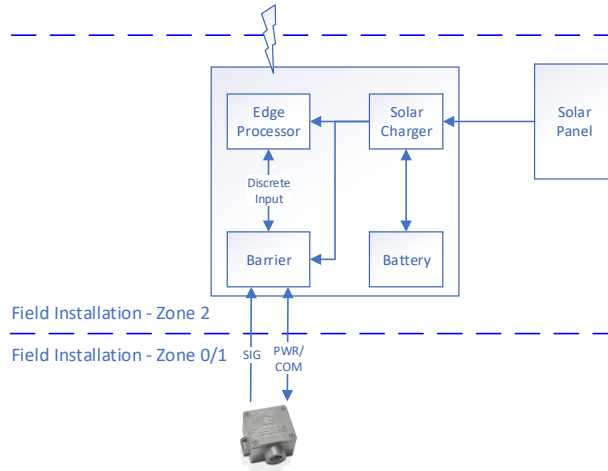


Figure 1 - Zone 2 Edge Processor with Zone 0/1 Cyclops IS

If you wish to avoid the IS barrier, then a Cyclops ExP can be used. This variant of the product will contain an explosion in the event of a failure.

NOTE: The Cyclops ExP is Zone 1 rated as explosion proof devices are not permitted in Zone 0.

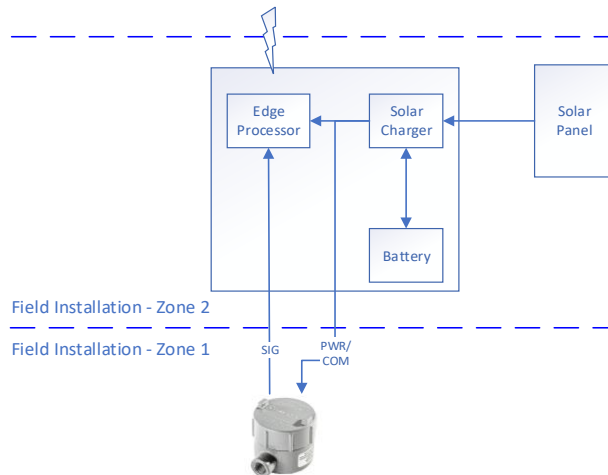


Figure 2 - Zone 2 Edge Processor with Zone 1 Cyclops ExP

Installation in Zone 2

If the well head is considered Zone 2, the Cyclops IS can be installed and connected directly to another device located in Zone 2 without a barrier.

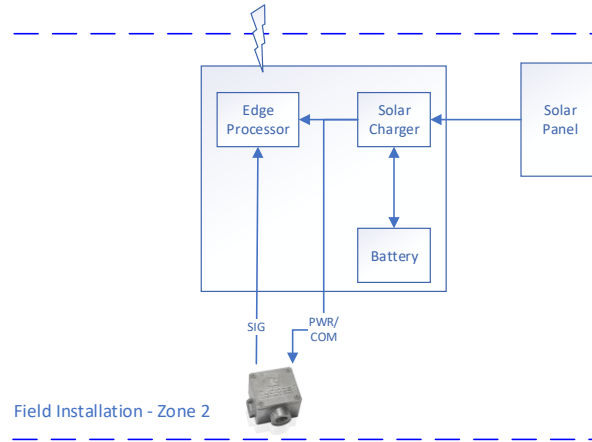


Figure 3 - Zone 2 Edge Processor with Zone 2 Cyclops IS

Plunger Arrival and Surface Velocity Monitoring with Sasquatch

The Sasquatch Plunger Velocity Sensor is a first of its kind and patented sensor that not only detects the arrival of the plunger at surface, but also records the velocity of the plunger as it passes the sensor. Any other sensor or system that reports velocity is reporting the average velocity of the plunger over the full travel from bottom hole to surface.

The dry contact output signals the arrival of the plunger and the velocity can be read via Modbus using the RS-485 port. The Sasquatch also features an arrival log if you want to read past values or want to read the velocities periodically as opposed to in real time.

The Sasquatch is dual certified:

Class I Division 2, Group A, B, C, D T4.

Class I Zone 2 Group IIC T4.

Ambient Temperature: -40°C to 70°C

Class I Division 1, Group C, D, T4

Class I Zone 0 AEx ia [ia] IIB T4 Ga

Ex ia [ia] IIB T4 Ga

Ambient temperature: -40°C to 70°C

This means that the Sasquatch can be installed in either Zone 2/Div 2 or Zone 0/1/Div 1. In either case, power must be provided as the Sasquatch does not have an internal battery.

NOTE: Some earlier versions of Sasquatch that may still be in the supply chain or in stock are only Zone 2/Div 2 certified.

Installation in Zone 0/1

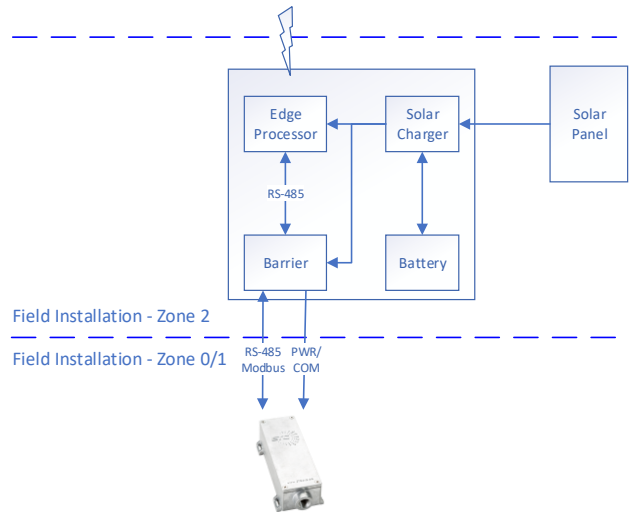


Figure 4 – Zone 2 Edge Processor with Zone 0/1 Sasquatch

In this case, if the communication panel and sensor are in different zones, a barrier should be used to cross the zone boundary. Power must be provided to the Sasquatch as it does not have an internal battery.

Installation in Zone 2

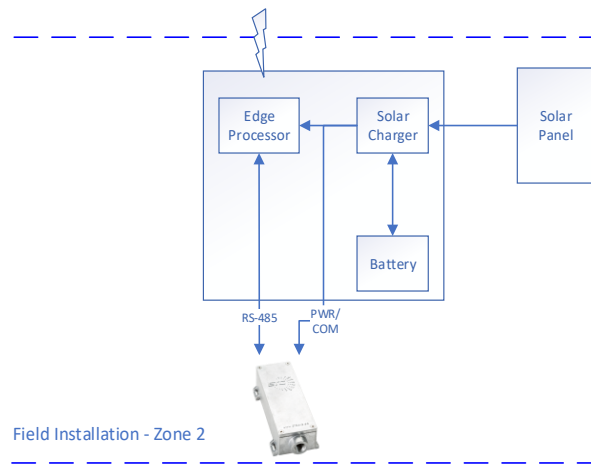


Figure 5 - Zone 2 Edge Processor with Zone 2 Sasquatch

In this case, the Sasquatch and communication panel are both located in the same zone, so a barrier is not required.

Plunger Control and Remote Monitoring with ALiEn²

The ALiEn2 and ALiEn2 Expert plunger lift controllers are highly reliable, wide temperature range, hazardous locations certified controllers that can run autonomously or as part of a wider scale monitoring and control system.

These controllers come with:

- Solar Panel and Battery
- Environmental Enclosure
- Solenoid
- Local User Interface

The ALiEn2 and ALiEn2 Expert are certified:

Class I, Division 1, Groups C and D
Class I, Zone 0, Ex/AEx ia [ia] IIB

Installation in Zone 0/1

In many cases, the installation of the plunger controller is considered Zone 0 or 1 as it is installed close to the motor valve and/or well head to minimize the length of instrument tubing and wiring to the arrival sensor. This classification is driven typically by:

- Surface casing vent
- Instrument vent

When installing the plunger controller in this area and connecting to an edge processor in a less hazardous zone, an IS barrier should be installed on the communication lines. Power does not have to be delivered to the controller as it has its own solar panel, charger, and battery.

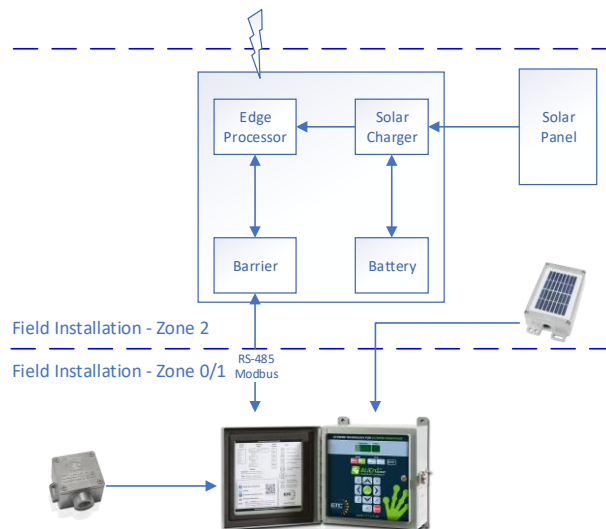


Figure 6 - Zone 2 Edge Processor with Zone 0/1 ALiEn2

Installation in Zone 2

While the ALiEn2 plunger lift controller is certified as Zone 0, it may be installed in a less hazardous zone.

NOTE: The control drawing that is part of the ALiEn2 certification does not currently show the installation without a barrier as the installation in Zone 2 was not envisioned and put on the control drawing. Some customers may have an issue with this. Given the right size of opportunity the certification could be updated to show this case.

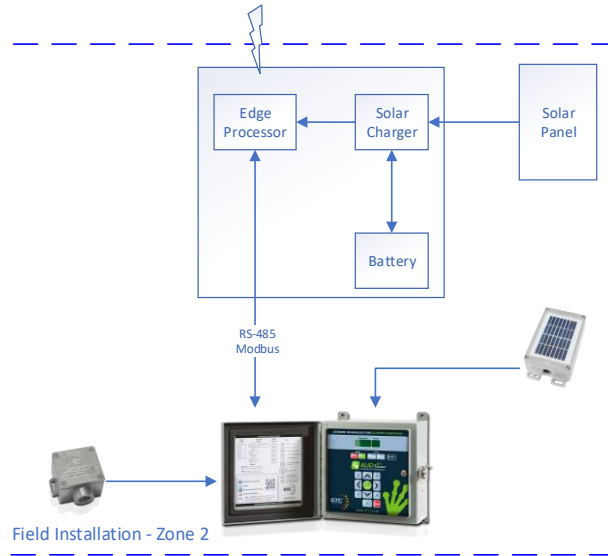


Figure 7 - Zone 2 Edge Processor with Zone 2 ALiEn2

Plunger Controller Node

To continually adapt to the changing needs of our customers, we have envisioned a slightly different variant of our controller. This cost reduced version would be the same as our ALiEn2 Expert, but would **NOT** include:

- Solar Panel and Battery
- Local User Interface

We can produce this version of our controller today, but it technically would not be certified as it is not a documented version. If you do require this plunger control node to be certified for one or more hazardous locations and have substantial volumes, we can work with you. In this case, the installation would be like the images shows for the controllers above.

NOTE: As this controller would not have a battery in it, power must be provided from other equipment at site.

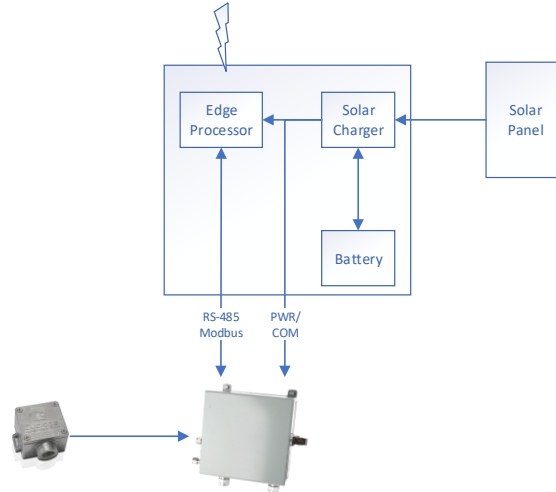


Figure 8 - Edge Processor with Plunger Controller Node

Going Wireless Locally

In many cases, it may be desirable to connect to ETC controls and sensors wirelessly to avoid running wires and potentially trenching. While this is possible, there are several things to consider:

- ETC sensors require power continuously so that they can pickup the plunger arrival
- Wireless transmitters need to either:
 - Be certified for and installed in the same Zone or
 - Incorporate a barrier to connect across the Zone boundary

NOTE: In the following example, the control node would need to be certified. All wireless transmitter devices shown would need to be sourced or designed before implementation.

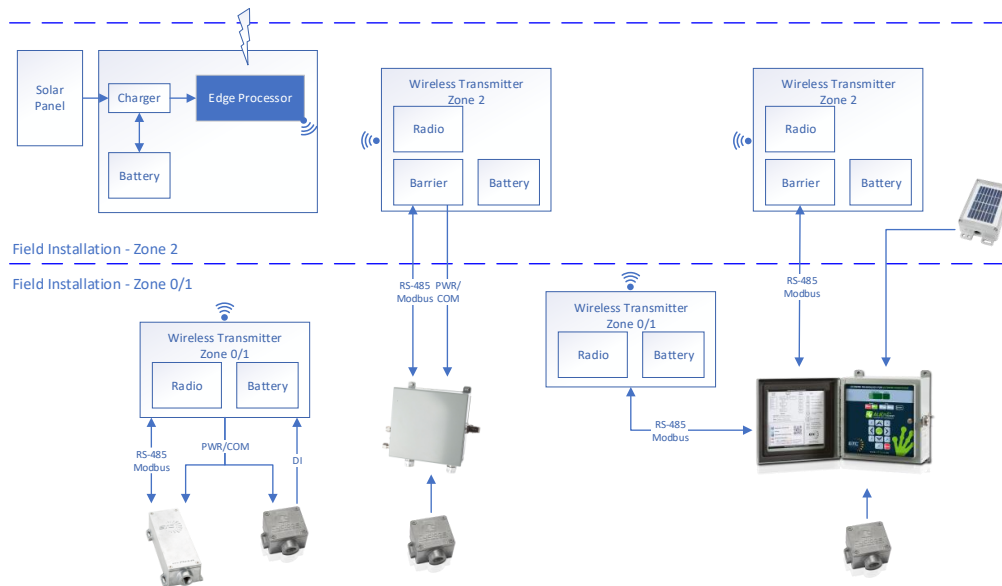


Figure 9 – Local Wireless Options