

Bear FSC

Power and RTU Fail Safe Controller

One of the main issues with electrifying oil/gas separator controls is how to shut down safely when either your power or RTU fails. Most electric actuators do not have built in backup power so the valving will typically fail in position and that can lead to a spill.

The Bear Fail Safe controller solves this by monitoring your separator control systems power, and optionally your RTU's health, to determine if something is wrong. Once a failure is detected it will override the actuator control signals and force the actuators to move valves to their fail positions. Combined with the Bear UPS, which has a -40°C Div2 25 amp rated backup power supply, the Bear FSC will facilitate your fail safe zero emission electric separator designs.

Features:

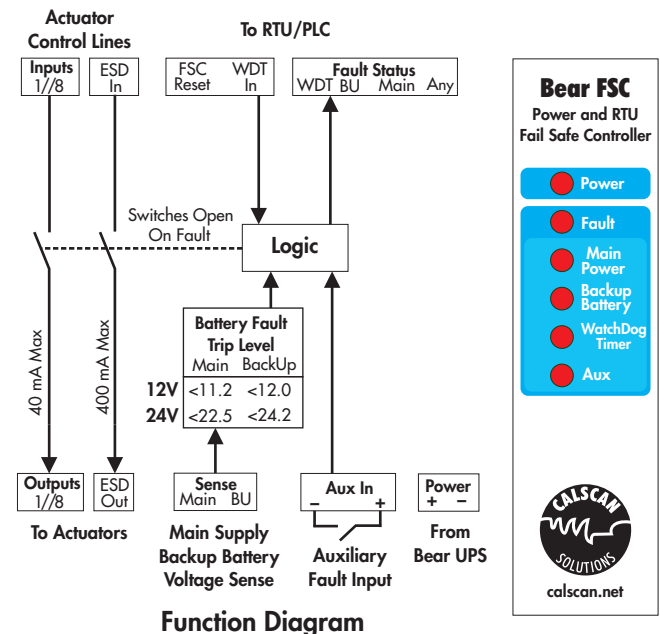
- Adds power fail safe operation to standard linear and rotary actuators
- Class 1 Div2 Certified
- Designed with easily verifiable discrete logic but with modern 21st Century components to ensure reliability
- Low quiescent current for solar powered operation
- Wide 10 to 35 VDC operating range
- Positive or negative logic inputs and outputs

Typical Applications

- Separator Control Systems



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Principles of Operation

All actuator control lines from the RTU are routed through the FSC. See the function diagram above. Once the FSC detects a fault, such as loss of main power, all the actuator control lines are switched opened. As long as the actuator is configured to move to the fail position on loss of signal, like most 4-20mA control lines, the actuator will move to the failed position automatically. Combined with the Bear UPS to supply power in the event of main power loss, the FSC adds a power fail safe feature for up to nine actuators without internal backup power.

Pin Function Description

Fault Detection Pins

The FSC monitors the main power supply, a backup battery and a periodic signal, referred to as a "heartbeat", from the RTU to determine if it is running correctly.

Sense Main & Sense BU

These inputs need to be connected to Main Supply and Backup Battery, typically from the Bear UPS module. These two pins supply the FSC with the voltage values to determine if the main power or battery is low or missing. To prevent false triggering a fault must be detected for at least 5 seconds before the FSC will start moving the actuators to the fail position. The FSC can be configured via internal jumpers to monitor 12 or 24VDC systems.

WDT in

This watchdog timer input (WDT) is used to determine if the RTU is operating. The FSC expect a periodic heartbeat signal to this input. It must be energized then de-energized at least once every 10 seconds but no faster than every 0.015 seconds. If the FSC fails to receive a pulse in this time period, it will cause a fault. If the FSC is already faulted for another reason, the WDT is ignored and will not cause a fault in absence of heartbeat signal from the RTU.

Aux In + and -

If the FSC is being used in a stand alone situation with no RTU being used, this input can be used for monitoring other sources of separator failure like pressure switches and level control. This input is self powered and current limited and designed to be used with dry contact switches. If an RTU is being used, this input is normally shorted to prevent an Aux Fault.

Actuator Control Lines Pins

The FSC needs to override the actuator control lines once a fault is detected. To enable this the control lines are routed through internal solid state switches in the FSC before they go out to the actuators. Once a fault is detected the switches will open one at a time in sequence every 1/2 second. The switches are sequenced to prevent overloading the backup battery with the starting current of the actuators.

ESD In & Out

This actuator control line is the first to open once a fault is detected and it has a maximum current of 400mA. This allows the FSC to directly power a solenoid that is often used on hydraulic and rack and pinion ESD's. This is the first actuator to trip, as it is typically the most critical actuator.

Ctrl In & Out 1//8

Actuator Control lines 1 through 8 are opened in sequence 1/2 second apart after the ESD Control line is opened. The max current allowed is 40mA and is designed for 4-20mA loops and low power I/O control.

Fault Status and Reset Pins

WDT, Main & BU

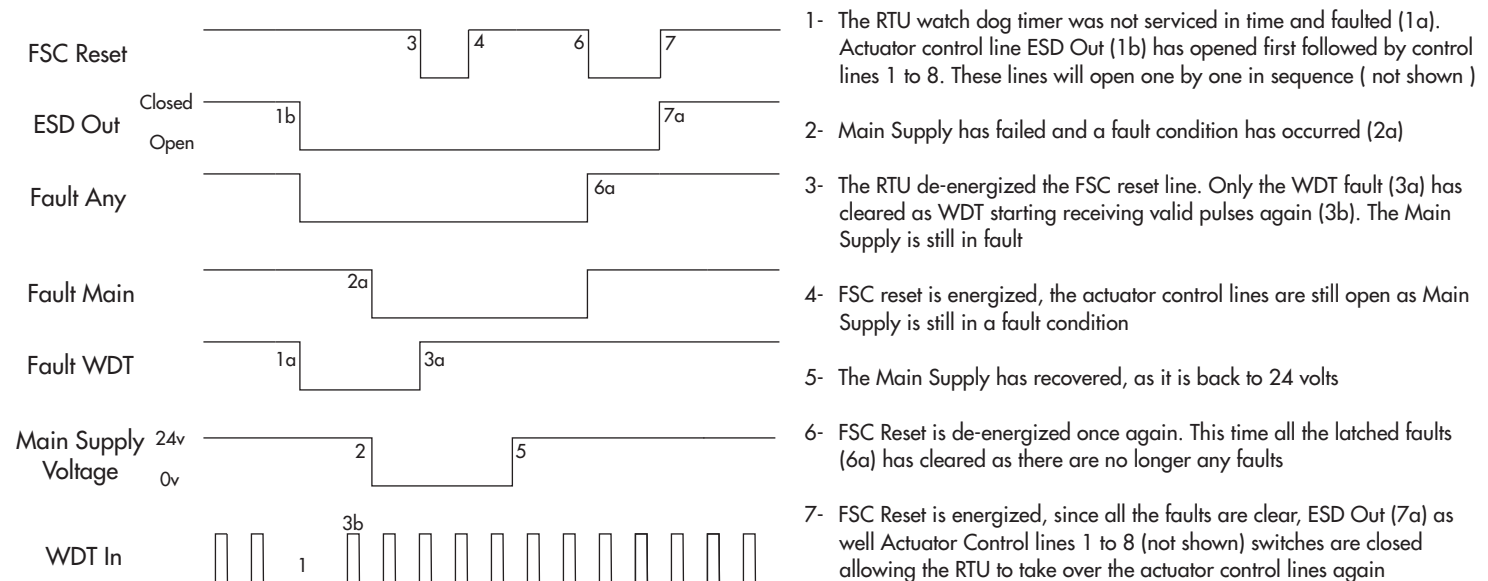
If the FSC watchdog timer (WDT) times out, the backup battery (BU) or the Main Supply has failed the corresponding output will become non energized. These can optionally be used by the RTU to determine the fault source.

Any

If there is any fault this output will become non energized. This is typically used when there is limited I/O on the RTU for feedback wires.

FSC Reset

When the FSC has tripped, forcing all the actuators to go to the fail position, this line is used to reset the FSC to allow the RTU to take control of the Actuator Control lines again. De-energizing this input will clear the latched faults as long as the faults are no longer failed. If all faults are cleared once the FSC Reset input is energized again, the FSC will be reset and the RTU will be able to control the actuator lines. Below is a timing diagram example that illustrates how this works.



FSC Reset Timing Diagram

Nominal Module Ratings

| Parameter | Min | Max | Unit |
|-----------------------------------|--------------------------------|------------|------|
| DC Supply Voltage | 10 | 35 | V |
| Operating and Storage Temperature | -40 | +50 | °C |
| Quiescent Current | Supply = 12 V Supply = 24 V | <20 <15 | mA |

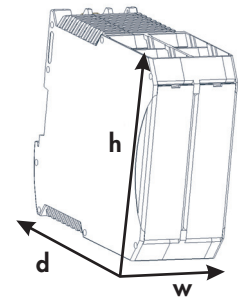
| Inputs: FSC Reset, WDT In and Aux In | | Min | Max | Unit |
|--------------------------------------|---------------|-------|-----|---------|
| Energized Voltage Range | | 10 | 35 | V |
| Off Voltage Range | | -0.5 | 0.5 | V |
| Input Drive Current | Supply = 12 V | 1 | 2 | mA |
| | Supply = 24 V | 2 | 3 | mA |
| WDT In Reset Timing Range | | 0.015 | 10 | Seconds |

| Outputs: Fault Status | | Min | Max | Unit |
|-----------------------------|--|-----|-----|------|
| Voltage Range | | 0 | 35 | V |
| Sinking or Sourcing Current | | 0 | 50 | mA |

| Actuator Control Lines | | Min | Max | Unit |
|------------------------|----------------------|-----|-----|------|
| Voltage Range | | 0 | 35 | V |
| Current Handling | ESD In/Out | 0 | 400 | mA |
| | Control Lines 1 to 8 | 0 | 40 | mA |

| Main and Backup Sense Trip Voltages | | Trip | | | Recovery Nominal | Unit |
|-------------------------------------|---------------|------|---------|------|------------------|------|
| | | Min | Nominal | Max | | |
| Main Power | Supply = 12 V | 11.1 | 11.2 | 11.3 | 11.6 | V |
| | Supply = 24 V | 22.3 | 22.5 | 22.7 | 23.4 | V |
| Backup Battery | Supply = 12 V | 11.9 | 12 | 12.1 | 12.3 | V |
| | Supply = 24 V | 23.9 | 24.2 | 24.4 | 24.6 | V |

Mechanical



45mm wide x 99mm high x 115mm deep
35mm DIN-rail Connection
Wire Size 12 to 24 AWG and 90°C Minimum

Certification

Class I, Division 2, Groups C&D T3C
Class I Zone 2 Group IIB T3C
Ambient Temperature: $-40^{\circ}\text{C} \leq T_a \leq 50^{\circ}\text{C}$
Certified to CAN/CSA Std. C22.2 No. 213, 61010-1 and 61010-2-201
Conforms to UL Std. 121201, 61010-1 and 61010-2-201
This module shall be installed and DIN railed inside an approved outdoor rated enclosure



Patent:
CA2727208
US8783648

Patent Pending:
CA3035597
US62/663248

Maintenance and Service

No serviceable parts inside the module or any module within the Bear Fail Safe System. Consult Calscan

Configuration Jumpers



Inside the Bear FSC are configuration jumpers for features and to set the FSC's input and output pins to either positive or negative logic. These jumpers facilitate interfacing to a separator control system.

Features

Voltage Sense - 12V/24V
Set both jumpers to 12 or 24VDC

Watch Dog Timer - On/Off
Turn the RTU WDT Monitor on or off

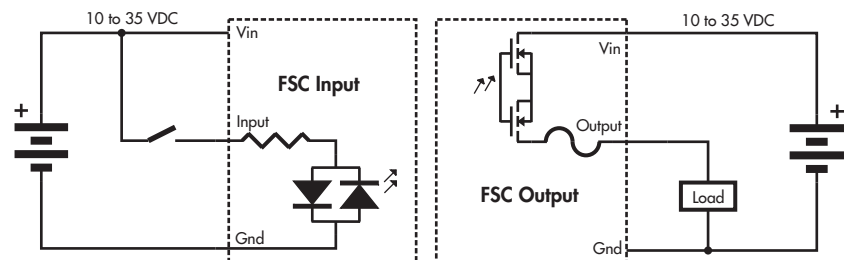
Inputs

WDT Logic - Neg/Pos
Set the input "WDT In" to negative or positive logic
Reset Logic - Neg/Pos
Set the input "FSC Reset" to negative or positive logic

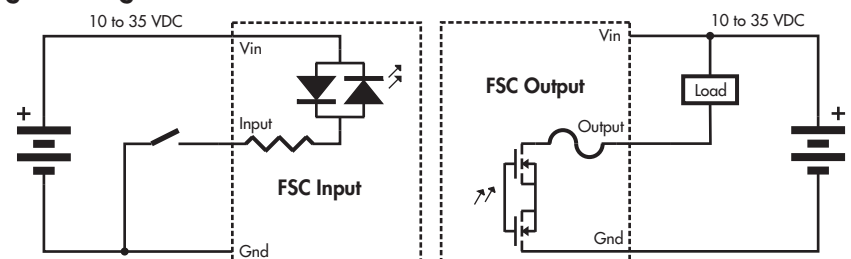
Outputs

Status Logic - Neg/Pos
Set all four the Fault Status outputs to negative or positive logic

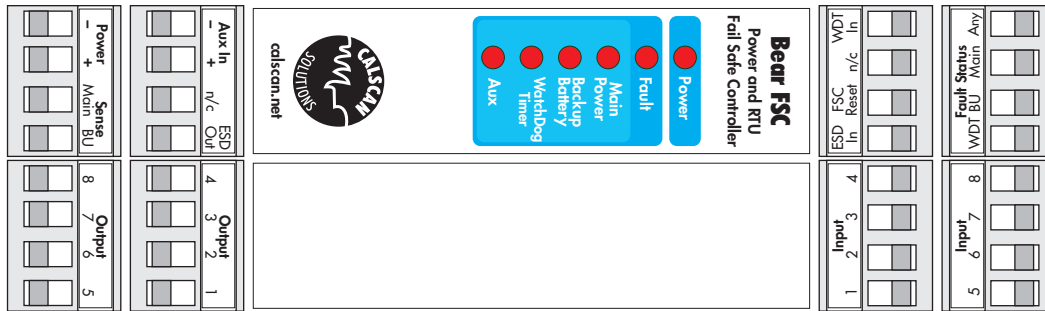
Positive Logic



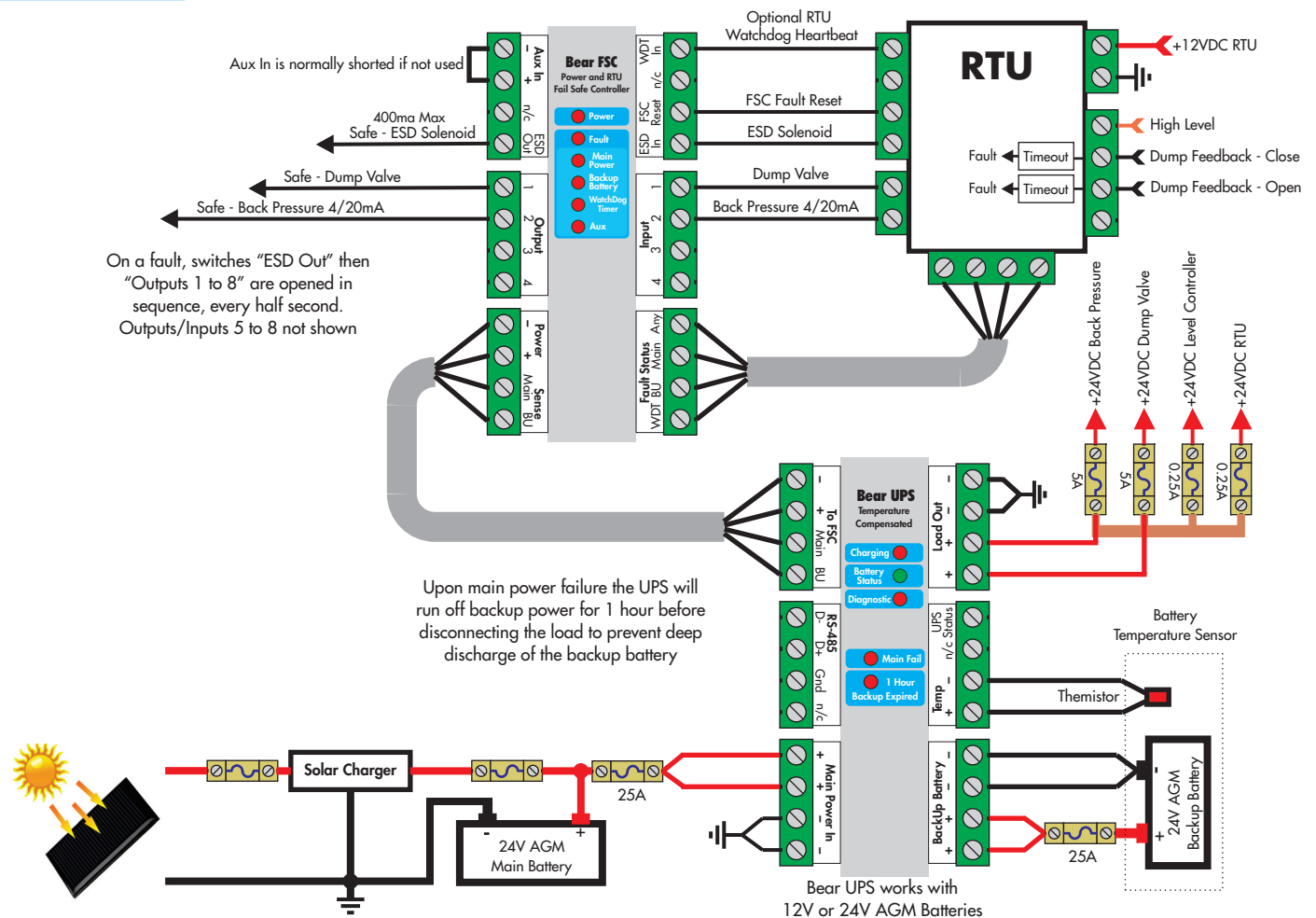
Negative Logic



Terminal Block Placement



Wiring Example



Ordering Information

| | | | | |
|------------|--------------------------|-------------------------------|--------------------------------|------------------------|
| FSC | OPERATING VOLTAGE | INPUT LOGIC | OUTPUT LOGIC | WDT MONITOR |
| | -12 = 12 VDC System | -IN = Input Negative Logic | -ON = Output Negative Logic | -W = WDT Monitor On |
| | -24 = 24 VDC System | -IP = Input Positive Logic | -OP = Output Positive Logic | |

Calscan Solutions
 4188 93 St NW
 Edmonton, Alberta, Canada
 T6E 5P5
 Ph:780-944-1377
 www.calscan.net