Falk V-Class IIoT Smart Gearbox Ethernet/IP PLC Connectivity Guide

Introduction

The Falk V-Class IIoT Smart Gearbox is configured from the factory to connect to an Ethernet/IP based PLC network. The IIoT Smart Gearbox acts as an I/O adapter on the PLC network. It will make the data available to the PLC network, but not be able to ingest any data from the network.

Configuring the IIoT Smart Gearbox for your PLC Network

The edge device on your IIoT Smart Gearbox will need to be configured to communicate on your specific PLC network. To do this, you will need a laptop or tablet computer physically located at the gearbox with an Ethernet port.

1. Attach an Ethernet cable between the laptop and the Ethernet/IP port on the edge device. Configure the laptop's Ethernet adapter to be on the same subnet as the edge device. This step should not be performed over an Ethernet switch because in the case of multiple edge devices, all of the edge devices default to an IP address of 192.168.20.51. If you have multiple on the same subnet you will have IP address conflicts and configuration will not be possible.

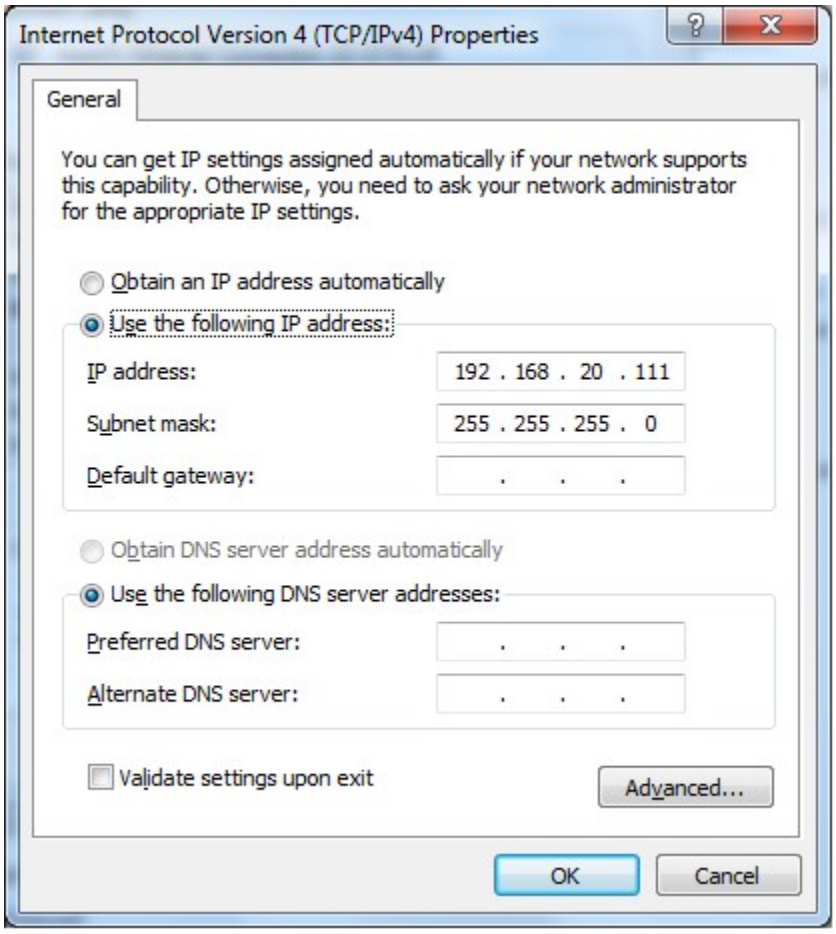

Figure 1 - Configuring your laptop to connect to the IIoT Edge Device

2. Use cmd.exe to send an ICMP ping to the edge devices' default IP of 192.168.20.51. Once you issue the ping you can use the ARP command to get the MAC address of the edge device.

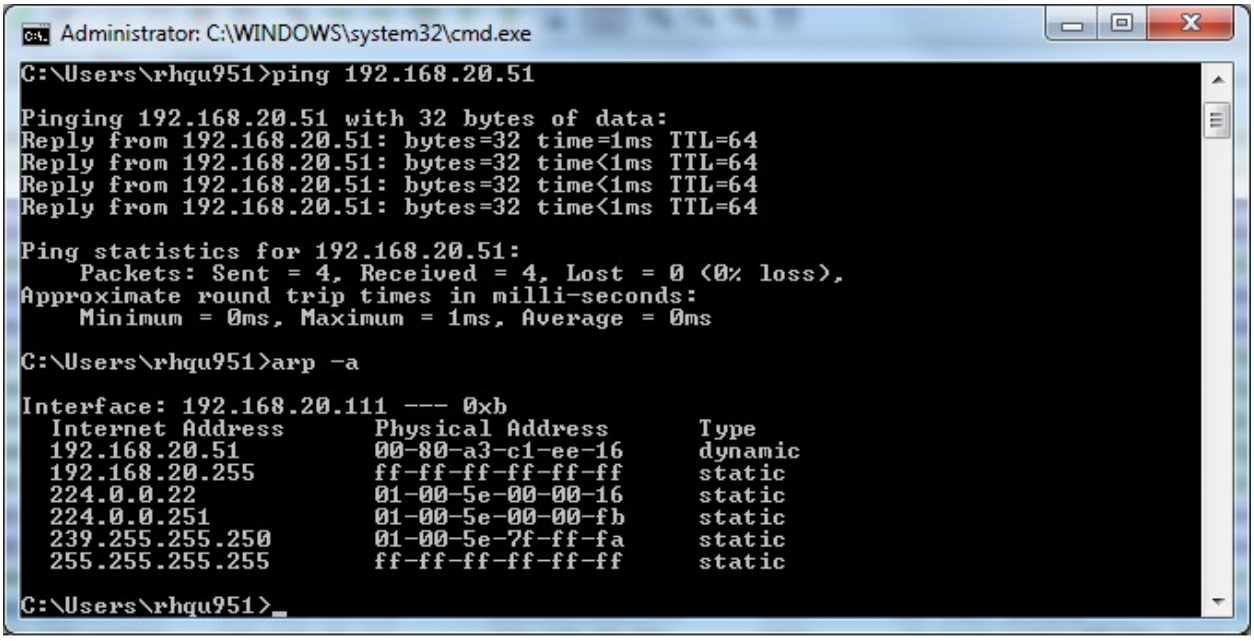

Figure 2 - Finding the Edge Device's MAC address

3. After recording the MAC address (Physical Address) of the edge device launch the Rockwell BootP utility. The utility will ask you to enter the addresses for your network, enter them following the screenshot.

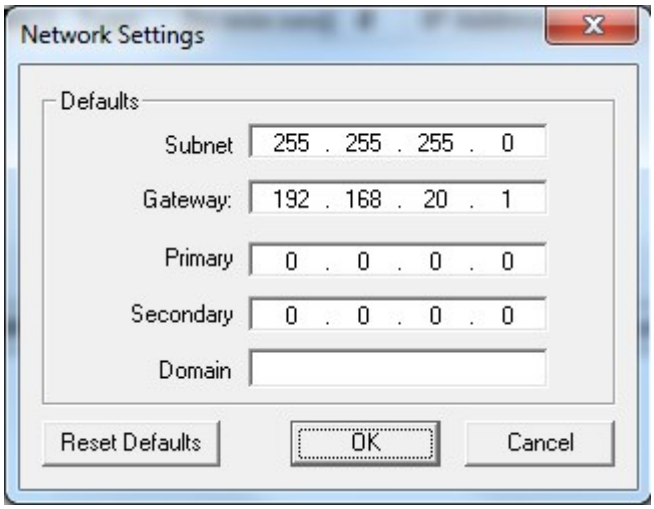

Figure 3 - Configuring the BootP Utility

4. Using the MAC address recorded in Step 2 add a relation between the MAC address and IP address of the edge device.

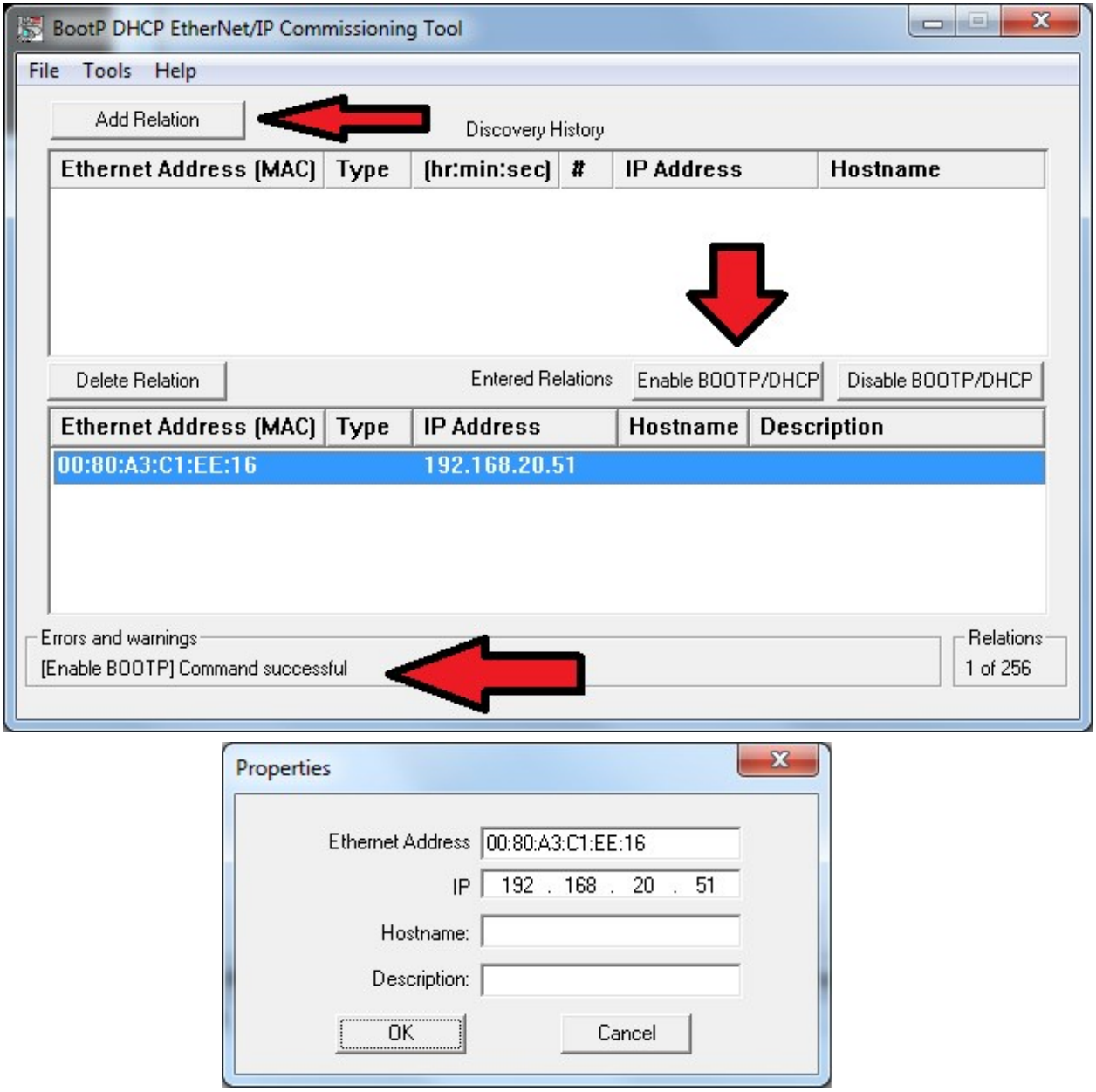

Figure 4 - Adding a relationship in BootP

5. Once the relation is added you can select the relation and enable BootP. Verify that the tool reports that enabling BootP was successful.

6. Now the device should be accessible on your PLC network using the Rockwell Automation's Studio 5000 software. To add the Edge Device as an Ethernet/IP device in Studio, right-click on the controller's Ethernet adapter (Ethernet) and add a device. Filter to show only Allen-Bradley communication devices, and select generic Ethernet module. Configuration details are outlined in the following steps.

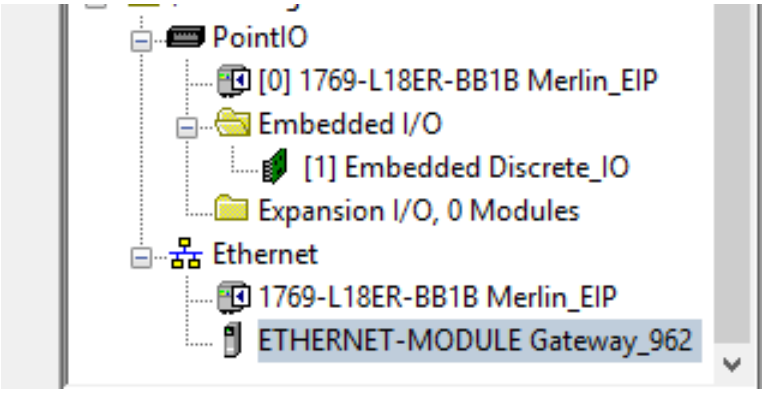

Figure 5 - The IIoT Smart Gearbox Edge Device configured in Studio 5000

a. When adding the Ethernet device, select data type "INT" and provide the IP address of the edge device. The proper assembly instance and size settings are shown below.

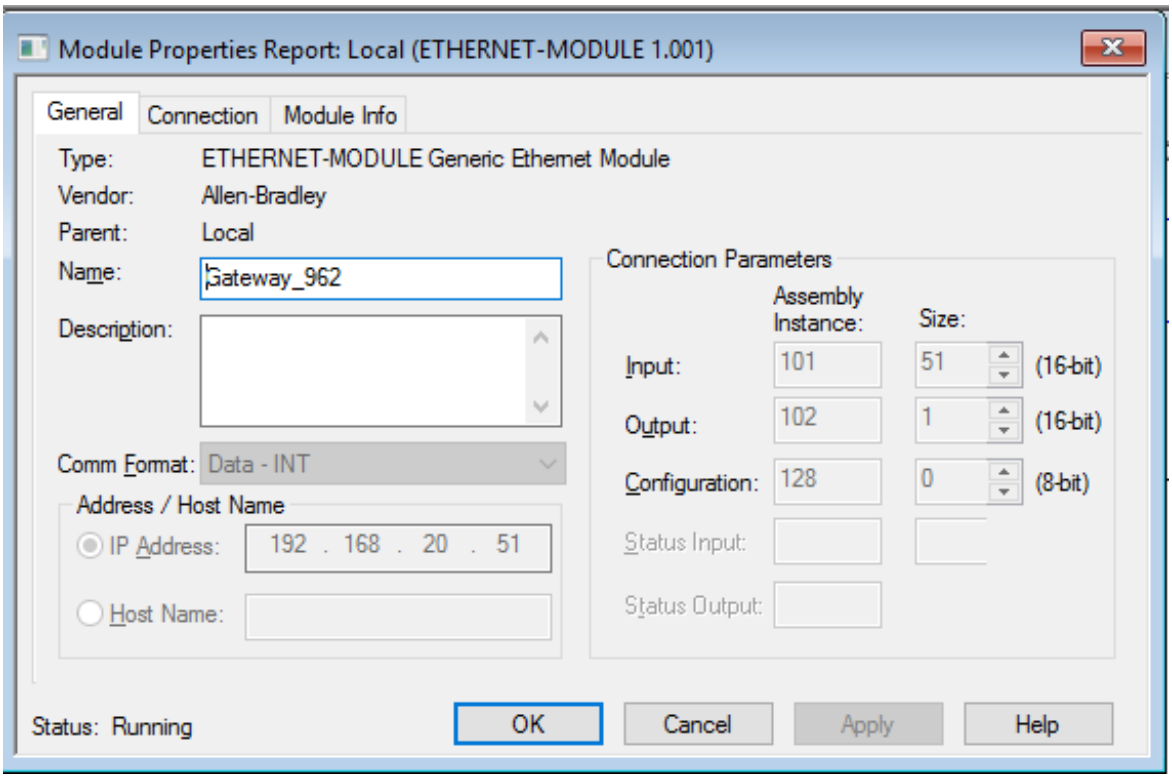

Figure 6 - Ethernet/IP Module configuration settings

b. Set the RPI to 100ms and uncheck the Unicast checkbox. The Module Fault area should be blank and the module status should appear as "running."

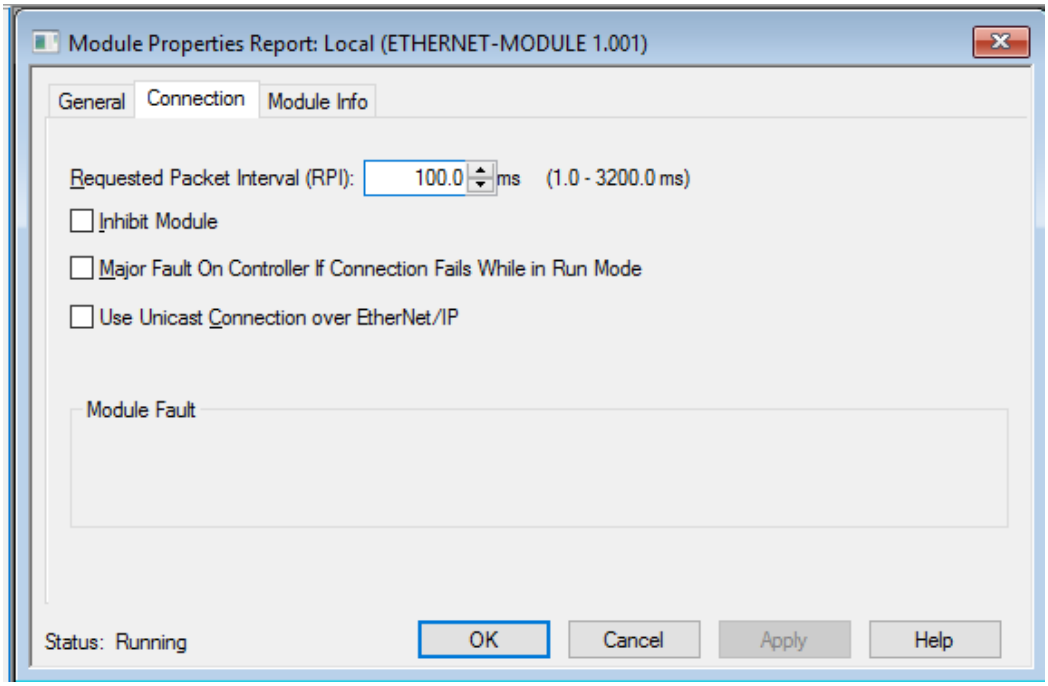

Figure 7 - Connection settings

c. The Module info should be displayed as shown below.

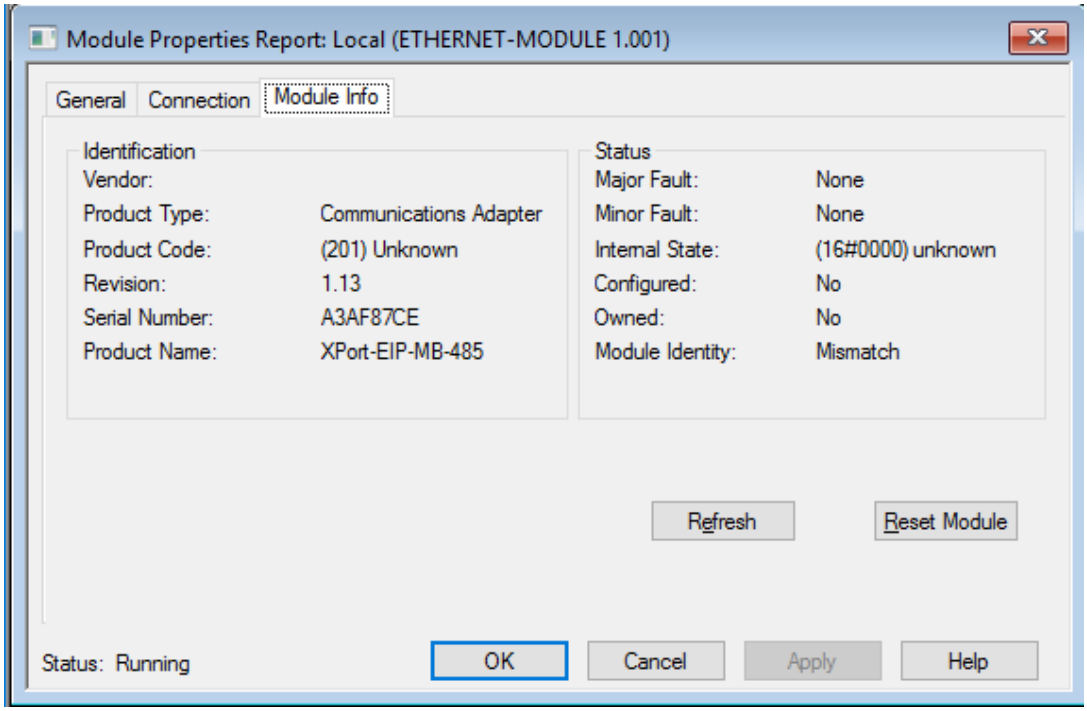

Figure 8 - Module info

7. Once the module is configured, next a data conversion routine must be added to the project to convert the elements of the E/IP INT array to individual tags of type REAL.

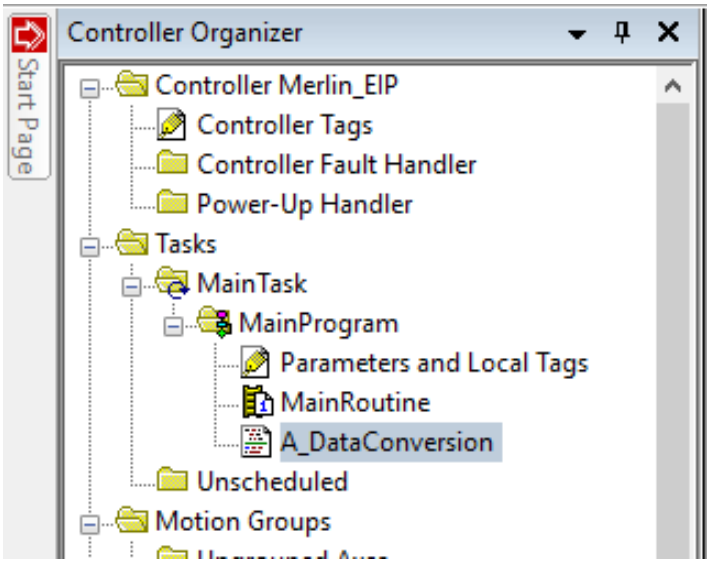

Figure 9 - Data conversion routine in the tree

8. Below are the recommended contents of the data conversion routine. Tags can be named to suite the customer's needs and/or standardized naming conventions. The names listed below correlate with those on Rexnord's cloud. Note the "Gateway_962" will be replaced with whatever device name was entered above in Figure 6.

```
CPS(Gateway_962:I.Data[2],Temp_Ambient,1);
CPS(Gateway_962:I.Data[4],Temp_Inboard_Bearing,1);
CPS(Gateway_962:I.Data[6],Temp_Inboard_Bearing_Event,1);
CPS(Gateway_962:I.Data[8],Temp_Outboard_Bearing,1);
CPS(Gateway_962:I.Data[10],Temp_Outboard_Bearing_Event,1);
CPS(Gateway_962:I.Data[12],Temp_Oil,1);
CPS(Gateway_962:I.Data[14],Temp_Oil_Event,1);
CPS(Gateway_962:I.Data[16],Vibe_Input_Shaft,1);
CPS(Gateway_962:I.Data[18],Vibe_Input_Shaft_Event,1);
CPS(Gateway_962:I.Data[20],Vibe_Output_Shaft,1);
CPS(Gateway_962:I.Data[22],Vibe_Output_Shaft_Event,1);
CPS(Gateway_962:I.Data[24],Motor_Amps_Raw_mA,1);
CPS(Gateway_962:I.Data[26],Oil_Coarse_Particulates,1);
CPS(Gateway_962:I.Data[28],Oil_Coarse_Particulates_Event,1);
CPS(Gateway_962:I.Data[30],Oil_Fine_Particulates,1);
CPS(Gateway_962:I.Data[32],Oil_Fine_Particulates_Event,1);
CPS(Gateway_962:I.Data[38],Oil_Oxidation,1);
CPS(Gateway_962:I.Data[40],Oil_RH,1);
CPS(Gateway_962:I.Data[42],Output_Shaft_RPM,1);
```

Interpreting the Data

1. Temp_Ambient: This is the ambient temperature near the gearbox, in Degrees F.
2. Temp_Inboard_Bearing: This is the temperature at the outer race of the inboard high speed bearing, in degrees F.
3. Temp_Inboard_Bearing_Event: This channel corresponds to the alert status of the inboard high speed bearing temperature. The values are as follows:
    a. 0 = Normal (temperature within normal operating parameters – green status)
    b. 50 = Warning (temperature is slightly elevated above normal operating parameters – yellow status)
    c. 100 = Critical (temperature is above normal operating parameters – red status)
4. Temp_Outboard_Bearing: This is the temperature at the outer race of the outboard high speed bearing, in degrees F.
5. Temp_Outboard_Bearing_Event: This channel corresponds to the alert status of the outboard high speed bearing temperature. The values are as follows:
    a. 0 = Normal (temperature within normal operating parameters – green status)
    b. 50 = Warning (temperature is slightly elevated above normal operating parameters – yellow status)
    c. 100 = Critical (temperature is above normal operating parameters – red status)
6. Temp_Oil: This is the temperature of the oil sump in the gearbox, in degrees F.
7. Temp_Oil_Event: This channel corresponds to the alert status of gearbox oil sump temperature. The values are as follows:
    a. 0 = Normal (temperature within normal operating parameters – green status)
    b. 50 = Warning (temperature is slightly elevated above normal operating parameters – yellow status)
    c. 100 = Critical (temperature is above normal operating parameters – red status)
8. Vibe_Input_Shaft: This is the overall vibration reported by the accelerometer located nearest the input shaft. The units are in peak inches / second.
9. Vibe_Input_Shaft_Event: This channel corresponds to the alert status of the overall vibration near the input shaft. The values are as follows:
    a. 0 = Normal (Vibration within normal operating parameters – green status)
    b. 50 = Warning (Vibration is slightly elevated above normal operating parameters – yellow status)
    c. 100 = Critical (Vibration is above normal operating parameters – red status)
10. Vibe_Output_Shaft: This is the overall vibration reported by the accelerometer located nearest the output shaft. The units are in peak inches / second.
11. Vibe_Input_Shaft_Event: This channel corresponds to the alert status of the overall vibration near the output shaft. The values are as follows:
    a. 0 = Normal (Vibration within normal operating parameters – green status)
    b. 50 = Warning (Vibration is slightly elevated above normal operating parameters – yellow status)
    c. 100 = Critical (Vibration is above normal operating parameters – red status)
12. Motor_Amps_Raw_mA: This is the value of the motor amp draw signal connected to the edge device (typically from a current transducer). This is the raw, unscaled value in mA.
13. Oil_Coarse_Particulates: This is the amount of larger sized ferrous particles present in the oil sump, reported by the ferrous particulate sensor - if the corresponding sensor is present. The value is a percentage, from 0 to 100.

14. Oil_Coarse_Particulates_Event: This channel corresponds to the alert status of the level of larger ferrous particles present in the oil (if the corresponding sensor is present). The values are as follows:
    a. 0 = Normal (Coarse ferrous particle levels within normal operating parameters – green status)
    b. 50 = Warning (Coarse ferrous particle levels slightly elevated above normal operating parameters – yellow status)
    c. 100 = Critical (Coarse ferrous particle levels are above normal operating parameters – red status)
15. Oil_Fine_Particulates: This is the amount of smaller sized ferrous particles present in the oil sump, reported by the ferrous particulate sensor - if the corresponding sensor is present. The value is a percentage, from 0 to 100.
16. Oil_Fine_Particulates_Event: This channel corresponds to the alert status of the level of smaller ferrous particles present in the oil (if the corresponding sensor is present). The values are as follows:
    a. 0 = Normal (Fine ferrous particle levels within normal operating parameters – green status)
    b. 50 = Warning (Fine ferrous particle levels slightly elevated above normal operating parameters – yellow status)
    c. 100 = Critical (Fine ferrous particle levels are above normal operating parameters – red status)
17. Oil_Oxidation: This is a scalar value that correlates to oil aging / oxidation.
18. Oil_RH: This value is the relative humidity of the oil in percent, from 0 to 100.
19. Output_Shaft_RPM: This value is the current speed of the output shaft of the gearbox, in RPM, if a factory installed speed sensor is present.