Franklin Electric
FUELING SYSTEMS

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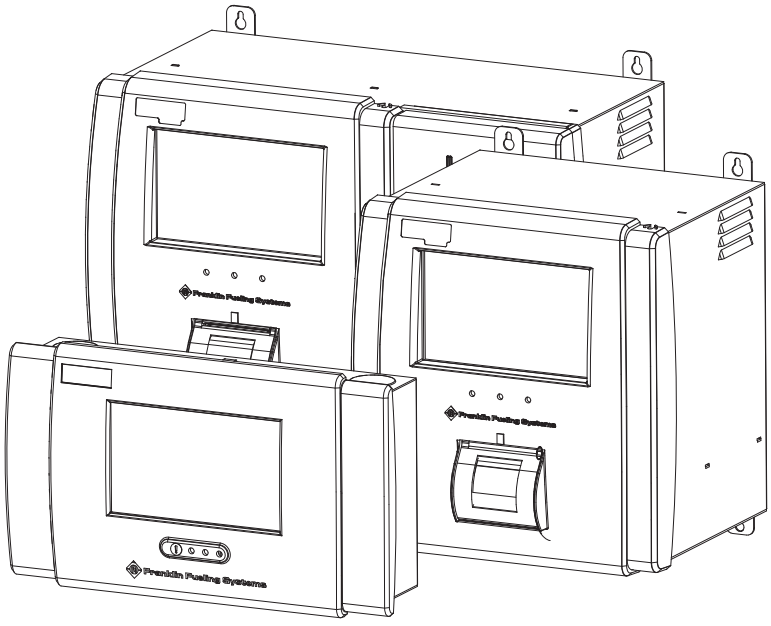
# EVO™ 200/400/600/6000 MODBUS INTERFACE

## PROGRAMMING GUIDE

10000011156 r1

**MONITORING CONSOLE**
EVO200
EVO400
EVO600
EVO6000



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## CONVENTIONS USED IN THIS DOCUMENT

This document includes safety precautions and other important information presented in the following format:

**NOTE**: This provides helpful supplementary information.

**IMPORTANT**: This provides important supplementary information and instructions to avoid damaging hardware or a potential hazard.

⚠ **CAUTION**: This indicates a potentially hazardous situation that could result in minor or moderate injury if not avoided. This may also be used to alert against unsafe practices.

⚠ **WARNING**: This indicates a potentially hazardous situation that could result in severe injury or death if not avoided.

⚠ **DANGER**: This indicates an imminently hazardous situation that will result in death if not avoided.

## OPERATING PRECAUTIONS

Franklin Electric equipment is designed to be installed in areas where volatile liquids such as gasoline and diesel fuel are present. Working in such a hazardous environment presents a risk of severe injury or death if you do not follow standard industry practices and the instructions in this document. Before working with or installing the equipment covered in this document, or any related equipment, read this entire document, particularly the following precautions:

**IMPORTANT**: To help prevent spillage from an underground storage tank, make sure the delivery equipment is well-maintained, that there is a proper connection, and that the fill adaptor is tight. Delivery personnel should inspect delivery elbows and hoses for damage and missing parts.

⚠ **CAUTION**: Use only original Franklin Electric parts. Substituting non-Franklin Electric parts could cause the device to fail, which could create a hazardous condition and/or harm the environment.

⚠ **WARNING**: Follow all codes that govern the installation and service of this product and the entire system. Always lock out and tag electrical circuit breakers while installing or servicing this equipment and related equipment. A potentially lethal electrical shock hazard and the possibility of an explosion or fire from a spark can result if the electrical circuit breakers are accidentally turned on while installing or servicing this product. Refer to this document (and documentation for related equipment) for complete installation and safety information.

⚠ **WARNING**: Before entering a containment sump, check for the presence of hydrocarbon vapors. Inhaling these vapors may cause dizziness/unconsciousness, and if ignited, can explode causing serious injury or death. Containment sumps are designed to trap hazardous liquid spills and prevent environmental contamination, so they can accumulate dangerous amounts of hydrocarbon vapors. Check the atmosphere in the sump regularly while work is in process. If vapors reach unsafe levels, exit the sump and ventilate it with fresh air before resuming work. Always have another person standing by for assistance.

⚠ **WARNING**: Follow all federal, state, and local laws governing the installation of this product and its associated systems. When no other regulations apply, follow NFPA codes 30, 30A, and 70 from the National Fire Protection Association. Failure to follow these codes could result in severe injury, death, serious property damage, and/or environmental contamination.

⚠ **WARNING**: Always secure the work area from moving vehicles. The equipment in this document is usually mounted underground, so reduced visibility puts service personnel working on it in danger from moving vehicles that enter the work area. To help prevent this safety hazard, secure the area by using a service truck or other vehicle to block access to the work area.

⚠ **DANGER**: Inspect the installation location for potential ignition sources such as flames, sparks, radio waves, ionizing radiation, and ultrasound sonic waves. If any potential ignition sources are identified, implement proper safety measures.

# Contents

# 1 Introduction

This guide describes the installation and setup of the Modbus interface on EVO™ 200, 400, 600 and 6000 Series consoles. The content of this document is intended for users with pre-existing understanding of Modbus protocol who will be configuring the Modbus feature on an EVO™ console. The information provided includes protocol descriptions, register mapping, and data descriptions for the supported data.

## 1.1 Documentation

- This document is intended for qualified and certified installation persons.
- Instructions of this document are in English. All other language versions are translations of this original document.
- Illustrations in this document show a typical setup and are for instruction and description purposes only.
- Information given in this document is given as a guide only. It is the installer's responsibility to ensure that correct and safe procedures are followed at all times.
- This document and related documents are available from Franklin Electric at www.franklinfueling.com.

### 1.1.1 Symbol Legend


Wear Protective Headwear


Wear Eye Protection


Wear Protective Clothing


Wear High-Visibility Clothing


Wear Protective Gloves


Wear Safety Footwear


Refer to instruction guide.


Connect an earth terminal to the ground


Disconnect main plug from electrical outlet


Disconnect before carrying out maintenance or repair


General Warning


Warning: Electricity


No open flame; Fire, open ignition source and smoking prohibited

# 2 Safety/Security

## 2.1 General Safety Information

- Only perform procedures in this document that you are qualified and certified to perform.
- Personnel working on or with energized equipment must be authorized by relevant regulatory bodies to carry out such work and must have the appropriate training. Check with your employer and relevant regulatory body's rules for working with energized equipment.
- Obey all local laws, rules, regulations, and instructions in this document. In case of inconsistency or contradiction between information contained in this document and any laws, rules and regulations, obey the stricter of the two.
- Keep unqualified personnel at a safe distance during installation.
- If it is necessary to remove safety/security devices, immediately reinstall the safety/security devices after completing the work.

### 2.1.1 Station Owner or Operator

Save this guide for future use, and make sure to provide it to anyone who services this equipment.

## 2.2 Hazard Assessment

Prior to beginning work and prior to recommencing work after leaving and returning to the worksite, a worksite, *pre-job hazard assessment* must be performed to identify safety and environmental needs. At a minimum, this hazard assessment should:

- Identify possible hazards and risks.
- Identify the safety needs of the job.
- Identify the correct procedures, practices and equipment.
- Eliminate unsafe conditions and actions from the worksite.
- Identify the need for personal protective equipment.
- Inspect equipment before use.
- Confirm sheaths of all cables are secured and undamaged.
- Confirm plugs and connectors are properly connected and serviceable.
- Perform ongoing risk assessment during the project.

## 2.3 Required Personal Protective Equipment (PPEs)

These PPEs are required during all phases of installation.


Wear Protective Clothing


Wear Eye Protection


Wear High-Visibility Clothing


Wear Protective Gloves


Wear Protective Headwear


Wear Safety Footwear

## 2.4 Cyber Security

This product is designed to be connected to and to communicate information and data via a network interface. It is solely the owner's responsibility to provide and continuously ensure a secure connection between the product and Owner's network or any other network (as the case may be).

The Owner shall establish and maintain appropriate measures (such as but not limited to the installation of firewalls, application of authentication measures, encryption of data, installation of anti-virus programs, etc.) to protect the product, the network, its system and the interface against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information.

The manufacturer, Franklin Electric, and its affiliates are not liable for damages and/or losses related to such security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information.

# 3 Programming

Modbus is a serial communication protocol that allows for simple system integration across various devices on the same network. This technology enables EVO™ 200, 400, 600 and 6000 Series consoles to be connected to a host system that supports Modbus TCP or RTU communications. Modbus TCP is available via the Ethernet ports and Modbus RTU is available via RS-232 Comm Port 1.

## 3.1 Programming Overview

Modbus communication is a standard feature on the EVO™ 200, 400, 600 and 6000 Series consoles with firmware versions 3.7.1 or higher. It is available over standard Ethernet and RS-232 Comm Port 1 and once connected to the appropriate port, no additional hardware installation is required.

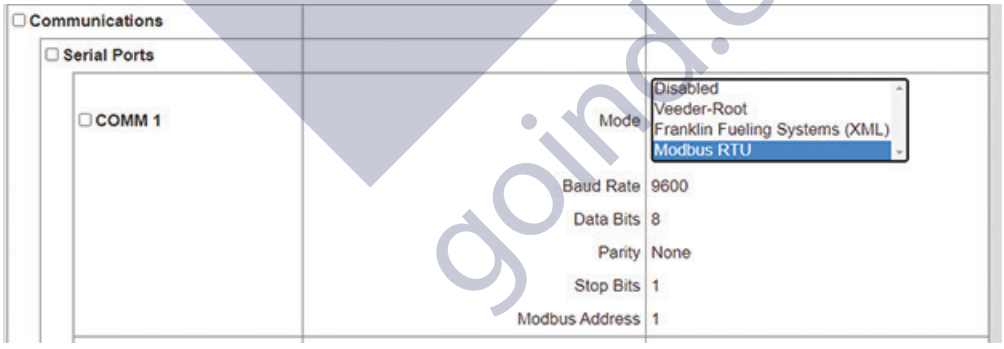
**NOTE**: Related documents with details on establishing Modbus connections can be found in Section 6.1, Related Documents.

## 3.2 Programming Instructions

### 3.2.1 Modbus RTU

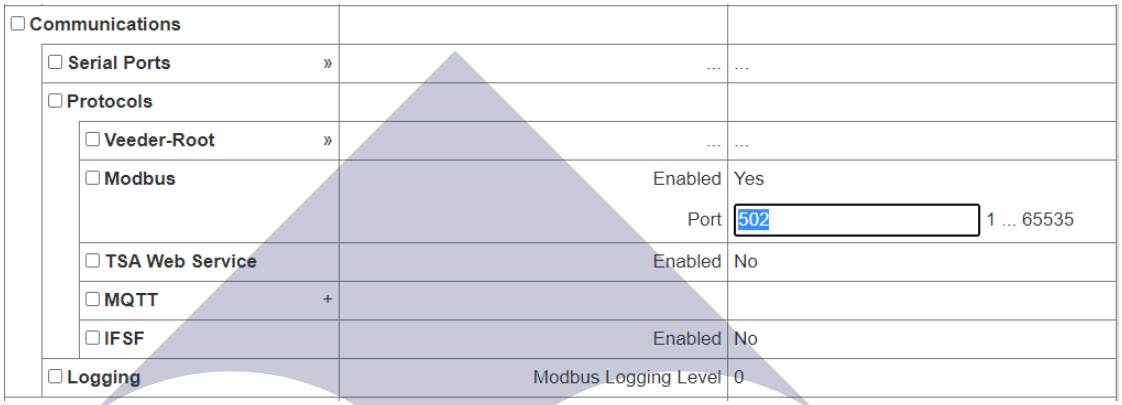
Setting up Modbus RTU format requires editing the Comm Port 1 setting in the EVO™ system parameters.

1. Select “Modbus RTU” for the mode.
2. Define the additional configurations as required for the configuration.



## 3.2.2 Modbus TCP

- Modbus TCP can be enabled on any port; however, it is *recommended* to use port 502, the standard port number for Modbus TCP communications.
- Establish a connection between the primary device and the EVO™ Series console over the selected port number to access the Modbus register.




**NOTE**: Refer to the Programming Guides listed in Section 6.1 for details on connecting a PC or Laptop to EVO™ 200, 400, 600 or 6000 Series consoles.

## 3.2.3 Modbus Register Map

### 3.2.3.1 Register Values

#### 3.2.3.1.1 Little Endian Ordering

All 32-bit values are stored such that the least significant bits are in the lower of the two register addresses (a.k.a. Little Endian). For example, Tank 1 Product Level is stored in registers 204 and 205. If the value happened to be large enough that it spanned two registers, say 9,876.5 gallons, the values would be stored as follows:

Gallons resolution is 0.1, so the floating point value is multiplied by 10 and converted to the integer value 98765. In hex, this value is 0x000181CD. Mapping this into registers:

Address 204: 0x81CD

Address 205: 0x0001

#### 3.2.3.1.2 Two's Complement Integer Representation

Negative values are stored as 2's complement values. For example, assume a value of -9,876.5 gallons. The 2's complement value of -98765 in hex is 0xFFFE7E33. Identifying the highest bit as a 1 indicates the number is signed. To identify the positive value, invert the bits and add 1. In this case, the resulting positive value would be 0x000181CD. This will be set up in the Modbus client software.

The following table (see Section 3.2.3.2) is of Input Register Addresses that can be accessed using function code 0x04.

### 3.2.3.2 Register Mapping Overview

| Register Address | Data Set | Data Type |
|---|---|---|
| 100-107 | System Units | System Unit Setting |
| 200-229 | Tank 1 | Tank 1 Data |
| 230-259 | Tank 2 | Tank 2 Data |
| … | … | |
| 3170-3199 | Tank 100 | Tank 100 Data |
| 3200-3399 | Reserved | |
| 3400-3419 | Manifold 1 | Manifold 1 Data |
| 3420-3439 | Manifold 2 | Manifold 2 Data |
| … | … | |
| 4380-4399 | Manifold 50 | Manifold 50 Data |
| 4400-4599 | Reserved | |
| 4600-4606 | Sensor 1 | Sensor 1 Data |
| 4607-4613 | Sensor 2 | Sensor 2 Data |
| | … | |
| 6343-6349 | Sensor 250 | Sensor 250 Data |
| 6350-6599 | Reserved | |
| 6600-6601 | Relay 1 | Relay 1 Data |
| 6602-6603 | Relay 2 | Relay 2 Data |
| | … | |
| 6998-6999 | Relay 200 | Relay 200 Data |
| 7000-7199 | Reserved | |
| 7200-7201 | Pump 1 | Pump 1 Data |
| 7202-7203 | Pump 2 | Pump 2 Data |
| | … | |
| 7258-7259 | Pump 30 | Pump 30 Data |
| 7260-7499 | Reserved | |
| 7500-7501 | Input 1 | Input 1 Data |
| 7502-7503 | Input 2 | Input 2 Data |
| | … | |
| 7898-7899 | Input 200 | Input 200 Data |
| 8200-8211 | Line 1 | Line 1 Data |
| 8212-8223 | Line 2 | Line 2 Data |
| | … | |
| 8764-8775 | Line 48 | Line 48 Data |

## 3.2.3.3 Units Data Register Set

### 3.2.3.3.1 System Units

- Units Register Set Start Address = 100.

| Address Offset | Unit Type | Data Type (see Section…) |
|---|---|---|
| 0 | Length | 3.2.3.3.2 |
| 1 | Volume | 3.2.3.3.3 |
| 2 | Temperature | 3.2.3.3.4 |
| 3 | Density | 3.2.3.3.5 |
| 4 | Mass | 3.2.3.3.6 |
| 5 | Pressure | 3.2.3.3.7 |
| 6-7 | Reserved | NA |

**NOTE**: The listed "Units Precision" in the following tables is the multiplier needed to convert a signed integer value (e.g. Volume) into a floating point number. For example, if the system preference for length is set to inches, and the combined register value for Product Level is 589, then multiply by 0.1 in.

### 3.2.3.3.2 Length Units

| Register Value | Unit Type | Units Precision |
|---|---|---|
| 0 | Millimeters | 1 mm |
| 1 | Centimeters | 0.1 cm |
| 2 | Meters | 0.001 m |
| 3 | Inches | 0.1 in |

### 3.2.3.3.3 Volume Units

| Register Value | Unit Type | Units Precision |
|---|---|---|
| 0 | Liters | 0.1 L |
| 1 | Gallons | 0.1 gal |
| 2 | Imperial Gallons | 0.1 imp gal |

### 3.2.3.3.4 Temperature Units

| Register Value | Unit Type | Units Precision |
|---|---|---|
| 0 | Centigrade | 0.1° C |
| 1 | Fahrenheit | 0.1° F |

### 3.2.3.3.5 Density Units

| Register Value | Unit Type | Units Precision |
|---|---|---|
| 0 | Kilograms per cubic meter | 0.1 $kg/m^3$ |
| 1 | Grams per cubic centimeter | 1 $g/cm^3$ |
| 2 | Pounds per cubic foot | 0.001 $lbs/ft^3$ |

### 3.2.3.3.6 Mass Units Table

| Register Value | Unit Type | Units Precision |
|---|---|---|
| 0 | Kilograms | 0.1 kg |
| 1 | Grams | 1 g |
| 2 | Pounds | 0.01 lbs |

### 3.2.3.3.7 Pressure Units Table

| Register Value | Unit Type | Units Precision |
|---|---|---|
| 0 | Bar | 0.01 bar |
| 1 | Kilopascals | 1 kPa |
| 2 | Reserved | NA |
| 3 | Pounds per square inch | 0.1 psi |
| 4 | Inches of water column | 0.001 inWc |
| 5 | Inches of mercury | 0.1 inHg |

## 3.2.3.4 Tank Data Register Set

- Tank Register Start Address = (TankNumber - 1) * 30 + 200

| Register Description | Address Offset | Data Format | Resolution (see Section…) |
|---|---|---|---|
| Tank Status Register | 0,1 | See Section 3.2.3.4.1 | |
| Tank Alarms Register | 2,3 | See Section 3.2.3.4.2 | |
| Product Level | 4,5 | Signed 32-bit Integer | 3.2.3.3.2 |
| Water Level | 6,7 | | |
| Temperature | 8,9 | Signed 32-bit Integer | 3.2.3.3.4 |
| Gross Product Volume | 10,11 | Signed 32-bit Integer | 3.2.3.3.3 |
| Net Product Volume | 12,13 | | |
| Water Volume | 14,15 | | |
| Ullage Volume | 16,17 | | |
| Density | 18,19 | Signed 32-bit Integer | 3.2.3.3.5 |
| Net Density | 20,21 | | |
| Mass | 22,23 | Signed 32-bit Integer | 3.2.3.3.6 |

### 3.2.3.4.1 Tank Status Register Bit Definitions

| Bit # | Status Bit |
|---|---|
| 0 | Tank in Alarm |
| 1 | Delivery in Progress |
| 2 | Static Tank Test in Progress |
| 3-31 | Reserved |

### 3.2.3.4.2 Tank Alarms Register

| Bit # | Status Bit |
|---|---|
| 0 | High High Product |
| 1 | High Product |
| 2 | High Water |
| 3 | Low Product |
| 4 | Low Low Product |
| 5 | Precision Leak Detected |
| 6 | Gross Leak Detected |
| 7 | SCALD Leak Detected |
| 8 | Product Density High Limit Exceeded |
| 9 | Product Density Low Limit Exceeded |
| 10 | Float Missing |
| 11 | Probe Synchronization Error |
| 12 | No Probe Detected |
| 13 | Float Height Error |
| 14-31 | Reserved |

**NOTE**: This register does not contain all possible alarms for a tank.

## 3.2.3.5 Manifold Data Register Set

- Manifold Register Start Address = (ManifoldNumber - 1) * 20 + 3400

| Registration Description | Address Offset | Data Format | Resolution (see Section…) |
|---|---|---|---|
| Manifold Status Register | 0,1 | See Section 3.2.3.5.1 | |
| Manifold Alarms Register* | 2,3 | See Section 3.2.3.5.2 | |
| Temperature | 4,5 | Signed 32-bit Integer | 3.2.3.3.4 |
| Gross Product Volume | 6,7 | Signed 32-bit Integer | 3.2.3.3.3 |
| Net Product Volume | 8,9 | | |
| Water Volume | 10,11 | | |
| Ullage Volume | 12,13 | | |
| Reserved | 14-20 | N/A | |

**NOTE**: *This register does not contain all possible alarms for a manifold.

### 3.2.3.5.1 Manifold Status Register Bit Definitions

| Bit # | Status Bit |
|---|---|
| 0 | Manifold in Alarm |
| 1 | Delivery in Progress |
| 2-31 | Reserved |

#### 3.2.3.5.2 Manifold Alarms Register Bit Definitions

| Bit # | Status Bit |
|---|---|
| 0 | Low Product |
| 1 | Low Low Product |
| 2 | SCALD Leak Detected |
| 3-31 | Reserved |

## 3.2.4 Sensor Data

### 3.2.4.1 Sensor Data Register Set

- Sensor Register Set Start Address = (SensorNumber - 1) * 7 + 4600

| Register Description | Address Offset | Data Format (see Section...) |
|---|---|---|
| Sensor Type | 0 | 3.2.4.1.1 |
| Sensor State | 1 | 3.2.4.1.2 |
| Reserved | 2-6 | |

#### 3.2.4.1.1 Sensor Type

| Register Value | Sensor Type |
|---|---|
| 0 | Unknown Sensor |
| 1 | DIS Sensor |
| 2 | DDS Sensor |
| 3 | DTS Sensor |
| 4 | MWS Sensor |
| 5 | HIS Sensor |
| 6 | EIS Sensor |
| 7 | DVS Sensor |
| 8 | MIS Sensor |
| 9 | CDS Sensor |
| 100 | DMS Sensor |
| 1000 | ULS Sensor |
| 1999 | 2-Wire Sensor |

#### 3.2.4.1.2 Sensor State

| Register Value | Sensor State |
|---|---|
| 0 | Ok |
| 1 | Malfunction |
| 2 | Error |
| 3 | Fault |
| 4 | Liquid Warning |
| 5 | Vapor Detected |
| 6 | Product Detected |
| 7 | Water Detected |
| 8 | Sensor Active |
| 9 | High Brine |
| 10 | Low Brine |
| 11 | Sump Full |
| 12 | Dry Well |
| 13 | Configuration Error |
| 14 | Installation Error |
| 15 | Not Learned |

### 3.2.4.2 Mag Sensor Register Set

- Mag Sensors Start Address = (SensorNumber - 1) * 7 + 5200

| Register Description | Address Offset | Data Format |
|---|---|---|
| Product Level | 0,1 | Signed Integer (see Section 3.2.3.3.2) |
| Water Level | 2,3 | |
| Status Register | 4 | See Section 3.2.4.2.1 |
| Reserved | 5-8 | |

#### 3.2.4.2.1 Mag Sensor Status Register

| Bit # | Status Bit |
|---|---|
| 0 | Water Warning Active |
| 1 | Water Alarm Active |
| 2 | Product Alarm Active |
| 3 | Installation Alarm Active |
| 4 | Sensor Missing Alarm Active |
| 5 | Sensor Sync Alarm Active |
| 6 | Sensor Float Missing Active |
| 7-15 | Reserved |

# 3.2.5 Relay Data

## 3.2.5.1 Relay Data Register Set

- Relay Register Set Start Address = (RelayNumber - 1) * 2 + 6600

| Register Description | Address Offset | Data Format |
|---|---|---|
| Relay Status Register | 0 | See Section 3.2.5.1.1 |

### 3.2.5.1.1 Relay Status Register Bit Definitions

| Bit # | Status Bit |
|---|---|
| 0 | Relay State ( Inactive = 0, Active = 1 ) |
| 1-15 | Reserved |

# 3.2.6 Turbine Pump Interface (TPI) Data

## 3.2.6.1 Pump Data Register Set

- Pump Register Set Start Address = (PumpNumber - 1) * 2 + 7200

| Register Description | Address Offset | Data Format |
|---|---|---|
| Pump Status Register | 0 | See Section 3.2.6.1.1 |

### 3.2.6.1.1 Pump Status Register Bit Definitions

| Bit # | Status Bit |
|---|---|
| 0 | Pump Status ( Idle = 0, Running = 1 ) |
| 1 | Pump Forced Off ( False = 0, True = 1 ) |
| 2 | Controller Faulted ( False = 0, True = 1 ) |
| 1-15 | Reserved |

### 3.2.6.1.2 Pump Status

| Register Value | Pump Status State |
|---|---|
| 0 | Idle |
| 1 | Running |

### 3.2.6.1.3 Pump Forced Off State

| Register Value | Pump Forced Off State |
|---|---|
| 0 | Ok |
| 1 | Force Off |

#### 3.2.6.1.4 Pump Controller Faulted

| Register Value | Pump Controller Faulted State |
|---|---|
| 0 | Ok |
| 1 | Controller Faulted |

## 3.2.7 Input Data

### 3.2.7.1 Input Data Register Set

- Input Register Set Start Address = (InputNumber - 1) * 2 + 7500

| Bit # | Status Bit |
|---|---|
| 0 | Relay State ( Inactive = 0, Active = 1 ) |
| 1-15 | Reserved |

#### 3.2.7.1.1 Low Voltage Input Status

| Bit Value | Low Voltage Input State |
|---|---|
| 0 | In-Active |
| 1 | Active |

### 3.2.7.2 AC Input Status Register

- DHI Start Address = (DHI Num - 1) * 2 + 6700

| Bit # | Status Bit |
|---|---|
| 0 | Input On |
| 1-15 | Reserved |

#### 3.2.7.2.1 AC Input Bit Value

| Register Value | AC Input State |
|---|---|
| 0 | In-Active |
| 1 | Active |

### 3.2.7.3 GIO Inputs Status Register

- GIO Start Address = (GIO Num - 1) * 2 + 7100

| Bit # | Status Bit |
|---|---|
| 0 | Input On |
| 1-15 | Reserved |

#### 3.2.7.3.1 GIO Input Bit Value Table

| Register Value | GIO Input State |
|---|---|
| 0 | Inactive |
| 1 | Active |

### 3.2.7.4 Line Data Register Set

- Line Register Set Start Address = (LineNumber - 1) * 12 + 8200

| Registration Description | Address Offset | Data Format | Resolution (see Section…) |
|---|---|---|---|
| Line Status Register | 0,1 | See §3.2.7.4.1 | |
| Line Alarms Register | 2,3 | See §3.2.7.4.2 | |
| Line Pressure | 4,5 | Signed 32-bit Integer | See §3.2.3.3.7 |

#### 3.2.7.4.1 Lines Status Register Bit Definitions

| Bit # | Status Bit |
|---|---|
| 0 | Line in Alarm |
| 1 | Line Learned |
| 2 | Line Learning |
| 3 | Line Enabled |
| 4 | Gross Test Active |
| 5 | Monthly Test Active |
| 6 | Annual Test Active |
| 7 | Test Running |
| 8 | Between Tests |
| 9 | Waiting Out Thermals |
| 10 | Line User Disabled |
| 11 | Line Failure |
| 12 | Line Testing System Error |
| 13-31 | Reserved |

#### 3.2.7.4.2 Line Alarms Register Bit Definitions

| Bit # | Status Bit |
|---|---|
| 0 | Gross Test Failed |
| 1 | Precision (0.2 gph) Test Failed |
| 2 | Precision (0.1 gph) Test Failed |
| 3 | Failed To Pressure Up |
| 4 | Failed To Catch Pressure |
| 5 | Sudden Pressure Loss |
| 6 | Dispensing Pressure Test Failed |
| 7 | High Line Pressure |
| 8 | Extended Hook Signal |
| 9 | Line Pump Request Ignored |
| 10 | Line Testing Not Active |
| 11 | Line Not Learned |
| 12 | Line Pressure Reading Not Valid |
| 13 | Pressure Transducer Stuck |
| 14 | Pressure Transducer Open Circuit |
| 15–31 | Reserved |

# 4 Troubleshooting

When configuring system for Modbus communication, be aware of offsets and the discrepancy between “Register” and “Address”.

- Example: User would like to retrieve the Gross Product Volume information for Tank 1. Referring to the Tank Data Register, Section 3.2.3.4, they determine the Address Offset for Gross Product Volume is 10, 11.

## Tank Data Register Set

- Tank Register Start Address = (TankNumber - 1) * 30 + 200

| Register Description | Address Offset | Data Format | Resolution (see Section…) |
|---|---|---|---|
| Tank Status Register | 0,1 | See § 3.2.3.4.1 | |
| Tank Alarms Register | 2,3 | See § 3.2.3.4.2 | |
| Product Level | 4,5 | Signed 32-bit Integer | 3.2.3.3.2 |
| Water Level | 6,7 | | |
| Temperature | 8,9 | Signed 32-bit Integer | 3.2.3.3.4 |
| Gross Product Volume | 10,11 | Signed 32-bit Integer | 3.2.3.3.3 |
| Net Product Volume | 12,13 | | |
| Water Volume | 14,15 | | |
| Ullage Volume | 16,17 | | |
| Density | 18,19 | Signed 32-bit Integer | 3.2.3.3.5 |
| Net Density | 20,21 | | |
| Mass | 22,23 | Signed 32-bit Integer | 3.2.3.3.6 |

## Calculations

The user uses the Tank Register Start Address equation to perform the following calculations.

- Tank Register Start Address = ( (Tank Number - 1) * 30 + 200) + Address Offset) = ( (1 – 1) * 30 + 200) + 10) and ( (1 – 1) * 30 + 200) + 11) = 210 and 211. These results, 210 and 211, are the Register Addresses.

There are three ways to interpret this information:

1. The Input Register Addresses - 210, 211.
2. The Input Register Numbers - 211, 212 (as Register Numbers are 1-based while addresses are 0-based).
3. The Modicon Standard Register Numbers - 30211, 30212 (as Modicon Standard Register Numbers are 30001-based while addresses are 0-based).

**NOTE**: Certain software applications use “Address” and “Number” interchangeably. Pay close attention to the particular software application examples.

# 5 Appendix

## 5.1 Related Documents

Installation, Operating, Troubleshooting and Console Maintenance guides are separate documents for your use. Detailed information for the various types of leak detection Sensors are provided in the relevant individual documents. Installation, testing, and programming of the various upgrade kits and optional accessories are included in the individual documents. Documentation can be found online at www.franklinfueling.com.

**TABLE 5.1 – Related Documents**

| Part Number | Description |
|---|---|
| 228180003 | EVO™ 200 and 400 Series Console Install Guide |
| 228180015 | EVO™ 200 and 400 Series Console Programming Guide |
| 228180033 | EVO™ 600 and 6000 Series Console Install Guide |
| 228180061 | EVO™ 600 and 6000 Series Console Programming Guide |

## 5.2 Glossary

DHI..... Direct Hydrocarbon Indicators.

DIM ..... Dispenser Interface Module.

FMS..... Fuel Management System.

GIO..... General-Purpose Input/Output.

Little Endian Ordering ... An order in which the "little end" (least significant value in the sequence) is stored first.

Modbus ..... A serial communication protocol that allows for communication across various devices on the same network.

Modbus RTU..... Modbus protocol is used on top of a serial line with an RS-232, RS-485 or similar physical interface.

Modbus TCP ..... TCP interface that runs on Ethernet using Modbus RTU protocol.

RS-232 ..... An IEEE standard for serial communications using a 9-pin connector.

RS-485 ..... An IEEE standard for serial communications using shielded or unshielded twisted pair cables.

RTU..... Directly transmits data through binary data.

TCP ..... Converts each byte of binary data into a fixed two-digit hexadecimal string, and then serially connects them together to transmit data in the form of TCP code.

TPI..... Turbine Pump Interface.

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