PC180 MODBUS COMMUNICATION MANUAL

INJECTION MANAGEMENT SYSTEM

The PC180 Chemical Management System (CMS) is an electronic control and monitoring system designed to augment chemical injection pumps found in oil and gas fields. This system helps reduce the amount of waste during the chemical injection process. The PC180 calculates and manages an optimal chemical injection cycle for the desired injection rate.

1 | Introduction

The Remote Access Interface allows access to functions which are normally accessed using the integral front panel interface.

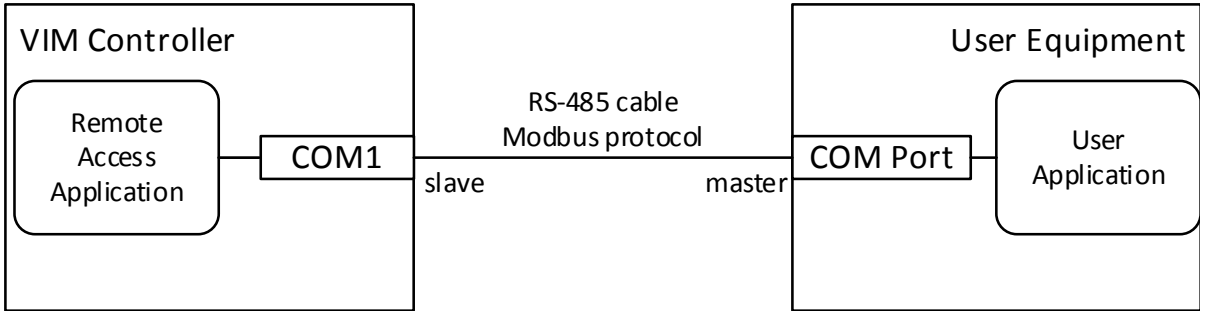

Figure 1 | High Level Connection Overview

This document describes how to use Modbus commands to operate the Remote Access Application. The Modbus registers and functionality described in this document are for the monitoring and modification of typical controller parameters.

1.1 | References

1. PC180 Installation and Operations Manual
2. Modicon Modbus Protocol Reference Guide; PI-MBUS-300 Rev. J; June 1996; MODICON Inc.
3. Modbus Application Protocol Specification; modbus.org; May 8, 2002.

2 | Controller Setup

Access to the settings used for Modbus Communications are only available through the controller menus. The following sections give a brief overview of the initial setup required. More detailed descriptions are available in the PC180 Installation and Operations Manual.

2.1 | Communication Settings

The Modbus menu is available inside the Install menu. This menu allows you to configure the settings of the controller. Please note that these settings must match the settings of your communications network and SCADA Host in order to function properly.

2.1.1 | Station Address

The station address is a unique identifier that will be used by the host to communicate with a single controller. This address must not be duplicated within the same segment of your network. Valid addresses are 1 to 247. The default is 1.

2.1.2 | Protocol

The protocol can be set to either RTU(binary) or ASCII (text). RTU is definitely more common as it takes less bits to transmit the same amount of information. This must match the same setting that is used by your SCADA Host. The default is RTU.

2.1.3 | Baud Rate

The baud rate can be set to 1200, 2400, 4800, 9600, or 19200. This is used to se the bit rate of data transmitted on the communication line. This must match the same baud rate as the rest of your network. A mismatched baud rate will result in all communication being discarded at the controller. The default is 9600 bps.

2.1.4 | Data Bits

The data bits parameter sets the number of bits in each transmitted or received character. This can be set to 7 or 8. The default is 8.

2.1.5 | Parity

This parameter will set the parity of the character. It can be set to even, odd, or none. The default is none.

2.1.6 | Stop Bits

The stop bits controls the number of stop bits that are to be present at the end of each character. This parameter can be set to 1 or 2. The default is 1.

3 | Layer 1 Operation

The PC180 has a 2-wire RS-485 port (COM 1) that operates as a Modbus Slave. The feature set associated with COM 2 on the PC180 is still under development. See [1], for wiring details.

Supported bit rates: 1200, 2400, 4800, 9600, and 19,200 bps.

Supported character formats:

Table 1 - Supported Communication Rates and Formats

Data Bits	*Parity*	*Stop Bits*	*Protocol*
7	None	2	ASCII, RTU
7	Odd	1	ASCII, RTU
7	Odd	2	ASCII, RTU
7	Even	1	ASCII, RTU
7	Even	2	ASCII, RTU
8	None	1	ASCII, RTU
8	None	2	ASCII, RTU
8	Odd	1	ASCII, RTU
8	Odd	2	ASCII, RTU
8	Even	1	ASCII, RTU
8	Even	2	ASCII, RTU

The bit rate and character format are configured using the front panel only. Technically, all character formats for RTU protocol support must be 11-bits in length with 8-bits of data. This allows for 1 start bit, 8 bits of data, and two bits for parity and stop. In actual practice, this is rarely followed, so all combinations are allowed.

4 | Layer 2 Operation

The PC180 Controller supports both the Modbus ASCII and RTU protocols (see [2]). Protocol selection is configured from the front panel only, and defaults to RTU mode.

The PC180 Controller Modbus station address is configured using the front panel only (range: 1 – 247), but has a default value of 1. The PC180 Controller will act on, but not respond to, commands using the broadcast address (i.e. zero).

The maximum byte-length of Modbus commands and responses is limited to 256 characters (see [3], §4.1).

When operating in ASCII mode, the PC180 Controller performs the following required layer 2 checks on incoming commands:

- Parity
- LRC
- character silence period (1 second)

ASCII commands can be accepted upon silence detection without a terminating CR/LF.

When operating in RTU mode, the PC180 Controller performs the following required layer 2 checks on incoming commands:

- Parity
- CRC
- character timeout period (1.5 character times)
- frame silence period (3.5 character times)

5 | Layer 3 Operation

The following Modbus commands are supported:

Table 2 | Supported Modbus Commands

Code	*Current Terminology*	*Classic Terminology*	*Data Resolution*
01	Read Coils	Read Coil Status	1-bit
02	Read Input Discretes	Read Input Status	1-bit
03	Read Multiple Registers	Read Holding Registers	16-bit
04	Read Input Registers	Read Input Registers	16-bit
05	Write Coil	Force Single Coil	1-bit
06	Write Single Register	Preset Single Register	16-bit
15	Force Multiple Coils	Force Multiple Coils	16-bit
16	Write Multiple Registers	Preset Multiple Registers	16-bit

Normal responses are issued as required by [2].

Modbus allows for exception responses to be returned under certain failure conditions. Once again, this is not typically desired in the process control industry. As such, the controller does not normally return any exception responses. This can however be enabled through the user interface if desired. The following Modbus Exception Responses are supported:

Table 3 | Supported Modbus Exception Responses

Code	*Response*
01	Illegal Function
02	Illegal Data Address
03	Illegal Data Value
04	Slave Device Failure

The PC180 Controller performs consistency checks on the following items received in commands:

- number of bytes received1 (In the Modbus ASCII protocol, a single byte is sent as 2 HEX-ASCII characters.)

- Number of Points field
- Byte Count field (if present)

If any of these checks fail, an Illegal Data Value exception is returned.

If an Address field, either explicit or implicit, is outside the known range, an Illegal Data Address exception is returned. The User Application may read Input Registers 3:1001 and 3:1002 to determine the first bank and address in the command which caused the exception. No part of the command is executed.

A Slave Device Failure exception is used to indicate Application Layer errors. The User Application may read Input Registers 3:1001 and 3:1002 to determine the bank and address in the command which caused the exception. Execution of the command terminates at this address.

5.1 | Address Coding

Each register of the PC180 Controller is accessed via a specific Modbus operation. Each operation contains an implied address offset. The mapping between traditional Modbus address notation, the operation performed, and the address sent in Modbus messages is shown below.

Table 4 | Modbus Message Coding

Code	*Operation*	*Modbus Address Notation*	*Message Address*
01	Read Coils	0: abcd	abcd
02	Read Input Discretes	1: abcd	abcd
03	Read Multiple Registers	4: abcd	abcd
04	Read Input Registers	3: abcd	abcd
05	Write Coil	0: abcd	abcd
06	Write Single Register	4: abcd	abcd
15	Force Multiple Coils	0: abcd	abcd
16	Write Multiple Registers	4: abcd	abcd

For example, accessing register 4:4000 is done via the following operations: ReadMultipleRegisters, WriteSingleRegister, and WriteMultipleRegisters. All of these operations use the address value 4000. Accessing register 0:4000 is done with the following operations: ReadCoils and WriteCoils. These two operations also use the address value 4000, but access a different register.

6 | Application Layer Operation

6.1 | Basic Operation

The PC180 Controller is designed to allow concurrent operation from the front panel and Modbus interface. This requires that the front panel user (UI Application) and the User Application (via the Remote Access Interface) not access data at the same time or overwrite each other's data. This is achieved by allowing each application to have a copy of the PC180 Controller parameters to read and modify. This imposes special requirements on the User Application.

The information within the PC180 Controller is grouped into a number of data-sets. Before accessing any data within a data-set, it must be retrieved by the Remote Access Application. This is done so that:

- The User Application can read a consistent data-set: That is, one in which the data is not changing while it is being read. This means that, in general, the data-set will be out-of-date. The User Application should have the Remote Access Application retrieve a fresh copy of a data-set before each read "session".
- Changes made to a data-set will not be lost: If parameters are changed using the front panel and User Application at the same time, there is a potential for changes to be lost. For this reason, a lock-out mechanism is provided. The User Application can retrieve a data-set "for writing". This will lock-out changes to the data-set by the front panel.

6.1.1 | History Logs

The PC180 Controller provides access to history records. These history records are provided in a format that allows various aspects of the history to be compared. One must keep in mind that the history data is constantly changing.

The controller however does not write data to the history until a predetermined even happens. For the cycle logs, the history is written each time that a cycle starts (controller moves from Inject to Recycle). Daily production logs are modified at the specified Day Start Time. Reading the history at the exact time that the history is being updated could lead to inconsistent data. Therefore, it is best to avoid reading the history at these times.

6.1.2 | Register Set Access

A register set is defined as a fixed number of contiguous 16-bit memory locations that represent a single PC180 Controller parameter. For a register set to be valid it must be accessed as an aggregate from the start address.

For read operations, the User Application should query the starting register address and read the entire length of the register set. Register sets must be written from low to high order with no intervening write operations. The register set is validated, by the Remote Access Application, as an aggregate when the high order register is written.

PC180 Controller register set formats are defined in 7 Register Formats

6.2 | Automatic Dependent Parameter Update

The range of values for some control parameters depend on the current value of other parameters. This means that when a parameter is changed, its dependent parameters may become invalid. In this case, the dependent parameters are automatically changed in order to avoid an invalid configuration. Register assignments are such that dependent parameters have a higher register number than their "parent". This allows a group of parameters to be written with a single Modbus command with no undesired side-effects.

6.3 | Concurrency Issues

6.3.1 | Controller Operation

Changes to control parameters may be made while the control algorithm is running. These changes are saved when the Modbus Write Time expires, but are not applied until the start of the next cycle or after a controller cycle restart.

The following Historical Logs are updated by the control algorithm:

Table 5 - Available Logs

Log	Updated
Cycle	At the end of each cycle when the controller moves from Inject to Recycle.
Daily Production	Every 24 hours at the Day Start Time "Today's" daily production is updated every second at minimum.

It is possible, therefore, that the history us being updated while it is being read by the User Application. For example, at the end of the gas day, the Log 1 data becomes Log 2 and Log 7 data is removed. It is the responsibility of the User Application to manage this sliding window of log data at the gas day or plunger cycle boundary.

6.3.2 | History Logs

All logs may be reset from the front panel. It is possible, therefore, that the currently selected log may be updated while it is being read by the User Application. It is the responsibility of the User Application to manage this concurrent access to log data.

6.4 | Error Reporting

When a Slave Device Failure exception is returned, the User Application may read Input Register 3:1000 to determine the type of failure, as follows:

Table 6 | Supported Modbus Error Codes

Error Type	Code	Description
MODBUS_ACCESS_DENIED	01	Modbus access to registers has been lockout from the device front panel. Only registers 1:0300, and 3:0300-3:0302 are accessible.
FUNCTION_NOT_SUPPORTED	02	The specified functionality of this register is not available in this firmware version.
FEATURE_NOT_ENABLED	03	The application attempted to access a data item belonging to a disabled value-added firmware feature. These features may only be enabled from the front panel.

Error Type	Code	Description
FUNCTION_NOT_ENABLED	04	The application attempted to access a data item that requires activation via another register.
DEVICE_NOT_ENABLED	05	The application attempted to access a real device which is not present (i.e. enabled) in the PC180 Controller configuration.
DATASET_NOT_LOCKED	06	The application attempted to write to a dataset which was not locked.
DEPENDENT_DATASET_NOT_ LOCKED	07	The application attempted to modify parameter in a locked dataset that required an auto update parameter in an unlocked dependent dataset.
DATASET_ALREADY_LOCKED	08	The application attempted to lock a dataset which is currently locked by the integral control panel user. Try the request at a later time.
VALUE_OUT_OF_RANGE	09	The preset value for a register was outside the acceptable range of values.
WRITE_SEQUENCE_ERROR	10	The registers in a register set were not written in the proper order.
LOG_NOT_SELECTED	11	The application attempted to read a data value belonging to a historical log which has not been loaded.
LOW_BATTERY	12	The request could not be performed because the PC180 Controller is in a low battery condition.

7 | Register Formats

The following sections outline the available register formats that are used throughout the register map.

- MSW = most significant word (16 bits)
- LSW = least significant word (16-bits)

7.1 | Date/Time Register

- Range: 0 – 4,294,967,295
- Write MSW first when writing in seconds format, followed by LSW
- Use the Time Format coil to switch the format

Table 7 | Date/Time Register Format

Number	*Description (Seconds Format)*	*Description(H:M:S Format)*
Start	Seconds since January 1, 2000 (MSW)	Year
Start + 1	Seconds since January 1, 2000 (LSW)	Month
Start + 2	Reserved	Day
Start + 3	Reserved	Hours
Start + 4	Reserved	Minutes
Start + 5	Reserved	Seconds

7.2 | Elapsed Time Register

- Range: 0 – 3,599,999 seconds (1000 hours)
- Write LSW first when writing in seconds format
- Use the Time Format coil to switch the format

Table 8 | Elapsed Time Register Format

Number	*Description (Seconds Format)*	*Description(H:M:S Format)*
Start	Seconds (MSW)	Hours
Start + 1	Seconds (LSW)	Minutes
Start + 2	Reserved	Seconds

7.3 | Double Word Register

Table 9 | Double Word Register Format

Number	*Description*
Start	MSW
Start + 1	LSW

8 | Register Map

The following sections outline each of the sections of registers as defined by the Modbus protocol. These groups are as follows:

- Coils – Single bit registers that can be written to cause an action
- Input Discretes – single bit registers that are a read only status
- Input Registers – 16 bit registers that are a read only status
- Holding Registers – 16 bit registers that can be read and read.

Note: Any registers that are grayed out have not been implemented. Writes to these registers will be ignored. Reads from these registers will return unpredictable results.

Note: Modbus uses a register number, which starts at 1 to describe the location of data. The actual address that is passed in the protocol layer is 0. This means that depending on the tool you are using, you may need to subtract 1 from the register number to access the appropriate data.

8.1 | Coils

Table 10 - Available Coils (Basic Control)

Register	*Description*	*Read*	*Write*
0:0001	Stop (Inject Hold). Mimic the stop button functionality from the keypad.	N/A	1 – Stop
0:0002	Run (Start Inject). Mimic the Run button functionality from the keypad.	N/A	1 – Close
0:0003	Restart Controller	N/A	1- Restart Controller
0:0004	Reset Cycle Log	N/A	1- Reset Log
0:0005	Reset Daily Statistics Log. This resets all previous days, but does not reset the current day.	N/A	1- Reset Log
0:0006	Reset Error Logs	N/A	1- Reset Log
0:0007	Time Format	Current Value	0 – Seconds 1 – H:M:S

Register	Description	Read	Write
0:0008	Units	Current Value	0 – Imperial 1- Metric
0:0009	Recycle Hold	N/A	1 – Recycle Hold
0:0010	Recycle	N/A	1 – Start Recycle
0:0011	Manually Open Sales	N/A	1 – Open
0:0012	Manually Close Sales	N/A	1 – Close
0:0013	Manually Open Valve B	N/A	1 – Open
0:0014	Manually Close Valve B	N/A	1 – Close
0:0015 – 0:0016	Reserved	N/A	N/A

8.2 | Input Discretes

Table 11 - Available Input Discretes (Controller Information)

Register	Description	Read
1:0001	Operator Present	0 – No operator at the controller 1 – An operator is currently using the controller
1:0002	Slave Device Access. This register may be read to determine if access to data registers in the Modbus slave device is permitted.	0 – Modbus slave access disabled 1 – Modbus slave access enabled
1:0003	Date/Time Set	0 – date/time not set 1- date/time set
1:0004 – 1:0020	Reserved	N/A

Table 11 - Available Input Discretes (Output Status)

Register	Description	Read
1:0021	Sales Valve A Status	0- Valve A closed 1- Valve A open
1:0022	Valve B Status. This valve status is only valid when valve B is enabled. 0- Valve B closed 1- Valve B open	
1:0023 – 1:0030	Reserved	N/A

Table 11 - Available Input Discretes (Input Device Status)

Register	Description	Read
1:0031	Battery Switch Value	0 – Battery Good 1 – Battery Low
1:0032	Line Pressure Switch Value. The registers may only be read when the Line Pressure Device is enabled as a switch (see register 4:0081)	0 – Line Pressure Reset 1 – Line Pressure Tripped
1:0033	Tank Pressure Switch Value. The registers may only be read when the Tank Pressure Device is enabled as a switch (see register 4:0101)	0 – Tank Pressure Reset 1 – Tank Pressure Tripped

8.3 | Input Registers

Table 12 - Available Input Registers (Controller Information)

Register	Description	Read
3:0001 – 3:0002	Controller Serial Number	Double Word format: 0- 99999

Register	Description	Read
3:0003	Firmware Version – Major Version	0 – 99
3:0004	Firmware Version – Minor Version	0 – 99
3:0005	Firmware Version – Fix Version	0 – 99
3:0006 – 3:0010	Reserved	N/A
3:0011	Current Controller State	0 = Recycle 2 = Inject 6 = Stopped
3:0012 – 3:0014	Controller Status Time Remaining. If the controller is stopped, the contents of these registers are zero.	Elapsed Time format
3:0015 – 3:0020	Current State Begin Time	Date/Time format
3:0021	Controller Status Reason	9 = Normal Operation 10 = Operator Command 11 = Startup 13 = Hold Inject 14 = Hold Recycle
3:0028 – 3:0030	Reserved	N/A

Table 12 - Available Input Registers (Input Device Value)

Register	Description	Read
3:0031	Battery Voltage Value. The value returned from this register may be invalid. The validity of the reading can be determined by reading the Battery Voltage Valid Flag (input discrete 1:0010).	350 – 999 (centi-volts)
3:0032	Battery Voltage Status. The contents of this address are latched after executing a read operation of the Battery Voltage Value (register 3:0002).	1- scan pending 2- def change pending 3 – value under range 4 – value over range 5 – value invalid 6 – value valid
3:0033	Temperature Value. Note: This includes any offsets	-100 C to +100 C

Register	Description	Read
3:0034	Temperature Device Status. Makes the status of the Temperature Reading available	0- disabled 1 – scan pending 2- def change pending 3 – value under range 4 – value over range 5 – value invalid 6 – value valid
3:0035	Line Pressure Value. The registers may only be read when the Line Pressure Device is enabled as a sensor (see register 4:0081).	0 – Max Line Pressure psi (Multiplied by 10 to show decimal resolution. i.e. 100 = 10.0 psi)
3:0036	Line Pressure Device Status. The contents of this address are latched after executing a read operation of the Line Pressure Sensor Value (register 3:0035).	0- disabled 1 – scan pending 2- def change pending 3 – value under range 4 – value over range 5 – value invalid 6 – value valid
3:0037	Tank Pressure Value. The registers may only be read when the Tank Pressure Device is enabled as a sensor (see register 4:0101).	0 – Max Tank Pressure (psi) (Multiplied by 1000 to show decimal resolution. i.e. 1000 = 1.000 psi)
3:0038	Tank Pressure Device Status. The contents of this address are latched after executing a read operation of the Tank Pressure Sensor Value (register 3:0037).	0- disabled 1 – scan pending 2- def change pending 3 – value under range 4 – value over range 5 – value invalid 6 – value valid
3:0039 – 3:0050	Reserved	N/A

Table 12 - Available Input Registers (Calculated Timers)

Register	Description	Read
3:0051 – 3:0053	Injection Time1	Elapsed Time format: 1 – 1,799,998 (000:00:01 – 499:59:58)

Register	Description	Read
3:0054 – 3:0056	Recycle Time1	Elapsed Time format: 1 – 1,799,998 (000:00:01 – 499:59:58)
3:0057 – 3:0059	Injection Time2	Elapsed Time format: 1 – 1,799,998 (000:00:01 – 499:59:58)
3:0060 – 3:0062	Recycle Time2	Elapsed Time format: 1 – 1,799,998 (000:00:01 – 499:59:58)
3:0063 – 3:0100	Reserved	N/A

Table 12 - Available Input Registers (Daily Production Log)

Register	Description	Read
3:0101	Daily Production Log Count	0- 8
3:0102- 3:0107	Daily Production Log- Save Time- Entry-1	Date/Time format
3:0108- 3:0113	Daily Production Log- Save Time- Entry-2	Date/Time format
3:0114- 3:0119	Daily Production Log- Save Time- Entry-3	Date/Time format
3:0120- 3:0125	Daily Production Log- Save Time- Entry-4	Date/Time format
3:0126- 3:0131	Daily Production Log- Save Time- Entry-5	Date/Time format
3:0132- 3:0137	Daily Production Log- Save Time- Entry-6	Date/Time format
3:0138- 3:0143	Daily Production Log- Save Time- Entry-7	Date/Time format
3:0144- 3:0149	Daily Production Log- Save Time- Entry-8	Date/Time format
3:0150- 3:0152	Daily Production Log- Recycle Time- Entry-1	Elapsed Time format
3:0153- 3:0155	Daily Production Log- Recycle Time- Entry-2	Elapsed Time format
3:0156- 3:0158	Daily Production Log- Recycle Time- Entry-3	Elapsed Time format
3:0159- 3:0161	Daily Production Log- Recycle Time- Entry-4	Elapsed Time format
3:0162- 3:0164	Daily Production Log- Recycle Time- Entry-5	Elapsed Time format
3:0165- 3:0167	Daily Production Log- Recycle Time- Entry-6	Elapsed Time format
3:0168- 3:0170	Daily Production Log- Recycle Time- Entry-7	Elapsed Time format
3:0171- 3:0173	Daily Production Log- Recycle Time- Entry-8	Elapsed Time format

Register	Description	Read
3:0174- 3:0176	Daily Production Log- Inject Time- Entry-1	Elapsed Time format
3:0177- 3:0179	Daily Production Log- Inject Time- Entry-2	Elapsed Time format
3:0180- 3:0182	Daily Production Log- Inject Time- Entry-3	Elapsed Time format
3:0183- 3:0185	Daily Production Log- Inject Time- Entry-4	Elapsed Time format
3:0186- 3:0188	Daily Production Log- Inject Time- Entry-5	Elapsed Time format
3:0189- 3:0191	Daily Production Log- Inject Time- Entry-6	Elapsed Time format
3:0192- 3:0194	Daily Production Log- Inject Time- Entry-7	Elapsed Time format
3:0195- 3:0197	Daily Production Log- Inject Time- Entry-8	Elapsed Time format
3:0198	Daily Production Log – Number of Pump Actuation Cycles – Entry- 1	0 – 65535
3:0199	Daily Production Log – Number of Pump Actuation Cycles – Entry – 2	0 – 65535
3:0200	Daily Production Log – Number of Pump Actuation Cycles – Entry – 3	0 – 65535
3:0201	Daily Production Log – Number of Pump Actuation Cycles – Entry – 4	0 – 65535
3:0202	Daily Production Log – Number of Pump Actuation Cycles – Entry – 5	0 – 65535
3:0203	Daily Production Log – Number of Pump Actuation Cycles – Entry- 6	0 – 65535
3:0204	Daily Production Log – Number of Pump Actuation Cycles – Entry- 7	0 – 65535
3:0205	Daily Production Log – Number of Pump Actuation Cycles – Entry- 8	0 – 65535
3:0206- 3:0213	Reserved	N/A
3:0214	Daily Production Log- Cycle Count- Entry-1	0- 65535
3:0215	Daily Production Log- Cycle Count- Entry-2	0 – 65535
3:0216	Daily Production Log- Cycle Count- Entry-3	0 – 65535
3:0217	Daily Production Log- Cycle Count- Entry-4	0 – 65535
3:0218	Daily Production Log- Cycle Count- Entry-5	0 – 65535
3:0219	Daily Production Log- Cycle Count- Entry-6	0 – 65535
3:0220	Daily Production Log- Cycle Count- Entry-7	0 – 65535
3:0221	Daily Production Log- Cycle Count- Entry-8	0- 65535
3:0222	Daily Production Log- Normal Cycle Count-1	0- 65535

Register	Description	Read
3:0223	Daily Production Log- Normal Cycle Count-2	0- 65535
3:0224	Daily Production Log- Normal Cycle Count-3	0- 65535
3:0225	Daily Production Log- Normal Cycle Count-4	0- 65535
3:0226	Daily Production Log- Normal Cycle Count-5	0- 65535
3:0227	Daily Production Log- Normal Cycle Count-6	0- 65535
3:0228	Daily Production Log- Normal Cycle Count-7	0- 65535
3:0229	Daily Production Log- Normal Cycle Count-8	0- 65535
3:0230 – 3:0261	Reserved	N/A
3:0262	Daily Production Log – Low Battery Count- 1	0- 65535
3:0263	Daily Production Log – Low Battery Count- 2	0- 65535
3:0264	Daily Production Log – Low Battery Count- 3	0- 65535
3:0265	Daily Production Log – Low Battery Count- 4	0- 65535
3:0266	Daily Production Log – Low Battery Count- 5	0- 65535
3:0267	Daily Production Log – Low Battery Count- 6	0- 65535
3:0268	Daily Production Log – Low Battery Count- 7	0- 65535
3:0269	Daily Production Log – Low Battery Count- 8	0- 65535
3:0270	Daily Production Log – Operator Change Count Entry-1	0- 65535
3:0271	Daily Production Log – Operator Change Count Entry-2	0- 65535
3:0272	Daily Production Log – Operator Change Count Entry-3	0- 65535
3:0273	Daily Production Log – Operator Change Count Entry-4	0- 65535
3:0274	Daily Production Log – Operator Change Count Entry-5	0- 65535
3:0275	Daily Production Log – Operator Change Count Entry-6	0- 65535
3:0276	Daily Production Log – Operator Change Count Entry-7	0- 65535
3:0277	Daily Production Log – Operator Change Count Entry-8	0- 65535
3:0278	Daily Production Log – Startup Count – Entry-1	0- 65535
3:0279	Daily Production Log – Startup Count – Entry-2	0- 65535

Register	Description	Read
3:0280	Daily Production Log – Startup Count – Entry-3	0- 65535
3:0281	Daily Production Log – Startup Count – Entry-4	0- 65535
3:0282	Daily Production Log – Startup Count – Entry-5	0- 65535
3:0283	Daily Production Log – Startup Count – Entry-6	0- 65535
3:0284	Daily Production Log – Startup Count – Entry-7	0- 65535
3:0285	Daily Production Log – Startup Count – Entry-8	0- 65535
3:0286 – 3:1000	Reserved	N/A

Table 12 - Available Input Registers (Plunger Cycle Log)

Register	Description	Read
3:1001	Cycle Log Count	0- 20
3:1002-3:1007	Cycle Log Start Time – Entry-1	Date/Time format
3:1008-3:1013	Cycle Log Start Time – Entry-2	Date/Time format
3:1014-3:1019	Cycle Log Start Time – Entry-3	Date/Time format
3:1020-3:1025	Cycle Log Start Time – Entry-4	Date/Time format
3:1026-3:1031	Cycle Log Start Time – Entry-5	Date/Time format
3:1032-3:1037	Cycle Log Start Time – Entry-6	Date/Time format
3:1038-3:1043	Cycle Log Start Time – Entry-7	Date/Time format
3:1044-3:1049	Cycle Log Start Time – Entry-8	Date/Time format
3:1050-3:1055	Cycle Log Start Time – Entry-9	Date/Time format
3:1056-3:1061	Cycle Log Start Time – Entry-10	Date/Time format
3:1062-3:1067	Cycle Log Start Time – Entry-11	Date/Time format
3:1068-3:1073	Cycle Log Start Time – Entry-12	Date/Time format
3:1074-3:1079	Cycle Log Start Time – Entry-13	Date/Time format
3:1080-3:1085	Cycle Log Start Time – Entry-14	Date/Time format

Register	Description	Read
3:1086-3:1091	Cycle Log Start Time – Entry-15	Date/Time format
3:1092-3:1097	Cycle Log Start Time – Entry-16	Date/Time format
3:1098-3:1103	Cycle Log Start Time – Entry-17	Date/Time format
3:1104-3:1109	Cycle Log Start Time – Entry-18	Date/Time format
3:1110-3:1115	Cycle Log Start Time – Entry-19	Date/Time format
3:1116-3:1121	Cycle Log Start Time – Entry-20	Date/Time format
3:1122-3:1127	Cycle Log Start Time – Entry-21	Date/Time format
3:1128-3:1133	Cycle Log Start Time – Entry-22	Date/Time format
3:1134-3:1139	Cycle Log Start Time – Entry-23	Date/Time format
3:1140-3:1145	Cycle Log Start Time – Entry-24	Date/Time format
3:1146-3:1151	Cycle Log Start Time – Entry-25	Date/Time format
3:1152-3:1157	Cycle Log Start Time – Entry-26	Date/Time format
3:1158-3:1163	Cycle Log Start Time – Entry-27	Date/Time format
3:1164-3:1169	Cycle Log Start Time – Entry-28	Date/Time format
3:1170-3:1175	Cycle Log Start Time – Entry-29	Date/Time format
3:1176-3:1181	Cycle Log Start Time – Entry-30	Date/Time format
3:1182	Cycle Log Type – Entry-1	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup
3:1183	Cycle Log Type – Entry-2	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup
3:1184	Cycle Log Type – Entry-3	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup

Register	Description	Read
3:1185	Cycle Log Type – Entry-4	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup
3:1186	Cycle Log Type – Entry-5	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup
3:1187	Cycle Log Type – Entry-6	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup
3:1188	Cycle Log Type – Entry-7	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup
3:1189	Cycle Log Type – Entry-8	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup
3:1190	Cycle Log Type – Entry-9	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup
3:1191	Cycle Log Type – Entry-10	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup
3:1192	Cycle Log Type – Entry-11	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup

Register	Description	Read
3:1193	Cycle Log Type – Entry-12	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup
3:1194	Cycle Log Type – Entry-13	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup
3:1195	Cycle Log Type – Entry-14	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup
3:1196	Cycle Log Type – Entry-15	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup
3:1197	Cycle Log Type – Entry-16	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup
3:1198	Cycle Log Type – Entry-17	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup
3:1199	Cycle Log Type – Entry-18	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup
3:1200	Cycle Log Type – Entry-19	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup

Register	Description	Read
3:1201	Cycle Log Type – Entry-20	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup
3:1202	Cycle Log Type – Entry-21	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup
3:1203	Cycle Log Type – Entry-22	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup
3:1204	Cycle Log Type – Entry-23	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup
3:1205	Cycle Log Type – Entry-24	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup
3:1206	Cycle Log Type – Entry-25	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup
3:1207	Cycle Log Type – Entry-26	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup
3:1208	Cycle Log Type – Entry-27	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup

Register	Description	Read
3:1209	Cycle Log Type – Entry-28	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup
3:1210	Cycle Log Type – Entry-29	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup
3:1211	Cycle Log Type – Entry-30	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup
3:1212 - 3:1301	Reserved	N/A
3:1302 - 3:1204	Cycle Log Recycle Time – Entry-1	Elapsed Time format
3:1305 - 3:1207	Cycle Log Recycle Time – Entry-2	Elapsed Time format
3:1308 - 3:1210	Cycle Log Recycle Time – Entry-3	Elapsed Time format
3:1311 - 3:1213	Cycle Log Recycle Time – Entry-4	Elapsed Time format
3:1314 - 3:1216	Cycle Log Recycle Time – Entry-5	Elapsed Time format
3:1317 - 3:1219	Cycle Log Recycle Time – Entry-6	Elapsed Time format
3:1320 - 3:1222	Cycle Log Recycle Time – Entry-7	Elapsed Time format
3:1323 - 3:1225	Cycle Log Recycle Time – Entry-8	Elapsed Time format
3:1326 - 3:1228	Cycle Log Recycle Time – Entry-9	Elapsed Time format
3:1329 - 3:1231	Cycle Log Recycle Time – Entry-10	Elapsed Time format
3:1332 - 3:1234	Cycle Log Recycle Time – Entry-11	Elapsed Time format
3:1335 - 3:1237	Cycle Log Recycle Time – Entry-12	Elapsed Time format
3:1338 - 3:1240	Cycle Log Recycle Time – Entry-13	Elapsed Time format
3:1341 - 3:1243	Cycle Log Recycle Time – Entry-14	Elapsed Time format
3:1344 - 3:1346	Cycle Log Recycle Time – Entry-15	Elapsed Time format
3:1347 - 3:1349	Cycle Log Recycle Time – Entry-16	Elapsed Time format

Register	Description	Read
3:1350- 3:1352	Cycle Log Recycle Time – Entry-17	Elapsed Time format
3:1353- 3:1355	Cycle Log Recycle Time – Entry-18	Elapsed Time format
3:1356- 3:1358	Cycle Log Recycle Time – Entry-19	Elapsed Time format
3:1359- 3:1361	Cycle Log Recycle Time – Entry-20	Elapsed Time format
3:1362- 3:1364	Cycle Log Recycle Time – Entry-21	Elapsed Time format
3:1365- 3:1367	Cycle Log Recycle Time – Entry-22	Elapsed Time format
3:1368- 3:1370	Cycle Log Recycle Time – Entry-23	Elapsed Time format
3:1371- 3:1373	Cycle Log Recycle Time – Entry-24	Elapsed Time format
3:1374- 3:1376	Cycle Log Recycle Time – Entry-25	Elapsed Time format
3:1377- 3:1379	Cycle Log Recycle Time – Entry-26	Elapsed Time format
3:1380- 3:1382	Cycle Log Recycle Time – Entry-27	Elapsed Time format
3:1383- 3:1385	Cycle Log Recycle Time – Entry-28	Elapsed Time format
3:1386- 3:1388	Cycle Log Recycle Time – Entry-29	Elapsed Time format
3:1389- 3:1391	Cycle Log Recycle Time – Entry-30	Elapsed Time format
3:1392- 3:1394	Cycle Log Inject Time – Entry-1	Elapsed Time format
3:1395- 3:1397	Cycle Log Inject Time – Entry-2	Elapsed Time format
3:1398- 3:1400	Cycle Log Inject Time – Entry-3	Elapsed Time format
3:1401- 3:1403	Cycle Log Inject Time – Entry-4	Elapsed Time format
3:1404- 3:1406	Cycle Log Inject Time – Entry-5	Elapsed Time format
3:1407- 3:1409	Cycle Log Inject Time – Entry-6	Elapsed Time format
3:1410- 3:1412	Cycle Log Inject Time – Entry-7	Elapsed Time format
3:1413- 3:1415	Cycle Log Inject Time – Entry-8	Elapsed Time format
3:1416- 3:1418	Cycle Log Inject Time – Entry-9	Elapsed Time format
3:1419- 3:1421	Cycle Log Inject Time – Entry-10	Elapsed Time format
3:1422- 3:1424	Cycle Log Inject Time – Entry-11	Elapsed Time format
3:1425- 3:1427	Cycle Log Inject Time – Entry-12	Elapsed Time format

Register	Description	Read
3:1428- 3:1430	Cycle Log Inject Time – Entry-13	Elapsed Time format
3:1431- 3:1433	Cycle Log Inject Time – Entry-14	Elapsed Time format
3:1434- 3:1436	Cycle Log Inject Time – Entry-15	Elapsed Time format
3:1437- 3:1439	Cycle Log Inject Time – Entry-16	Elapsed Time format
3:1440- 3:1442	Cycle Log Inject Time – Entry-17	Elapsed Time format
3:1443- 3:1445	Cycle Log Inject Time – Entry-18	Elapsed Time format
3:1446- 3:1448	Cycle Log Inject Time – Entry-19	Elapsed Time format
3:1449- 3:1451	Cycle Log Inject Time – Entry-20	Elapsed Time format
3:1452- 3:1454	Cycle Log Inject Time – Entry-21	Elapsed Time format
3:1455- 3:1457	Cycle Log Inject Time – Entry-22	Elapsed Time format
3:1458- 3:1460	Cycle Log Inject Time – Entry-23	Elapsed Time format
3:1461- 3:1463	Cycle Log Inject Time – Entry-24	Elapsed Time format
3:1464- 3:1466	Cycle Log Inject Time – Entry-25	Elapsed Time format
3:1467- 3:1469	Cycle Log Inject Time – Entry-26	Elapsed Time format
3:1470- 3:1472	Cycle Log Inject Time – Entry-27	Elapsed Time format
3:1473- 3:1475	Cycle Log Inject Time – Entry-28	Elapsed Time format
3:1476- 3:1478	Cycle Log Inject Time – Entry-29	Elapsed Time format
3:1479- 3:1481	Cycle Log Inject Time – Entry-30	Elapsed Time format
3:1482	Cycle Log – Number of Pump Actuation Cycles – Entry- 1	0 – 65535
3:1483	Cycle Log – Number of Pump Actuation Cycles – Entry – 2	0 – 65535
3:1484	Cycle Log – Number of Pump Actuation Cycles – Entry – 3	0 – 65535
3:1485	Cycle Log – Number of Pump Actuation Cycles – Entry – 4	0 – 65535
3:1486	Cycle Log – Number of Pump Actuation Cycles – Entry – 5	0 – 65535
3:1487	Cycle Log – Number of Pump Actuation Cycles – Entry – 6	0 – 65535
3:1488	Cycle Log – Number of Pump Actuation Cycles – Entry – 7	0 – 65535
3:1489	Cycle Log – Number of Pump Actuation Cycles – Entry – 8	0 – 65535

Register	Description	Read
3:1490	Cycle Log – Number of Pump Actuation Cycles – Entry – 9	0 – 65535
3:1491	Cycle Log – Number of Pump Actuation Cycles – Entry – 10	0 – 65535
3:1492	Cycle Log – Number of Pump Actuation Cycles – Entry – 11	0 – 65535
3:1493	Cycle Log – Number of Pump Actuation Cycles – Entry – 12	0 – 65535
3:1494	Cycle Log – Number of Pump Actuation Cycles – Entry – 13	0 – 65535
3:1495	Cycle Log – Number of Pump Actuation Cycles – Entry – 14	0 – 65535
3:1496	Cycle Log – Number of Pump Actuation Cycles – Entry – 15	0 – 65535
3:1497	Cycle Log – Number of Pump Actuation Cycles – Entry – 16	0 – 65535
3:1498	Cycle Log – Number of Pump Actuation Cycles – Entry – 17	0 – 65535
3:1499	Cycle Log – Number of Pump Actuation Cycles – Entry – 18	0 – 65535
3:1500	Cycle Log – Number of Pump Actuation Cycles – Entry – 19	0 – 65535
3:1501	Cycle Log – Number of Pump Actuation Cycles – Entry – 20	0 – 65535
3:1502	Cycle Log – Number of Pump Actuation Cycles – Entry – 21	0 – 65535
3:1503	Cycle Log – Number of Pump Actuation Cycles – Entry – 22	0 – 65535
3:1504	Cycle Log – Number of Pump Actuation Cycles – Entry – 23	0 – 65535
3:1505	Cycle Log – Number of Pump Actuation Cycles – Entry – 24	0 – 65535
3:1506	Cycle Log – Number of Pump Actuation Cycles – Entry – 25	0 – 65535
3:1507	Cycle Log – Number of Pump Actuation Cycles – Entry – 26	0 – 65535
3:1508	Cycle Log – Number of Pump Actuation Cycles – Entry – 27	0 – 65535
3:1509	Cycle Log – Number of Pump Actuation Cycles – Entry – 28	0 – 65535
3:1510	Cycle Log – Number of Pump Actuation Cycles – Entry – 29	0 – 65535
3:1511	Cycle Log – Number of Pump Actuation Cycles – Entry – 30	0 – 65535
3:1512 - 3:2000	Reserved	N/A

Table 12 - Available Input Registers (Modbus Error Log)

Register	Description	Read
3:2001	Slave Access Failure Type. This register may be read to view details of the last Slave Device Failure or Illegal Data Address exception response (see §6.4).	0 – 12
3:2002	Slave Access Failure Bank. Contains the Modbus bank in which the last Slave Device Failure or Illegal Data Address exception response occurred. The bank returned does not include any address information.	0 – 4
3:2003	Slave Access Failure Register. Contains the register number at which the last Slave Device Failure or Illegal Data Address exception response occurred. The address returned does not include any bank information. For example, abcd is returned for an error at address 0:abcd, 1:abcd, 3:abcd, or 4:abcd.	0 – 65535
3:2004 – 3:2010	Reserved	N/A

Table 12 - Available Input Registers (Firmware Error Log)

Register	Description	Read
3:2011	Number of Log Entries	0- 20
3:2012 + 3(n – 1)	Error Log Type |20 Available error logs. "n" in the register column represents the error log number.	1 = System Definition Error 2 = Assertion Failure 3 = Check Failure 255 = No Error Log Available
3:2013 + 3(n – 1)	Error Log Data 1	Contact Profire for Details
3:2014 + 3(n – 1)	Error Log Data 2	Contact Profire for Details
4:0001 – 4:0002	Operator ID. Write either the operator ID or the Installer ID to gain access to protected registers.	Double Word format: 0- 9999999
4:0003 – 4:0004	Reserved	N/A
4:0005	Modbus Write Time. The amount of time to wait after the last written value before saving all changes to the controller.	0 – 65535 seconds. Writing zero (which is the default) will save all changes as they are made.
4:0006 – 4:0011	Controller Date/Time	Date/Time

Register	Description	Read
4:0012	Daylight Savings Time configuration	0 = Disabled 1 = Enabled
4:0013 – 4:0014	Day Start Time – Start of the gas day.	Elapsed Time format: 0 – 86340 (00:00: – 23:59) When in HH:MM:SS format, only Hours and Minutes are available.
4:0015	Cycle Restart Request State. This is will restart the controller with the selected state	0 = Inject 2 = Recycle
4:0016 – 4:0018	Cycle Restart Request Duration. The controller stays in the above state for this duration	Elapsed Time format: 0 – 17,280,000 (000:00:00 – 4800:00:00)
4:0019	Temperature Source	0 – Use internal temperature sensor 1 – Value as written to External Temperature Below
4:0020	External Temperature	-99 C to +99 C
4:0021	Internal Temperature Offset. Applies an offset to the reading taken from the internal temperature sensor.	10 C to +10 C
4:0022– 4:0030	Reserved	N/A

Table 12 - Available Input Registers (Well Information)

Register	Description	Read
4:0031	Pump 1 Pump Rate	1 – 1000 (Low Rate) 1 – 10000 (High Rate) (1000 = 100.0 L/day)
4:0032	Pump 1 Target Rate	1 – Pump Rate (1000 = 100.0 L/day)
4:0033	Program Mode	0 – Auto 1 – Custom
4:0034	Pump 1 Pressure	0 – 27580 kPa
4:0035	Pump 1 Pump Type	0 – Low Rate 1 – High Rate

Register	Description	Read
4:0036	Pump 1 Optimization	0 – Disabled 1 - Temperature
4:0037	Pump 1 Low Temp Target Rate – Rate to inject at when at low temperature.	0 – Pump Rate (1000 = 100.0 L/day)
4:0038	Pump 1 High Temp Target Rate – Rate to inject at when at high temperature.	0 – Pump Rate (1000 = 100.0 L/day)
4:0039	Pump 1 Low Temp – The Temperature at which to inject at the low temp target rate	0 C to High Temp- 1
4:0040	Pump 1 High Temp – The Temperature at which to inject at the high temp target rate	Low Temp +1 to 99 C
4:0041	Pump 2 Pump Rate	1 – 1000 (Low Rate) 1 – 10000 (High Rate) (1000 = 100.0 L/day)
4:0042	Pump 2 Target Rate	1 – Pump Rate (1000 = 100.0 L/day)
4:0043	Pump 2 Enable	0 – Disabled 1 – Enabled
4:0044	Pump 2 Pressure	0 – 27580 kPa
4:0045	Pump 2 Pump Type	0 – Low Rate 1 – High Rate
4:0046	Pump 2 Optimization	0 – Disabled 1 - Temperature
4:0047	Pump 2 Low Temp Target Rate – Rate to inject at when at low temperature.	0 – Pump Rate (1000 = 100.0 L/day)
4:0048	Pump 2 High Temp Target Rate – Rate to inject at when at high temperature.	0 – Pump Rate (1000 = 100.0 L/day)
4:0049	Pump 2 Low Temp – The Temperature at which to inject at the low temp target rate	0 C to High Temp- 1
4:0050	Pump 2 High Temp – The Temperature at which to inject at the high temp target rate	Low Temp +1 to 99 C

Table 12 - Available Input Registers (Timer Settings)

Register	Description	Read
4:0051 - 4:0053	Cycle Time	Elapsed Time format: 30 s – 3599 s (000:00:30 – 00:59:59)
4:0054 - 4:0056	Pump 1 Fine Tune Time	Elapsed Time format: 0s – 30s (000:00:00 – 00:00:30)
4:0057 - 4:0059	Pump 2 Fine Tune Time	Elapsed Time format: 0s – 30s (000:00:00 – 00:00:30)
4:0057– 4:0070	Reserved	N/A

Table 12 - Available Input Registers (Exception Handling)

Register	Description	Read
4:0071	Low Battery Fail Mode	0 – Fail Closed 1 – Fail Open
4:0072– 4:0080	Reserved	N/A

Table 12 - Available Input Registers (Device Configuration)

Register	Description	Read
4:0081	Line Pressure Device Configuration. Changes to this parameter will not take effect until the next cycle or a restart. A restart can be accomplished by setting the Controller restart coil (0:0003) high.	0 = Disabled 1 = Line Pressure Switch 2 = Line Pressure Sensor
4:0082Line Pressure Switch Mode	0 = Normally Open 1 = Normally Closed	
4:0083	Line Pressure Sensor Range. If the Line Pressure Sensor Range is modified the following parameters may be auto-updated: Line Pressure Trip Point Line Pressure Reset Point	100.0 – 5000.0 psi Where 1000 = 100.0
4:0084– 4:0100	Reserved	N/A

Register	Description	Read
4:0101	Tank Pressure Device Configuration. Changes to this parameter will not take effect until the next cycle or a restart. A restart can be accomplished by setting the Controller restart coil (0:0003) high.	0 = Disabled 1 = Line Pressure Switch 2 = Line Pressure Sensor
4:0102	Tank Pressure Switch Mode	0 = Normally Open 1 = Normally Closed
4:0103	Tank Pressure Sensor Range	1.000 – 50.000 psi Where 1000 = 1.000
4:0104– 4:0120	Reserved	N/A
4:0121	Pump Actuation Sensor Configuration	0 = Disabled 1 = Enabled
4:0122	Pump Actuation Sensor Switch Mode	0 = Normally Open 1 = Normally Closed
4:0123	Pump Actuation Sensor Monitor	0 = When Injecting (default) 1 = When Recycling 2 = Always

9 | Acronyms

Acronyms	Phrase
ADC	Analog-to-Digital Converter
AI	Analog Input
DAC	Digital-to-Analog Converter
DI	Digital Input
DO	Digital Output
ESD	Emergency Shut Down
N/C	Normally Closed
N/O	Normally Open
PSI	Pounds per Square Inch
PAS	Pump Actuation Sensor
R	Read Permission
RTU	Remote Terminal Unit
R/W	Read/Write Permission
SCADA	Supervisory Control And Data Acquisition
V	Volts
VFD	Vacuum Fluorescent Display
VI	Virtual Input
VFD	Vacuum Fluorescent Display
VI	Virtual Input

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