



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.

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1 | Introduction

1.1 | Purpose

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

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

1.2 | References

1. PC180 User Manual: July 2015
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 User Manual.

2.1 | Communication Settings

The Modbus menu is available inside the 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 set 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 parameter 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

<i>Data Bits</i>	<i>Parity</i>	<i>Stop Bits</i>	<i>Protocol</i>
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

<i>Code</i>	<i>Current Terminology</i>	<i>Classic Terminology</i>	<i>Data Resolution</i>
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

<i>Code</i>	<i>Response</i>
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 received (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

<i>Code</i>	<i>Operation</i>	<i>Modbus Address Notation</i>	<i>Message Address</i>
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 WriteTime 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 StartTime "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 production 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 production 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.

Error Type	Code	Description
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.
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)

<i>Register</i>	<i>Description</i>	<i>Read</i>	<i>Write</i>
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 Pump 1 Valve	N/A	1 – Open
0:0012	Manually Close Pump 1 Valve	N/A	1 – Close
0:0013	Manually Open Pump 2 Valve	N/A	1 – Open
0:0014	Manually Close Pump 2 Valve	N/A	1 – Close
0:0015	Manually Open Pump 3 Valve	N/A	1 - Open
0:0016	Manually Close Pump 3 Valve	N/A	1 - Close
0:0017 – 0:0018	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	Pump 1 Valve Status	0 - Valve Closed 1 - Valve Open
1:0022	Pump 2 Valve Status This valve status is only valid when Pump 2 is enabled.	0 - Valve Closed 1 - Valve Open
1:0023	Pump 3 Valve Status This valve status is only valid when Pump 3 is enabled.	0 - Valve Closed 1 - Valve Open
1:0024 – 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
1:0034	Artificial Lift optimization switch value. The register may only be read when the analog2 input is configured as an artificial lift switch.	0 – Artificial Lift Switch Reset 1 – Artificial Lift Switch Tripped
1:0035- 1:0040	Reserved	N/A
1:0041	Pump1 Alarm Status	0- 65535
1:0042	Pump2 Alarm Status	0- 65535
1:0043	Pump3 Alarm Status	0- 65535

8.3 | Input Registers

Table 12 - Available Input Registers (Controller Information)

<i>Register</i>	<i>Description</i>	<i>Read</i>
3:0001 – 3:0002	Controller Serial Number	Double Word format: 0- 99999
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 Note: This includes offsets.	-100 C to +100 C -147 F to +212 F
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)

Register	Description	Read
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	Line Temperature Value. This register may only be read when the Analog2 input is configured as a Line sensor	Contact Profile
3:0040	Line Temperature Device Status. The contents of this address are latched after executing a read operation of the Line Temperature Sensor Value (register 3:0038)	0- disabled 1 – scan pending 2- def change pending 3 – value under range 4 – value over range 5 – value invalid 6 – value valid
3:0041	H2S Sensor Value. This register may only be read when the Analog2 input is configured as an H2S sensor	0- max ppm for H2S sensor (i.e. 10 ppm)
3:0042	H2S Device Status. The contents of this address are latched after executing a read operation of the Line H2S Sensor Value (register 3:0041)	0- disabled 1 – scan pending 2- def change pending 3 – value under range 4 – value over range 5 – value invalid 6 – value valid
3:0043 – 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- 3:0065	Injection Time 3	Elapsed Time format: 1 – 1,799,998 (000:00:01 – 499:59:58)
3:0066- 3:0068	Recycle Time 3	Elapsed Time format: 1 – 1,799,998 (000:00:01 – 499:59:58)
3:0069 – 3:0090	Reserved	N/A
3:0091	Pump1 H2S Current Rate	0- 65535
3:0092	Pump1 H2S Delay Count	0- 65535
3:0093	Pump2 H2S Current Rate	0- 65535
3:0094	Pump2 H2S Delay Count	0- 65535
3:0095	Pump3 H2S Current Rate	0- 65535
3:0096	Pump3 H2S Delay Count	0- 65535
3:0097 – 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

Register	Description	Read
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
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 1 Cycles – Entry- 1	0 – 65535
3:0199	Daily Production Log – Number of Pump 1 Cycles – Entry – 2	0 – 65535
3:0200	Daily Production Log – Number of Pump 1 Cycles – Entry – 3	0 – 65535
3:0201	Daily Production Log – Number of Pump 1 Cycles – Entry – 4	0 – 65535
3:0202	Daily Production Log – Number of Pump 1 Cycles – Entry – 5	0 – 65535
3:0203	Daily Production Log – Number of Pump 1 Cycles – Entry- 6	0 – 65535
3:0204	Daily Production Log – Number of Pump 1 Cycles – Entry- 7	0 – 65535
3:0205	Daily Production Log – Number of Pump 1 Cycles – Entry- 8	0 – 65535
3:0206	Daily Production Log – Number of Pump 2 Cycles – Entry- 1	0 – 65535
3:0207	Daily Production Log – Number of Pump 2 Cycles – Entry- 2	0 – 65535

Register	Description	Read
3:0208	Daily Production Log – Number of Pump 2 Cycles – Entry- 3	0 – 65535
3:0209	Daily Production Log – Number of Pump 2 Cycles – Entry- 4	0 – 65535
3:0210	Daily Production Log – Number of Pump 2 Cycles – Entry- 5	0 – 65535
3:0211	Daily Production Log – Number of Pump 2 Cycles – Entry- 6	0 – 65535
3:0212	Daily Production Log – Number of Pump 2 Cycles – Entry- 7	0 – 65535
3:0213	Daily Production Log – Number of Pump 2 Cycles – Entry- 8	0 – 65535
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
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	Daily Production Log- High Line Pressure Recycle Count-1	0- 65535
3:0231	Daily Production Log- High Line Pressure Recycle Count-2	0- 65535
3:0232	Daily Production Log- High Line Pressure Recycle Count-3	0- 65535
3:0233	Daily Production Log- High Line Pressure Recycle Count-4	0- 65535

Register	Description	Read
3:0234	Daily Production Log- High Line Pressure Recycle Count-5	0- 65535
3:0235	Daily Production Log- High Line Pressure Recycle Count-6	0- 65535
3:0236	Daily Production Log- High Line Pressure Recycle Count-7	0- 65535
3:0237	Daily Production Log- High Line Pressure Recycle Count-8	0- 65535
3:0238	Daily Production Log- Artificial Lift Optimization Rate Change Count-1	0- 65535
3:0239	Daily Production Log- Artificial Lift Optimization Rate Change Count-2	0- 65535
3:0240	Daily Production Log- Artificial Lift Optimization Rate Change Count-3	0- 65535
3:0241	Daily Production Log- Artificial Lift Optimization Rate Change Count-4	0- 65535
3:0242	Daily Production Log- Artificial Lift Optimization Rate Change Count-5	0- 65535
3:0243	Daily Production Log- Artificial Lift Optimization Rate Change Count-6	0- 65535
3:0244	Daily Production Log- Artificial Lift Optimization Rate Change Count-7	0- 65535
3:0245	Daily Production Log- Artificial Lift Optimization Rate Change Count-8	0- 65535
3:0246-3:0261	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

Register	Description	Read
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
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	Daily Production Log – Number of Pump3 Pulses Entry-1	0- 65535
3:0287	Daily Production Log – Number of Pump3 Pulses Entry-2	0- 65535
3:0288	Daily Production Log – Number of Pump3 Pulses Entry-3	0- 65535
3:0289	Daily Production Log – Number of Pump3 Pulses Entry-4	0- 65535
3:0290	Daily Production Log – Number of Pump3 Pulses Entry-5	0- 65535
3:0291	Daily Production Log – Number of Pump3 Pulses Entry-6	0- 65535
3:0292	Daily Production Log – Number of Pump3 Pulses Entry-7	0- 65535
3:0293	Daily Production Log – Number of Pump3 Pulses Entry-8	0- 65535
3:0294-3:0296	Daily Production Log – Pump2 Recycle Time Entry-1	Elapsed Time format
8:0297-3:0299	Daily Production Log – Pump2 Recycle Time Entry-2	Elapsed Time format
3:0300-3:0302	Daily Production Log – Pump2 Recycle Time Entry-3	Elapsed Time format
3:0303-3:0305	Daily Production Log – Pump2 Recycle Time Entry-4	Elapsed Time format
3:0306-3:0308	Daily Production Log – Pump2 Recycle Time Entry-5	Elapsed Time format
3:0309-3:0311	Daily Production Log – Pump2 Recycle Time Entry-6	Elapsed Time format
3:0312-3:0314	Daily Production Log – Pump2 Recycle Time Entry-7	Elapsed Time format

Register	Description	Read
3:0315-3:0317	Daily Production Log – Pump2 Recycle Time Entry-8	Elapsed Time format
3:0318-3:0320	Daily Production Log – Pump2 Inject Time Entry-1	Elapsed Time format
3:0321-3:0323	Daily Production Log – Pump2 Inject Time Entry-2	Elapsed Time format
3:0324-3:0326	Daily Production Log – Pump2 Inject Time Entry-3	Elapsed Time format
3:0327-3:0329	Daily Production Log – Pump2 Inject Time Entry-4	Elapsed Time format
3:0330-3:0332	Daily Production Log – Pump2 Inject Time Entry-5	Elapsed Time format
3:0333-3:0335	Daily Production Log – Pump2 Inject Time Entry-6	Elapsed Time format
3:0336-3:0338	Daily Production Log – Pump2 Inject Time Entry-7	Elapsed Time format
3:0339-3:0341	Daily Production Log – Pump2 Inject Time Entry-8	Elapsed Time format
3:0342-3:0344	Daily Production Log – Pump3 Recycle Time Entry-1	Elapsed Time format
3:0345-3:0347	Daily Production Log – Pump3 Recycle Time Entry-2	Elapsed Time format
3:0348-3:0350	Daily Production Log – Pump3 Recycle Time Entry-3	Elapsed Time format
3:0351-3:0353	Daily Production Log – Pump3 Recycle Time Entry-4	Elapsed Time format
3:0354-3:0356	Daily Production Log – Pump3 Recycle Time Entry-5	Elapsed Time format
3:0357-3:0359	Daily Production Log – Pump3 Recycle Time Entry-6	Elapsed Time format
3:0360-3:0362	Daily Production Log – Pump3 Recycle Time Entry-7	Elapsed Time format
3:0363-3:0365	Daily Production Log – Pump3 Recycle Time Entry-8	Elapsed Time format
3:0366-3:0368	Daily Production Log – Pump3 Inject Time Entry-1	Elapsed Time format
3:0369-3:0371	Daily Production Log – Pump3 Inject Time Entry-2	Elapsed Time format
3:0372-3:0374	Daily Production Log – Pump3 Inject Time Entry-3	Elapsed Time format
3:0375-3:0377	Daily Production Log – Pump3 Inject Time Entry-4	Elapsed Time format
3:0378-3:0380	Daily Production Log – Pump3 Inject Time Entry-5	Elapsed Time format
3:0381-3:0383	Daily Production Log – Pump3 Inject Time Entry-6	Elapsed Time format
3:0384-3:0386	Daily Production Log – Pump3 Inject Time Entry-7	Elapsed Time format
3:0387-3:0389	Daily Production Log – Pump3 Inject Time Entry-8	Elapsed Time format
3:0390-3:1000	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
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

Register	Description	Read
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
3:1152-3:1181	Reserved	N/A
3:1182	Cycle Log Type – Entry-1	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup 9 = Artificial Lift Optimized
3:1183	Cycle Log Type – Entry-2	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup 9 = Artificial Lift Optimized
3:1184	Cycle Log Type – Entry-3	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup 9 = Artificial Lift Optimized
3:1185	Cycle Log Type – Entry-4	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup 9 = Artificial Lift Optimized
3:1186	Cycle Log Type – Entry-5	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup 9 = Artificial Lift Optimized
3:1187	Cycle Log Type – Entry-6	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup 9 = Artificial Lift Optimized

Register	Description	Read
3:1188	Cycle Log Type – Entry-7	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup 9 = Artificial Lift Optimized
3:1189	Cycle Log Type – Entry-8	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup 9 = Artificial Lift Optimized
3:1190	Cycle Log Type – Entry-9	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup 9 = Artificial Lift Optimized
3:1191	Cycle Log Type – Entry-10	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup 9 = Artificial Lift Optimized
3:1192	Cycle Log Type – Entry-11	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup 9 = Artificial Lift Optimized
3:1193	Cycle Log Type – Entry-12	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup 9 = Artificial Lift Optimized

Register	Description	Read
3:1194	Cycle Log Type – Entry-13	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup 9 = Artificial Lift Optimized
3:1195	Cycle Log Type – Entry-14	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup 9 = Artificial Lift Optimized
3:1196	Cycle Log Type – Entry-15	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup 9 = Artificial Lift Optimized
3:1197	Cycle Log Type – Entry-16	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup 9 = Artificial Lift Optimized
3:1198	Cycle Log Type – Entry-17	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup 9 = Artificial Lift Optimized
3:1199	Cycle Log Type – Entry-18	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup 9 = Artificial Lift Optimized

Register	Description	Read
3:1200	Cycle Log Type – Entry-19	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup 9 = Artificial Lift Optimized
3:1201	Cycle Log Type – Entry-20	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup 9 = Artificial Lift Optimized
3:1202	Cycle Log Type – Entry-21	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup 9 = Artificial Lift Optimized
3:1203	Cycle Log Type – Entry-22	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup 9 = Artificial Lift Optimized
3:1204	Cycle Log Type – Entry-23	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup 9 = Artificial Lift Optimized
3:1205	Cycle Log Type – Entry-24	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup 9 = Artificial Lift Optimized

Register	Description	Read
3:1206	Cycle Log Type – Entry-25	0 = Normal 4 = Low Battery Shutdown 5 = Operator Change 7 = Startup 9 = Artificial Lift Optimized
3:1207- 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
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

Register	Description	Read
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- 3:1391	Reserved	N/A
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
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

Register	Description	Read
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- 3:1481	Reserved	N/A
3:1482	Cycle Log – Number of Pump1 Pulses – Entry – 1	0 – 65535
3:1483	Cycle Log – Number of Pump1 Pulses – Entry – 2	0 – 65535
3:1484	Cycle Log – Number of Pump1 Pulses – Entry – 3	0 – 65535
3:1485	Cycle Log – Number of Pump1 Pulses – Entry – 4	0 – 65535
3:1486	Cycle Log – Number of Pump1 Pulses – Entry – 5	0 – 65535
3:1487	Cycle Log – Number of Pump1 Pulses – Entry – 6	0 – 65535
3:1488	Cycle Log – Number of Pump1 Pulses – Entry – 7	0 – 65535
3:1489	Cycle Log – Number of Pump1 Pulses – Entry – 8	0 – 65535
3:1490	Cycle Log – Number of Pump1 Pulses – Entry – 9	0 – 65535
3:1491	Cycle Log – Number of Pump1 Pulses – Entry – 10	0 – 65535
3:1492	Cycle Log – Number of Pump1 Pulses – Entry – 11	0 – 65535
3:1493	Cycle Log – Number of Pump1 Pulses – Entry – 12	0 – 65535
3:1494	Cycle Log – Number of Pump1 Pulses – Entry – 13	0 – 65535
3:1495	Cycle Log – Number of Pump1 Pulses – Entry – 14	0 – 65535
3:1496	Cycle Log – Number of Pump1 Pulses – Entry – 15	0 – 65535
3:1497	Cycle Log – Number of Pump1 Pulses – Entry – 16	0 – 65535
3:1498	Cycle Log – Number of Pump1 Pulses – Entry – 17	0 – 65535
3:1499	Cycle Log – Number of Pump1 Pulses – Entry – 18	0 – 65535
3:1500	Cycle Log – Number of Pump1 Pulses – Entry – 19	0 – 65535
3:1501	Cycle Log – Number of Pump1 Pulses – Entry – 20	0 – 65535
3:1502	Cycle Log – Number of Pump1 Pulses – Entry – 21	0 – 65535

Register	Description	Read
3:1503	Cycle Log – Number of Pump1 Pulses – Entry – 22	0 – 65535
3:1504	Cycle Log – Number of Pump1 Pulses – Entry – 23	0 – 65535
3:1505	Cycle Log – Number of Pump1 Pulses – Entry – 24	0 – 65535
3:1506	Cycle Log – Number of Pump1 Pulses – Entry – 25	0 – 65535
3:1507- 3:1511	Reserved	N/A
3:1512	Cycle Log – Number of Pump2 Pulses – Entry – 1	0 – 65535
3:1513	Cycle Log – Number of Pump2 Pulses – Entry – 2	0 – 65535
3:1514	Cycle Log – Number of Pump2 Pulses – Entry – 3	0 – 65535
3:1515	Cycle Log – Number of Pump2 Pulses – Entry – 4	0 – 65535
3:1516	Cycle Log – Number of Pump2 Pulses – Entry – 5	0 – 65535
3:1517	Cycle Log – Number of Pump2 Pulses – Entry – 6	0 – 65535
3:1518	Cycle Log – Number of Pump2 Pulses – Entry – 7	0 – 65535
3:1519	Cycle Log – Number of Pump2 Pulses – Entry – 8	0 – 65535
3:1520	Cycle Log – Number of Pump2 Pulses – Entry – 9	0 – 65535
3:1521	Cycle Log – Number of Pump2 Pulses – Entry – 10	0 – 65535
3:1522	Cycle Log – Number of Pump2 Pulses – Entry – 11	0 – 65535
3:1523	Cycle Log – Number of Pump2 Pulses – Entry – 12	0 – 65535
3:1524	Cycle Log – Number of Pump2 Pulses – Entry – 13	0 – 65535
3:1525	Cycle Log – Number of Pump2 Pulses – Entry – 14	0 – 65535
3:1526	Cycle Log – Number of Pump2 Pulses – Entry – 15	0 – 65535
3:1527	Cycle Log – Number of Pump2 Pulses – Entry – 16	0 – 65535
3:1528	Cycle Log – Number of Pump2 Pulses – Entry – 17	0 – 65535
3:1529	Cycle Log – Number of Pump2 Pulses – Entry – 18	0 – 65535
3:1530	Cycle Log – Number of Pump2 Pulses – Entry – 19	0 – 65535
3:1531	Cycle Log – Number of Pump2 Pulses – Entry – 20	0 – 65535
3:1532	Cycle Log – Number of Pump2 Pulses – Entry – 21	0 – 65535

Register	Description	Read
3:1533	Cycle Log – Number of Pump2 Pulses – Entry – 22	0 – 65535
3:1534	Cycle Log – Number of Pump2 Pulses – Entry – 23	0 – 65535
3:1535	Cycle Log – Number of Pump2 Pulses – Entry – 24	0 – 65535
3:1536	Cycle Log – Number of Pump2 Pulses – Entry – 25	0 – 65535
3:1537-3:1541	Reserved	N/A
3:1542	Cycle Log – Number of Pump3 Pulses – Entry – 1	0 – 65535
3:1543	Cycle Log – Number of Pump3 Pulses – Entry – 2	0 – 65535
3:1544	Cycle Log – Number of Pump3 Pulses – Entry – 3	0 – 65535
3:1545	Cycle Log – Number of Pump3 Pulses – Entry – 4	0 – 65535
3:1546	Cycle Log – Number of Pump3 Pulses – Entry – 5	0 – 65535
3:1547	Cycle Log – Number of Pump3 Pulses – Entry – 6	0 – 65535
3:1548	Cycle Log – Number of Pump3 Pulses – Entry – 7	0 – 65535
3:1549	Cycle Log – Number of Pump3 Pulses – Entry – 8	0 – 65535
3:1550	Cycle Log – Number of Pump3 Pulses – Entry – 9	0 – 65535
3:1551	Cycle Log – Number of Pump3 Pulses – Entry – 10	0 – 65535
3:1552	Cycle Log – Number of Pump3 Pulses – Entry – 11	0 – 65535
3:1553	Cycle Log – Number of Pump3 Pulses – Entry – 12	0 – 65535
3:1554	Cycle Log – Number of Pump3 Pulses – Entry – 13	0 – 65535
3:1555	Cycle Log – Number of Pump3 Pulses – Entry – 14	0 – 65535
3:1556	Cycle Log – Number of Pump3 Pulses – Entry – 15	0 – 65535
3:1557	Cycle Log – Number of Pump3 Pulses – Entry – 16	0 – 65535
3:1558	Cycle Log – Number of Pump3 Pulses – Entry – 17	0 – 65535
3:1559	Cycle Log – Number of Pump3 Pulses – Entry – 18	0 – 65535
3:1560	Cycle Log – Number of Pump3 Pulses – Entry – 19	0 – 65535
3:1561	Cycle Log – Number of Pump3 Pulses – Entry – 20	0 – 65535
3:1562	Cycle Log – Number of Pump3 Pulses – Entry – 21	0 – 65535

Register	Description	Read
3:1563	Cycle Log – Number of Pump3 Pulses – Entry – 22	0 – 65535
3:1564	Cycle Log – Number of Pump3 Pulses – Entry – 23	0 – 65535
3:1565	Cycle Log – Number of Pump3 Pulses – Entry – 24	0 – 65535
3:1566	Cycle Log – Number of Pump3 Pulses – Entry – 25	0 – 65535
3:1567-3:1571	Reserved	N/A
3:1572-3:1574	Cycle Log- Pump2 Recycle Time – Entry-1	Elapsed Time format
3:1575-3:1577	Cycle Log- Pump2 Recycle Time – Entry-2	Elapsed Time format
3:1578-3:1580	Cycle Log- Pump2 Recycle Time – Entry-3	Elapsed Time format
3:1581-3:1583	Cycle Log- Pump2 Recycle Time – Entry-4	Elapsed Time format
3:1584-3:1586	Cycle Log- Pump2 Recycle Time – Entry-5	Elapsed Time format
3:1587-3:1589	Cycle Log- Pump2 Recycle Time – Entry-6	Elapsed Time format
3:1590-3:1592	Cycle Log- Pump2 Recycle Time – Entry-7	Elapsed Time format
3:1593-3:1595	Cycle Log- Pump2 Recycle Time – Entry-8	Elapsed Time format
3:1596-3:1598	Cycle Log- Pump2 Recycle Time – Entry-9	Elapsed Time format
3:1599-3:1601	Cycle Log- Pump2 Recycle Time – Entry-10	Elapsed Time format
3:1602-3:1604	Cycle Log- Pump2 Recycle Time – Entry-11	Elapsed Time format
3:1605-3:1607	Cycle Log- Pump2 Recycle Time – Entry-12	Elapsed Time format
3:1608-3:1610	Cycle Log- Pump2 Recycle Time – Entry-13	Elapsed Time format
3:1611-3:1613	Cycle Log- Pump2 Recycle Time – Entry-14	Elapsed Time format
3:1614-3:1616	Cycle Log- Pump2 Recycle Time – Entry-15	Elapsed Time format
3:1617-3:1619	Cycle Log- Pump2 Recycle Time – Entry-16	Elapsed Time format
3:1620-3:1622	Cycle Log- Pump2 Recycle Time – Entry-17	Elapsed Time format
3:1623-3:1625	Cycle Log- Pump2 Recycle Time – Entry-18	Elapsed Time format
3:1626-3:1628	Cycle Log- Pump2 Recycle Time – Entry-19	Elapsed Time format
3:1629-3:1631	Cycle Log- Pump2 Recycle Time – Entry-20	Elapsed Time format
3:1632-3:1634	Cycle Log- Pump2 Recycle Time – Entry-21	Elapsed Time format

Register	Description	Read
3:1635-3:1637	Cycle Log- Pump2 Recycle Time – Entry-22	Elapsed Time format
3:1638-3:1640	Cycle Log- Pump2 Recycle Time – Entry-23	Elapsed Time format
3:1641-3:1643	Cycle Log- Pump2 Recycle Time – Entry-24	Elapsed Time format
3:1644-3:1646	Cycle Log- Pump2 Recycle Time – Entry-25	Elapsed Time format
3:1647-3:1661	Reserved	N/A
3:1662-3:1664	Cycle Log- Pump2 Inject Time – Entry-1	Elapsed Time format
3:1665-3:1667	Cycle Log- Pump2 Inject Time – Entry-2	Elapsed Time format
3:1668-3:1670	Cycle Log- Pump2 Inject Time – Entry-3	Elapsed Time format
3:1671-3:1673	Cycle Log- Pump2 Inject Time – Entry-4	Elapsed Time format
3:1674-3:1676	Cycle Log- Pump2 Inject Time – Entry-5	Elapsed Time format
3:1677-3:1679	Cycle Log- Pump2 Inject Time – Entry-6	Elapsed Time format
3:1680-3:1682	Cycle Log- Pump2 Inject Time – Entry-7	Elapsed Time format
3:1683-3:1685	Cycle Log- Pump2 Inject Time – Entry-8	Elapsed Time format
3:1686-3:1688	Cycle Log- Pump2 Inject Time – Entry-9	Elapsed Time format
3:1689-3:1691	Cycle Log- Pump2 Inject Time – Entry-10	Elapsed Time format
3:1692-3:1694	Cycle Log- Pump2 Inject Time – Entry-11	Elapsed Time format
3:1695-3:1697	Cycle Log- Pump2 Inject Time – Entry-12	Elapsed Time format
3:1698-3:1700	Cycle Log- Pump2 Inject Time – Entry-13	Elapsed Time format
3:1701-3:1703	Cycle Log- Pump2 Inject Time – Entry-14	Elapsed Time format
3:1704-3:1706	Cycle Log- Pump2 Inject Time – Entry-15	Elapsed Time format
3:1707-3:1709	Cycle Log- Pump2 Inject Time – Entry-16	Elapsed Time format
3:1710-3:1712	Cycle Log- Pump2 Inject Time – Entry-17	Elapsed Time format
3:1713-3:1715	Cycle Log- Pump2 Inject Time – Entry-18	Elapsed Time format
3:1716-3:1718	Cycle Log- Pump2 Inject Time – Entry-19	Elapsed Time format
3:1719-3:1721	Cycle Log- Pump2 Inject Time – Entry-20	Elapsed Time format
3:1722-3:1724	Cycle Log- Pump2 Inject Time – Entry-21	Elapsed Time format

Register	Description	Read
3:1725-3:1727	Cycle Log- Pump2 Inject Time – Entry-22	Elapsed Time format
3:1728-3:1730	Cycle Log- Pump2 Inject Time – Entry-23	Elapsed Time format
3:1731-3:1733	Cycle Log- Pump2 Inject Time – Entry-24	Elapsed Time format
3:1734-3:1736	Cycle Log- Pump2 Inject Time – Entry-25	Elapsed Time format
3:1737-3:1751	Reserved	N/A
3:1752-3:1754	Cycle Log- Pump3 Recycle Time- Entry-1	Elapsed Time format
3:1755-3:1757	Cycle Log- Pump3 Recycle Time- Entry-2	Elapsed Time format
3:1758-3:1760	Cycle Log- Pump3 Recycle Time- Entry-3	Elapsed Time format
3:1761-3:1763	Cycle Log- Pump3 Recycle Time- Entry-4	Elapsed Time format
3:1764-3:1766	Cycle Log- Pump3 Recycle Time- Entry-5	Elapsed Time format
3:1767-3:1769	Cycle Log- Pump3 Recycle Time- Entry-6	Elapsed Time format
3:1770-3:1772	Cycle Log- Pump3 Recycle Time- Entry-7	Elapsed Time format
3:1773-3:1775	Cycle Log- Pump3 Recycle Time- Entry-8	Elapsed Time format
3:1776-3:1778	Cycle Log- Pump3 Recycle Time- Entry-9	Elapsed Time format
3:1779-3:1781	Cycle Log- Pump3 Recycle Time- Entry-10	Elapsed Time format
3:1782-3:1784	Cycle Log- Pump3 Recycle Time- Entry-11	Elapsed Time format
3:1785-3:1787	Cycle Log- Pump3 Recycle Time- Entry-12	Elapsed Time format
3:1788-3:1790	Cycle Log- Pump3 Recycle Time- Entry-13	Elapsed Time format
3:1791-3:1793	Cycle Log- Pump3 Recycle Time- Entry-14	Elapsed Time format
3:1794-3:1796	Cycle Log- Pump3 Recycle Time- Entry-15	Elapsed Time format
3:1797-3:1799	Cycle Log- Pump3 Recycle Time- Entry-16	Elapsed Time format
3:1800-3:1802	Cycle Log- Pump3 Recycle Time- Entry-17	Elapsed Time format
3:1803-3:1805	Cycle Log- Pump3 Recycle Time- Entry-18	Elapsed Time format
3:1806-3:1808	Cycle Log- Pump3 Recycle Time- Entry-19	Elapsed Time format
3:1809-3:1811	Cycle Log- Pump3 Recycle Time- Entry-20	Elapsed Time format
3:1812-3:1814	Cycle Log- Pump3 Recycle Time- Entry-21	Elapsed Time format

Register	Description	Read
3:1815-3:1817	Cycle Log- Pump3 Recycle Time- Entry-22	Elapsed Time format
3:1818-3:1820	Cycle Log- Pump3 Recycle Time- Entry-23	Elapsed Time format
3:1821-3:1823	Cycle Log- Pump3 Recycle Time- Entry-24	Elapsed Time format
3:1824-3:1826	Cycle Log- Pump3 Recycle Time- Entry-25	Elapsed Time format
3:1827-3:1841	Reserved	N/A
3:1842-3:1844	Cycle Log- Pump3 Inject Time- Entry-1	Elapsed Time format
3:1845-3:1847	Cycle Log- Pump3 Inject Time- Entry-2	Elapsed Time format
3:1848-3:1850	Cycle Log- Pump3 Inject Time- Entry-3	Elapsed Time format
3:1851-3:1853	Cycle Log- Pump3 Inject Time- Entry-4	Elapsed Time format
3:1854-3:1856	Cycle Log- Pump3 Inject Time- Entry-5	Elapsed Time format
3:1857-3:1859	Cycle Log- Pump3 Inject Time- Entry-6	Elapsed Time format
3:1860-3:1862	Cycle Log- Pump3 Inject Time- Entry-7	Elapsed Time format
3:1863-3:1865	Cycle Log- Pump3 Inject Time- Entry-8	Elapsed Time format
3:1866-3:1868	Cycle Log- Pump3 Inject Time- Entry-9	Elapsed Time format
3:1869-3:1871	Cycle Log- Pump3 Inject Time- Entry-10	Elapsed Time format
3:1872-3:1874	Cycle Log- Pump3 Inject Time- Entry-11	Elapsed Time format
3:1875-3:1877	Cycle Log- Pump3 Inject Time- Entry-12	Elapsed Time format
3:1878-3:1880	Cycle Log- Pump3 Inject Time- Entry-13	Elapsed Time format
3:1881-3:1883	Cycle Log- Pump3 Inject Time- Entry-14	Elapsed Time format
3:1884-3:1886	Cycle Log- Pump3 Inject Time- Entry-15	Elapsed Time format
3:1887-3:1889	Cycle Log- Pump3 Inject Time- Entry-16	Elapsed Time format
3:1890-3:1892	Cycle Log- Pump3 Inject Time- Entry-17	Elapsed Time format
3:1893-3:1895	Cycle Log- Pump3 Inject Time- Entry-18	Elapsed Time format
3:1896-3:1898	Cycle Log- Pump3 Inject Time- Entry-19	Elapsed Time format
3:1899-3:1901	Cycle Log- Pump3 Inject Time- Entry-20	Elapsed Time format
3:1902-3:1904	Cycle Log- Pump3 Inject Time- Entry-21	Elapsed Time format

Register	Description	Read
3:1905-3:1907	Cycle Log- Pump3 Inject Time- Entry-22	Elapsed Time format
3:1908-3:1910	Cycle Log- Pump3 Inject Time- Entry-23	Elapsed Time format
3:1911-3:1913	Cycle Log- Pump3 Inject Time- Entry-24	Elapsed Time format
3:1914-3:1916	Cycle Log- Pump3 Inject Time- Entry-25	Elapsed Time format
3:1917-3:2000	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
3:2014 + 3(n – 1)	Error Log Data 2	Contact ETC for Details

Register	Description	Read
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 ETC for Details
3:2014 + 3(n - 1)	Error Log Data 2	Contact ETC for Details

Table 13 - Available Input Registers (Firmware Error Log)

Register	Description	Read
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
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

Register	Description	Read
4:0020	External Temperature	-99 C to +99 C -146 F to +210 F
4:0021	Internal Temperature Offset. Applies an offset to the reading taken from the internal temperature sensor.	-10 C to +10 C -10 F to +10 F
4:0022– 4:0030	Reserved	N/A

Table 13 - Available Input Registers (Well Information)

Register	Description	Read
4:0031	Pump 1 Pump Rate	1 – 1000 (Low Rate Metric) 1 – 10000 (High Rate Metric) 1- 263 (Low Rate Imperial) 1- 2631 (High Rate Imperial) (1000 = 100.0 L/day or 100.0 gallons/day)
4:0032	Pump 1 Target Rate	1 – Pump Rate (1000 = 100.0 L/day or 100.0 gallons/day)
4:0033	Reserved	N/A
4:0034	Pump 1 Pressure	0 – 27580 kPa 0- 4000 psi
4:0035	Pump 1 Pump Type	0 – Low Rate 1 – High Rate
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 or 100.0 gallons a 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 or 100.0 gallons a 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 32 F to High Temp- 1

Register	Description	Read
4:0040	Pump 1 High Temp – The Temperature at which to inject at the high temp target rate	Low Temp +1 to 99 C Low Temp +1 to 148 F
4:0041	Pump 2 Pump Rate	1 – 1000 (Low Rate Metric) 1 – 10000 (High Rate Metric) 1- 263 (Low Rate Imperial) 1- 2631 (High Rate Imperial) (1000 = 100.0 L/day or 100.0 gallons/day)
4:0042	Pump 2 Target Rate	1 – Pump Rate (1000 = 100.0 L/day or 100.0 gallons/day)
4:0043	Pump 2 Enable	0 – Disabled 1 – Enabled
4:0044	Pump 2 Pressure	0 – 27580 kPa 0- 4000 psi
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 or 100.0 gallons/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 or 100.0 gallons/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 32 F 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 Low Temp +1 to 148 F

Table 13 - Available Input Registers (Timer Settings)

Register	Description	Read
4:0051- 4:0053	Cycle Time	Deprecated
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)
4:0060- 4:0062	Pump 3 Fine Tune Time	Elapsed Time format: 0s – 30s (000:00:00 – 00:00:30)
4:0063- 4:0070	Reserved	N/A

Table 13 - Available Input Registers (Exception Handling)

Register	Description	Read
4:0071	Low Battery Fail Mode	0 – Fail Closed 1 – Fail Open
4:0072	High Line Pressure Recycle Enable	0 – Disabled 1 – Enabled
4:0073	Pump Pulse Alarm Enable	0- Disabled 1- Enabled
4:0074	Pump Pulse Alarm Period	0- 1000 cycles
4:0075– 4:0080	Reserved	N/A

Table 13 - Available Input Registers (Device Configuration)

Register	Description	Read
4:0081	This register has been deprecated. 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 = Pressure Switch 2 = Pressure Sensor
4:0082	This register has been deprecated. Line Pressure Switch Mode	0 = Normally Open 1 = Normally Closed

Register	Description	Read
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 689.5 – 34475.0 kPa Where 1000 = 100.0
4:0084– 4:0090	Reserved	N/A
4:0091	Digital Input Configuration	0 = Disabled 1 = Pump Pulse1
4:0092	Analog1 Input Configuration	0 = Disabled 1 = Tank Sensor 2 = Tank Switch 3 = Pump Pulse2
4:0093	Analog2 Input Configuration	0 = Disabled 1 = Line Pressure Sensor 2 = Line Pressure Switch 3 = Artificial Lift Optimization Switch 4 = Pump Pulse3 5 = Line Temperature
4:0094-4:0100	Reserved	N/A
4:0101	This register has been deprecated. 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 = Pressure Switch 2 = Pressure Sensor
4:0102	This register has been deprecated. Tank Pressure Switch Mode	0 = Normally Open 1 = Normally Closed
4:0103	Tank Pressure Sensor Range	1.000 – 50.000 psi 6.895 – 34.475 kPa Where 1000 = 1.000
4:0104– 4:0110	Reserved	N/A
4:0111	H2S Sensor Range	0 – 100.0 ppm
4:0112 – 4:0120	Reserved	N/A

Register	Description	Read
4:0121	This register has been deprecated. Pump Actuation Sensor Configuration	0 = Disabled 1 = Enabled
4:0122	Pump Actuation Sensor Switch Mode	0 = Normally Open 1 = Normally Closed
4:0123	This register has been deprecated. Pump Actuation Sensor Monitor	0 = When Injecting (default) 1 = When Recycling 2 = Always
4:0124- 4:0130	Reserved	N/A
4:0131	Pump 3 Pump Rate	1- 1000 (Low Rate Metric) 1- 10000 (High Rate Metric) 1- 263 (Low Rate Imperial) 1- 2631 (High Rate Imperial)
4:0132	Pump 3 Target Rate	1- Pump Rate (1000 = 100.0L/day or 100.0 gallons/day)
4:0133	Program Mode	0- Auto 1- Custom
4:0134	Pump 3 Pressure	0- 27580 kPa 0- 4000 psi
4:0135	Pump 3 Pump Type	0- Low Rate 1- High Rate
4:0136	Pump 3 Optimization	0- Disabled 1- Temperature
4:0137	Pump 3 Low Temp Target Rate- Rate to inject at when at low temperature.	0- Pump Rate (1000 = 100.0 L/day or 100.0 gallons/day)
4:0138	Pump 3 High Temp Target Rate- Rate to inject at when at high temperature.	0- Pump Rate (1000 = 100.0 L/day or 100.0 gallons/day)

Register	Description	Read
4:0139	Pump 3 Low Temp-The temperature at which to inject at the low temp target rate.	0 C to High Temp -1 32 F to High Temp -1
4:0140	Pump 3 High Temp-The temperature at which to inject at the high temp target rate.	Low Temp +1 to 99 C High Temp +1 to 148 F
4:0141- 4:0150	Reserved	N/A

Table 13 - Artificial Lift Optimization

Register	Description	Read
4:0151	Artificial Lift Injection Optimization	0- Disable 1- Enable
4:0152	Pump 1 Rate (Production Rate)	0- Pump Rate (1000 = 100.0 L/day or 100.0 gallons/day)
4:0153	Pump 2 Rate (Shut In Rate)	0- Pump Rate (1000 = 100.0L/day or 100.0gallons/day)
4:0154	Pump 2 Rate 1 (Production Rate)	0- Pump Rate (1000 = 100.0 L/day or 100.0 gallons/day)
4:0155	Pump 2 Rate 2 (Shut In Rate)	0- Pump Rate (1000 = 100.0 L/day or 100.0 gallons/day)
4:0156	Pump 3 Rate 1 (Production Rate)	0- Pump Rate (1000 = 100.0 L/day or 100.0 gallons/day)
4:0157	Pump 3 Rate 2 (Shut In Rate)	0- Pump Rate (1000 = 100.0 L/day or 100.0 gallons/day)
4:0158-4:0170	Reserved	N/A

Table 13 - Line Pressure Optimization

Register	Description	Read
4:0171	Pump 1 Low Line Pressure- Line pressure at which to inject at the low target rate	0- Max Line Pressure psi (Multiplied by 10 to show decimal resolution. i.e. 100 = 10.0 psi)
4:0172	Pump 1 High Line Pressure- Line pressure at which to inject at the high target rate	0- Max Line Pressure psi (Multiplied by 10 to show decimal resolution. i.e. 100 = 10.0 psi)
4:0173	Pump 2 Low Line Pressure- Line pressure at which to inject at the low target rate	0- Max Line Pressure psi (Multiplied by 10 to show decimal resolution. i.e. 100 = 10.0 psi)
4:0174	Pump 2 High Line Pressure- Line pressure at which to inject at the high target rate	0- Max Line Pressure psi (Multiplied by 10 to show decimal resolution. i.e. 100 = 10.0 psi)
4:0175	Pump 3 Low Line Pressure- Line pressure at which to inject at the low target rate	0- Max Line Pressure psi (Multiplied by 10 to show decimal resolution. i.e. 100 = 10.0 psi)
4:0176	Pump 3 High Line Pressure- Line pressure at which to inject at the high target rate	0- Max Line Pressure psi (Multiplied by 10 to show decimal resolution. i.e. 100 = 10.0 psi)

Table 13 - Available Input Registers (H2S Optimization)

Register	Description	Read
4:0181	H2S Optimization	0- Disable 1- Enable
4:0182	H2S Threshold	0 – H2S Sensor input range ppm
4:0183	Pump 1 H2S Increase Rate	0- Pump 1 H2S Injection Rate Limit
4:0184	Pump 1 H2S Increase Delay	0 – 100 cycles
4:0185	Pump 1 H2S Decrease Rate	0- Pump 1 H2S Injection Rate Limit
4:0186	Pump 1 H2S Decrease Delay	0 – 100 cycles
4:0187	Pump 1 H2S Injection Rate Limit	0- Pump Rate
4:0188	Pump 2 H2S Increase Rate	0- Pump 2 H2S Injection Rate Limit
4:0189	Pump 2 H2S Increase Delay	0 – 100 cycles

Register	Description	Read
4:0190	Pump 2 H2S Decrease Rate	0- Pump 2 H2S Injection Rate Limit
4:0191	Pump 2 H2S Decrease Delay	0 – 100 cycles
4:0192	Pump 2 H2S Injection Rate Limit	0- Pump Rate
4:0193	Pump 3 H2S Increase Rate	0- Pump 3 H2S Injection Rate Limit
4:0194	Pump 3 H2S Increase Delay	0 – 100 cycles
4:0195	Pump 3 H2S Decrease Rate	0- Pump 3 H2S Injection Rate Limit
4:0196	Pump 3 H2S Decrease Delay	0 – 100 cycles
4:0197	Pump 3 H2S Injection Rate Limit	0- Pump Rate

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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