

# Model 600

# Model 650

## Modbus Communications User Guide



**WELL MASTER** CORPORATION

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Model 600/Model 650 Modbus Communications User Guide

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#### Revision History

Rev	Date	Author	Changes
1.x.x	17/12/2010	Mark Scantlebury	Initial Version
1.1.x	8/2/2011	Ahmad Haydar	Add support for grayed register. And added Cycle restart state and duration, and close CP type
1.1.x	12/4/2011	Ahmad Haydar	Add danger velocity and clean up the time remaining description.
1.1.1	25/4/2011	Ahmad Haydar	Add Valve Auto Catch Status to Modbus Add more details to cycle log and daily production.
1.3.x	29/2/2012	Mark Scantlebury	Add in the new registers for Afterflow and Close time that is the combination of the Min and Extended times. Renamed Max Open to Max Afterflow.
1.4.x	27/04/2012	Mark Scantlebury	Add in the ability to get/set units. Add in more optimization modes Additional plunger arrival sensor settings and statuses.
1.6.x	19/09/2013	Mark Scantlebury	Add in vent time tracking, total stats and plunger stats. Add in Valve B Purge

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## 1 Introduction

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

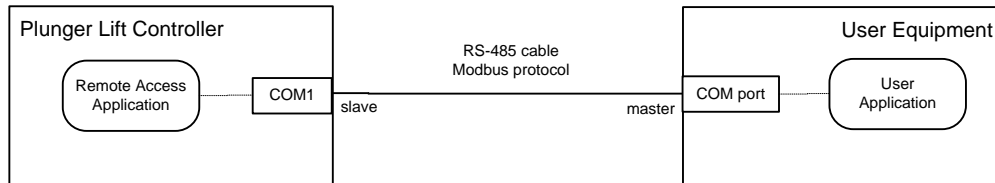


Figure 1 - High Level Connection Overview

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] Model 600/Model 650 *Installation and Operations Manual*; v 1.6.x Sept 19, 2013;
- [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 Model 600 Installation and Operations 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 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 Model 600 has a 2-wire RS-485 port (COM 1) that operates as a Modbus Slave. The feature set associated with COM 2 on the 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 Model 600/Model 650 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 Model 600/Model 650 Modbus station address is configured using the front panel only (range: 1 – 247), but has a default value of 1. The Model 600/Model 650 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 Model 600/Model 650 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 Model 600/Model 650 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**

<b>Code</b>	<b>Current Terminology</b>	<b>Classic Terminology</b>	<b>Data Resolution</b>
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**

<b>Code</b>	<b>Response</b>
01	Illegal Function
02	Illegal Data Address
03	Illegal Data Value
04	Slave Device Failure

The Model 600/Model 650 performs consistency checks on the following items received in commands:

- number of bytes received<sup>1</sup>
- *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 Model 600/Model 650 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: <i>abcd</i>	<i>abcd</i>
02	Read Input Discretes	1: <i>abcd</i>	<i>abcd</i>
03	Read Multiple Registers	4: <i>abcd</i>	<i>abcd</i>

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<sup>1</sup> In the Modbus ASCII protocol, a single byte is sent as 2 HEX-ASCII characters.

04	Read Input Registers	3: <i>abcd</i>	<i>abcd</i>
05	Write Coil	0: <i>abcd</i>	<i>abcd</i>
06	Write Single Register	4: <i>abcd</i>	<i>abcd</i>
15	Force Multiple Coils	0: <i>abcd</i>	<i>abcd</i>
16	Write Multiple Registers	4: <i>abcd</i>	<i>abcd</i>

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 Model 600/Model 650 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 Model 600/Model 650 parameters to read and modify. This imposes special requirements on the *User Application*.

The information within the Model 600/Model 650 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 Model 600/Model 650 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 event happens. For the plunger cycle logs, the history is written each time that a cycle starts (controller moves from Close to Rise). 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 Model 600/Model 650 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.

Model 600/Model 650 register set formats are defined in §7.1.

## 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 Plunger Lift Controller Algorithm

Changes to plunger lift 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 plunger lift cycle or 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 plunger lift cycle when the controller moves from Close to Rise.
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 is 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
<b>MODBUS_ACCESS_DENIED</b>	01	Modbus access to registers has been lockout from the device front panel. Only registers 1:0300, and 3:0300-3:0302 are accessible.
<b>FUNCTION_NOT_SUPPORTED</b>	02	The specified functionality of this register is not available in this firmware version.
<b>FEATURE_NOT_ENABLED</b>	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.
<b>FUNCTION_NOT_ENABLED</b>	04	The application attempted to access a data item that requires activation via another register.
<b>DEVICE_NOT_ENABLED</b>	05	The application attempted to access a real device which is not present (i.e. enabled) in the Model 600/Model 650 configuration.
<b>DATASET_NOT_LOCKED</b>	06	The application attempted to write to a dataset which was not locked.
<b>DEPENDENT_DATASET_NOT_LOCKED</b>	07	The application attempted to modify parameter in a locked dataset that required an auto update parameter in an unlocked dependent dataset.

Error Type	Code	Description
<b>DATASET_ALREADY_LOCKED</b>	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.
<b>VALUE_OUT_OF_RANGE</b>	09	The preset value for a register was outside the acceptable range of values.
<b>WRITE_SEQUENCE_ERROR</b>	10	The registers in a register set were not written in the proper order.
<b>LOG_NOT_SELECTED</b>	11	The application attempted to read a data value belonging to a historical log which has not been loaded.
<b>LOW_BATTERY</b>	12	The request could not be performed because the Model 600/Model 650 is in a low battery condition.



## 7 Address Assignments

The following sections outline the available register formats and the specific registers that are currently available. Please note that 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.

### 7.1 Register Formats

MSW = most significant word (16 bits)

LSW = least significant word (16-bits)

#### 7.1.1 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

#### 7.1.2 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

### 7.1.3 Double Word Register

Table 9 - Double Word Register Format

Number	Description
Start	MSW
Start + 1	LSW

## 7.2 Coils

Table 10 - Available Coils

Register	Description	Read	Write
<b>Basic Control</b>			
0:0001	Open  Mimic the Open button functionality from the keypad.	N/A	1 – Open
0:0002	Close  Mimic the Close 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

Register	Description	Read	Write
0:0006	Reset Error Logs	N/A	1 - Reset Log
0:0007	Time Format	Current Value	0 – Seconds 1 – H:M:S
0:0008	Stop Hold Open	N/A	1 – Open
0:0009	Stop Hold Closed	N/A	1 – Close
0:0010	Units	N/A	0 - Imperial 1 - Metric
0:0011	Reset Total Production Log	N/A	1 - Reset Log
0:0012	Reset Plunger Statistics	N/A	1 - Reset Log

### 7.3 Input Discretes

Table 11 - Available Input Discretes

Register	Description	Read
<b>Controller Information</b>		
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. (see § <b>Error! Reference source not found.</b> ).	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 – 1:0013	Reserved	N/A

Register	Description	Read
1:0014	Product Feature – Timer Based Optimization	0 – Feature disabled 1 – Feature enabled
1:0015 – 1:0020	Reserved	N/A
<b>Output Status</b>		
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	Auto Catch Status	0 - Valve Auto Catch closed 1 - Valve Auto Catch open
1:0024	Plunger Status	0 – Absent  1 - Present
1:0025 – 1:0030	Reserved	N/A
<b>Input Device Status</b>		
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 <i>Line Pressure Device</i> is enabled as a switch (see register 4:0241)  The value returned from this register may be invalid. The validity of the reading can be determined by reading the Line Pressure Device Status (see register 3:0052).	0 – Line Pressure Reset 1 – Line Pressure Tripped

Register	Description	Read
1:0033	<p>Casing Pressure Switch Value</p> <p>The registers may only be read when the <i>Casing Pressure Device</i> is enabled as a switch (see register 4:0261)</p> <p>The value returned from this register may be invalid. The validity of the reading can be determined by reading the Casing Pressure Device Status (see register 3:0053).</p>	<p>0 – Casing Pressure Reset</p> <p>1 – Casing Pressure Tripped</p>
1:0034	<p>Differential Pressure Switch Value</p> <p>The registers may only be read when the <i>Differential Pressure Device</i> is enabled as a switch (see register 4:0291)</p> <p>The value returned from this register may be invalid. The validity of the reading can be determined by reading the Differential Pressure Device Status (see register 3:0054).</p>	<p>0 – Flow DP Reset</p> <p>1 – Flow DP Tripped</p>
1:0035	<p>Flow Switch Value</p> <p>The registers may only be read when the <i>Flow Device</i> is enabled as a switch (see register 4:0311)</p> <p>The value returned from this register may be invalid. The validity of the reading can be determined by reading the Flow Device Status (see register 3:0055).</p>	<p>0 – Flow Reset</p> <p>1 – Flow Tripped</p>

## 7.4 Input Registers

Table 12 - Available Input Registers

Register	Description	Read
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Register	Description	Read
<b>Controller Information</b>		
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 = Afterflow 1 = Afterflow Delay 2 = Close 3 = Non-Arrival Close 4 = Extended Afterflow 5 = Rise 6 = Stopped 7 = Extra Close
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

Register	Description	Read
3:0021	Controller Status Reason	0 = Fast Trip 1 = High Line Pressure 2 = High Casing Line Diff 3 = Low CP Rate of Change 4 = Low Casing Pressure 5 = Low Battery 6 = Low Flow 7 = Max Open Time Expired 8 = Non-Arrival 9 = Normal Operation 10 = Operator Command 11 = Startup 12 = Danger Velocity
3:0022 – 3:0030	Reserved	N/A
<b>Input Device Value</b>		
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)

Register	Description	Read
3:0032	<p>Line Pressure Value</p> <p>The registers may only be read when the <i>Line Pressure Device</i> is enabled as a sensor (see register 4:6030).</p> <p>The value returned from this register may be invalid. The validity of the reading can be determined by reading the Line Pressure Valid Flag (input discrete 1:0011).</p>	<p>0 – Max Line Pressure psi</p> <p>(Multiplied by 10 to show decimal resolution. i.e. 100 = 10.0 psi)</p>
3:0033	Casing Pressure Value	<p>0 – Max Casing Pressure psi</p> <p>(Multiplied by 10 to show decimal resolution. i.e. 100 = 10.0 psi)</p>
3:0034	Differential Pressure Value	<p>0 – Max Differential “ WC</p> <p>(Multiplied by 10 to show decimal resolution. i.e. 100 = 10.0 “ WC)</p>
3:0035	Flow Value	<p>0 – Max Flow e3m3/d</p> <p>(Multiplied by 10 to show decimal resolution. i.e. 100 = 10.0 e3m3/d)</p>
3:0036 – 3:0050	Reserved	N/A
3:0051	<p>Battery Voltage Status</p> <p>The contents of this address are latched after executing a read operation of the Battery Voltage Value (register 3:0002).</p>	<p>1 - scan pending</p> <p>2 - def change pending</p> <p>3 – value under range</p> <p>4 – value over range</p> <p>5 – value invalid</p> <p>6 – value valid</p>



Register	Description	Read
3:0052	Line Pressure Device Status  The contents of this address are latched after executing a read operation of the Line Pressure Switch Value (input discrete 1:0003) or the Line Pressure Sensor Value (register 3:0003).	0 - disabled 1 - scan pending 2 - def change pending 3 - value under range 4 - value over range 5 - value invalid 6 - value valid
3:0053	Casing Pressure Device Status	0 - disabled 1 - scan pending 2 - def change pending 3 - value under range 4 - value over range 5 - value invalid 6 - value valid
3:0054	Differential Pressure Device Status	0 - disabled 1 - scan pending 2 - def change pending 3 - value under range 4 - value over range 5 - value invalid 6 - value valid
3:0055	Flow Device Status	0 - disabled 1 - scan pending 2 - def change pending 3 - value under range 4 - value over range 5 - value invalid 6 - value valid
3:0056 – 3:0100	Reserved	N/A
<b>Daily Production Log</b>		
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

Register	Description	Read
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 - Open Time - Entry -1	Elapsed Time format
3:0153 - 3:0155	Daily Production Log - Open Time - Entry -2	Elapsed Time format
3:0156 - 3:0158	Daily Production Log - Open Time - Entry -3	Elapsed Time format
3:0159 - 3:0161	Daily Production Log - Open Time - Entry -4	Elapsed Time format
3:0162 - 3:0164	Daily Production Log - Open Time - Entry -5	Elapsed Time format
3:0165 - 3:0167	Daily Production Log - Open Time - Entry -6	Elapsed Time format
3:0168 - 3:0170	Daily Production Log - Open Time - Entry -7	Elapsed Time format
3:0171 - 3:0173	Daily Production Log - Open Time - Entry -8	Elapsed Time format
3:0174 - 3:0176	Daily Production Log - Close Time - Entry -1	Elapsed Time format
3:0177 - 3:0179	Daily Production Log - Close Time - Entry -2	Elapsed Time format
3:0180 - 3:0182	Daily Production Log - Close Time - Entry -3	Elapsed Time format
3:0183 - 3:0185	Daily Production Log - Close Time - Entry -4	Elapsed Time format
3:0186 - 3:0188	Daily Production Log - Close Time - Entry -5	Elapsed Time format
3:0189 - 3:0191	Daily Production Log - Close Time - Entry -6	Elapsed Time format
3:0192 - 3:0194	Daily Production Log - Close Time - Entry -7	Elapsed Time format
3:0195 - 3:0197	Daily Production Log - Close Time - Entry -8	Elapsed Time format
3:0198 - 3:0199	Daily Production Log - Prod Volume - Entry -1	0 - 4294967296

Register	Description	Read
3:0200 - 3:0201	Daily Production Log - Prod Volume - Entry -2	0 - 4294967296
3:0202 - 3:0203	Daily Production Log - Prod Volume - Entry -3	0 - 4294967296
3:0204 - 3:0205	Daily Production Log - Prod Volume - Entry -4	0 - 4294967296
3:0206 - 3:0207	Daily Production Log - Prod Volume - Entry -5	0 - 4294967296
3:0208 - 3:0209	Daily Production Log - Prod Volume - Entry -6	0 - 4294967296
3:0210 - 3:0211	Daily Production Log - Prod Volume - Entry -7	0 - 4294967296
3:0212 - 3:0213	Daily Production Log - Prod Volume - Entry -8	0 - 4294967296
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 Arrival Count -1	0 - 65535
3:0223	Daily Production Log - Normal Arrival Count -2	0 - 65535
3:0224	Daily Production Log - Normal Arrival Count -3	0 - 65535
3:0225	Daily Production Log - Normal Arrival Count -4	0 - 65535
3:0226	Daily Production Log - Normal Arrival Count -5	0 - 65535
3:0227	Daily Production Log - Normal Arrival Count -6	0 - 65535
3:0228	Daily Production Log - Normal Arrival Count -7	0 - 65535
3:0229	Daily Production Log - Normal Arrival Count -8	0 - 65535

Register	Description	Read
3:0230	Daily Production Log - Non-Arrival Count -1	0 - 65535
3:0231	Daily Production Log - Non-Arrival Count -2	0 - 65535
3:0232	Daily Production Log - Non-Arrival Count -3	0 - 65535
3:0233	Daily Production Log - Non-Arrival Count -4	0 - 65535
3:0234	Daily Production Log - Non-Arrival Count -5	0 - 65535
3:0235	Daily Production Log - Non-Arrival Count -6	0 - 65535
3:0236	Daily Production Log - Non-Arrival Count -7	0 - 65535
3:0237	Daily Production Log - Non-Arrival Count -8	0 - 65535
3:0238	Daily Production Log - Fast Trip Count- Entry -1	0 - 65535
3:0239	Daily Production Log - Fast Trip Count- Entry -2	0 - 65535
3:0240	Daily Production Log - Fast Trip Count- Entry -3	0 - 65535
3:0241	Daily Production Log - Fast Trip Count- Entry -4	0 - 65535
3:0242	Daily Production Log - Fast Trip Count- Entry -5	0 - 65535
3:0243	Daily Production Log - Fast Trip Count- Entry -6	0 - 65535
3:0244	Daily Production Log - Fast Trip Count- Entry -7	0 - 65535
3:0245	Daily Production Log - Fast Trip Count- Entry -8	0 - 65535
3:0246	Daily Production Log - Line Pressure Shut-in Count - Entry -1	0 - 65535
3:0247	Daily Production Log - Line Pressure Shut-in Count - Entry -2	0 - 65535
3:0248	Daily Production Log - Line Pressure Shut-in Count - Entry -3	0 - 65535
3:0249	Daily Production Log - Line Pressure Shut-in Count - Entry -4	0 - 65535

Register	Description	Read
3:0250	Daily Production Log - Line Pressure Shut-in Count - Entry -5	0 - 65535
3:0251	Daily Production Log - Line Pressure Shut-in Count - Entry -6	0 - 65535
3:0252	Daily Production Log - Line Pressure Shut-in Count - Entry -7	0 - 65535
3:0253	Daily Production Log - Line Pressure Shut-in Count - Entry -8	0 - 65535
3:0254	Daily Production Log – Max Open Count - 1	0 - 65535
3:0255	Daily Production Log – Max Open Count - 2	0 - 65535
3:0256	Daily Production Log – Max Open Count - 3	0 - 65535
3:0257	Daily Production Log – Max Open Count - 4	0 - 65535
3:0258	Daily Production Log – Max Open Count - 5	0 - 65535
3:0259	Daily Production Log – Max Open Count - 6	0 - 65535
3:0260	Daily Production Log – Max Open Count - 7	0 - 65535
3:0261	Daily Production Log – Max Open Count - 8	0 - 65535
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

Register	Description	Read
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
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 – Danger Count – Entry -1	0 - 65535
3:0287	Daily Production Log – Danger Count – Entry -2	0 - 65535

Register	Description	Read
3:0288	Daily Production Log – Danger Count – Entry -3	0 - 65535
3:0289	Daily Production Log – Danger Count – Entry -4	0 - 65535
3:0290	Daily Production Log – Danger Count – Entry -5	0 - 65535
3:0291	Daily Production Log – Danger Count – Entry -6	0 - 65535
3:0292	Daily Production Log – Danger Count – Entry -7	0 - 65535
3:0293	Daily Production Log – Danger Count – Entry -8	0 - 65535
3:0294 - 3:0296	Daily Production Log - Vent Time - Entry -1	Elapsed Time format
3:0297 - 3:0299	Daily Production Log - Vent Time - Entry -2	Elapsed Time format
3:0300 - 3:0302	Daily Production Log - Vent Time - Entry -3	Elapsed Time format
3:0303 - 3:0305	Daily Production Log - Vent Time - Entry -4	Elapsed Time format
3:0306 - 3:0308	Daily Production Log - Vent Time - Entry -5	Elapsed Time format
3:0309 - 3:0311	Daily Production Log - Vent Time - Entry -6	Elapsed Time format
3:0312 - 3:0314	Daily Production Log - Vent Time - Entry -7	Elapsed Time format
3:0315 - 3:0317	Daily Production Log - Vent Time - Entry -8	Elapsed Time format
3:0318 – 3:0900	Reserved	N/A
<b>Total Production Log</b>		
3:0901 - 3:0906	Total Production Log - Reset Time	Date/Time format
3:0907 - 3:0909	Total Production Log - Open Time	Elapsed Time format
3:0910 - 3:0912	Total Production Log - Close Time	Elapsed Time format
3:0913 - 3:0914	Total Production Log - Prod Volume	0 - 4294967296
3:0915	Total Production Log - Cycle Count	0 - 65535
3:0916	Total Production Log - Normal Arrival Count	0 - 65535
3:0917	Total Production Log - Fast Trip Count	0 - 65535

Register	Description	Read
3:0918	Total Production Log - Line Pressure Shut-in Count	0 - 65535
3:0919	Total Production Log – Max Open Count	0 - 65535
3:0920	Total Production Log – Low Battery Count	0 - 65535
3:0921	Total Production Log – Operator Change Count	0 - 65535
3:0922	Total Production Log – Startup Count	0 - 65535
3:0923	Total Production Log – Danger Count	0 - 65535
3:0924 - 3:0926	Total Production Log - Vent Time	Elapsed Time format
3:0927 – 3:0980	Reserved	N/A
<b>Plunger Statistics</b>		
3:0981 - 3:0986	Plunger Statistics - Reset Time	Date/Time format
3:0987 – 3:0988	Total Plunger Arrivals	0 - 4294967296
3:0989 – 3:0990	Total Plunger kms Travelled	0 - 4294967296
3:0991 – 3:1000	Reserved	N/A
<b>Plunger Cycle Log</b>		
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



Register	Description	Read
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	Cycle Log Type – Entry -1	0 = Normal  1 = Fast-Trip  2 = Non-Arrival  3 = Max Open  4 = Low Battery Shutdown  5 = Operator Change  6 = Line Pressure Shut In  7 = Startup  8 = Danger Velocity

Register	Description	Read
3:1123	Cycle Log Type – Entry -2	0 = Normal 1 = Fast-Trip 2 = Non-Arrival 3 = Max Open 4 = Low Battery Shutdown 5 = Operator Change 6 = Line Pressure Shut In 7 = Startup 8 = Danger Velocity
3:1124	Cycle Log Type – Entry -3	0 = Normal 1 = Fast-Trip 2 = Non-Arrival 3 = Max Open 4 = Low Battery Shutdown 5 = Operator Change 6 = Line Pressure Shut In 7 = Startup 8 = Danger Velocity

Register	Description	Read
3:1125	Cycle Log Type – Entry -4	0 = Normal 1 = Fast-Trip 2 = Non-Arrival 3 = Max Open 4 = Low Battery Shutdown 5 = Operator Change 6 = Line Pressure Shut In 7 = Startup 8 = Danger Velocity
3:1126	Cycle Log Type – Entry -5	0 = Normal 1 = Fast-Trip 2 = Non-Arrival 3 = Max Open 4 = Low Battery Shutdown 5 = Operator Change 6 = Line Pressure Shut In 7 = Startup 8 = Danger Velocity

Register	Description	Read
3:1127	Cycle Log Type – Entry -6	0 = Normal 1 = Fast-Trip 2 = Non-Arrival 3 = Max Open 4 = Low Battery Shutdown 5 = Operator Change 6 = Line Pressure Shut In 7 = Startup 8 = Danger Velocity
3:1128	Cycle Log Type – Entry -7	0 = Normal 1 = Fast-Trip 2 = Non-Arrival 3 = Max Open 4 = Low Battery Shutdown 5 = Operator Change 6 = Line Pressure Shut In 7 = Startup 8 = Danger Velocity

Register	Description	Read
3:1129	Cycle Log Type – Entry -8	0 = Normal 1 = Fast-Trip 2 = Non-Arrival 3 = Max Open 4 = Low Battery Shutdown 5 = Operator Change 6 = Line Pressure Shut In 7 = Startup 8 = Danger Velocity
3:1130	Cycle Log Type – Entry -9	0 = Normal 1 = Fast-Trip 2 = Non-Arrival 3 = Max Open 4 = Low Battery Shutdown 5 = Operator Change 6 = Line Pressure Shut In 7 = Startup 8 = Danger Velocity

Register	Description	Read
3:1131	Cycle Log Type – Entry -10	0 = Normal 1 = Fast-Trip 2 = Non-Arrival 3 = Max Open 4 = Low Battery Shutdown 5 = Operator Change 6 = Line Pressure Shut In 7 = Startup 8 = Danger Velocity
3:1132	Cycle Log Type – Entry -11	0 = Normal 1 = Fast-Trip 2 = Non-Arrival 3 = Max Open 4 = Low Battery Shutdown 5 = Operator Change 6 = Line Pressure Shut In 7 = Startup 8 = Danger Velocity

Register	Description	Read
3:1133	Cycle Log Type – Entry -12	0 = Normal 1 = Fast-Trip 2 = Non-Arrival 3 = Max Open 4 = Low Battery Shutdown 5 = Operator Change 6 = Line Pressure Shut In 7 = Startup 8 = Danger Velocity
3:1134	Cycle Log Type – Entry -13	0 = Normal 1 = Fast-Trip 2 = Non-Arrival 3 = Max Open 4 = Low Battery Shutdown 5 = Operator Change 6 = Line Pressure Shut In 7 = Startup 8 = Danger Velocity

Register	Description	Read
3:1135	Cycle Log Type – Entry -14	0 = Normal 1 = Fast-Trip 2 = Non-Arrival 3 = Max Open 4 = Low Battery Shutdown 5 = Operator Change 6 = Line Pressure Shut In 7 = Startup 8 = Danger Velocity
3:1136	Cycle Log Type – Entry -15	0 = Normal 1 = Fast-Trip 2 = Non-Arrival 3 = Max Open 4 = Low Battery Shutdown 5 = Operator Change 6 = Line Pressure Shut In 7 = Startup 8 = Danger Velocity



Register	Description	Read
3:1173	Cycle Log Type – Entry -16	0 = Normal 1 = Fast-Trip 2 = Non-Arrival 3 = Max Open 4 = Low Battery Shutdown 5 = Operator Change 6 = Line Pressure Shut In 7 = Startup 8 = Danger Velocity
3:1138	Cycle Log Type – Entry -17	0 = Normal 1 = Fast-Trip 2 = Non-Arrival 3 = Max Open 4 = Low Battery Shutdown 5 = Operator Change 6 = Line Pressure Shut In 7 = Startup 8 = Danger Velocity

Register	Description	Read
3:1139	Cycle Log Type – Entry -18	0 = Normal 1 = Fast-Trip 2 = Non-Arrival 3 = Max Open 4 = Low Battery Shutdown 5 = Operator Change 6 = Line Pressure Shut In 7 = Startup 8 = Danger Velocity
3:1140	Cycle Log Type – Entry -19	0 = Normal 1 = Fast-Trip 2 = Non-Arrival 3 = Max Open 4 = Low Battery Shutdown 5 = Operator Change 6 = Line Pressure Shut In 7 = Startup 8 = Danger Velocity

Register	Description	Read
3:1141	Cycle Log Type – Entry -20	0 = Normal 1 = Fast-Trip 2 = Non-Arrival 3 = Max Open 4 = Low Battery Shutdown 5 = Operator Change 6 = Line Pressure Shut In 7 = Startup 8 = Danger Velocity
3:1142 - 3:1144	Cycle Log Rise Time – Entry -1	Elapsed Time format
3:1145 - 3:1147	Cycle Log Rise Time – Entry -2	Elapsed Time format
3:1148 - 3:1150	Cycle Log Rise Time – Entry -3	Elapsed Time format
3:1151 - 3:1153	Cycle Log Rise Time – Entry -4	Elapsed Time format
3:1154 - 3:1156	Cycle Log Rise Time – Entry -5	Elapsed Time format
3:1157 - 3:1159	Cycle Log Rise Time – Entry -6	Elapsed Time format
3:1160 - 3:1162	Cycle Log Rise Time – Entry -7	Elapsed Time format
3:1163 - 3:1165	Cycle Log Rise Time – Entry -8	Elapsed Time format
3:1166 - 3:1168	Cycle Log Rise Time – Entry -9	Elapsed Time format
3:1169 - 3:1171	Cycle Log Rise Time – Entry -10	Elapsed Time format
3:1172 - 3:1174	Cycle Log Rise Time – Entry -11	Elapsed Time format
3:1175 - 3:1177	Cycle Log Rise Time – Entry -12	Elapsed Time format
3:1178 - 3:1180	Cycle Log Rise Time – Entry -13	Elapsed Time format
3:1181 - 3:1183	Cycle Log Rise Time – Entry -14	Elapsed Time format

Register	Description	Read
3:1184 - 3:1186	Cycle Log Rise Time – Entry -15	Elapsed Time format
3:1187 - 3:1189	Cycle Log Rise Time – Entry -16	Elapsed Time format
3:1190 - 3:1192	Cycle Log Rise Time – Entry -17	Elapsed Time format
3:1193 - 3:1195	Cycle Log Rise Time – Entry -18	Elapsed Time format
3:1196 - 3:1198	Cycle Log Rise Time – Entry -19	Elapsed Time format
3:1199 - 3:1201	Cycle Log Rise Time – Entry -20	Elapsed Time format
3:1202 - 3:1204	Cycle Log Afterflow Time – Entry -1	Elapsed Time format
3:1205 - 3:1207	Cycle Log Afterflow Time – Entry -2	Elapsed Time format
3:1208 - 3:1210	Cycle Log Afterflow Time – Entry -3	Elapsed Time format
3:1211 - 3:1213	Cycle Log Afterflow Time – Entry -4	Elapsed Time format
3:1214 - 3:1216	Cycle Log Afterflow Time – Entry -5	Elapsed Time format
3:1217 - 3:1219	Cycle Log Afterflow Time – Entry -6	Elapsed Time format
3:1220 - 3:1222	Cycle Log Afterflow Time – Entry -7	Elapsed Time format
3:1223 - 3:1225	Cycle Log Afterflow Time – Entry -8	Elapsed Time format
3:1226 - 3:1228	Cycle Log Afterflow Time – Entry -9	Elapsed Time format
3:1229 - 3:1231	Cycle Log Afterflow Time – Entry -10	Elapsed Time format
3:1232 - 3:1234	Cycle Log Afterflow Time – Entry -11	Elapsed Time format
3:1235 - 3:1237	Cycle Log Afterflow Time – Entry -12	Elapsed Time format
3:1238 - 3:1240	Cycle Log Afterflow Time – Entry -13	Elapsed Time format
3:1241 - 3:1243	Cycle Log Afterflow Time – Entry -14	Elapsed Time format
3:1244 - 3:1246	Cycle Log Afterflow Time – Entry -15	Elapsed Time format
3:1247 - 3:1249	Cycle Log Afterflow Time – Entry -16	Elapsed Time format
3:1250 - 3:1252	Cycle Log Afterflow Time – Entry -17	Elapsed Time format

Register	Description	Read
3:1253 - 3:1255	Cycle Log Afterflow Time – Entry -18	Elapsed Time format
3:1256 - 3:1258	Cycle Log Afterflow Time – Entry -19	Elapsed Time format
3:1259 - 3:1261	Cycle Log Afterflow Time – Entry -20	Elapsed Time format
3:1262 - 3:1264	Cycle Log Close Time – Entry -1	Elapsed Time format
3:1265 - 3:1267	Cycle Log Close Time – Entry -2	Elapsed Time format
3:1268 - 3:1270	Cycle Log Close Time – Entry -3	Elapsed Time format
3:1271 - 3:1273	Cycle Log Close Time – Entry -4	Elapsed Time format
3:1274 - 3:1276	Cycle Log Close Time – Entry -5	Elapsed Time format
3:1277 - 3:1279	Cycle Log Close Time – Entry -6	Elapsed Time format
3:1280 - 3:1282	Cycle Log Close Time – Entry -7	Elapsed Time format
3:1283 - 3:1285	Cycle Log Close Time – Entry -8	Elapsed Time format
3:1286 - 3:1288	Cycle Log Close Time – Entry -9	Elapsed Time format
3:1289 - 3:1291	Cycle Log Close Time – Entry -10	Elapsed Time format
3:1292 - 3:1294	Cycle Log Close Time – Entry -11	Elapsed Time format
3:1295 - 3:1297	Cycle Log Close Time – Entry -12	Elapsed Time format
3:1298 - 3:1300	Cycle Log Close Time – Entry -13	Elapsed Time format
3:1301 - 3:1303	Cycle Log Close Time – Entry -14	Elapsed Time format
3:1304 - 3:1306	Cycle Log Close Time – Entry -15	Elapsed Time format
3:1307 - 3:1309	Cycle Log Close Time – Entry -16	Elapsed Time format
3:1310 - 3:1312	Cycle Log Close Time – Entry -17	Elapsed Time format
3:1313 - 3:1315	Cycle Log Close Time – Entry -18	Elapsed Time format
3:1316 - 3:1318	Cycle Log Close Time – Entry -19	Elapsed Time format
3:1319 - 3:1321	Cycle Log Close Time – Entry -20	Elapsed Time format

Register	Description	Read
3:1322 - 3:1324	Cycle Log Vent Time – Entry -1	Elapsed Time format
3:1325 - 3:1327	Cycle Log Vent Time – Entry -2	Elapsed Time format
3:1328 - 3:1330	Cycle Log Vent Time – Entry -3	Elapsed Time format
3:1331 - 3:1333	Cycle Log Vent Time – Entry -4	Elapsed Time format
3:1334 - 3:1336	Cycle Log Vent Time – Entry -5	Elapsed Time format
3:1337 - 3:1339	Cycle Log Vent Time – Entry -6	Elapsed Time format
3:1340 - 3:1342	Cycle Log Vent Time – Entry -7	Elapsed Time format
3:1343 - 3:1345	Cycle Log Vent Time – Entry -8	Elapsed Time format
3:1346 - 3:1348	Cycle Log Vent Time – Entry -9	Elapsed Time format
3:1349 - 3:1351	Cycle Log Vent Time – Entry -10	Elapsed Time format
3:1352 - 3:1354	Cycle Log Vent Time – Entry -11	Elapsed Time format
3:1355 - 3:1357	Cycle Log Vent Time – Entry -12	Elapsed Time format
3:1358 - 3:1360	Cycle Log Vent Time – Entry -13	Elapsed Time format
3:1361 - 3:1363	Cycle Log Vent Time – Entry -14	Elapsed Time format
3:1364 - 3:1366	Cycle Log Vent Time – Entry -15	Elapsed Time format
3:1367 - 3:1369	Cycle Log Vent Time – Entry -16	Elapsed Time format
3:1370 - 3:1372	Cycle Log Vent Time – Entry -17	Elapsed Time format
3:1373 - 3:1375	Cycle Log Vent Time – Entry -18	Elapsed Time format
3:1376 - 3:1378	Cycle Log Vent Time – Entry -19	Elapsed Time format
3:1379 - 3:1381	Cycle Log Vent Time – Entry -20	Elapsed Time format
3:1382 – 3:2000	Reserved	N/A

Register	Description	Read
<b>Modbus Error Log</b>		
3:2001	<p>Slave Access Failure Type</p> <p>This register may be read to view details of the last <i>Slave Device Failure</i> or <i>Illegal Data Address</i> exception response (see §6.4).</p>	0 – 12
3:2002	<p>Slave Access Failure Bank</p> <p>Contains the Modbus bank in which the last <i>Slave Device Failure</i> or <i>Illegal Data Address</i> exception response occurred. The bank returned does not include any address information.</p>	0 – 4
3:2003	<p>Slave Access Failure Register</p> <p>Contains the register number at which the last <i>Slave Device Failure</i> or <i>Illegal Data Address</i> exception response occurred. The address returned does not include any bank information. For example, <i>abcd</i> is returned for an error at address 0:<i>abcd</i>, 1:<i>abcd</i>, 3:<i>abcd</i>, or 4:<i>abcd</i>.</p>	0 – 65535
3:2004 – 3:2010	Reserved	N/A
<b>Firmware Error Log</b>		
3:2011	Number of Log Entries	0 - 20
3:2012 + 3(n – 1)	<p>Error Log Type</p> <p>20 Available error logs.</p> <p>“n” in the register column represents the error log number.</p>	<p>1 = System Definition Error</p> <p>2 = Assertion Failure</p> <p>3 = Check Failure</p> <p>255 = No Error Log Available</p>

Register	Description	Read
3:2013 + 3(n – 1)	Error Log Data 1	Contact for Details
3:2014 + 3(n – 1)	Error Log Data 2	Contact for Details

## 7.5 Holding Registers

Table 13 - Available Holding Registers

Register	Description	Read/Write
<b>General Controller Settings</b>		
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 will restart the controller with the selected state	0 = Close  1 = Rise  2 = AfterFlow



Register	Description	Read/Write
4:0016 – 4:0018	Cycle Restart Request Duration  The controller stays in the above state for this duration	Elapsed Time format: 0 – 1,800,000 (000:00:00 – 500:00:00)
4:0019– 4:0090	Reserved	N/A
<b>Well Information</b>		
4:0091	Plunger Type	0 = Conventional  1 = Free Cycle  2 = Continuous
4:0092	Well Depth	1 – 50,000 m
4:0093	Fast Trip Velocity	1 – 2500 m/min
4:0094	Rise Velocity	1 – 2500 m/min
4:0095	Target Velocity	1 – 2500 m/min
4:0096	Close Velocity	1 – 2500 m/min
4:0097	Danger Velocity	1 – 2500 m/min
<b>Timer Settings</b>		
4:0098 – 4:0100	Danger Time	Elapsed Time format: 1 – 1,800,000 (000:00:00 – 499:59:56)  A value of zero disables the timer.
4:0101 – 4:0103	Minimum Close Time	Elapsed Time format: 1 – 1,800,000 (000:00:01 – 500:00:00)
4:0104 – 4:0106	Non-Arrival Close Time	Elapsed Time format: 1 – 1,800,000 (000:00:01 – 500:00:00)

Register	Description	Read/Write
4:0107 – 4:0109	<p>Rise Time</p> <p>If the <i>Rise Duration</i> is modified the following parameters <i>may</i> be auto-updated:</p> <ul style="list-style-type: none"> <li>• <i>Max Open Time</i></li> <li>• <i>Tank Delay Time</i></li> </ul>	Elapsed Time format: 0 – 1,799,999 (000:00:00 – 499:59:59)
4:0110 – 4:0112	<p>Tank Delay Time</p> <p>The maximum value for the <i>Tank Delay Time</i> parameter is the lesser of: 499h59m59s and the current <i>Rise Time</i> parameter value.</p> <p>Valid only if Valve B is configured as a Tank Valve and the <i>Arrival Sensor</i> is enabled.</p>	Elapsed Time format: 0 – 1,799,999 (000:00:00 – 499:59:59)
4:0113 – 4:0115	Fast Trip Time	<p>Elapsed Time format: 0 – 1,799,997 (000:00:00 – 499:59:57)</p> <p>A value of zero disables the timer.</p>
4:0116 – 4:0118	Target Rise Time	Elapsed Time format: 1 – 1,799,998 (000:00:01 – 499:59:58)
4:0119 – 4:0121	Afterflow Delay	Elapsed Time format: 0 – 36,000 (00:00:00 – 10:00:00)
4:0122 – 4:0124	Minimum Afterflow Time	Elapsed Time format: 1 – 1,800,000 (000:00:01 – 500:00:00)
4:0125 – 4:0127	Arrival Guard Time	Elapsed Time format: 1 – 600 (000:00:00 – 00:10:00)

Register	Description	Read/Write
4:0128 – 4:0130	Extended Afterflow Time	Elapsed Time format: 0 – 1,799,999 (000:00:00 – 499:59:59)
4:0131 – 4:0133	Max Afterflow Time	Elapsed Time format: 1 – 1,800,000 (000:00:00 – 500:00:00)
4:0134 – 4:0136	Extended Close Time	Elapsed Time format: 0 – 1,799,999 (000:00:00 – 499:59:59)
4:0137 – 4:0139	Max Close Time	Elapsed Time format: 1 – 1,800,000 (000:00:00 – 500:00:00)
4:0140 – 4:0142	PAS Delay Time	Elapsed Time format: 0 – 1,799,999 (000:00:00 – 499:59:57)
4:0143 – 4:0145	Close Time (Sum of Min Close Time and Extended Close Time)	Elapsed Time format: 1 – 1,800,000 (000:00:00 – 500:00:00)
4:0146 – 4:0148	Afterflow Time (Sum of Min Afterflow Time and Extended Afterflow Time)	Elapsed Time format: 1 – 1,800,000 (000:00:00 – 500:00:00)
4:0149 – 4:0150	Reserved	N/A
<b>Virtual Sensors</b>		
4:0151	Reserved	N/A
4:0152	Reserved	N/A
4:0153	Reserved	N/A
4:0154	Virtual Flow Value	0 – 500.0 e3m3/d (5000 = 500.0)
4:0155 – 4:0170	Reserved	N/A

Register	Description	Read/Write
<b>Exception Handling</b>		
4:0171	Non-Arrival Count	0 – 99
4:0172	Fast-Trip Count	0 – 99
4:0173	Low Battery Fail Mode	0 – Fail Closed 1 – Fail Open
4:0174	Fast Trip Fail Mode	0 – Fail Closed 1 – Fail Open
4:0175	Non-Arrival Fail Mode	0 – Fail Closed 1 – Fail Open
4:0176 – 4:0200	Reserved	N/A
<b>Device Configuration</b>		
4:0201	Optimization Type  Specifies the type of optimization scheme to use. Only optimization types that have been enabled are available here.	0 = Disabled  1 = Pressure Optimization  2 = Afterflow Timer Optimization  3 = Close Timer Optimization  4 = Close Then Afterflow Optimization
4:0202	Afterflow Scale Factor  Is used to scale the adjustments that are made to the Afterflow Time.	0 – 100%  0 will disable all adjustments
4:0203	Close Casing Pressure Type	1 = Rate Drop  2 = Absolute

Register	Description	Read/Write
4:0204	<p>Close Scale Factor</p> <p>Is used to scale the adjustments that are made to the Close Time.</p>	<p>0 – 100%</p> <p>0 will disable all adjustments</p>
4:0205	<p>Valve B Configuration</p> <p>When the valve is enabled:</p> <ul style="list-style-type: none"> <li>its wiring location defaults to the first free location</li> <li>The valve is closed</li> </ul> <p>If the <i>Valve B configuration</i> is modified the following parameters <i>may</i> be auto-updated:</p> <ul style="list-style-type: none"> <li><i>Tank Delay Time</i></li> </ul>	<p>0 = Disabled</p> <p>1 = Line, Valve A only open during After-Flow</p> <p>2 = Line, Valves A and B open during After-Flow</p> <p>3 = Tank</p> <p>4 = Flow Control</p> <p>5 = Purge</p>
4:0206	<p>Proportional Adjustment Type</p> <p>Adjusts using difference between the Maximum and Minimum times for a given parameter or uses the current time.</p> <p>i.e. When using Afterflow optimization, scale adjustments based on Maximum Afterflow – Min Afterflow or the current Afterflow Time.</p>	<p>0 – Max – Min</p> <p>1 – Current Time</p>
4:0207 – 4:0220	Reserved	
4:0221	Arrival Sensor Configuration	<p>0 = Disabled</p> <p>1 = Enabled</p>
4:0222	Arrival Switch Mode	<p>0 = Normally Open</p> <p>1 = Normally Closed</p>

Register	Description	Read/Write
4:0223	Arrival Sensor Power	0 = Rise Only 1 = When Open 2 = Always On
4:0224 – 4:0240	Reserved	
4:0241	Line Pressure Device Configuration	0 = Disabled 1 = Line Pressure Switch 2 = Line Pressure Sensor
4:0242	Line Pressure Switch Mode	0 = Normally Open 1 = Normally Closed
4:0243	<p>Line Pressure Sensor Range</p> <p>If the <i>Line Pressure Sensor Range</i> is modified the following parameters <i>may</i> be auto-updated:</p> <ul style="list-style-type: none"> <li>• <i>Line Pressure Trip Point</i></li> <li>• <i>Line Pressure Reset Point</i></li> <li>• <i>Open Casing-Line Differential Pressure Trip Point</i></li> <li>• <i>Open Casing-Line Differential Pressure Reset Point</i></li> </ul>	<p>100.0 – 5000.0 psi</p> <p>Where 1000 = 100.0</p>

Register	Description	Read/Write
4:0244	<p>Line Pressure Trip Point</p> <p>A value must be entered in the range:</p> <ul style="list-style-type: none"> <li>• <i>current dead-band</i>, to</li> <li>• <i>Line Pressure Sensor Maximum Value</i>.</li> </ul> <p>Where <i>current dead-band</i> = <i>Line Pressure Trip Point</i> – <i>Line Pressure Reset Point</i></p> <p>If the <i>Line Pressure Trip Point</i> is modified the following parameters will be auto-updated:</p> <ul style="list-style-type: none"> <li>• <i>Line Pressure Reset Point</i></li> </ul>	<p>0 – Line Pressure Sensor Range (psi)</p> <p>Where 1000 = 100.0</p>
4:0245	<p>Line Pressure Reset Point</p> <p>A value must be entered in the range:</p> <ul style="list-style-type: none"> <li>• <i>0 to Line Pressure Trip Point – 1</i>.</li> </ul>	<p>0 – Line Pressure Sensor Range (psi)</p> <p>Where 1000 = 100.0</p>
4:0246 – 4:0248	Line Pressure Stable Time	Elapsed Time format: 0 – 7199s (00:00:00 – 01:59:00)
4:0249 – 4:0260	Reserved	
4:0261	Casing Pressure Device Configuration	<p>0 = Disabled</p> <p>1 = Casing Pressure Switch</p> <p>2 = Casing Pressure Sensor</p>
4:0262	Casing Pressure Switch Mode	<p>0 = Normally Open</p> <p>1 = Normally Closed</p>

Register	Description	Read/Write
4:0263	<p>Casing Pressure Sensor Range</p> <p>If the <i>Casing Pressure Sensor Range</i> is modified the following parameters <i>may</i> be auto-updated:</p> <ul style="list-style-type: none"> <li>• <i>Open Casing Pressure Trip Point</i></li> <li>• <i>Open Casing Pressure Reset Point</i></li> <li>• <i>Close Casing Differential Pressure Trip Point</i></li> <li>• <i>Close Casing Differential Pressure Reset Point</i></li> <li>• <i>Open Casing-Line Differential Pressure Trip Point</i></li> <li>• <i>Open Casing-Line Differential Pressure Reset Point</i></li> </ul>	<p>100.0 – 5000.0 psi</p> <p>Where 1000 = 100.0</p>
4:0264	<p>Open Casing Pressure Trip Point</p> <p>A value must be entered in the range:</p> <ul style="list-style-type: none"> <li>• <i>current dead-band, to</i></li> <li>• <i>Casing Pressure Sensor Maximum Value.</i></li> </ul> <p>Where <i>current dead-band</i> = <i>Open Casing Pressure Trip Point</i> – <i>Open Casing Pressure Reset Point</i></p> <p>If the <i>Open Casing Pressure Trip Point</i> is modified the following parameters will be auto-updated:</p> <ul style="list-style-type: none"> <li>• <i>Open Casing Pressure Reset Point</i></li> </ul>	<p>0 – Casing Pressure Sensor Range (psi)</p> <p>Where 1000 = 100.0</p>



Register	Description	Read/Write
4:0265	<p>Open Casing Pressure Reset Point</p> <p>A value must be entered in the range:</p> <ul style="list-style-type: none"> <li>• <i>0 to Open Casing Pressure Trip Point – 1.</i></li> </ul>	<p>0 – Casing Pressure Sensor Range (psi)</p> <p>Where 1000 = 100.0</p>
4:0266 – 4:0268	Open Casing Pressure Stable Time	Elapsed Time format: 0 – 7199s (00:00:00 – 01:59:00)
4:0269	<p>Close Casing Differential Pressure Trip Point</p> <p>A value must be entered in the range:</p> <ul style="list-style-type: none"> <li>• <i>current dead-band, to</i></li> <li>• <i>Casing Pressure Sensor Maximum Value.</i></li> </ul> <p>Where <i>current dead-band</i> = <i>Close Casing Differential Pressure Trip Point – Close Casing Differential Pressure Reset Point</i></p> <p>If the <i>Close Casing Differential Pressure Trip Point</i> is modified the following parameters will be auto-updated:</p> <ul style="list-style-type: none"> <li>• <i>Close Casing Differential Pressure Reset Point</i></li> </ul>	<p>0 – Casing Pressure Sensor Range (psi)</p> <p>Where 1000 = 100.0</p>
4:0270	<p>Close Casing Differential Pressure Reset Point</p> <p>A value must be entered in the range:</p> <ul style="list-style-type: none"> <li>• <i>0 to Close Casing Differential Pressure Trip Point – 1.</i></li> </ul>	<p>0 – Casing Pressure Sensor Range (psi)</p> <p>Where 1000 = 100.0</p>
4:0271 – 4:0273	Close Casing Differential Pressure Stable Time	Elapsed Time format: 0 – 7199s (00:00:00 – 01:59:00)

Register	Description	Read/Write
4:0274	<p>Open Casing-Line Differential Pressure Trip Point</p> <p>A value must be entered in the range:</p> <ul style="list-style-type: none"> <li>• <i>current dead-band, to</i></li> <li>• <i>Open Casing-Line Differential Pressure Sensor Maximum Value.</i></li> </ul> <p>Where <i>current dead-band</i> = <i>Open Casing-Line Differential Pressure Trip Point</i> – <i>Open Casing-Line Differential Pressure Reset Point</i></p> <p>If the <i>Open Casing-Line Differential Pressure Trip Point</i> is modified the following parameters will be auto-updated:</p> <ul style="list-style-type: none"> <li>• <i>Open Casing-Line Differential Pressure Reset Point</i></li> </ul>	<p>0 – Casing Pressure Sensor Range (psi)</p> <p>Where 1000 = 100.0</p>
4:0275	<p>Open Casing-Line Differential Pressure Reset Point</p> <p>A value must be entered in the range:</p> <ul style="list-style-type: none"> <li>• <i>0 to Open Casing-Line Differential Pressure Trip Point – 1.</i></li> </ul>	<p>0 – Casing Pressure Sensor Range (psi)</p> <p>Where 1000 = 100.0</p>
4:0276-4:0278	Open Casing-Line Differential Pressure Stable Time	Elapsed Time format: 0 – 7199s (00:00:00 – 01:59:00)
4:0279	<p>Close Casing Pressure Threshold</p> <p>Defines the rate of change at which the casing pressure is low enough to start the Trip Delay Timer or the turnaround point for the minimum casing pressure for Low Rise.</p>	<p>0 – Casing Pressure Sensor Range (psi/min)</p> <p>Where 1000 = 100.0</p>

Register	Description	Read/Write
4:0280	Close Casing Pressure Trip Point  A value must be entered in the range: <ul style="list-style-type: none"> <li>• <i>0 to Casing Pressure Sensor Maximum -1</i></li> </ul>	0 – Casing Pressure Sensor Range (psi)  Where 1000 = 100.0
4:0281	Close Casing Pressure Reset Point  A value must be entered in the range: <ul style="list-style-type: none"> <li>• <i>Casing Pressure Sensor Maximum to Close Casing Pressure Trip Point - 1</i></li> </ul>	0 – Casing Pressure Sensor Range (psi)  Where 1000 = 100.0
4:0282-4:0284	Close Casing Pressure Stable Time	Elapsed Time format: 0 – 7199s (00:00:00 – 01:59:00)
4:0285 – 4:0290	Reserved	
4:0291	Differential Pressure Device Configuration	0 = Disabled  1 = Flow DP Switch  2 = Flow DP Sensor
4:0292	Differential Pressure Switch Mode	0 = Normally Open 1 = Normally Closed
4:0293	Differential Pressure Sensor Range  If the <i>Differential Pressure Sensor Range</i> is modified the following parameters <i>may</i> be auto-updated: <ul style="list-style-type: none"> <li>• <i>Differential Pressure Trip Point</i></li> <li>• <i>Differential Pressure Reset Point</i></li> </ul>	30.0 – 3000.0 (“H2O)  Where 1000 = 100.0

Register	Description	Read/Write
4:0294	<p>Differential Pressure Trip Point</p> <p>A value must be entered in the range:</p> <ul style="list-style-type: none"> <li>• <i>current dead-band</i>, to</li> <li>• <i>Differential Pressure Sensor Maximum Value</i>.</li> </ul> <p>Where <i>current dead-band</i> = <i>Differential Pressure Trip Point</i> – <i>Differential Pressure Reset Point</i></p> <p>If the <i>Differential Pressure Trip Point</i> is modified the following parameters will be auto-updated:</p> <ul style="list-style-type: none"> <li>• <i>Differential Pressure Reset Point</i></li> </ul>	<p>0 – Differential Pressure Sensor Range (“H2O)</p> <p>Where 1000 = 100.0</p>
4:0295	<p>Differential Pressure Reset Point</p> <p>A value must be entered in the range:</p> <ul style="list-style-type: none"> <li>• <i>0 to Differential Pressure Trip Point – 1</i>.</li> </ul>	<p>0 – Differential Pressure Sensor Range (“H2O)</p> <p>Where 1000 = 100.0</p>
4:0296 – 4:0298	Differential Pressure Stable Time	Elapsed Time format: 0 – 7199s (00:00:00 – 01:59:00)
4:0299 – 4:0310	Reserved	
4:0311	Flow Device Configuration	<p>0 = Disabled</p> <p>1 = Flow Switch</p>
4:0312	Flow Switch Mode	<p>0 = Normally Open</p> <p>1 = Normally Closed</p>

Register	Description	Read/Write
4:0313	<p>Flow Sensor Range</p> <p>If the <i>Flow Sensor Range</i> is modified the following parameters <i>may</i> be auto-updated:</p> <ul style="list-style-type: none"> <li>• <i>Flow Trip Point</i></li> <li>• <i>Flow Reset Point</i></li> </ul>	0 = 500 e3m3/d
4:0314	<p>Flow Trip Point</p> <p>A value must be entered in the range:</p> <ul style="list-style-type: none"> <li>• <i>current dead-band</i>, to</li> <li>• <i>Flow Sensor Maximum Value</i>.</li> </ul> <p>Where <i>current dead-band</i> = <i>Flow Trip Point</i> – <i>Flow Reset Point</i></p> <p>If the <i>Flow Trip Point</i> is modified the following parameters will be auto-updated:</p> <ul style="list-style-type: none"> <li>• <i>Flow Reset Point</i></li> </ul>	<p>0 – Flow Sensor Range</p> <p>(e3m3/d)</p> <p>Where 5000 = 500.0</p>
4:0315	<p>Flow Reset Point</p> <p>A value must be entered in the range:</p> <ul style="list-style-type: none"> <li>• <i>0 to Flow Trip Point – 1</i>.</li> </ul>	<p>0 – Flow Sensor Range</p> <p>(e3m3/d)</p> <p>Where 5000 = 500.0</p>
4:0316 – 4:0318	Flow Stable Time	Elapsed Time format: 0 – 7199 (00:00:00 – 01:59:00)

## 8 Acronyms

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

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