YASKAWA iQpump

Intelligent Pump Controller

Manual Supplement

Software No.VSP130035 and VSP130036

Use this supplement with User Manual TM.iQp.06 and Programming Manual TM.iQp.07. To properly use the product, read this manual thoroughly and retain for easy reference, inspection, and maintenance. Ensure the end user receives this manual.

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1   Preface and Safety

Yaskawa manufactures products used as components in a wide variety of industrial systems and equipment. The selection and application of Yaskawa products remain the responsibility of the equipment manufacturer or end user. Yaskawa accepts no responsibility for the way its products are incorporated into the final system design. Under no circumstances should any Yaskawa product be incorporated into any product or design as the exclusive or sole safety control. Without exception, all controls should be designed to detect faults dynamically and fail safely under all circumstances. All systems or equipment designed to incorporate a product manufactured by Yaskawa must be supplied to the end user with appropriate warnings and instructions as to the safe use and operation of that part. Any warnings provided by Yaskawa must be promptly provided to the end user. Yaskawa offers an express warranty only as to the quality of its products in conforming to standards and specifications published in the Yaskawa manual. NO OTHER WARRANTY, EXPRESSED OR IMPLIED, IS OFFERED. Yaskawa assumes no liability for any personal injury, property damage, losses, or claims arising from misapplication of its products.

◆ Applicable Documentation

The following manuals are available for the iQpump Controller:

Option Supplement	
SUPPLEMENT	**Yaskawa AC Drive - iQpump Controller Manual Supplement** **Manual No: TM.iQp.10**
	Read this manual first. This document is a supplement to the iQpump Controller User Manual and Technical Manual and Simplex Cheat Sheet. This supplement lists the effect of this custom software on the parameters in the drive and function descriptions in the manual. Access this web site to obtain a PDF or additional printed copies of this supplement. U.S.: http://www.yaskawa.com

Yaskawa Drive		
	Yaskawa AC Drive-iQpump Controller User Manual TM.iQp.06	To obtain instruction manuals for Yaskawa products access these sites: U.S.: http://www.yaskawa.com Other areas: contact a Yaskawa representative.
	Yaskawa AC Drive-iQpump Controller Programming Manual TM.iQp.07	
	iQpump Controller Simplex Cheat Sheet TM.iQp.04	For questions, contact the local Yaskawa sales office or the nearest Yaskawa representative.

◆ Terminology Used in this Manual

These terms are used in this manual.

iQpump Controller: The iQpump Controller may also be referred to as **"drive"** in this manual.

◆ Obtaining Support

When seeking support for a drive with custom software, it is imperative to provide the unique part number shown on the drive nameplate. The software is flashed to the control board memory and the operation of parameters, functions, and monitors are different than the standard drive software, as described herein.

Refer to the Yaskawa office location listed on the back cover of this supplement for support inquiries.

2   General Safety

NOTICE
Abnormal Pump Operation Hazard
Important note when replacing an iQpump Controller. Verify software ID drive monitor U1-14 when replacing an iQpump Controller in a multiplex network configuration. Set parameter P9-99 to a value of 0 : "A-version 30034" if (ONE or MORE) iQpump Controllers on the network have software version monitor U1-14=30034 and nameplate PRG: 0034. Otherwise do not change P9-99 setting from factory default. Failure to comply will result abnormal drive operation.

◆ Supplemental Safety Information

Read and understand this manual and the iQpump Controller User Manual before installing, operating, or servicing this option unit. The drive must be installed according to the iQpump Controller User Manual and local codes. Observe all cautions and warnings in this document and the standard drive manuals.

Refer to the iQpump Controller Simplex Cheat Sheet TM.iQp.04 and the iQpump Controller User Manual TM.iQp.06 for safety information and installation and start-up instructions.

This document is a supplement to the standard iQpump Controller Manuals. It describes the enhanced functionality of drive software version U1-14=30035 and nameplate PRG: 0035 or greater.

• Custom software is provided to add functionality to a standard AC drive to enhance or enable use in a specific application.

3   Product Overview

◆ About This Product

Yaskawa has simplified the application of variable frequency drives to pumping applications. Pumps are typically used whenever water must be pumped from deep water wells or open bodies of water such as rivers, lakes, irrigation canals, and water storage facilities. The integrated pump specific software and quick setup parameters, allow the operator easy access to setup control values for a wide range of applications.

■ Feature Enhancement Summary

The following is a brief summary of features for drive software PRG:0035 that are added or enhanced over previous iQpump Controllers:

Initialization Function: A special initialization function is created to quickly and conveniently configure the drive as a generic speed controller. This initialization re-configures the Pump Quick Setup (Quick Start) menu to show parameters likely to require adjustment in generic applications.

b1-04 (Reverse Operation Selection): Added new parameter B1-04 (Reverse Operation Selection) which allows the motor phases to be exchanged.

FCarrier Frequency Selection (C6-02): Default has been changed to 1 (2.0 kHz).

Remote Drive Disable: This feature prohibits the drive from running when a new multifunction digital input is closed for a set amount of time.

Low City Pressure Alarm Selection: Added a parameter that selects the Low City Pressure alarm text that will show when in a Low City Pressure condition.

Suction Control Support via the Constant Pressure with Well Draw Down Control: Suction control option has been integrated into the Water Level control.

Modified Terminal A1 Loss Detection: Different alarm/fault texts will occur when feedback loss is detected on Terminal A1 to differentiate from PI feedback loss on Terminal A2.

iQpump Memobus Multiplex: Lag Drive Speed Follower: Lag drives follow the speed of the lead drive.

iQpump Memobus Multiplex: Lag Turn Off: Lag drives can run at a fixed speed for a set time before turning off.

iQpump Memobus Multiplex: Flow Meter: New option to stage or de-stage based on Flow Rate.

iQpump Memobus Multiplex: Stop History: A new lead drive selection (P1-01) option has been added.

Geothermal Mode: The speed of the drive is determined by an analog temperature input and a temperature-speed curve.

iQpump Multiplex: Water Level/Suction Pressure Control

- Ability to run the iQpump Controller Memobus network with just 1 drive connected to a Water Level or Suction Pressure device
- Ability to automatically switch from the Analog Water Level/Suction Pressure Source to the Network Source in case of transducer loss or wire breaks.
- Pump De-stage due to the Water Level being below the Minimum Water Level.
- Pump De-stage due to the Suction Pressure being below the Minimum Suction Pressure.
- Disallow Pump Staging when PI is being influenced by the Water Level/Suction Pressure control

◆ Applicable Models

The iQpump Controller is available in these models in *Table 1*.

Table 1 Applicable Models

Drive	Software Version <1>
(All P7 drive models) CIMR-P7U□□□□□-107	VSP1300035 or VSP1300036. Listed on the drive nameplate as PRG:0035 or PRG:0036

<1> See "PRG" on the drive nameplate or drive monitor U1-14 for the software version number.

4   Drive Change Summary

◆ Overview

The following is an overview of changes made the drive with software PRG: 0035 and PRG: 0036.

■ Drive Software Changes

Table 2 Parameter Enhancements for PRG: 0035

Parameter	Description	Page
A1-01 Language Selection	Selection 6:Portuguese is removed.	*40*
A1-03 Initialization Mode	Added selection 7770:General Purpose.	*38*
b1-01 Frequency Reference Selection	Added selection 5:Geothermal Mode.	*20*
b1-03 Stop Method	Default changed from: Ramp to Stop (0) to Coast to Stop (1).	*41*
C6-02 Carrier Frequency	Default value changed to setting 1 (2.0 kHz) for all drive sizes.	*41*
P8-01 Water Lev./Suc. Pres. Selection	Selection 1: Changed from Enabled to Water Level Control. Added selection 2:Suction Pressure Control.	*16*
P8-09 Low Level Behavior	Added selection 3:Auto-Restart (time set by P8-12).	*17*
P9-01 Lead Drive Selection	Added selection 2:Stop History.	*34*
P9-05 Lag Drive Mode	Added selection 3:Follow Lead Speed.	*29*
P9-08 Add Pump Mode	Added selection 3:Flow Meter.	*32*
P9-12 Remove Pump Mode	Added selection 3:Flow Meter.	*33*
P9-23 Max Pumps Running	Range changed from 1 - 16 to 1 - 8. Default changed from 16 to 8.	–
P9-25 Highest Node Address	Range changed from 2 – 16 to 2 - 8.	*42*

Table 3 Digital Input H1-□□ Enhancements for PRG: 0035

Function	Description	Page
72 Remote Drive Disable	Digital Input function (normally open or normally closed) that can be used to prevent the drive from running with a programmable delay time.	*11*

Table 4 Digital Output H2-□□ Enhancements for PRG: 0035

Function	Description	Page
4A Transducer Loss **<1>**	Closed: During a "Feedback Loss" alarm. Closed: During a "FBL – Feedback Loss" fault". Closed: During an "A1-LOST Terminal A1 Lost" alarm. **<1>**New Closed: During an "A1-LOST Terminal A1 Lost" fault. **<1>**New	*36*
57 Low Water Level **<1>**	This will energize if P8-01 = 1 and the level in the well drops below the Low Level Detection Level (P8-07) for more than the Low Level Detection Delay Time (P8-08), or if there is a LOWWL – Low Water Level Fault.	*18*
58 Low Suction Level	This will energize if P8-01 = 2 and the suction pressure drops below the Low Suction Pressure Detection Level (P8-07) for more than the Low Suction Pressure Delay Time (P8-08), or if there is a LOSUC – Low Suction Pressure Fault.	*18*

<1> Modified from previous version.

Table 5 Added H3-09 Analog Input Function for PRG: 0035

Function	Description	Page
20 Geothermal Mode	Temperature input for geothermal mode operation.	*21*

Table 6 Additional or Modified Fault Codes for PRG: 0035

Fault Code	Description	Page
OPE13 Terminal A1	Displayed when terminal A1 is assigned to more than one function. OPE13 is modified from the previous software version PRG:0034.	*28*
OPE17 Run/Stp-CoastTmr	Displayed when Run/Stop Control and Coast To Stop w/Timer are both enabled.	*42*
OPE18 Net Incompatible	Displayed when using features specific to iQpump software version 30035+ and nameplate PRG: 0035 or greater with parameter P9-99 set to (0: A:Version 30034).	*43*
OPE19 Geothermal Set	Displayed when a parameter selection is not compatible with the Geothermal Mode (b1-01 = 5) setting.	*42*
Temp Lost Geothermal Input	Displayed when geothermal input is not present.	*23*
LOSUC Low Suction	Suction pressure is below programmed level.	*18*

Table 7 Additional Alarms or Messages for PRG:0035

Alarm	Description	Page
Net FlowMeter Lost, Chk Source	Displayed when there is no drive on the Memobus Network with an analog Flow Meter.	*28*
LOSUC Low Suction	Displayed when Low City Pressure is active and alarm selection P4-27 = 1.	*13*
Low Water in Tank	Displayed when Low City Pressure is active and alarm selection P4-27 = 2.	*13*
Temp Lost Geothermal Input	Displayed when a geothermal input is not present.	*23*
R-DNE-S☐ <1> Remote Drv Dis	Remote drive disable is active.	*12*
AnalogA1 Lost Switched to Net	Displayed when there is a defective or broken analog input source. Analog Terminal A1 has not been detected, and the Network Water Level or Suction Pressure signal is now used.	*23*
Net Wtr/Suctn Lost, Chk Source	Displayed when a valid analog source for Water Level or Suction Control Pressure can not be found on the network.	*23*

<1> The ☐ character is a place holder for the actual digital input designation, such as S1, S2, or S3.

Table 8 Additional Alarms or Messages for PRG:0036

Alarm	Description	Page
OPE20 Net WL/SP Mode	Incompatible Network Water Level / Suction Pressure Mode.	-
Low WL/SP Drive Disabled	Drive is unable to run because the Water Level or Suction Pressure is below the P8-05 setting.	-

5   Feature Details - Remote Drive Disable

◆ Overview

This function allows users to prohibit the iQpump Controller from running by using a multi-function digital input set to **"Remote Drv Disbl"** (72) in combination with a programmable on time (P4-25) and off time delay (P4-26).

The **"Remote Drive Disable"** input logic can be selected with parameter P4-24.

■ Function Operation

When the Remote Drive Disable (H1-0□ = 72) input is active for the amount of time specified in P4-25 the drive will be forced into a sleep-like state. Stopping method used is defined by b1-03 (Stopping Method Selection) setting.

If the iQpump Controller is running as part of a Memobus Network (multiplex system), it will be taken out and considered unavailable to run.

Alarm "R-DNE-S□" will be displayed, where S□ is the Terminal programmed for Remote Drive Disable (H1-0□ = 72).

The iQpump Controller will restart and perform a pre-charge if needed when the Remote Drive Disable (H1-0□ = 72) is inactive for the time specified in P4-26.

  Note: When the drive run is disabled using this feature, the pre-charge function is reset and will run if necessary.

P4-24 Remote Drive Disable Selection

Selects the type of pressure switch connected to the "Remote Drv Disbl" digital input (H1-0□ = 72).

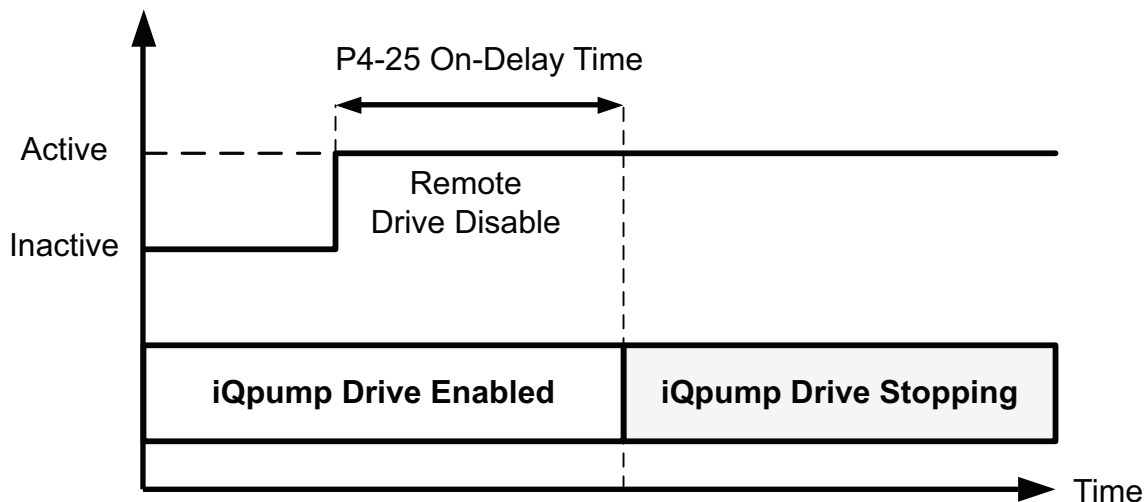| Setting	Description
0	Normally Open (factory default) Closed indicates a "Remote Disable" condition - active
1	Normally Closed Open indicates a "Remote Disable" condition - active

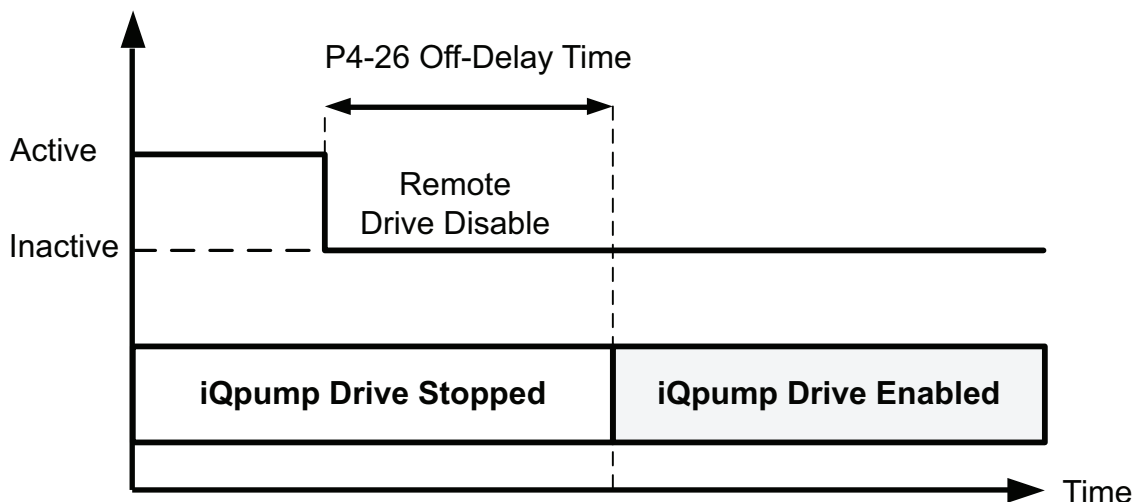**Figure 1 Remote Disable: Inactive to Active Operation**

Figure 2 Remote Disable: Active to Inactive Operation

P4-25 Remote Drive Disable On-Delay Time

Range	Description	Default
1 - 1000 sec	Sets the amount of time a "Remote Drive Disable" condition needs to be present before the drive will stop.	0 sec

P4-26 Remote Drive Disable Off-Delay Time

Range	Description	Default
1 - 1000 sec	Sets the amount of time a "Remote Drive Disable" condition must be absent before the drive will be allowed to run.	0 sec

Multi-function Input Setting: Remote Drive Disable Function

Setting	Description
72 Remote Drv Disbl	Remote Drive Disable: Prevents the iQpump Controller from running when active for the time set in P4-25. Must be inactive for the time set in P4-26 to allow the drive to run again. **Note:** Parameter P4-24 determines if this input is Normally Open or Normally Closed.

Alarm: Remote Drive Disable

Alarm Display	Description
R-DNE-Sx Remote Drv Dis	Multi-function Input Terminal S□ (H1-0□ = 72) has been closed for the time set in P4-25 when P4-24 = 0. or Multi-function Input Terminal S□ (H1-0□ = 72) has been open for the time set in P4-25 when P4-24 = 1.

Note: S□ or Sx denotes the digital input terminal programmed for this function.

6   Feature Details - Low City Pressure Alarm

◆ Overview

The alarm function is used for stopping the iQpump Controller or preventing the iQpump Controller from running based on an external contact closure.

This function has been enhanced by parameter P4-27 which allows users to select the alarm message that will be displayed when a Low City Pressure condition is detected.

■ Function Operation

P4-27 Low City Pressure Alarm Text

Selects the alarm message that will be displayed when a Low City Pressure condition is detected.

Setting	Description
0	Low City Pressure (factory default)
1	Low Suction Pressure
2	Low Water in Tank

Alarm: Low Pressure/Low Water in Tank

Alarm Display	Description
Low Suction Pressure	Shown when P4-27 = 1 and when the digital input has been active (closed for P4-21 = 0, or open for P4-21 = 1) for the time set in P4-22. The drive, if running, coasts-to-stop and does not run until the digital input has been inactive for the time set in P4-22.
Low Water In Tank	Shown when P4-27 = 2 and when the digital input has been active (closed for P4-21 = 0, or open for P4-21 = 1) for the time set in P4-22. The drive, if running, coasts-to-stop and does not run until the digital input has been inactive for the time set in P4-22.

■ Related Parameters

P4-21 Low City Pressure Input Select

Setting	Description
0	Normally Open (closed for the "Low City Pressure" condition)
1	Normally Closed (open for the "Low City Pressure" condition) (factory default)

P4-22 Low City Pressure Input Delay Time

Range	Description	Default
1 - 1000 sec	Sets the amount of time a "Low City Pressure" condition must be present before the drives will stop. Also sets the amount of time that the pressure must be adequate before the drive system will restart.	10 sec

Multi-function Input Setting H1-☐☐: Low City Pressure

Setting	Description
73 Low City Pressure	Indicates that sufficient/insufficient pressure is present on the inlet to the pump. This setting is used mainly for pressure booster stations.

7 Suction Control via Constant Pressure w/Well Draw Down

◆ Overview

This function enables the iQpump Controller to monitor suction pressure at the inlet of the pumps.

> **Note:** This function is active when parameter P8-01 is set to 2 for Suction Control.

Packaged Booster Systems have a desired discharge pressure and a given suction pressure from the city water system or from a suction tank. Such systems are often designed to handle a specific pressure and flow rate.

The suction pressure may have a wide range between high and low pressures. The suction pressure typically decreases with increased fluid flow rate. In some instances, pump cavitation may occur if suction pressure falls below a certain pressure level.

In addition low or negative suction pressure can lead to damage such as pipe collapse due to external forces acting on the pipe.

The iQpump Controller will accept an analog suction transducer (Terminal A1) and can be programmed to trigger an alarm or shutdown the system when the suction pressure falls outside of a normal operating range.The iQpump Controller will automatically restart and return to normal operation once the suction pressure returns to a normal level.

When operating in multiplex mode, additional control can be programmed to de-stage any active pumps as a method to try and reduce pump loading to prevent suction pressure from continuing to drop below the shut down level.

■ Function Description

The iQpump Controller will regulate outlet pressure of the pump system using the standard iQpump Controller features when there is adequate suction pressure available at the inlet of the pumps and offers two options to respond to a drop in suction pressure.

1. **Regulate Outlet Pressure and Suction Pressure: (P8-03 > or = P8-04)**
   To regulate suction pressure set the suction pressure setpoint (P8-03) to a value greater or equal than the minimum suction pressure (P8-04). In this mode the iQpump Controller will try to regulate the suction pressure based on the programmed suction pressure setpoint (P8-03) level.

   As the suction pressure decreases and approaches the suction pressure setpoint level (P8-03), the iQpump Controller will slow down causing the outlet pressure and flow to decrease. When the suction pressure rises above the P8-05 level for more than the P1-05 time, normal operation (outlet pressure regulation) will resume.

   When the suction pressure drops below Minimum Suction Pressure (P8-04), for more than the Sleep Delay Time (P2-03), the iQpump Controller will go to sleep.
   Note: The Suction Control Minimum Speed parameter (P8-06) should be set to a high enough value that will ensure flow.

2. **Regulate Outlet Pressure Only: (P8-03 < P8-04)**
   Set the suction pressure setpoint (P8-03) to a value smaller than the minimum suction pressure (P8-04) to regulate outlet pressure.

   This mode allows the iQpump Controller to maintain the outlet pressure setpoint using the standard iQpump Controller features and go to sleep immediately when the suction pressure drops below the Minimum Suction Pressure (P8-04), for more than the Sleep Delay Time (P2-03).

   Normal operation (outlet pressure regulation) will resume when the suction pressure returns above the P8-05 level for more than the P1-05 time.

■ Duplex System Example

Example:	A pump system consisting of a duplex domestic pressure booster system using a pressured city supply averaging 40 - 60 psi. If city pressure starts to fall below 40 psi the pump system will start to slow down to reduce the chances of pump cavitation. When suction pressure (city pressure) drops to 30 psi, the pump system will shut down (sleep) and wait until city pressure returns, after which the system will automatically start and operate under normal condition.

Pump System Settings
- All pumps have the same flow rate and will alternate
- Lag Pump will track speed of lead pump
- All drives have individual discharge transducers rated 150 psi. Upon failure, system will look to network for feedback information.
- Suction Transducer is rated 75 psi
- Below 40 psi city pressure the pump system will start to reduce speed until reaching 30 psi
- System Auto setpoint 85 psi, with a 5 psi start level.

Duplex System Example (Related Parameters)

Parameter	Description	Booster Pump 1	Booster Pump 2
H3-02	Terminal A1 Gain	231.3%	231.3%
H3-03	Terminal A1 Bias	-25.0%	-25.0%
H3-08	Terminal A2 Signal	2	2
H5-01	Drive Node Network Address	1	2
P1-01	Pump Mode	3	3
P1-03	FD Device Scaling	150 psi	150 psi
P1-04	Start Level	-5.0 psi	-5.0 psi
P8-01	WtrLvl/SuctionPres Selection	2	2
P8-02	Suction Transducer Scaling	75 psi	75 psi
P8-03	Suction Pressure Setpoint	40.0 psi	40.0 psi
P8-04	Minimum Suction Pressure	30.0 psi	30.0 psi
P8-05	Wakeup Suction Pressure	40.0 psi	40.0 psi
P9-02	Feedback Source	2	2
P9-05	Lag Drive Mode	2	2
P9-25	Highest Node Address	3	3
P9-50	Suction Pressure Source	2	2
U1-01	Auto Setpoint	85 psi	85 psi

Note: In multiplex mode the network signal for suction pressure can be used. *Refer to Transducer Wiring using an External Power Supply on page 48*.

■ Enabling Suction Pressure Control

The suction pressure control selection is added to parameter P8-01 Water Level/Suction Pressure Selection. Follow these steps for basic suction pressure control setup:

1. Enable suction control by setting parameter P8-01 to 2 (Suction Control).
2. Set suction transducer scaling (P8-03) in psi, scaling for analog input A1 (20 mA scale).
3. Set suction pressure setpoint (P8-03) in psi.
4. Select iQpump operation when a drop in suction pressure occurs:

a. Regulate outlet pressure only and go to sleep immediately when suction pressure falls below minimum suction pressure level (P8-04). Set suction pressure setpoint (P8-03) below minimum suction pressure level (P8-04).

b. Regulate suction pressure when pressure is below suction pressure setpoint (P8-03) but above the minimum suction pressure level (P8-04). Set suction pressure setpoint (P8-03) to above the minimum suction pressure level (P8-04).

5. Set minimum suction pressure (P8-04) – Sleep Level for Suction Control.
6. Set suction pressure wake-up level (P8-05) – Wake-up level.
7. Set suction control minimum speed (P8-06) – Minimum Flow Speed.

P8-01 Water Level/Suction Pressure Selection

Sets the mode of operation for the Water Level / Suction Control function.

Setting	Description
0	Disabled (factory default)
1	Water Level Control (This function is defined as "Enabled" for iQpump software PRG: 0034)
2	Suction Pressure Control (New)

Note: The iQpump Controller will only perform the outlet pressure and suction pressure control when "normal" PI mode is enabled (b5-01 > 0, not jogging, not disabled via MFDI, etc.).

P8-02 Suction Transducer Scaling

Terminal A1 is used for the suction pressure analog input. The analog pressure sensor, mounted on the inlet side of the pump(s) will provide the required signal. Set this parameter to the full-scale pressure of the transducer. The suction pressure will then be displayed on the U1-98 monitor.

Range	Description	Default
5 - 500 psi	Sets the full scale (20 mA) output of the pressure transducer connected to Terminal A1.	100 psi

P8-03 Suction Pressure Setpoint

Range	Description	Default
0.0 - 1200.0 psi	Sets the amount of suction pressure the iQpump Controller will attempt to regulate.	20.0 psi

P8-04 Minimum Suction Pressure

Range	Description	Default
0.0 - 1200.0 psi	When the suction pressure drops to below this level for more than the P2-03 time, the drive will go to sleep and turn off all lag pumps.	10.0 psi

P8-05 Wake-Up Suction Pressure

Range	Description	Default
0.0 - 1200.0 psi	If the drive is forced to sleep based upon the minimum suction pressure (P8-04), the suction pressure must go above this level for more than the P8-13 time in order to wake up.	30.0 psi

P8-06 Suction Control Minimum Speed

Range	Description	Default
0.00 - 120.00 Hz	This parameter sets the minimum speed the drive will run when the drive is controlling suction pressure. When the drive is controlling outlet pressure or this parameter is set less than P1-06 and P4-05, P1-06 and P4-05 will be used as the minimum speed.	0.00 Hz

P8-07 Low Suction Pressure Detection Level <1>

Range	Description	Default
0.0 - 1200.0 psi	When the amount of suction pressure drops below this level for more than the P8-08 time, the drive will respond depending on the P8-09 setting. A setting of 0.0 disables this detection.	0.0 psi

P8-08 Low Suction Pressure Detection Time[1]

Range	Description	Default
0.0- 300.0 min	Sets the amount of time delay that the suction pressure must drop below the P8-07 level before the drive will react. *Time units are defined by P8-14.	0.1 min

P8-09 Water Level/Suction Pressure Selection

Sets how the drive will respond when the water level in the well drops below the P8-07 level for more than the P8-08 time.

Setting	Description
0	No Display (Digital Output Only)
1	Alarm Only (factory default)
2	Fault
3	Auto-Restart (time set by P8-12) (New)

P8-10 Suction Control Proportional Gain

Range	Description	Default
0.00 - 25.00	Sets the proportional gain for the suction pressure control.	2.00

P8-11 Suction Control Integral Time

Range	Description	Default
0.0 - 360.0 sec	Sets the integral time for the suction pressure control. A setting of zero disables the suction pressure control integrator.	5.0 min

P8-12 Suction Control Auto-Restart Time

Range	Description	Default
0.1 - 6000.0 min	Sets the amount of time the drive will wait before attempting an auto-restart of the "Low Suction" fault. Effective only when P8-09 = 3 and L5-01 > 0.	5.0 min

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[1]Low Level/Low Suction Detection (P8-07/P8-08): This feature is disabled when the drive is in Run-Stop control (b1-02 = 5, Timed Run).

P8-13 Suction Pressure Sleep Wake-Up Time

Range	Description	Default
0 - 3600 sec	If the iQpump Controller has been forced to sleep based upon the minimum suction pressure (P8-04), the pressure must go above the P8-05 level for more than this time in order to wake up.	1 sec

P8-14 Low Suction Pressure Detection Time Unit

Defines the time unit for P8-08.

Setting	Description
0	Minutes (factory default)
1	Seconds

Suction Pressure Transducer Wire-break Detection

Wire-break detection is active on Terminal A1 when PI Feedback Loss Detection is enabled (b5-12 = 1 or 2) , Suction control is enabled (P8-01 = 2) and PI control is **NOT** disabled via Multi-Function Digital Input.

The iQpump Controller detects a wire-break condition when the suction transducer signal on Terminal A1 falls below -6.25 % or rises above 106.25 % for more than 1 second and will react according to parameter b5-12 (Feedback Loss Detection).

Note: Wire-break detection on Terminal A1 detection is checked **after** the gain/bias parameters (H3-02 and H3-03) are applied.

Fault: Low Suction

Fault Display	Description
LOSUC Low Suction	Low Suction: Suction pressure is below the P8-07 level for more than the P8-08 time.

Parameters P8-12 to P8-14 are also available for Water Level control P8-01 set to 1. The parameter titles change accordingly.

P8-12 Water Level Auto-Restart Time

Range	Description	Default
0.1 - 6000.0 min	Sets the amount of time the iQpump Controller will wait before attempting an auto-restart of the "Low Water" fault. Effective only when P8-09 = 3 and L5-01 > 0.	5.0 min

P8-13 Water Level Sleep Wake-Up Time

Range	Description	Default
0 - 3600 sec	If the iQpump Controller is forced to sleep based upon the minimum water level (P8-04), the pressure must go above the P8-05 level for more than this time in order to wake up.	1 sec

P8-14 Low Water Detection Time Unit

Setting	Description
0	Minutes (factory default)
1	Seconds

Multi-function Output Setting H2-□□: Low Suction (Modified)

Setting	Description
57 Low Water	This output will energize if P8-01 = 1 and the level in the well drops below the Low Level Detection Level (P8-07) for more than the Low Level Detection Delay Time (P8-08), or if there is a LOWWL - Low Water Level Fault.

Multi-function Output Setting H2-□□: Low Suction (New)

Setting	Description
58 Low Suction	This output will energize if P8-01 = 2 and the suction pressure drops below the Low Suction Pressure Detection Level (P8-07) for more than the Low Suction Pressure Delay Time (P8-08), or if there is a LOSUC - Low Suction Pressure Fault.

■ Related Parameters

When P1-01 = 3 (Memobus Multiplex), the Water Level or Suction Pressure can be transmitted or read through the network. .

P9-50 Water Level Source (P8-01 set to 0 or 1, Water Level Control)

Defines which signal to use for Water Level Control (P8-□□) when P1-01=3.

Setting has no effect when P1-01≠3.

Setting	Description
0	Analog Only (factory default)
1	Analog -> Network, No Alarm
2	Analog -> Network, Alarm
3	Network Only

P9-50 Suction Pressure Level Source (P8-01 set to 2 Suction Control)

Defines which signal to use for Suction Pressure Control (P8-□□) when P1-01=3.

Setting has no effect when P1-01≠3.

Setting	Description
0	Analog Only (factory default)
1	Analog -> Network, No Alarm
2	Analog -> Network, Alarm
3	Network Only

8   Geothermal Mode

◆ Overview

A geothermal well facilitates heat transfer between the earth and a known system, such as space heating, dehydration, electric power generation and food processing.

The geothermal function has the ability to regulate the speed of the iQpump Controller based on an external temperature signal following a preset temperature-speed curve.
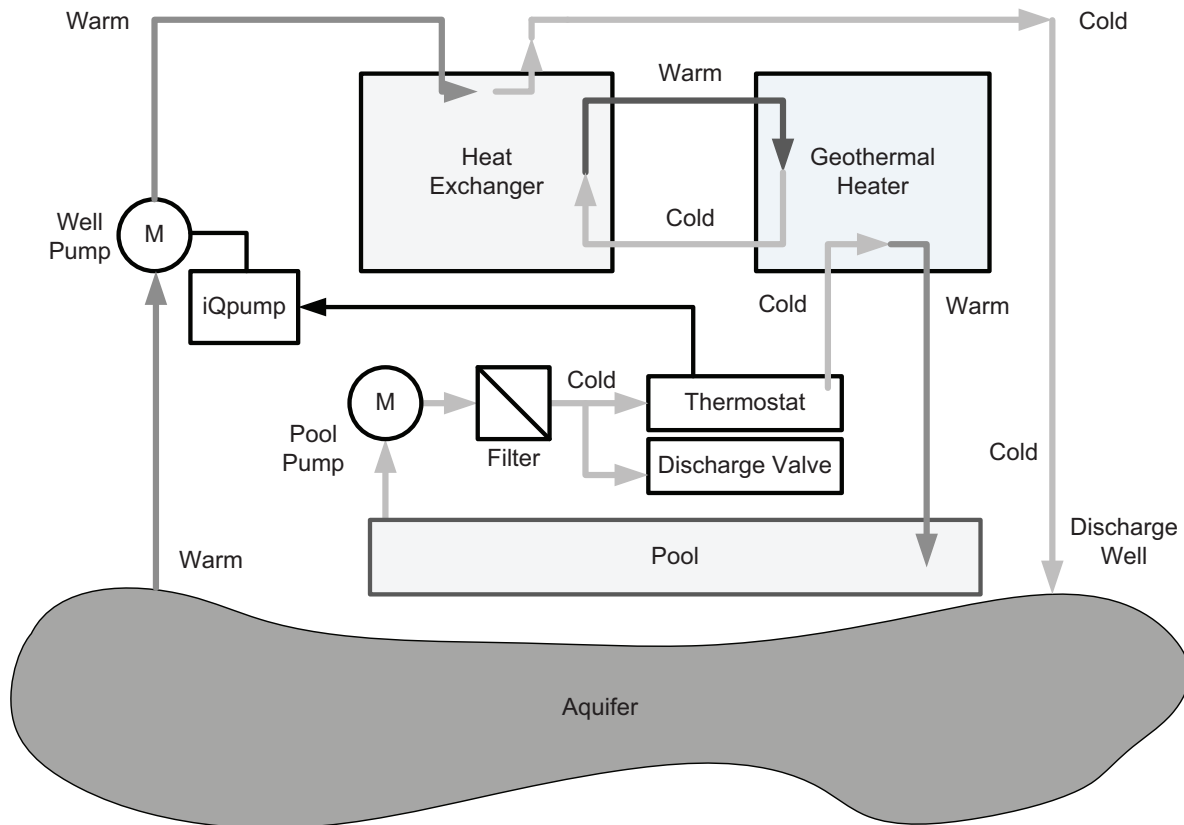

Figure 3 Geothermal Pool Application

◆ Geothermal Mode Setup Procedure

Follow these steps to setup the iQpump Controller in Geothermal Mode:

1. Set iQpump Controller parameters to factory default by setting parameter A1-03 to 2220 for "2 Wire" Initialization.[1]
2. Disable PI Control by setting parameter b5-01 to 0 "Disabled"
3. Set multi-function analog input function H3-09 to 20 "Geothermal Temp"
4. Enable Geothermal Mode by setting parameter b1-01 to 5 "Geothermal Mode"
5. Set display monitor to selectable mode by setting o1-06 to 1 "3 Mon Selectable"
6. Select monitor display line #1 to display output frequency by setting o2-01 to 2 "Output Freq"
7. Select monitor display line #3 to display temperature by setting o1-08 to 80 "Geothermal Temp"
8. Set the temperature transducer range to properly scale the input. (P4-31 and P4-32)
9. Set the temperature-speed curve to the intended operation (P4-33 ~ P4-38)

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[1] "3330" for 3-Wire Initialization or "7770" for General Purpose Initialization can also be used.

◆ Related Parameters

■ b1-01 Frequency Reference Source Selection

Set the frequency reference source (b1-01) to 5 for Geothermal mode operation.

Setting	Description
0	Operator - Digital preset speed d1-01 (factory default)
1	Terminals - Analog input Terminal A1 (or Terminal A2, see parameter H3-13)
2	Serial Com - RS-485 terminals R+, R-, S+ and S-
3	Option PCB - Option board connected at 2CN
5	Geothermal Mode - Frequency reference is dependent on temperature input (H3-09 = 20) <0035>

■ H3-09 Multi-function Analog Input Setting: Geothermal Temperature

Program H3-09 = 20 to use an external temperature sensor in Geothermal mode operation.

Setting	Description
20	**Geothermal Temperature** Analog input function for use with an external temperature sensor. Range scaling: 0V (or 4 mA) = P4-31 ~ 10 V (or 20 mA) = P4-32

■ Geothermal Mode Frequency/Temperature Characteristic

When the iQpump Controller is set to operate in Geothermal Mode (b1-01 = 5), the drive's frequency reference is determined by the analog input Geothermal Temperature (H3-09 = 20) and the setting of parameters P4-33 ~ P4-38. The Geothermal characteristic can be programmed in normal or inverse operation.

Normal Operation: P4-33 < P4-34 and P4-35 < P4-36 < P4-37 < P4-38

Inverse Operation: P4-33 > P4-34 and P4-35 < P4-36 < P4-37 < P4-38

P4-31 Minimum Geothermal Temperature Input

Range	Description	Default
-110.0 ~ 440.0 °F	Sets the temperature that corresponds to a 0V (or 4 mA) analog input.	0.0 °F

P4-32 Maximum Geothermal Temperature Input

Range	Description	Default
-110.0 ~ 450.0 °F	Sets the temperature that corresponds to a 10V (or 20 mA) analog input.	150.0 °F

| Parameter No.	Parameter Name	Description	Range	Default
P4-33	Minimum Geothermal Speed	Sets the frequency reference characteristics based on the set temperature points and the corresponding frequency. For proper operation, P4-34 > P4-33 and P4-38 > P4-37 > P4-36 > P4-35.	0.00 ~ 120.00 Hz	40.00 Hz
P4-34	Maximum Geothermal Speed		0.00 ~ 120.00 Hz	40.00 Hz
P4-35	Low Temperature to Run at Maximum Geothermal Speed		-110.0 ~ 450.0 °F	55.0 °F
P4-36	Low Temperature to Run at Minimum Geothermal Speed	Geothermal Mode Frequency/Temperature Characteristic (Normal Operation)	-110.0 ~ 450.0 °F	65.0 °F
P4-37	High Temperature to Run at Minimum Geothermal Speed		-110.0 ~ 450.0 °F	75.0 °F
P4-38	High Temperature to Run at Maximum Geothermal Speed	**Geothermal Mode Frequency/Temperature Characteristic (Inverse Operation)**	-110.0 ~ 450.0 °F	85.0 °F
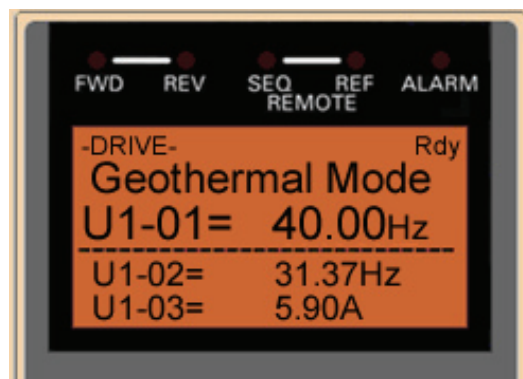
Figure 4 Digital Operator Display Showing Geothermal Mode Operation

■ Geothermal Mode iQpump Controller Monitors

U1-80 Geothermal Temperature Input

Unit	Description
0.1 °F	Displays Geothermal temperature input after gain and bias are applied. This is the temperature used by the Geothermal Function to determine what frequency to run the iQpump Controller.

Note: Only shown when b1-05 = 5 (Geothermal Mode)

■ Geothermal Temperature Loss Detection

P4-39 Geothermal Temperature Loss Detection

Selects iQpump Controller action when the temperature sensor signal from Terminal A2 is below 3 mA or above 21 mA.

Setting	Description
0	Disabled
1	Alarm (factory default)
2	Fault

Note: Only effective when H3-08 = 2 (4-20 mA) and H3-09 = 20 (Geothermal Temp).

Alarm: Temperature Sensor Lost (factory default)

Alarm Display	Description
Temp Lost Geothermal Input	The geothermal temperature sensor is not present. Alarm occurs when: 1. b1-01 = 5, H3-09 = 20 (Geothermal Temp), H3-08 = 2 (4-20 mA), P4-39 = 1 (Alarm), and the input has either dropped below 3 mA or went above 21 mA. **Check:** Ensure the device connected to Terminal A2 is installed and working properly.
	2. b1-01 = 5, and H3-09 ≠ 20 (Geothermal Temp), and P4-39 = 1 (Alarm). **Check:** Terminal A2 must be assigned to Geothermal Temp (H3-09 = 20).
	3. b1-01 = 5, H3-09 = 20 (Geothermal Temp), H3-08 = 2 (4-20 mA), P4-39 = 2 (Fault), the drive is either in HAND mode or has no run command, and the input is below 3 mA or above 21 mA. **Check:** Ensure the device connected to Terminal A2 is installed and working properly.
	4. b1-01 = 5, and H3-09 ≠ 20 (Geothermal Temp), P4-39 = 2 (Fault), and the drive is either in HAND mode or has no run command. **Check:** Terminal A2 needs to be assigned to Geothermal Temp (H3-09=20).

Alarm: Geothermal Parameters Programming Error

Alarm Display	Description
Geo Params Check P4-35~P4-38	The drive is running at the P4-31 level because of an incorrect setting. The temperature parameter values must be set in the following order: P4-35 < P4-36 < P4-37 < P4-38

Fault: Temperature Sensor Lost

| Fault Display	Description
Temp Lost Geothermal Input	The geothermal temperature sensor is not present. Fault occurs when: 1. b1-01 = 5, and H3-09 ≠ 20 (Geothermal Temp), and P4-39 = 2 (Fault). **Check:** Terminal A2 must be assigned to Geothermal Temp (H3-09 = 20).
	2. b1-01 = 5, H3-09 = 20 (Geothermal Temp), H3-08 = 2 (4-20 mA), P4-39 = 2 (Fault), the drive is either in HAND mode or has no run command, and the input is below 3 mA or above 21 mA. **Check:** Ensure the device connected to Terminal A2 is installed and working properly.

Fault: Geothermal Frequency Reference/Temperature Curve Error: OPE19

Fault Display	Description
OPE19 Geothermal Set	Parameter selection is not compatible with the Geothermal Mode (b1-01 = 5) setting. Fault occurs when b1-01 = 5 (Geothermal Mode), and one of the following is NOT set: - b5-01 = 0 (PI Disabled) - P1-01 = 0 (Simplex) **Check:** Confirm parameter settings for b1-01, b5-01, and P1-01.

■ Example: Geothermal Pump System Transducer Setup

Example:	Geothermal Pump system using a temperature transducer 4 - 20 mA with a temperature range of 0 - 120 °F. The system requires a minimum pump speed of 35 Hz. The system requires increased pump speed when the temperature increases above 75 °F or when temperature falls below 65 °F.
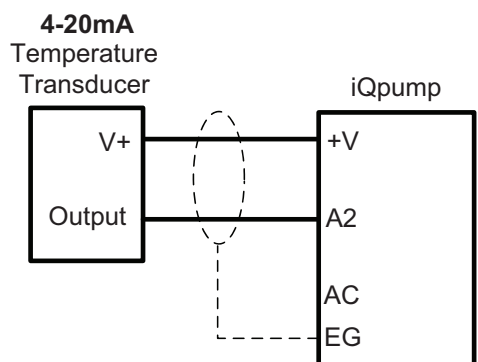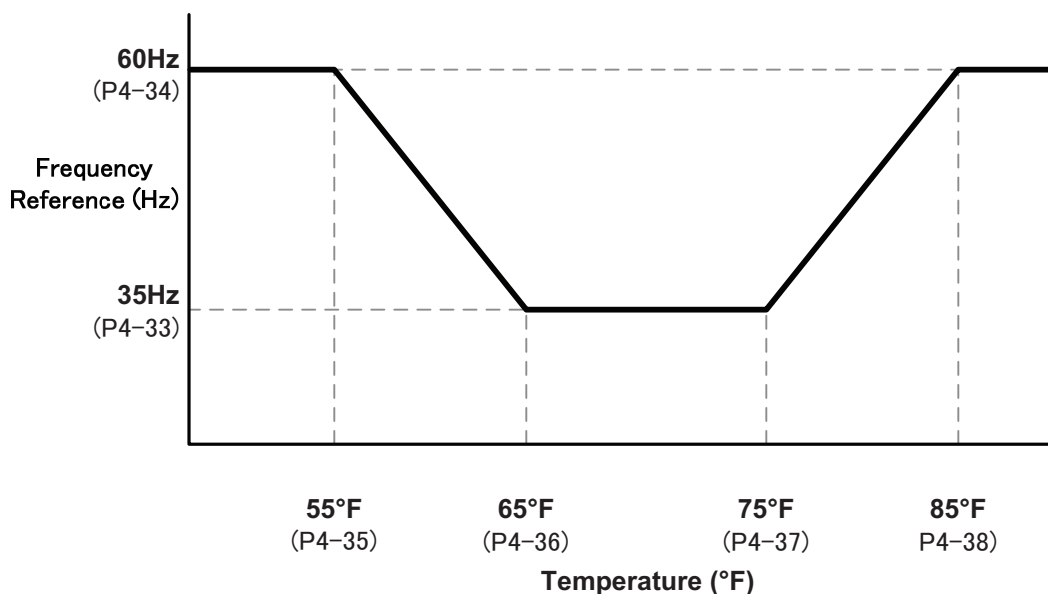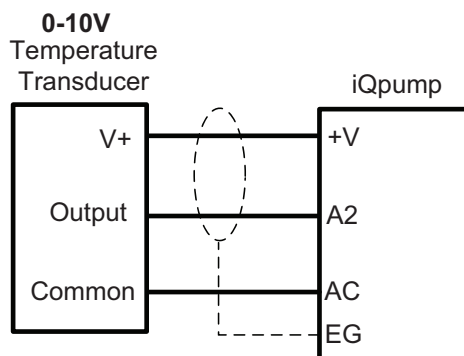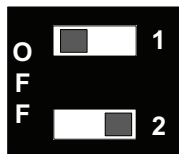
Geothermal Mode Setup Procedure:

■ **Related Parameters for Geothermal Mode Operation**

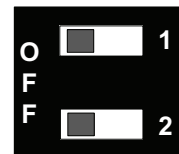| Parameter	Description	iQpump Controller
b1-01	Frequency Reference Source	5
b5-01	PI Mode	0
H3-09	Terminal A2 Function Selection	20
o1-06	User Monitor Selection Mode	1
o1-02 **<1>**	User Monitor Selection After Power-Up	2
o1-08	Third Line User Monitor Selection	80
P1-01	Pump Mode	0
P4-31	Minimum Geothermal Temperature Input	0.0 °F
P4-32	Maximum Geothermal Temperature Input	120.0 °F
P4-33	Minimum Geothermal Speed	35.00 Hz
P4-34	Maximum Geothermal Speed	60.00 Hz
P4-35	Low Temperature to Run at Max. Geothermal speed	55.0 °F
P4-36	Low Temperature to Run at Min. Geothermal speed	65.0 °F
P4-37	High Temperature to Run at Min. Geothermal speed	75.0 °F
P4-38	High Temperature to Run at Max. Geothermal speed	85.0 °F
P4-39	Geothermal Temperature Loss Detection	1

<1> After programming is completed, cycle power to the drive, as changes to the o1-02 monitor requires a drive power-up cycle to be effective.

9   Water Level/Suction Pressure Control in Memobus Multiplex

◆ Overview

When using Water Level or Suction Pressure Control in a Memobus Multiplex system, (see parameter P8-01). The iQpump Controller can be programmed to receive the Water Level or Suction Pressure information from another drive on the network with a Water Level or Suction Pressure input.

◆ Parameters

Parameter representation for this function depends on the setting of parameter P8-01.

■ Parameter Settings

P8-01 Water Level/Suction Pressure Selection

Setting	Description
0	Disabled (factory default)
1	Water Level Control (Previous version PRG: 0034 functionality for setting is "Enabled")
2	Suction Pressure Control

P9-50 Water Level Source (P8-01 set to 0 or 1, Water Level Control)

Setting	Description
0	Analog Only (factory default)
1	Analog -> Network, No Alarm
2	Analog -> Network, Alarm
3	Network Only

P9-50 Suction Pressure Level Source (P8-01 set to 2 Suction Pressure Control)

Setting	Description
0	Analog Only (factory default)
1	Analog -> Network, No Alarm
2	Analog -> Network, Alarm
3	Network Only

P9-50 = 0 (Analog Only)

This drive will transmit its Water Level/Suction Pressure signal to the network. If this signal is lost, the drive will not switch to another signal on the network. The detection action in this mode is solely on parameter b5-12.

P9-50 = 1 (Ana->Net, No Alarm)

This drive will transmit its Water Level/Suction Pressure signal to the network when the analog input is healthy. If this signal is lost, the drive will switch to another signal on the network if available. If there are no available network signals, then this drive will act according to the setting of parameter b5-12 (when = 1 or 2).

> **Note:** Setting parameter b5-12 to 0 will disable analog feedback detection and will prevent the iQpump Controller from switching to the Network Water Level/Suction Pressure.

P9-50 = 2 (Ana->Net, Alarm)

This drive will transmit its Water Level / Suction Pressure signal to the network when the analog input is healthy. If this signal is lost, the drive will switch to another signal on the network if available. An alarm will be displayed indicating that the analog signal has been lost and that the signal is coming from the network. If there are no available network signals, then this drive will act according to the setting of parameter b5-12 (when = 1 or 2).

> **Note:** Setting parameter b5-12 to 0 will disable analog feedback detection and will prevent the iQpump Controller from switching to the Network Water Level/Suction Pressure.

P9-50 = 3 (Network Only)

The drive will always use a valid network Water Level / Suction Pressure signal. If there are no available network signals, the drive will act according to the setting of b5-12 with the following differences:

Setting b5-12 to 1: Instead of an alarm, Network P8-□□ Lost message is displayed.

Setting b5-12 to 2: Instead of a fault, Network P8-□□ Lost message is displayed. In this condition the iQpump Controller no longer accepts iQpump Controller Network run commands and the stopping method is fixed to coast-to-stop.

b5-12 PI Feedback Reference Missing Detection Selection

Setting	Description
0	Disabled
1	Alarm
2	Fault (factory default)

Any drive with b5-12 set to 0 (Disabled) and P9-50 ≠ 3 will effectively have no Terminal A1 signal loss detection and will continuously send the Water Level/Suction Pressure to the iQpump Controller Network regardless of a faulty or an invalid signal.

When b5-12 set to 2 (Fault) and P9-02 = 3, iQpump Controller will display a feedback loss alarm instead of a fault when one of the following conditions active:

1. The iQpump Controller is in Hand Mode
2. There is no Lead iQpump Controller on the network
3. The iQpump Controller is not in Auto Mode

Minimum Water Level or Suction Pressure Detection Operation

In case of a minimum water level or suction pressure, the lead iQpump Controller will de-stage when one or more Lag iQpump Controllers are present, otherwise the lead iQpump Controller will go to sleep.

Note: Setting parameter b5-12 to 0 will disable analog feedback detection and will prevent the iQpump Controller from switching to the Network Water Level/Suction Pressure.

■ Related Parameters

b5-12 PI Feedback Reference Missing Detection Selection

Setting	Description
0	Disabled (factory default)
1	Alarm
2	Fault

P2-03 Sleep Delay Time

Sets delay time when water level or suction pressure signal falls below the minimum level programmed (P8-04).

Range	Description
0 - 3600 sec Default: 5 sec	**Network Multiplex Mode: Water Level Control (P8-01 = 1):** Parameter specifies the time delay before the lead drive de-stages when the water level (U1-98) falls below the Minimum Water Level (P8-04). **Network Multiplex Mode: Suction Control (P8-01 = 2):** Parameter specifies the time delay before the lead drive de-stages when the suction pressure (U1-98) falls below the Minimum Suction Pressure (P8-04). **Contactor Multiplex Mode (P1-01 =1 or 2):** There are two contactor multiplex modes, one for Water Level and another for Suction. Contactors programmed for Multiplex (H2-□□ = 40 and 41) will open one by one when the Water Level (U1-98) is below the Minimum Water Level (P8-04) for the time set in the Sleep Delay Time (P2-03).

IMPORTANT: Staging Restriction when in Water Level/Suction Pressure Control.

• When P1-01 = 3 (Memobus Network) and the iQpump Controller's PI output is being influenced by the Water Level/Suction Pressure Control, pump system staging is disabled.
• When P1-01 = 1 or 2 (Multiplex system) and the iQpump Controller's PI output is being influenced by the Water Level/Suction Pressure Control, Multi-function output contacts (H2-□□ = 40 and 41) are prohibited from closing.

Alarm: Water Level/Suction Pressure Transducer Lost

Alarm Display	Description
AnalogA1 Lost Switched to Net	Analog Terminal A1 signal is lost and the Network Water Level or Suction Pressure signal is now used. **Cause:** Defective or broken analog input source. **Countermeasure:** Check to ensure the Water Level or Suction Pressure source is installed and working properly. If no signal is present, set P9-50 = 3 to have it always read from another drive's network Water Level or Suction Pressure.

Alarm: Network Water or Suction Pressure Signal Lost

Alarm Display	Description
Net Wtr/Suctn Lost, Chk Source	Network source for Water Level or Suction Control Pressure is lost. **Cause:** Valid analog source for Water Level or Suction Control Pressure can not be found on the network. **Countermeasure:** Check the source on drives configured as P9-50 ≠ 3.

Fault: Programming Error: OPE13 Terminal A1

Fault Display	Description
OPE13 Terminal A1	**Cause:** Terminal A1 is assigned to more than one of the following functions. • Frequency Reference (b1-01 = 1) • Dual Zone PI is enabled (b5-01 = 2) • Flow Meter Enabled (P6-01 > 0)* • Water Level/Suction Pressure Control Enabled (P8-01>0)* • Hand Mode Ref Term A1 (P5-01 = 0) **Note:** An OPE13 error will not be generated if b1-01 = 1 and P5-01 = 0, and none of the other conditions listed above apply. *When P1-01 = 3 (Memobus), a setting of P6-01 > 0 and P8-01 > 0 is allowed only if P9-40 = 1 or P9-50 = 3. **Countermeasure:** Reprogram b1-01, b5-01, P6-01, or P8-01. Note: The OPE13 fault is modified in drive software version PRG:0035. Previous software versions have different functionality.

10   iQpump MEMOBUS/Network Operation

◆ Lag Drive Speed Follower and Lag Turn Off

Certain multiplex pump systems require a common pump speed for all running pumps. To allow for this operation, a new selection **"Follow Lead Spd"** is added to parameter P9-05.

■ Function Description

P9-05 Lag Drive Mode

Setting	Description
0	Fixed Speed (factory default) Runs at the P9-06 setting after the P9-07 time expires.
1	PI Regulation. Uses PI to determine speed.
2	Turn Off The iQpump Controller stops running when it switches to a lag drive after P9-07 time expires.
3	Follow Lead Spd The iQpump Controller follows the speed of the active Lead drive. Use P9-30 gain and P9-31 bias setting to adjust reference signal.

Note: The rate at which the Lag drives follow the Lead drive's output speed is dependent on the communication speed of the iQpump Controller network (H5-02), the maximum number of iQpump Controllers on the network (P9-25) and the current number of iQpump Controllers online.

Display Message for Follow Lead Speed Operation:

When the iQpump Controller is operating in Auto Mode, Lag operation and the Follow Lead Speed function is active (P9-05 = 3) then the display will show the actual frequency reference in Hz instead of the selected system units.

■ Related Parameters

P9-06 Lag Fixed Speed

Range	Description	Default
0 - 120.0 Hz	When the drive changes from a lead to a lag and P9-05 = 0, the drive will run at this speed after P9-07 delay time expires.	55.0 Hz

P9-07 Lag Fixed Speed Delay

Time delay before execution of P9-05 selection when the iQpump Controller changes from lead to lag.

> **Note:** Only active when Lag Mode Selection (P9-05) is set to 0, 2 or 3.

Range	Description	Default
0 - 1000 sec	When the drive changes from a lead to a lag and P9-05 ≠ 1, this time specified in parameter P9-07 determines how long the speed is latched before executing one of the following operations: 1. P9-05 = 0: Run at P9-06 2. P9-05 = 2: Turn off 3. P9-05 = 3: Follow the Lead Drive's speed.	5 sec

■ New Parameters

P9-30 Lag Follower Gain

Range	Description	Default
0.0 -300.0%	When P9-05 = 3, the drive will follow the speed of the active lead drive applying this gain and P9-31 bias to the reference signal.	100.0 %

P9-31 Lag Follower Bias

Range	Description	Default
-60.00 - 60.00 Hz	When P9-05 = 3, the drive will follow the speed of the active lead drive applying this bias and P9-30 gain to the reference signal.	0.00 Hz

◆ Flow Meter

Certain multiplex pump systems require staging/de-staging based on the flow rate. The iQpump Controller offers a dedicated set of parameters to operate multiplex pump systems based on flow control.
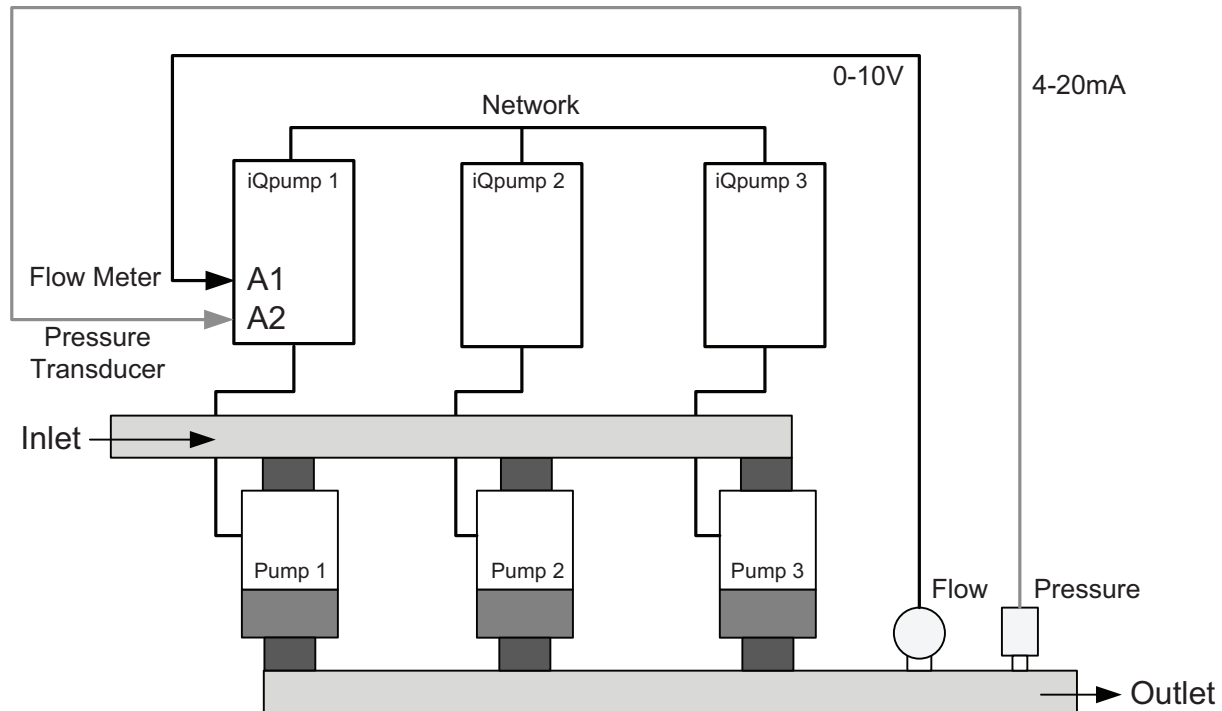
■ Multiplex Pump System Operation

Flow Rate Staging: Set P9-08 (Add Pump Mode) to 3: Flow Meter.

This mode monitors the Flow Rate to determine if staging is needed. If the Flow Rate of the lead iQpump Controller rises above the Flow Staging level (no. of pumps running times P9-41) for the time set in P9-11, the drive will issue a network stage request if an iQpump Controller is available to run.

Example:	If P9-41 Add Flow Rate Level set to 80.0 GPM, then the 2nd pump is called to run when the flow rate rises above 80.0 GPM. The 3rd pump is called to run the flow rate rises above 160.0 GPM and the 4th pump is called when the flow rate rises above 240.0 GPM.

De-staging: Set P9-12 (Remove Pump Mode) to 3: Flow Meter.

This mode monitors the Flow Rate to determine if de-staging is needed. If the flow rate of the lead iQpump Controller falls below the Flow De-Staging level ((no. of pumps running - 1) x P9-42) for the time set in P9-15, a de-stage request is issued if two or more iQpump Controllers are running on the network.

Example:	If P9-42 = 60.0 GPM, then the 4th pump is de-staged when flow rate falls below 180.0 GPM. The 3rd pump is de-staged when the flow rate falls below 120.0 GPM (gallons per minute) and the 2nd pump is de-staged when the flow rate falls below 60.0 GPM.

NOTICE: *Using Fixed Speed Lag Drive mode P9-05 = 0 in conjunction with Flow Meter Staging (P9-08 = 3) or Flow Meter De-staging (P9-12 = 3) could result in an unstable system depending on the system and the parameter settings.*

■ New Parameters

P9-40 Flow Rate Source

Defines the Flow Meter input source when P1-01=3 (Memobus Network).

Setting	Description
0	Analog (factory default)
1	Network Uses PI to determine speed.

P9-41 Add Flow Rate Level

Range	Description	Default
0.0 ~ 6000.0 **<1>**	When P9-08=3 and the Flow Rate is above this level times (No. of pumps running) for the time set in P9-11, the lead drive will request for a new lead drive through the iQpump Controller Memobus network.	0.0

<1> Displayed units are determined by parameter P6-02.

P9-42 Remove Flow Rate Level

Range	Description	Default
0.0 ~ 6000.0 **<1>**	When P9-12=3 and the Flow Rate is below this level times (No. of pumps running minus 1) for the time set in P9-15, the lead drive will request to be removed from the system through the iQpump Controller Memobus network.	0.0

<1> Displayed units are determined by parameter P6-02.

■ Related Parameters

P6-01 Flow Meter Scaling

Range	Description	Default
0.0 ~ 6000.0 GPM	Sets the scaling for the flow meter connected to terminal A1. Enter the gal/min when the flow meter is at its rated output. A setting of 0.0 disables all flow meter functions.	0.0 GPM

P6-02 Water Flow Units

Sets the units displayed for monitor U1-95. Also sets units for parameters P2-02, P6-04, P9-41 and P9-42.

Setting	Description
0	U.S. Gallons/min (GPM) (factory default)
1	U.S. Gallons/Hr (GPH)
2	U.S. Barrels/min (BPM)
3	U.S. Barrels/hour (BPH)
4	U.S. Barrels/day (BPD)

P9-08 Add Pump Mode

Selects the detection method for staging a new pump.

Setting	Description
0	Output Frequency (factory default)
1	Feedback
2	Feedback + Fout
3	Flow Meter **(New)**

P9-11 Add Delay Time

Range	Description	Default
0 ~ 3600 sec	Delay time before a new lead drive is added to the system.	10 sec

P9-12 Remove Pump Mode

Selects the detection method for de-staging to the previous lead pump.

Setting	Description
0	Output Frequency (factory default)
1	Feedback
2	Feedback + Fout
3	Flow Meter

P9-15 Remove Delay Time

Range	Description	Default
0 ~ 3600 sec	Delay time before the lead drive is removed from the system.	10 sec

Alarm: Network Water or Suction Pressure Signal Lost

Alarm Display	Description
Net FlowMeter Lost, Chk Source	There is no drive on the Memobus Network with an analog Flow Meter. **Cause:** With P1-01 = 3, P6-01 > 0 and P9-40 = 1 (Network), the Flow Meter function needs a valid Flow Rate from the network originating from another drive that is also running the Flow Meter function (P6-01 > 0) with P9-40 = 0 (Analog). **Countermeasure:** If the drive has an operational Flow Meter connected to Terminal A1, set P9-40 = 0. If another drive on the Memobus Network has a Flow meter connected to Terminal A1, confirm that drive is online, with P6-01 > 0 and P9-40 = 0.

◆ New Lead Drive Selection: Stop History

■ Overview

Many irrigation pumping skids consist of a PM pump (Pressure Maintenance) and typically two (2) larger booster pumps to maintain high flow peak demands.

In many cases depending on the number of irrigation zones in combination with the type of sprinkler heads used, the flow demand fluctuates and may not require the use of both larger booster pumps at the same time until higher flow rates are required.

The iQpump Controller "Run Stop" history ensures that both booster pumps alternate each run cycle.

■ Parameters

P9-01 Lead Drive Selection

Selects the detection method for staging a new pump.

Setting	Description
0	Next Available Select next available drive on the network as the new lead drive.
1	Lowest Runtime (factory default) Select the iQpump Controller with the lowest runtime as the new lead drive.
2	Stop History Select the iQpump that had been stopped the longest time.

Note: This new lead drive selection also applies to Alternation (P9-03 > 0) and will use the Stop History list when finding the alternate drive.

■ System Example: Triplex Irrigation Booster System-Using Stop History

Overview

A typical pump system operates as described below:

When pressure is dropping, the PM Pump (if installed) will attempt to return the system pressure to the desired setpoint level. If the PM Pump is not able to return the system to the setpoint pressure, typically due to a greater flow demand, the first booster pump (1) will be called to start.

The iQpump Controller will speed up or slow down the pump as needed to maintain the system pressure. When flow decreases and the pump system is no longer required to run, the system will go to sleep waiting for the pressure to drop. On the next run cycle the PM pump will start up again, and instead of running booster pump #1, booster pump #2 is started, since booster #1 ran during the last cycle.

This method ensures that during normal operation both booster pumps will operate evenly as lead or lag pumps each run cycle.

Detailed Description

Triplex irrigation booster system consisting of one PM Pump (pressure maintenance) and two larger booster pumps of the same horsepower. The customer would like to ensure that the PM Pump is also the lead pump to recharge the system during low flow usage, but during high demands the booster pumps alternate on each run cycle or if required will both run to support very high flow demands.

• Jockey/PM Pump will also be lead to start.
• Jockey/PM Pump will stage booster pump 1 or 2 and stay running for 20 seconds and then shut off.
• Booster pump 1 will run system and if required, call for booster pump 2 or vice versa.
• On sleep mode, the lead drive for starting will swap back to Jockey/PM Pump.
• System setpoint 100 psi.
• Pressure drop of 10 psi will start the Jockey pump.
• All drives have individual transducers rated 200 psi maximum, but if there is a transducer failure, switch to network.

Related Parameters: Triplex Irrigation Booster System

Parameter	Description	PM Pump	Booster Pump 1	Booster Pump 2
H5-01	Drive Node Network Address	1	2	3
P1-01	Pump Mode	3	3	3
P1-03	FD Device Scaling	200 psi	200 psi	200 psi
P1-04	Start Level	-10.0 psi	-10.0 psi	-10.0 psi
P9-01	Lead Drive Select	2	2	2
P9-02	Feedback Source	2	2	2
P9-07	Lag Fixed Spd Dly (PM Pump will shut off after 20 sec)	20 sec	5 sec	5 sec
P9-20	Allow Net Run (PM Pump will be lead Pump to start)	2	0	0
P9-21	Run Priority	7	8	8
P9-24	Lead Swap @ Sleep	0 sec	1 sec	1 sec
P9-25	Highest Node Address	3	3	3
U1-01	Auto Setpoint	100 psi	100 psi	100 psi
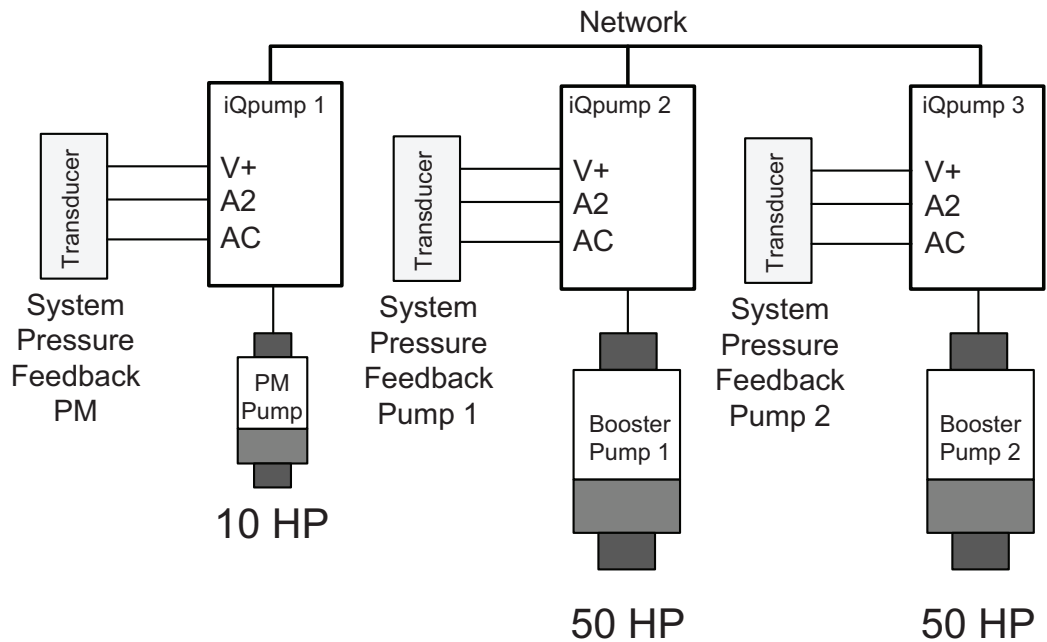
11   Improved and Miscellaneous Functions

◆ Terminal A1 Loss Detection

Feedback loss detection alarm and fault messages are enhanced to differentiate between terminal A1 feedback loss and Terminal A2 PI feedback loss.

Use parameter b5-12 is select feedback loss detection operation for terminal A1.

■ Parameters

b5-12 Feedback Loss Detection

Setting	Description
0	Disabled
1	Alarm
2	Fault (factory default)

New Alarm Message: Feedback Loss Terminal A1 (Modified)

Fault Display	Description
A1-LOST Terminal A1 Lost	Shown when b5-12 = 1 and feedback signal on terminal A1 is lost. Check to ensure the device connected to Terminal A1 is installed and working properly.

New Fault Message: Feedback Loss Terminal A1 (Modified)

Fault Display	Description
A1-LOST Terminal A1 Lost	Shown when b5-12 = 2 and feedback signal on terminal A1 is lost. Check to ensure the device connected to Terminal A1 is installed and working properly.

Multi-function Output Setting: Transducer Loss (Modified)

Setting	Description
4A	Transducer Loss Closed: During a "Feedback Loss" alarm. Closed: During a "FBL - Feedback Loss" fault". Closed: During an "A1-LOST Terminal A1 Lost" alarm (New) Closed: During an "A1-LOST Terminal A1 Lost" fault (New)

■ Function Description Feedback Loss Detection

Wire break (feedback loss detection) will be detected on Terminal A1 when all of the following conditions are satisfied:

• PI Feedback Loss Detection is enabled (b5-12 = 1 or 2).
• PI function is enabled (b5-01 > 0).
• Dual Zone PI or Water Level/Suction Pressure Control is enabled (b5-01 = 2 or P8-01 > 0, P1-01 = 0, b5-09 = 0, and H3-09 = B).
• PI function is **NOT** disabled via Multi-Function Digital Input.
• Signal on Terminal A1 falls below -6.25 % or rises above 106.25 % for more than 1 second.
  Note: Wire-break detection on Terminal A1 is checked **after** the gain/bias parameters (H3-02 and H3-03) are applied.

■ Feedback Loss Detection Special Conditions:

Auto Mode Operation and b5-12 is set to 2 (Fault):
• Running: The iQpump Controller will fault on feedback loss detection.
• Stopped: The iQpump Controller will display feedback loss alarm.

Hand Mode Operation and b5-12 is set to 2 (Fault):
• Running: The iQpump Controller will display feedback loss alarm.
• Stopped: The iQpump Controller will display feedback loss alarm.

Both the alarm or fault message display in any of these scenarios is: "A1-LOST Terminal A1 Lost."

> **Note:** To convert terminal A1 to a 4-20 mA signal, connect a 250 ohm precision resistor (1/4 Watt or greater) between iQpump Controller terminals A1 and AC. Then program H3-02 = 231.3% and H3-03 = -25.0 %.

◆ Initialization for Basic Applications (A1-03)

A new initialization mode setting 7770 is available under parameter A1-03 (Initialize Parameters). This setting allows users to easily configure the iQpump Controller for use as a standard drive in simple applications. In this mode the iQpump Controller defaults to start/stop operation from the terminals and speed control using a 0-10 Vdc signal to analog input A1.

■ A1-03 Initialize Parameters

Setting	Description
0	No Initialize (factory default)
1111	User Initialize The modified iQpump Controller parameters are returned to the values selected as user settings. User settings are stored when parameter o2-03 = 1: Set Defaults.
2220	2-Wire Initialize Initializes the iQpump Controller for 2 Wire Control Operation
3330	3-Wire Initialize Initializes the iQpump Controller for 3 Wire Control Operation
7770	General Purpose Configures the iQpump Controller for General Purpose Operation

The Table below shows the default parameters settings for the standard iQpump Controller 2-wire initialization (2220) and the General Purpose Initialization (7770).

■ Parameters Modified for General Purpose Initialization

Parameter No.	Parameter Name	Factory Default Setting	Setting After General Purpose Initialize (A1-03 = 7770)
b1-01	Frequency Reference Selection	0 (Operator)	1 (Terminals)
b1-02	Run Command Selection	0 (Operator)	1 (Terminals)
b5-01	PID Mode Setting	1 (Enabled)	0 (Disabled)
C1-01	Acceleration Time 1	20.0 sec	25.0 sec
C1-02	Deceleration Time 1	10.0 sec	25.0 sec
C6-02	Carrier Frequency Selection	1 (2.0 kHz)	kVA dependent
H1-04	Terminal S6 Selection	80 (Hand Mode)	4 (Multi-Step SP 2)
H1-05	Terminal S7 Selection	84 (Disable Pre-Charge)	F (Term Not Used)
H2-01	Terminal M1-M2 Selection	40 (Pump 2 Control)	0 (During Run 1)
H2-02	Terminal M3-M4 Selection	41 (Pump 3 Control)	A (Remote/Auto Oper)
H3-09*	Terminal A2 Function Selection	B (PID Feedback)	2 (Aux Reference)
L5-01	Number of Auto Restarts	5	0
L5-03	Maximum Restart Time	20.0 sec	180.0 sec
o1-06*	User Monitor Selection Mode	1 (3 Mon Selectable)	0 (3 Mon Sequential)
P1-02	System Units	1 (psi:lb/SqrInch)	14 (Hz: Hertz)
P1-03	Feedback Scaling	145	26000
P1-05	Start Level Delay Time	1 sec	0 sec
P1-06	Minimum Pump Frequency	40.0 Hz	0.0 Hz
P4-05	Thrust Frequency	30.00 Hz	0.00 Hz
P4-11	Utility Delay Time	0.2 minutes	0.0 minutes
P5-02	Hand Reference	40.00 Hz	0.00 Hz

Note: After performing a General Purpose initialization (7770), the parameters shown in this table will be visible in the Modified Constants menu, with the exception of parameters marked by *.

■ Pump Quick Setup Menu

Initializing the iQpump Controller for General Purpose Operation also re-configures the Pump Quick Setup (Quick Start) menu to show parameters for use in basic applications.

The table below shows the parameters that appear in the quick start menu for standard iQpump Controller 2-Wire Initialization (2220) and the General Purpose Initialization (7770).

Quick Setup Overview

A1-03 = 2220, 3330 iQpump Quick Setup	A1-03 = 7770 General Purpose Quick Setup
E2-01 (Motor Rated FLA)	b1-01 (Reference Source)
E2-04 (Number of Poles)	b1-02 (Run Source)
P1-03 (FB Dev. Scaling)	C1-01 (Accel Time 1)
D1-01 (Set-Point 1)	C1-02 (Decel Time 1)
P1-04 (Start Level)	E2-01 (Motor Rated FLA)
P1-06 (Min. Pump Freq.)	E2-04 (Number of Poles)
P4-10 (AMO PwDn-Storage)	L5-01 (Num of Restarts)
P5-04 (Oper HAND Key)	L5-03 (Max Restart Time)
-	P1-06 (Min. Pump Freq.)

■ General Purpose Initialization: Carrier Frequency Adjustment

Initializing the iQpump Controller for General Purpose Operation adjust the carrier frequency setting as shown in table below for each of the iQpump Controller models.

Carrier Frequency Setting for A1-03 = 7770 "General Purpose" Initialization

208-240 V Drives				480 V Drives		
Model CIMR-P7□□□□□-107	Parameter C6-02 Setting Value	C6-03 Carrier Frequency (kHz)		Model CIMR-P7□□□□□-107	Parameter C6-02 Setting Value	C6-03 Carrier Frequency (kHz)
20P41	3	8.0 kHz*		40P41	3	8.0 kHz*
20P71	3	8.0 kHz*		40P71	3	8.0 kHz*
21P51	3	8.0 kHz*		41P51	3	8.0 kHz*
22P21	3	8.0 kHz*		42P21	3	8.0 kHz*
23P71	3	8.0 kHz*		43P71	3	8.0 kHz*
25P51	3	8.0 kHz*		44P01	3	8.0 kHz*
27P51	3	8.0 kHz*		45P51	3	8.0 kHz*
20111	3	8.0 kHz*		47P51	3	8.0 kHz*
20151	3	8.0 kHz*		49P01	3	8.0 kHz*
20181	3	8.0 kHz*		40111	3	8.0 kHz*
20221	3	8.0 kHz*		40151	3	8.0 kHz*
20301	3	8.0 kHz*		40181	3	8.0 kHz*
20370	2	5.1 kHz		40221	3	8.0 kHz*
20450	2	5.1 kHz		40241	3	8.0 kHz*
20550	3	8.0 kHz*		40301	3	8.0 kHz*
20750	1	2.0 kHz		40371	3	8.0 kHz*
20900	1	2.0 kHz		40451	3	8.0 kHz*
21100	1	2.0 kHz		40551	2	5.1 kHz
				40750	2	5.1 kHz
				40900	3	8.0 kHz*
				41100-107	2	5.1 kHz
				41320-107	2	5.1 kHz
				41600-107	2	5.1 kHz
				41850-107	1	2.0 kHz
				42200-107	1	2.0 kHz
				43000-107	1	2.0 kHz

Note: * = when an option card is installed, C6-03 max is 7.0 kHz.

◆ Miscellaneous Changes

This following items are minor changes to existing iQpump Controller parameters and functions.

■ A1-01 Language Selection

Selection 6:Portuguese is removed.

■ Stopping Method - Default Value

Parameter b1-03 stopping method selection factory default has been changed from setting 0 (Ramp to Stop) to 1 (Coast to Stop).

b1-03 Stopping Method

Setting	Description
0	Ramp to Stop
1	Coast to Stop (factory default)
2	DC Injection to Stop
3	Coast w/Timer (A new run command is ignored if input before the time in C1-02 expires)

■ Output Phase Exchange

Parameter b1-04 allows users to switch the motor phasing in the software without physically switching the motor leads. When b1-04 is set to 3 (Exchange Phase, Reverse Disabled) "forward operation" is defined as the opposite direction.

NOTICE: *It is strongly recommended not to use this function to reverse motor rotation, but to exchange two of the output phases to the motor.* **Make sure the motor is wired correctly to the iQpump Controller and motor rotation is correct.**

b1-04 Reverse Operation

Setting	Description
1	Reverse Disabled (factory default) "Forward operation" is defined as the forward direction. Set when motor direction matches iQpump Controller forward operation.
3	Exchange Phase, Reverse Disabled Reverse motor phases in the software. "Forward operation" is defined as the opposite direction.

Note: b1-04 is not affected by initialization A1-03.

■ C6-02 Carrier Frequency - Default Value

The default setting for parameter C6-02 Carrier Frequency is changed to 1 (2.0 kHz).

■ L2-01 Momentary Power Loss Detection Selection

Setting	Description
0	Disabled Drive trips on (UV1) fault when power is lost.
1	PwrL Ride Thru t Drive will restart if power returns within the time set in L2-02. If a second power loss occurs within one hour, the drive will trip on Uv1.*
2	CPU Power Active (factory default) Drive will restart if power returns prior to internal power supply shut down. If a second power loss occurs within one hour, the drive will remain in an undervoltage state for an additional 10-second delay after power returns. With each additional power loss occurrence, the time delay will increase. If the drive operates for one hour with no power loss conditions detected, the time delay is cleared.* **Note:***In order for a restart to occur, the run command must be maintained throughout the ride thru period.

■ P9-23 Max Pumps Running

The Range changed from 1 - 16 to 1 - 8 and the default changed from 16 to 8.

■ P9-25 Highest Node Address - Range

The range for parameter P9-25 Highest Node Address changes to 2 - 8.

■ Fault: Programming Error: OPE17 Run/Stop - Coast Time

Fault Display	Description
OPE17 Run/Stp-CoastTmr	**Cause:** Run/Stop Control and Coast To Stop w/Timer are both enabled. 1. P8-18 > 0 AND 2. P8-19 > 0 AND 3. P8-20 > 0 AND 4. b1-03 = 3 (Coast w/Timer) **Countermeasure:** Reprogram b1-03 or P8-18 ~ P8-20.

◆ Compatibility Mode

A compatibility mode is available for using the iQpump Controller software or PRG:0035/U1-14=30036 on a multiplex network that consists of iQpump Controllers with software PRG:0034/U1-14=30034. Compatibility Mode must be enabled by the customer.
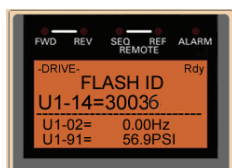
Figure 5 Example Software ID Check: Check iQpump Controller Monitor U1-14

■ P9-99 Network Compatibility Selection

Determines the communication compatibility for the iQpump Memobus Network.

Setting	Description
0	A-Version PRG:30034 Use this mode if (ONE or MORE) iQpump Controllers on the network have software version monitor U1-14=30034 and nameplate PRG: 0034.
1	B-Version PRG:30035+ or greater (factory default) Use this mode if (NONE) of the iQpump Controllers on the network have software version monitor U1-14=30034 and nameplate PRG: 0034.

NOTICE

Abnormal Pump Operation Hazard During iQpump Controller Replacement

Verify software ID (U1-14) when replacing an iQpump Controller in a multiplex network configuration. Set parameter P9-99 to a value of "0 :A-version 30034" if (ONE or MORE) iQpump Controllers on the network have Use this mode if (ONE or MORE) iQpump Controllers on the network have software version monitor U1-14=30034 and nameplate PRG: 0034. Failure to comply will result abnormal drive operation

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■ New Fault Message: Net Incompatible

Fault Display	Description
OPE18 Net Incompatible	Parameter selection is not compatible with the selected network, see parameter P9-99. When P1-01 = 3 (Memobus Networking), P9-99 = 0 (A-Version 30034), and one of the following is set: 1. P9-01 = 2 (Stop History) 2. P9-05 = 3 (Follow Lead Spd) 3. P8-01 = 1 or 2 (Water Level or Suction Control enabled). 4. P6-01 > 0 (Flow Meter Enabled) and P9-40 = 1 (Network)

12   Speed Follower Deceleration Time Switchover <0036>

◆ Overview

The current iQpump Speed Follower will attempt to match the speed of the Lead Drive after the Lag Drive Fixed Speed Delay.

Consider a scenario wherein the system needs help from an idle drive to maintain system pressure. When the idle drive is called to run, the difference between the set-point and the feedback may be too small to make the drive accelerate faster. In the case of a system is configured with these settings:

• Set for Lag Drive Speed Follower
• Add Pump method is Frequency Reference
• Frequency Reference setting close to the maximum frequency

The system will drop the speed after the Lag Drive Fixed Speed Delay expires in order to follow the output frequency of the previously idle drive. This transition may cause unwanted pressure drops. A longer deceleration time will be activated on the lag drives when the system switches the drive that is being followed. The longer deceleration time will be effective for a programmable setting, after which, the regular deceleration time is used.

Note: The Network Compatibility Mode parameter P9-99=1: B-Version 30035+ reflects support for drive software version U1-14=30036 and nameplate PRG: 0036.

■ Functional Operation

If P9-05 = 3 (Follow Lead Spd), the lag drive will use the network information and the lead drive's output speed as its frequency reference. The lag drive's final speed reference is affected by (Lag Follower Gain P9-30) and then by (Lag Follower Bias P9-31).

 Lag Drive Speed = (Lead Drive Speed x Lag Follower Gain) + Lag Follower Bias

When P9-33 > 0.0 sec, an alternate deceleration time (Lag Follower Decel P9-32) is used when the drive switches from the latched speed (Lag Fixed Delay P9-07) to the new Lead drive's output frequency. The deceleration time is active for the duration set in (Lag Followr Dtim P9-33), and will switch back to the regular deceleration rates when it expires.

   Note: Parameter functionality stated below only applies when P1-01 = 3 (Memobus Network)

P9-32 Lag Follower Deceleration Time

Range	Description	Default
0.0 ~ 1000.0 sec	When the P9-33 timer is running, and the drive is running as Lag Drive Speed Follower (P9-05 = 3), then the deceleration time is set to this value.	60.0 sec

P9-33 Lag Follower Deceleration Time Active Time

Range	Description	Default
0.0 ~ 360.0 sec	The P9-32 deceleration time is effective during this time window. The drive will use the standard deceleration rates when it expires. A setting of 0.0 sec will disable the Lag Follower deceleration time switching.	0.0 sec

■ Related Parameters
   Note: Parameter functionality stated below only applies when P1-01 = 3 (Memobus Network)

P9-05 Lag Drive Mode

Determines the function of the lag drive.

Setting	Description
0	Fixed Speed (factory default) Runs at the P9-06 setting after the P9-07 time expires.

Setting	Description
1	PI Regulation. Uses PI to determine speed.
2	Turn Off The iQpump Controller stops running when it switches to a lag drive after P9-07 time expires.
3	Follow Lead Spd The iQpump Controller follows the speed of the active Lead drive. Use P9-30 gain and P9-31 bias setting to adjust reference signal.

P9-07 Lag Fixed Speed Delay

Time delay before execution of P9-05 selection when the iQpump Controller changes from lead to lag.

Range	Description	Default
0 - 1000 sec	When the drive changes from a lead to a lag and P9-05 $\neq$ 1, this time specified in parameter P9-07 determines how long the speed is latched before executing one of the following operations: 1. P9-05 = 0: Run at P9-06 2. P9-05 = 2: Turn off 3. P9-05 = 3: Follow the Lead Drive's speed.	5 sec

P9-30 Lag Drive Speed Follower Gain

Range	Description	Default
0.0 - 300.0 %	When P9-05 = 3, the drive will follow the speed of the active lead drive applying this gain and P9-31 bias to the reference signal.	100.0 %

P9-31 Lag Drive Speed Follower Bias

Range	Description	Default
-60.00 - 60.00 Hz	When P9-05 = 3, the drive will follow the speed of the active lead drive applying this bias and P9-30 gain to the reference signal.	0.00 Hz

P9-99 Network Compatibility Selection

Determines the communication compatibility for the iQpump Memobus Network.

Setting	Description
0	A-Version 30034 Use this mode if (ONE or MORE) iQpump Controllers on the network have software version monitor U1-14=30034 and nameplate PRG: 0034.
1	B-Version 30035+ (factory default) Use this mode if (NONE) of the iQpump Controllers on the network have software version monitor U1-14=30034 and nameplate PRG: 0034.

■ Timing Diagrams - Speed Follower Deceleration Time Switchover (Disabled and Enabled)

P9-01 = 1 (Lowest Run-time)   P9-05 = 3 (Follow Lead Speed)
P9-08 = 0 (Output Frequency)   P9-12 = 0 (Output Frequency)
P9-32 = 60.0 sec   P9-33 = 0.0 sec
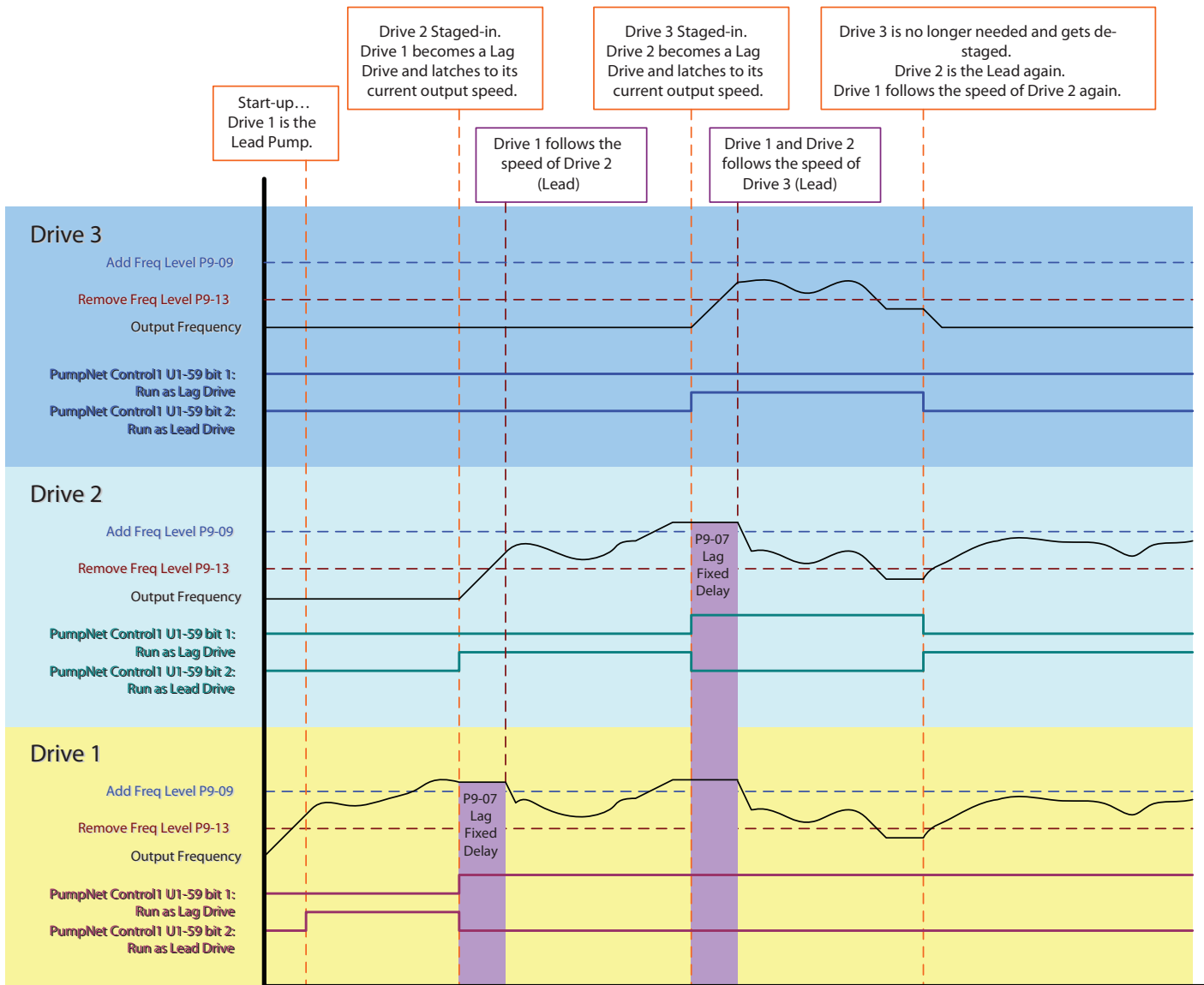
Figure 6 Lag Follower Deceleration Time Switching (Disabled)

P9-01 = 1 (Lowest Run-time)   P9-05 = 3 (Follow Lead Speed)
P9-08 = 0 (Output Frequency)   P9-12 = 0 (Output Frequency)
P9-32 = 60.0 sec   P9-33 = 10.0 sec
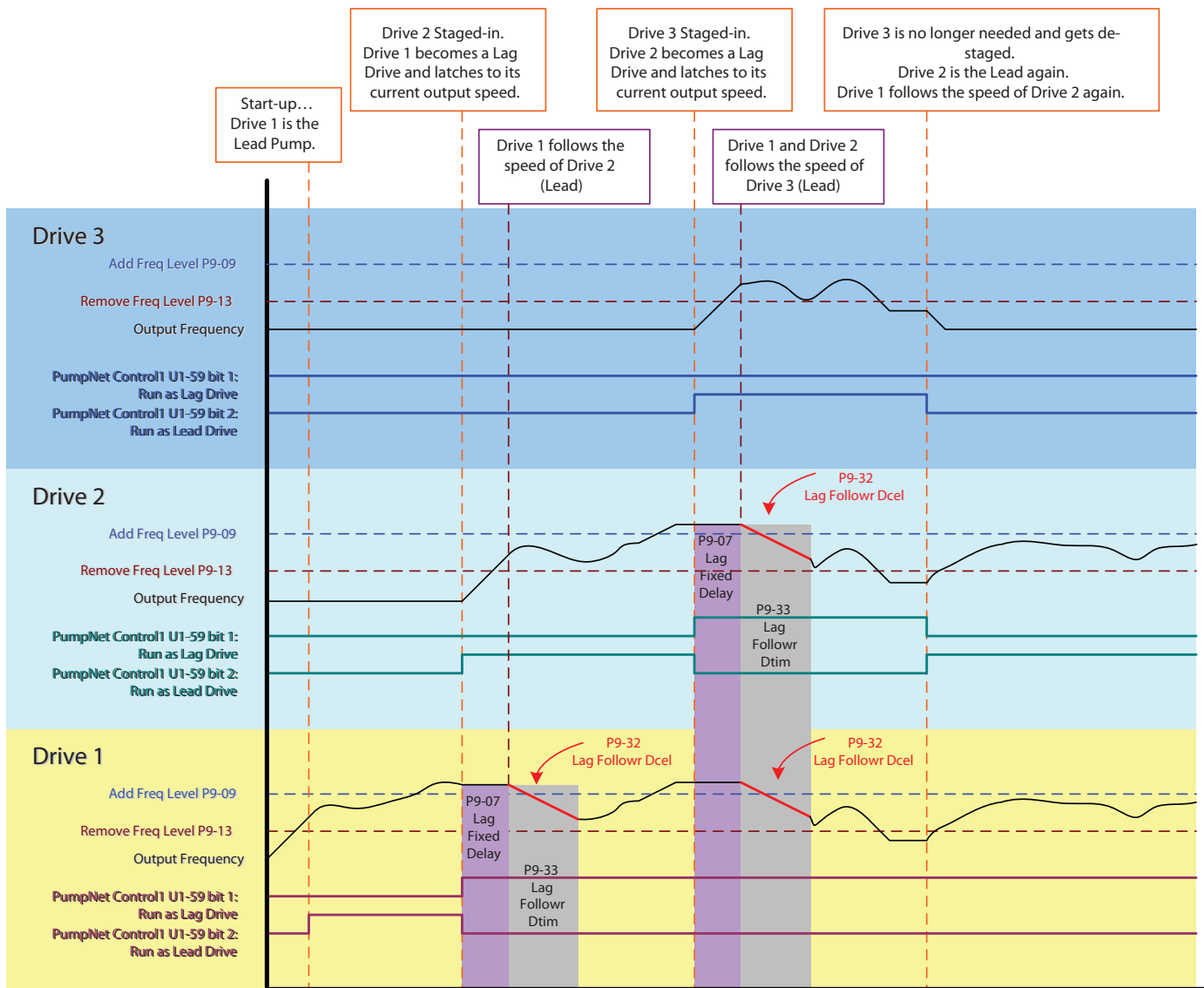
Figure 7 Lag Follower Deceleration Time Switching (Enabled)

13   Transducer Wiring using an External Power Supply

◆ Simplex Pump System - Transducer Connection using Analog Input A2 (4 - 20 mA Mode)

A2 used for pressure transducer.
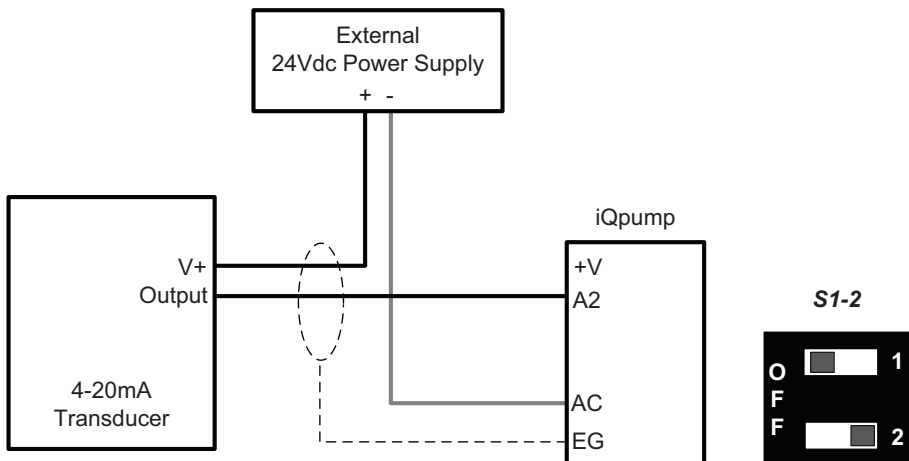
Set S1-2 to ON Position (4-20mA) for iQpump Drive (Factory Default)

◆ Simplex Pump System - Transducer Connection using Analog Input A1 (0 - 10 Vdc Mode)

A1 used for flow meter, water level or suction pressure transducer.
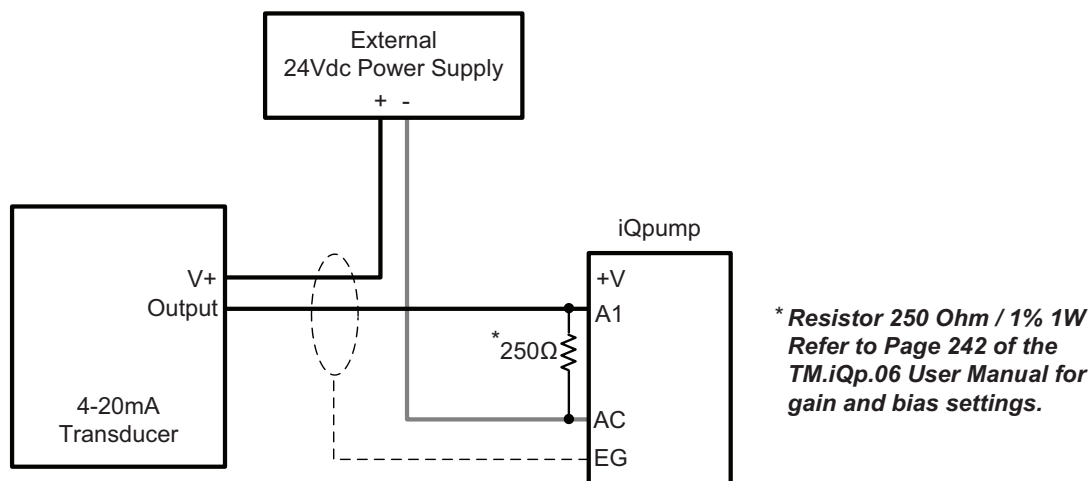
* *Resistor 250 Ohm / 1% 1W Refer to Page 242 of the TM.iQp.06 User Manual for gain and bias settings.*

◆ Duplex System: Single Transducer Connection using Analog Input A2

A2 used for pressure transducer.

Set S1-2 to ON Position (4-20mA) for both iQpump Drives (Factory Default)
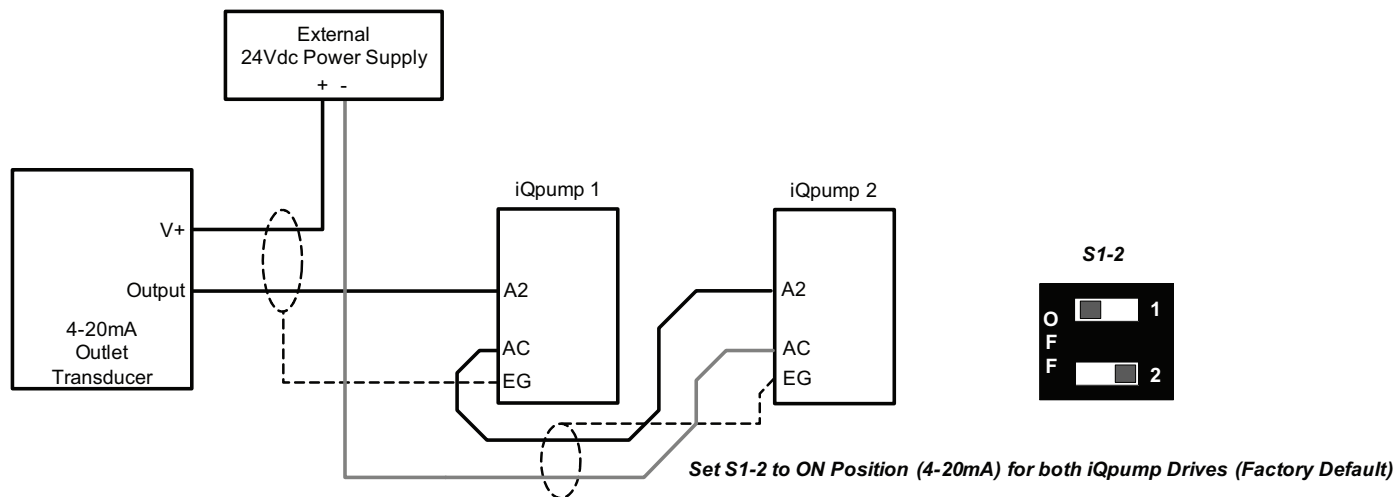
◆ Triplex System: Transducer Connection using Analog Input A2

A2 used for water level or suction pressure transducer.
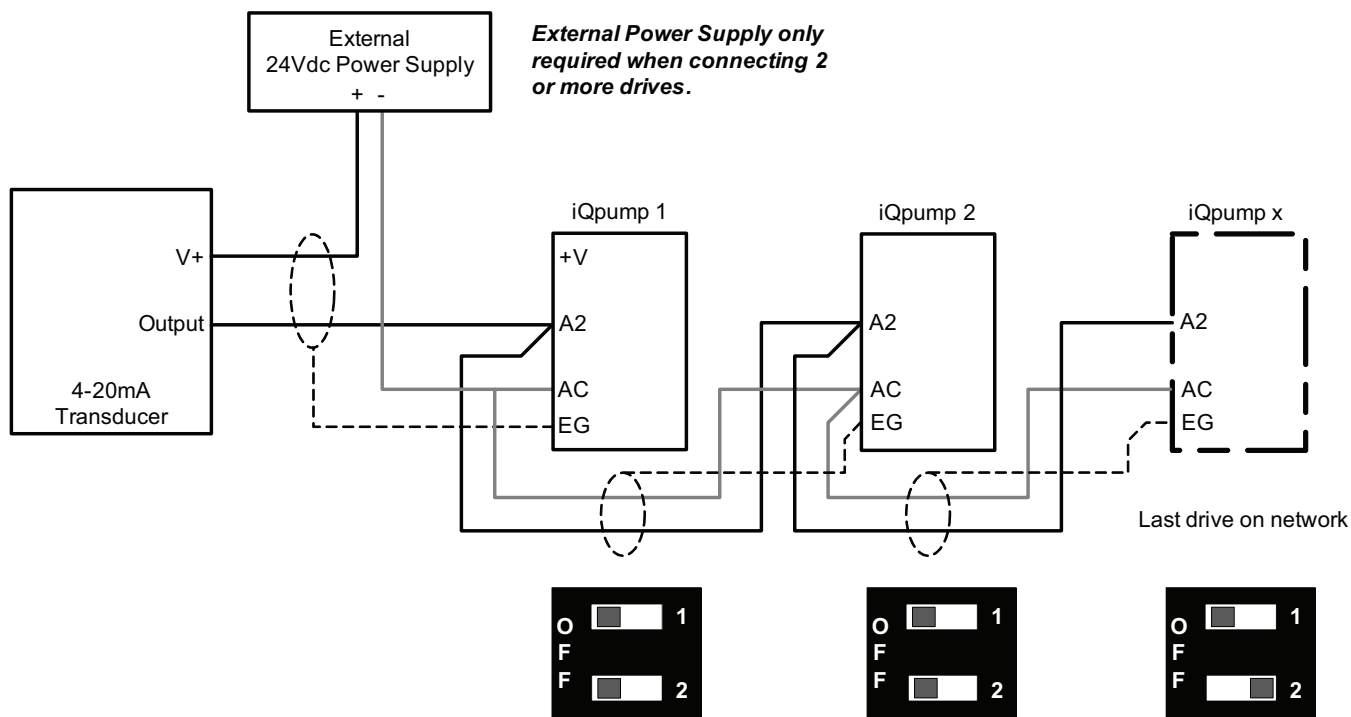
Set S1-2 to ON Position for the last iQpump Drive on the network. All other iQpump drives should have S1-2 set to OFF.

◆ Triplex System: Transducer Connection using Analog Input A1

A2 used for pressure transducer.

External Power Supply only required when connecting 2 or more drives.

External 24Vdc Power Supply
+ -

iQpump 1

iQpump 2

iQpump x

+V
A1
AC
EG

A1
AC
EG

A1
AC
EG

V+
Output

4-20mA
Transducer

* 250

*Resistor 250 Ohm / 1% 1W
Refer to Page 242 of the
TM.iQp.06 User Manual for
gain and bias settings.*

Last drive on network

A
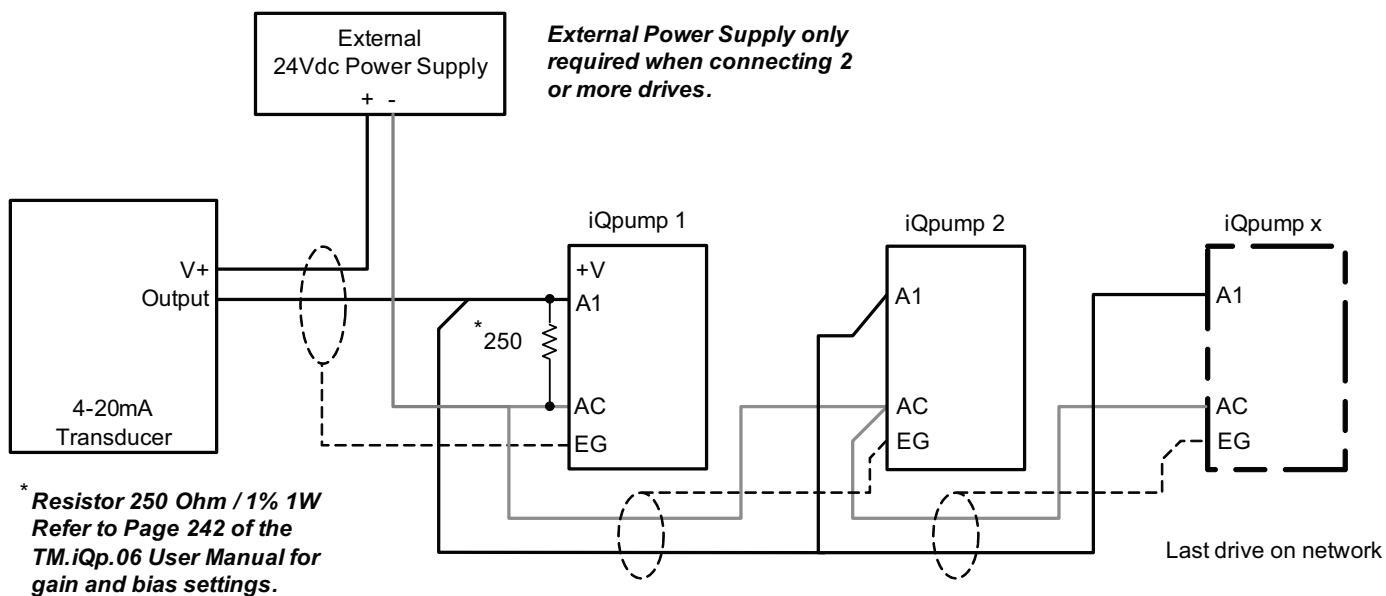
Parameters for iQpump Software PRG:0035 and 0036

This appendix lists all the parameter numbers and names, along with a description of each. Also, below the parameter name in bold type is the abbreviated name as it appears on the digital operator display/keypad.

Parameter List

Table 1 Parameter List

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
			Initialization			
A1-00 ♦	0100	Language Selection **Select Language**	Language selection for digital operator display. 0: English 2: Deutsch 3: Francais 4: Italiano 5: Espanol *Not returned to factory setting by initialization	0 ~ 6	0	Programming
A1-01 ♦	0101	Access Level Selection **Access Level**	This setting determines which parameters are accessible. 0: Operation Only 2: Advanced Level	0 or 2	2	Programming
A1-03	0103	Initialize Parameters **Init Parameters**	Used to return all parameters to their factory or user setting. 0: No Initialize 1110: User Initialize (The user must set their own parameter default values and then parameter o2-03 must be set to "1" to save them. If the parameter values are changed after o2-03 is set to "1", the user default values can be restored by setting A1-03 to 1110.) 2220: 2-Wire Initial 3330: 3-Wire Initial 7770: General Purpose <0035>	0 ~ 7770	0	Programming
A1-04	0104	Password 1 **Enter Password**	When the value set into A1-04 does NOT match the value set into A1-05, parameters A1-01 thru A1-03 cannot be changed.	0 ~ 9999	0	Programming
A1-05	0105	Password 2 **Select Password**	All other parameters as determined by A1-01 can be changed. Parameter A1-05 can be accessed by pressing the MENU key while holding the RESET key.	0 ~ 9999	0	Programming
♦ Denotes that parameter can be changed when the drive is running. * Menu location is Pump Quick Setup when b5-01=1, and Programming when b5-01=0.						
			Sequence			
b1-01	0180	Frequency Reference Selection **Reference Source**	Selects the speed command (frequency reference) input source. 0: Operator - Digital preset speed d1-01 1: Terminals - Analog Input Terminal A1 (or Terminal A2 see parameter H3-13) 2: Serial Com - RS-485 Terminals R+, R-, S+ and S- 3: Option PCB - Option board connected at 2CN 5: Geothermal Mode - frequency reference dependent on temperature input (H3-09=20) <0035>	0 ~ 5	0	Programming
b1-02	0181	Run Command Selection **Run Source**	Selects the run command input source. 0: Operator - "Hand" and "Off" keys on digital operator 1: Terminals - Contact Closure on Terminal S1 2: Serial Com - RS-485 Terminals R+, R-, S+ and S- 3: Option PCB - Option board connected at 2CN 5: Timed Run <0034>	0 ~ 3, 5	0	Programming
b1-03	0182	Stopping Method Selection **Stopping Method**	Selects the stopping method when the run command is removed. 0: Ramp to Stop 1: Coast to Stop 2: DC Injection to Stop 3: Coast w/Timer (A new run command is ignored if input before the time in C1-02 expires.)	0 ~ 3	1 Default =0 prior to PRG: <0035>	Programming
b1-04 <0035>	0183	Reverse Operation Selection **Reverse Operation**	1: Reverse Disabled 3: Exchange Phase, Reverse Disabled	1, 3	1	Programming
b1-07	0186	Local/Remote Run Selection **LOC/REM RUN Sel**	0: Cycle External RUN - If the run command is closed when switching from hand (local) mode to auto (remote) mode, the drive will not run. 1: Accept External RUN - If the run command is closed when switching from hand (local) mode to auto (remote) mode, the drive WILL run. **Note:** Used with LCD Operator only.	0 ~ 1	0	Programming
b1-08	0187	Run Command Selection During Program **RUN CMD at PRG**	0: Disabled - Run command accepted only in the operation menu. 1: Enabled - Run command accepted in all menus (except when b1-02 = 0).	0 ~ 1	0	Programming
b1-11	010F	Drive Delay Time Setting **Wait to Run Time**	After a run command, drive output will start after this delay time.	0 ~ 600 sec	0 sec	Programming

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
			DC Braking			
b2-01	0189	DC Injection Braking Start Frequency **DCInj Start Freq**	Sets the frequency at which DC injection braking starts when ramp to stop (b1-03 = 0) is selected. If b2-01 < E1-09, DC injection braking starts at E1-09.	0.0 ~ 10.0 Hz	0.5 Hz	Programming
b2-02	018A	DC Injection Braking Current **DCInj Current**	Selects the DC injection braking current as a percentage of the drive rated current.	0 ~ 100 %	50 %	Programming
b2-03	018B	DC Injection Braking Time at Start **DCInj Time @ Start**	Sets the time length of DC injection braking at start in units of 1 second.	0.00 to 10.00 sec	0.00 sec	Programming
b2-04	018C	DC Injection Braking Time at Stop **DCInj Time @ Stop**	When b1-03 = 2 actual DC Injection time is calculated as follows: b2-04 x 10 x Output Frequency/E1-04. When b1-03 = 0, this parameter determines the amount of time DC Injection is applied to the motor at the end of the decel ramp. This should be set to a minimum of 0.50 seconds when using HSB. This will activate DC injection during the final portion of HSB and help ensure that the motor stops completely.	0.00 ~ 10.00 sec	0.5 sec	Programming
b2-09	01E1	Motor Pre-Heat Current **Preheat Current**	Motor Pre-heat current in % of drive rated current. This is used to keep the motor warm to prevent condensation and is used in conjunction with a digital input (data = 60).	0 ~ 100 %	0 %	Programming
			Speed Search			
b3-01	0191	Speed Search Selection **SpdSrch at Start**	Enables/disables and selects the speed search function at start. 0: SpdsrchF Disable - Speed search at start is disabled (estimated speed method is used at other times) 1: SpdsrchF Enable - Speed search is enabled (estimated speed method) 2: SpdsrchI Disable - Speed search at start is disabled (current detection method is used at other times) 3: SpdscrhI Enable - Speed search is enabled (current detection method) Estimated Speed Method: Actual motor speed and direction is estimated, then the motor is ramped from that speed to the commanded speed. Current Detection Method: Current level is monitored while output frequency is ramped down.	0 ~ 3	2	Programming
b3-02	0192	Speed Search Deactivation Current **SpdSrch Current**	Used only when b3-01 = 3. Sets the speed search operation current as a percentage of drive rated current.	0 ~ 200 %	120 %	Programming
b3-03	0193	Speed Search Deceleration Time **SpdSrch Dec Time**	Used only when b3-01 = 3. Sets the deceleration time during speed search.	0.1 ~ 10.0 sec	2.0 sec	Programming
b3-05	0195	Speed Search Delay Time **Search Delay**	Delays the speed search operation after a momentary power loss to allow time for an external output contactor to re-energize.	0.0 ~ 20.0 sec	0.2 sec	Programming
b3-14	019E	Bidirectional Speed Search Selection **Bidir Search Sel**	0: Disabled 1: Enabled	0 ~ 1	1	Programming
			Delay Timers			
b4-01	01A3	Timer Function ON-Delay Time **Delay-ON Timer**	Used in conjunction with a multi-function digital input and a multi-function digital output. This sets the amount of time between when the digital input is closed, and the digital output is energized.	0.0 ~ 3000.0 sec	0.0 sec	Programming
b4-02	01A4	Timer Function OFF-Delay Time **Delay-OFF Timer**	Used in conjunction with a multi-function digital input and a multi-function digital output. This sets the amount of time the output stays energized after the digital input is opened.	0.0 ~ 3000.0 sec	0.0 sec	Programming
			PI Control			
b5-01	01A5	PI Mode Setting **PI Mode**	This parameter enable /disables the closed loop (PI) controller. 0: Disabled 1: Enabled (commanded speed becomes PI setpoint) 2: Enabled - 2 Zone (dual zone PI enabled) <0034>	0 ~ 2	1	Programming
b5-02 ♦	01A6	Proportional Gain Setting **P Gain**	Sets the proportional gain of the PI controller.	0.00 ~ 25.00	2.00	Programming
b5-03 ♦	01A7	Integral Time Setting **PI I Time**	Sets the integral time for the PI controller. A setting of zero disables integral control.	0.0 ~ 360.0 sec	3.0 sec	Programming
b5-04 ♦	01A8	Integral Limit Setting **PI I Limit**	Sets the maximum output possible from the integrator. Set as a % of fmax.	0.0 ~ 100.0 %	100.0 %	Programming
b5-06 ♦	01AA	PI Output Limit **PI Limit**	Sets the maximum output possible from the entire PI controller. Set as a % of fmax.	0.00 ~ 100.00 %	100.00 %	Programming
♦ Denotes that parameter can be changed when the drive is running.						

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
b5-07 ♦	01AB	PI Offset Adjustment **PI Offset**	Sets the amount of offset of the output of the PI controller. Set as a % of fmax. The PI Offset Adjustment parameter has two different uses. Parameter b5-07 serves different functions depending on whether it is used on a standard PI loop or a Differential PI loop. 1: Parameter b5-07 causes an offset to be applied to the output of the PI function in a non-Differential PI loop. Every time the PI output is updated, the offset is summed with the PI output. This can be used to artificially kick-start a slow starting PI loop. 2: If the drive is configured for Differential PI Regulation (H3-09 = 16), then the PI Offset is the targeted maintained differential between the signal measured on analog input A1 and the signal measured on analog input A2.	−100.0 ~ +100.0 %	0.0 %	Programming
b5-08 ♦	01AC	PI Primary Delay Time Constant **PI Delay Time**	Sets the amount of time for a filter on the output of the PI controller.	0.00 ~ 10.00 sec	0.00 sec	Programming
b5-09	01AD	PI Output Level Selection **Output Level Sel**	Determines whether the PI controller will be direct or reverse acting. 0: Normal Output (direct acting) 1: Reverse Output (reverse acting)	0 ~ 1	0	Programming
b5-10	01AE	PI Output Gain Setting **Output Gain**	Sets the output gain of the PI controller.	0.0 ~ 25.0	1.0	Programming
b5-12	01B0	PI Feedback Reference Missing Detection Selection **Fb los Det Sel**	0: Disabled 1: Alarm 2: Fault	0 ~ 2	2	Programming
b5-13	01B1	PI Feedback Loss Detection Level **Fb los Det Lvl**	Sets the PI feedback loss detection level as a percentage of maximum frequency (E1-04).	0 ~ 100 %	0 %	Programming
b5-14	01B2	PI Feedback Loss Detection Time **Fb los Det Time**	Sets the PI feedback loss detection delay time in terms of seconds.	0.0 ~ 25.5 sec	2.0 sec	Programming
b5-17	01B5	PI Accel/Decel Time **Acc/Dec Time**	Applies an accel/decel time to the PI setpoint reference.	0.0 ~ 25.5 sec	0.0 sec	Programming
b5-32	85F	Integrator Ramp Limit **Int Ramp Lim**	When set a value greater than zero, the PI Integrator is forced to be within +/- this amount of the soft starter output	0.0 ~ 10.0 Hz	0.0 Hz	Programming
♦ Denotes that parameter can be changed when the drive is running.						
			Energy Saving			
b8-01	01CC	Energy Saving Control Selection **Energy Save Sel**	Energy Savings function enable/disable selection 0: Disabled 1: Enabled	0 ~ 1	0	Programming
b8-04	01CF	Energy Saving Coefficient Value **Energy Save COEF**		0.0 ~ 655.0	kVA Dependent	Programming
b8-05	01D0	Power Detection Filter Time **kW Filter Time**	Used to fine-tune the energy savings function.	0 ~ 2000 ms	20 ms	Programming
b8-06	01D1	Search Operation Voltage Limit **Search V Limit**		0 ~ 100 %	0 %	Programming
			Accel/Decel			
C1-01 ♦	0200	Acceleration Time 1 **Accel Time 1**	Sets the time to accelerate from zero to maximum frequency.		20.0 sec	Programming
C1-02 ♦	0201	Deceleration Time 1 **Decel Time 1**	Sets the time to decelerate from maximum frequency to zero.		10.0 sec	Programming
C1-03 ♦	0202	Acceleration Time 2 **Accel Time 2**	Sets the time to accelerate from zero to maximum frequency when selected via a multi-function input.	0.0 ~ 6000.0 sec	10.0 sec	Programming
C1-04 ♦	0203	Deceleration Time 2 **Decel Time 2**	Sets the time to decelerate from maximum frequency to zero when selected via a multi-function input.		10.0 sec	Programming
C1-05 ♦	0204	Acceleration Time 3 **Accel Time 3**	Sets the time to accelerate from zero to maximum frequency when activated by P3-12. Used for system response stabilization.		50.0 sec	Programming
C1-06 ♦	0205	Deceleration Time 3 **Decel Time 3**	Sets the time to decelerate from maximum frequency to zero when activated by P3-12. Used for system response stabilization.		50.0 sec	Programming
♦ Denotes that parameter can be changed when the drive is running.						

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
C1-09	0208	Fast Stop Time **Fast Stop Time**	Sets the time to decelerate from maximum frequency to zero for the "Fast Stop" function.	0.0 ~ 6000.0 sec	10.0 sec	Programming
C1-11	020A	Accel/Decel Switch Frequency **Acc/Dec SW Freq**	Sets the frequency for automatic switching of accel/decel times. Fout < C1-11: Accel/Decel Time 2 Fout > = C1-11: Accel/Decel Time 1 Multi-function input "Multi-Acc/Dec 1" has priority over C1-11.	0.0 ~ 200.0 Hz	0.0 Hz	Programming
		S-Curve Accel/Decel				
C2-01	020B	S-Curve Characteristic at Accel Start **SCrv Acc @ Start**	S-curve is used to further soften the starting ramp. The longer the S-curve time, the softer the starting ramp.	0.00 ~ 2.50 sec	0.20 sec	Programming
C2-02	020C	S-Curve Characteristic at Accel End **SCrv Acc @ End**		0.00 ~ 2.50 sec	0.20 sec	Programming
		Torque Compensation				
C4-01 ♦	0215	Torque Compensation Gain **Torq Comp Gain**	This parameter helps to produce better starting torque. It determines the amount of torque or voltage boost based upon motor current and motor resistance.	0.00 ~ 2.50	1.00	Programming
C4-02	0216	Torque Compensation Primary Delay Time **Torq Comp Time**	This parameter adjusts a filter on the output of the torque compensation function. Increase to add torque stability, decrease to improve torque response.	0 ~ 10000 ms	200 ms	Programming
♦ Denotes that parameter can be changed when the drive is running.						
		Carrier Frequency				
C6-02	0224	Carrier Frequency Selection **CarrierFreq Sel**	Carrier frequency sets the number of pulses per second of the output voltage waveform. 1: 2.0 kHz 2: 5.1 kHz 3: 8.0 or 7.0* kHz F: Program (Determined by the setting of C6-03) * when an option card is installed **Note:** In PRG: <0035> C6-02 is default is 2 kHz for all KVA sizes except when A1-03=7770. Refer to page *40* for setting details.	1 ~ F	kVA Dependent	Programming
C6-03	0225	Carrier Frequency Upper Limit **CarrierFreq Max**	Maximum carrier frequency allowed when C6-02 = F.	0.4 ~ 15.0 kHz	kVA Dependent	Programming

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
			Preset Reference			
d1-01 ♦	0280	Set-point Reference 1 **Set-point 1**	Digital preset setpoint reference 1. Used when b1-01 = 0 and when in "hand" mode. Setting units are affected by P1-02.	1 ~ P1-03 Value 0.00 to P1-02 Value <0034>	0.00	Programming
d1-02 ♦	0281	Set-point Reference 2 **Set-point 2**	Digital preset setpoint reference 2. Selected via multi-function input terminals. Setting units are affected by P1-02. Parameter d1-02 is also the Zone 1 PI reference when b5-01 = 2. <0034>		0.00	Programming
d1-03 ♦	0282	Set-point Reference 3 **Set-point 3**	Digital preset setpoint reference 3. Selected via multi-function input terminals. Setting units are affected by P1-02. Parameter d1-03 is also the Zone 2 PI reference when b5-01 = 2. <0034>		0.00	Programming
d1-04 ♦	0283	Set-point Reference 4 **Set-point 4**	Digital preset setpoint reference 4. Selected via multi-function input terminals. Setting units are affected by P1-02. Parameter d1-04 is also the Zone 1 and 2 PI reference when b5-01 = 2. <0034>		0.00	Programming
d1-17 ♦	0292	Jog Frequency Reference **Jog Reference**	Jog reference used when a jog is selected via the LCD operator keypad. This parameter is not available with the HOA operator. Setting units are affected by o1-03.		0.00	Programming
♦ Denotes that parameter can be changed when the drive is running.						
			Reference Limits			
d2-01	0289	Frequency Reference Upper Limit **Ref Upper Limit**	Determines maximum speed command, set as a percentage of parameter E1-04. If speed command is above this value, actual drive speed will be limited to this value. This parameter applies to all speed command sources.	0.0 ~ 110.0 %	100.0 %	Programming
d2-02	028A	Frequency Reference Lower Limit **Ref Lower Limit**	Determines minimum speed command, set as a percentage of parameter E1-04. If speed command is below this value, actual drive speed will be set to this value. This parameter applies to all speed command sources.	0.0 ~ 110.0 %	0.0 %	Programming
d2-03	0293	Master Speed Reference Lower Limit **Ref1 Lower Limit**	Determines the minimum speed command, set as a percentage of parameter E1-04. If speed command is below this value, actual drive speed will be set to this value. This parameter only applies to analog inputs A1 and A2.	0.0 ~ 110.0 %	0.0 %	Programming
			Jump Frequencies			
d3-01	0294	Jump Frequency 1 **Jump Freq 1**	These parameters allow programming of up to three prohibited frequency points for eliminating problems with resonant vibration of the motor/ machine. This feature does not actually eliminate the selected frequency values, but will accelerate and decelerate the motor through the prohibited bandwidth.	0.0 ~ 200.0 Hz	0.0 Hz	Programming
d3-02	0295	Jump Frequency 2 **Jump Freq 2**			0.0 Hz	Programming
d3-03	0296	Jump Frequency 3 **Jump Freq 3**			0.0 Hz	Programming
d3-04	0297	Jump Frequency Width **Jump Bandwidth**	This parameter determines the width of the deadband around each selected prohibited frequency point. A setting of "1.0" will result in a deadband of +/- 1.0 Hz.	0.0 ~ 20.0 Hz	1.0 Hz	Programming
			V/f Pattern			
E1-01	0300	Input Voltage Setting **Input Voltage**	Set to the nominal voltage of the incoming line.	155 ~ 255.0 (240V) 310 to 510.0 (480V)	240 V 480 V	Programming
E1-03	0302	V/f Pattern Selection **V/f Selection**	0: 50 Hz 1: 60 Hz Saturation 2: 50 Hz Saturation 3: 72 Hz 4: 50 Hz VT1 5: 50 Hz VT2 6: 60 Hz VT1 7: 60 Hz VT2 8: 50 Hz HST1 9: 50 Hz HST2 A: 60 Hz HST1 B: 60 Hz HST2 C: 90 Hz D: 120 Hz F: Custom V/F FF: Custom w/o limit	0 ~ FF	F	Programming

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
E1-04	0303	Maximum Output Frequency **Max Frequency**		0.0 ~ 120.0 Hz	60.0 Hz	Programming
E1-05	0304	Maximum Output Voltage **Max Voltage**		0.0 ~ 255.0 (240V) 0.0 to 510.0 (480V)	230.0 V 460.0 V	Programming
E1-06	0305	Base Frequency **Base Frequency**		0.0 ~ 200.0 Hz	60.0 Hz	Programming
E1-07	0306	Mid Output Frequency A **Mid Frequency A**		0.0 ~ 200.0 Hz	3.0 Hz	Programming
E1-08	0307	Mid Output Voltage A **Mid Voltage A**		0.0 ~ 255.0 (240V) 0.0 to 510.0 (480V)	17.2 Vac 34.5 Vac	Programming
E1-09	0308	Minimum Output Frequency **Min Frequency**		0.0 ~ 200.0 Hz	1.5 Hz	Programming
E1-10	0309	Mid Output Voltage **Min Voltage**	To set V/f characteristics in a straight line, set the same values for E1-07 and E1-09. In this case, the setting for E1-08 will be disregarded. Always ensure that the four frequencies are set in the following manner: E1-04 (FMAX) ≍ E1-06 (FA) > E1-07 (FB) ≍ E1-09 (FMIN)	0.0 ~ 255.0 (240V) 0.0 to 510.0 (480V)	10.3 Vac 20.7 Vac	Programming
E1-11	030A	Mid Output Frequency B **Mid Frequency B**		0.0 ~ 200.0 Hz	0.0 Hz	Programming
E1-12	030B	Mid Output Voltage B **Mid Voltage B**	Set only when V/f is finely adjusted at rated output range. Adjustment is not normally required.	0.0 ~ 255.0 (240V) 0.0 to 510.0 (480V)	0.0 Vac	Programming
E1-13	030C	Base Voltage **Base Voltage**		0.0 ~ 255.0 (240V) 0.0 to 510.0 (480V)	0.0 Vac	Programming
Motor Setup						
E2-01	030E	Motor Rated Current **Motor Rated FLA**	Set to the motor nameplate full load amps.	10 ~ 200 %	kVA Dependent	Pump Quick Setup
E2-03	030F	**No-Load Current**	Sets the magnetizing current of the motor.	kVA Dependent	kVA Dependent	Programming
E2-04	0311	Number of Motor Poles **Number of Poles**	Set to the number of poles. Used for no-flow detection function and for the calculation of rpm related parameters.	2 ~ 48	2	Pump Quick Setup
E2-05	0312	Motor Line-to-Line Resistance **Term Resistance**	Phase to phase motor resistance, normally set by the autotuning routine.	0.000 ~ 65.000	kVA Dependent	Programming
Communication Option Setup						
F6-01	03A2	Operation Selection after Communication Error **Com Bus Flt Sel**	Sets the stopping method for option PCB communications error (BUS fault). Active only when a communications option PCB is installed and when b1-01 or b1-02 = 3. 0: Ramp to Stop 1: Coast to Stop 2: Fast-Stop 3: Alarm Only	0 ~ 3	1	Programming
F6-02	03A3	Input Level of External Fault from Communication Option Card **EF0 Detection**	0: Always detected 1: Detected only during run	0 ~ 1	0	Programming
F6-03	03A4	Stopping Method for External Fault from Communication Option Card **EF0 Fault Action**	0: Ramp to Stop 1: Coast to Stop 2: Fast-Stop 3: Alarm Only	0 ~ 3	1	Programming
F6-05	03A6	Current Monitor Display Unit Selection **Current Unit Sel**	0: A Display 1: 100 % /8192 (Drive Rated Current)	0 ~ 1	0	Programming

The diagram in the Description column (spanning E1-04 through E1-10) shows:
Output voltage (V)
VMAX (E1-05)
VBASE (E1-13)
VA (E1-08)
VMIN (E1-10)
FMIN (E1-09) — FA (E1-07) — FBASE (E1-06) — FMAX (E1-04)
Frequency (Hz)

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
			Digital Inputs			
H1-01	0400	Terminal S3 Function Selection **Terminal S3 Sel**	0: 3-wire control FWD/REV selection for 3-wire sequence 1: Local/Remote Sel Hand/Auto Selection - Closed = Hand, Open = Auto 2: Option/Inv Sel Selects source of speed command and sequence. Closed = b1-01 & b1-02, Open = Option Card 3: Multi-Step SP1 Closed = speed command from d1-02 or Aux Terminal. Open = speed command determined by b1-01. 4: Multi-Step SP2 Closed = speed command from d1-03 or d1-04. Open = speed command determined by b1-01. 7: Multi-Acc/Dec 1 Closed = Accel & Decel Ramps determined by C1-03 & C1-04. Open = Accel & Decel Ramps determined by C1-01 & C1-02. 8: Ext BaseBlk N.O. Closed = Output transistors forced off, Open = Normal operation. 9: Ext BaseBlk N.C. Closed = Normal Operation, Open = Output transistors forced off.	0 ~ 87	24	Programming
H1-02	0401	Terminal S4 Function Selection **Terminal S4 Sel**	A: Acc/Dec RampHold Closed = Acceleration suspended and speed held, Open = Normal Operation. C: Term A2 Enable Closed = Terminal A2 is active, Open = Terminal A2 is disabled. F: Term Not Used Terminal has no effect. 10: MOP Increase Closed = Speed Command Increases, Open = Speed Command Held. Must be set in conjunction with MOP Decrease and b1-02 must be set to 1. 11: MOP Decrease Closed = Speed Command Decreases, Open = Speed Command Held. Must be set in conjunction with MOP Increase and b1-02 must be set to 1.	0 ~ 87	14	Programming
H1-03 (continued on next page)	0402	Terminal S5 Function Selection **Terminal S5 Sel**	14: Fault Reset Closed = Resets the drive after the fault and the run command have been removed. 15: Fast-Stop N.O. Closed = Drive decelerates using C1-09, regardless of run command status. 17: Fast-Stop N.C. Closed = Normal operation. Open = Drive decelerates using C1-09, regardless of run command status. 18: Timer Function Input for independent timer, controlled by b4-01 and b4-02. Used in conjunction with a multi-function digital output. 19: PI Disable Turns off the PI controller, and PI setpoint becomes speed command. 1B: Program Lockout Closed =All parameter settings can be changed. Open = Only speed command at U1-01 can be changed. 20: External Pump Fault, Normally Open, Always Detected, Ramp To Stop 21: External Pump Fault, Normally Closed, Always Detected, Ramp To Stop 22: External Pump Fault, Normally Open, During Run, Ramp To Stop 23: External Pump Fault, Normally Closed, During Run, Ramp To Stop 24: External Pump Fault, Normally Open, Always Detected, Coast To Stop 25: External Pump Fault, Normally Closed, Always Detected, Coast To Stop	0 ~ 87	3: 2-wire 0: 3-wire	Programming

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
H1-04 (continued on next page)	0403	Terminal S6 Function Selection **Terminal S6 Sel**	26: External Pump Fault, Normally Open, During Run, Coast To Stop 27: External Pump Fault, Normally Closed, During Run, Coast To Stop 28: External Pump Fault, Normally Open, Always Detected, Fast-Stop 29: External Pump Fault, Normally Open, Always Detected, Fast-Stop 2A: External Pump Fault, Normally Open, During Run, Fast-Stop 2B: External Pump Fault, Normally Closed, During Run, Fast-Stop 2C: External Pump Fault, Normally Open, Always Detected, Alarm Only 2D: External Pump Fault, Normally Closed, Always Detected, Alarm Only 2E: External Pump Fault, Normally Open, During Run, Alarm Only 2F: External Pump Fault, Normally Closed, During Run, Alarm Only 30: PID Integral Reset 31: PID Integral Hold 34: PI SFS Cancel 36: Option/Inv Sel 2 Selects source of speed command and sequence. Closed = Option Card, Open = b1-01 & b1-02. 60: Motor Preheat Applies current to create heat to avoid condensation. Closed = Apply amount of current as set in parameter b2-09. 61: Speed Search 1 When closed as a run command is given, drive does a speed search starting at maximum frequency (E1-04). (Current detection.) 62: Speed Search 2 When closed as a run command is given, drive does a speed search starting at speed command. (Current detection.) 64: Speed Search 3 67: Com Test Mode - Used to test RS-485/422 interface. Direction determined by fwd/rev input. 3-wire control Only. 6A: Drive Enable - Closed = Drive will accept run command. Open = Drive will not run. If running, drive will stop per b1-03. 6B: Com/Inv Sel - Selects source of speed command and sequence Closed = Serial Communication (R+,R-,S+,S-), Open = b1-01 & b1-02 6C: Com/Inv Sel 2 72: Remote Drv Disbl <0035> Prevents the drive from running when active for the time set in P4-25. Must be inactive for the time set in P4-26 to allow the drive to run again. **Note**: Parameter P4-24 determines if this input is Normally Open or Normally Closed. 73: Low City Press <0034> Indicates that sufficient/insufficient pressure is present on the inlet to the pump. Used mainly for pressure booster stations. When P1-01 = 3, an alarm condition (see parameters P4-21 and P4-22) will cause drives in the network to stop running and show a "Net Pump Err" message. 75: Reset Accum <0034> Closed: Volume accumulated will be reset to zero (and held at zero if digital input remains closed). 76: High Water Level <0034> Function will be active whenever the drive is running. Function logic depends on parameter P1-15 (Water DI Config). P1-15 = 0 or 1 (Normally Open) Closed: High Water Level Fault Open: Reservoir/Tank is filled to normal level. P1-15 = 2 or 3 (Normally Closed) Closed: Reservoir/Tank is filled to normal level. Open: High Water Level Fault 80: Hand Mode Function Active in Stopped and Auto Mode. Closed: Hand mode operation as defined in P1-14. Open: Stop Mode when with no incoming run command. **Note:** Input not active when b1-02 is set for 0 – Operator. 81: Disable Sleep Mode Function Active in Auto Mode. Closed: Disables sleep function, Feedback Drop Detection and Over cycle protection. Open: Sleep function, Feedback Drop Detection and Over cycle protection enabled. 82: Sleep Activation Active in Auto Mode. Closed: Drive will go to sleep (External Digital Input). Open: No function.	0 ~ 87	80	Programming

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
H1-05	0404	Terminal S7 Function Selection **Terminal S7 Sel**	83: Thermostat Fault, Function Active in Auto Mode. Closed: Drive will trip on "Thermostat Fault". Open: Thermostat fault not active. Open: Low Water Level Fault. 84: Pre-charge Closed: Disables pre-charge function. Open: Pre-charge function enabled. 85: Low Water Level <0034> Function Active in Auto Mode during normal operation, also used with pre-charge function. Function logic depends on parameter P1-15 (Water DI Config). P1-15 = 0, or 2 (Normally open). Closed: Low Water Level Fault. Open: Reservoir/Tank is filled to normal level. P1-15 = 1 or 3 (Normally Closed). Closed: Reservoir/Tank is filled to normal level. Pre-charge function: Function uses low water level input as "Tank/Reservoir" feedback to indicate water level reached. **IMPORTANT** Program P1-15 to 0 or 2 when the "Low Water" function is not used. 86: Fixed Speed Auto Function Active in Auto Mode Only, Pre-charge and Thrust Bearing function have a higher priority. When fixed speed auto is active (closed) drive disabled Sleep Mode and Lead/Lag operation. Closed: Drive runs at P3-02 frequency, PI Control disabled Open: Drive runs normal operation auto mode. 87: Thermostat Fault, Normally Closed <0032> Function Active in Auto Mode. Closed: Thermostat fault not active. Open: Drive will trip on "Thermostat Fault".	0 ~ 87	84	Programming
H1-12 ♦ <0034>	87A	External Fault 3 Delay Time **EF3 Delay Time**	Sets the amount of time delay applied to the EF3 fault. (20 ≤ H1-01 ≤ 2F)	0.00 ~ 300.00 sec	0.00 sec	Programming
H1-13 ♦ <0034>	87B	External Fault 4 Delay Time **EF4 Delay Time**	Sets the amount of time delay applied to the EF4 fault. (20 ≤ H1-02 ≤ 2F)	0.00 ~ 300.00 sec	0.00 sec	Programming
H1-14 ♦ <0034>	87C	External Fault 5 Delay Time **EF5 Delay Time**	Sets the amount of time delay applied to the EF5 fault. (20 ≤ H1-03 ≤ 2F)	0.00 ~ 300.00 sec	0.00 sec	Programming
H1-15 ♦ <0034>	87D	External Fault 6 Delay Time **EF6 Delay Time**	Sets the amount of time delay applied to the EF6 fault. (20 ≤ H1-04 ≤ 2F)	0.00 ~ 300.00 sec	0.00 sec	Programming
H1-16 ♦ <0034>	87E	External Fault 7 Delay Time **EF7 Delay Time**	Sets the amount of time delay applied to the EF7 fault. (20 ≤ H1-05 ≤ 2F)	0.00 ~ 300.00 sec	0.00 sec	Programming
♦ Denotes that parameter can be changed when the drive is running.						

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
			Digital Outputs			
H2-01	040B	Terminal M1-M2 Function Selection **Term M1-M2 Sel**	0: During RUN 1 = Closed when a run command is input or the drive is outputting voltage. 1: Zero Speed = Closed when drive output frequency is less than Fmin (E1-09).	0 ~ 57	40	Programming
H2-02 (continued on next page)	040C	Terminal M3-M4 Function Selection **Term M3-M4 Sel**	2: Fref/Fout Agree 1 = Closed when drive output speed equals the speed command within the bandwidth of L4-02. 3: Fref/Set Agree 1 = Closed when the drive output speed and the speed command are equal to the value in L4-01 within the bandwidth of L4-02. 4: Freq Detect 1 = Closed when the drive output speed is less than or equal to the value in L4-01, with hysteresis determined by L4-02. 5: Freq Detect 2 = Closed when the drive output speed is greater than or equal to the value in L4-01, with hysteresis determined by L4-02. 6: Inverter Ready = Closed when the drive is not in a fault state, and not in program mode. 7: DC Bus Undervolt = Closed when the DC bus voltage falls below the UV trip level (L2-05). 8: Base Blk 1 = Closed when the drive is not outputting voltage. 9: Operator Reference = Closed when the speed command is coming from the digital operator. A: Remote/Auto Oper = Closed when the run command is coming from the digital operator. B: Trq Det 1 N.O. - Closes when the output current exceeds the value set in parameter L6-02 for more time than is set in parameter L6-03. C: Loss of Ref - Closes when the drive has detected a loss of analog speed command. Speed command is considered lost when it drops 90 % in 0.4 seconds. Parameter L4-05 determines drive reaction to a loss of speed command. D: DB Overheat. E: Fault - Closes when the drive experiences a major fault. F: Not Used 10: Minor Fault - Closes when drive experiences a minor fault or alarm. 11: Reset Cmd Active - Closes when the drive receives a reset command from terminals or serial comms. 12: Timer Output - Output for independent timer, controlled by b4-01 and b4-02. Used in conjunction with a multi-function digital input. 17: Trq. Det 1 N.C. - Opens when the output current exceeds the value set in parameter. L6-02 for more time than is set in parameter L6-03. 1A: Reverse Dir - Closes when the drive is running in the reverse direction. 1E: Restart Enabled - Closes when the drive is performing an automatic restart. Automatic restart is configured by parameter L5-01. 1F: Overload (OL1) - Closes before a motor overload occurs. (90 % of OL1 time). 20: OH Prealarm - Closes when the drive's heatsink temperature exceeds the setting of parameter L8-02. 38: Drive Enable - Closes when the drive enable input is active. 39: Waiting to Run - Closes during the time after a run command is issued, but the drive is not running due to the time set in parameter b1-10. 3A: OH Freq Reduce 3B: Run Src Com/Opt 3D: Cooling Fan Err = Closed during internal cooling fan failure. 40: Pump 2 Control Open: Shutdown Additional Pump 2. Closed: Start Additional Pump 2. Function Active in multiplex mode. Contactor control for second pump. 41: Pump 3 Control Open: Shutdown Additional Pump 3. Closed: Start Additional Pump 3. Function Active in multiplex mode. Contactor control for second pump.	0 ~ 57	41	Programming

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
H2-02 (continued)	040C	Terminal M3-M4 Function Selection **Term M3-M4 Sel**	42: Pump Fault Function Active in hand, auto, pre-charge and thrust mode Open: No Dedicated Pump Faults are active. Closed: Dedicated pump fault active (Low Feedback Fault, High Feedback Fault, Over Cycling Fault, Pump Protection Fault, Thermostat Fault, Low Water Fault, Ext. Pump Fault). 43: Mot 2 Alternate <0034> Used in conjunction with the 2-motor alternation function. Open: Motor 1 in use (or 2-motor alternation is disabled). Closed: Motor 2 in use. 44: Sleep Active <0034> Closed: Drive is in the sleep mode. 45: Start Lvl Delay <0034> Closed: During the Start Level Delay Time (P1-05). Feedback has dropped below the P1-04 level and the drive is delaying running. 46: Thrust Bearing <0034> Closed: The Thrust Bearing feature is active (output frequency is between zero and P4-05). 47: Pre-charge <0034> Closed: The Pre-charge feature is active (configured by P4-01 ~ P4-03). -OR- Closed: The Pre-charge 2 feature is active (configured by P4-12 ~ P4-13). 48: High Feedback <0034> Closed: During a "High FB/Water" Fault. -OR- Closed: During a "Low Feedback" Alarm. 49: Low Feedback <0034> Closed: During a "High FB/Water" Fault. -OR- Closed: During a "Low Feedback" Alarm. 4A: Transducer Loss <0034> Closed: Feedback Loss has been detected (configured by b5-12 ~ b5-14). -OR- Closed: Feedback Loss has been detected on A1 (dual-zone PI). <0035>-OR- Closed: During a "FBL - Feedback Loss Fault". 4B: Set-point Not Met <0034> Closed: During an "NMS - Set-point Not Met" Fault. -OR- Closed: Feedback level is outside of the P1-11 window. (P1-12 time delay is not applied). **Note:** If P1-11 is set to zero, this digital output will always be open. 4C: Loss of Prime <0034> Closed: During a "LOP - Loss Of Prime" Fault. -OR- Closed: Output current is below the P1-14 level. **Note** If P1-14 is set to zero, this digital output will always be open. 4D: Thermostat Fault <0034> Closed: Thermostat Fault is present. 4E: Low Flow <0034> Closed: During the "Low Flow Fault" condition. -OR- Closed: During a low flow condition as set by P6-04 ~ P6-06 (includes "Low Flow Alarm"). 4F: Accum Level <0034> Closed: Accumulated level has exceeded the P6-09 and P6-10 setting. -OR- Closed: During the "Accum Level" Fault. 50: Utility Delay <0034> Closed: Drive is stopped and is waiting for the utility delay timer to expire (configured by P4-11). 51: Run/Stop-Stop <0034> Closed: Drive is stopped due to the run/stop control (P4-18 and P4-19) -OR- Closed: Drive is stopped because the number of run/stop cycles has completed. (P4-20) 52: Run/Stop - Finish <0034> Closed: Drive is stopped because the number of run/stop cycles has completed. (P4-20) 53: Anti-Jam/De-Scale <0034> Closed: When the Anti-Jam or the De-Scale features are active (configured by P7-□□). 54: During Run 2 <0034> Closed: Whenever the drive is outputting voltage to the motor (not base-blocked).	0 ~ 57	41	Programming

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
H2-02 (continued)	040C	Terminal M3-M4 Function Selection **Term M3-M4 Sel**	55: Lube Pump <0034> Closed: When the Lube Pump Feature is active. This will energize for the time set in parameter P4-23 each time the drive is supposed to start. The drive will delay starting for the P4-23 time. 56: High Flow <0034> Closed: During the "High Flow Fault" condition. -OR- Closed: During a high flow condition as set by P6-12 ~ P6-14 (included "High Flow Alarm") 57: Low Water Level <0034> Closed: During the "Low Water Level" condition as set by P8-07 and P8-08. -OR- Closed: During the LOWWL - Low Water Level Fault". This will energize if P8-01 = 1 and the level in the well drops below the Low Level Detection Level (P8-07) for more than the Low Level Detection Delay Time (P8-08), or if there is a LOWWL - Low Water Level Fault. 58: Low Suction <0035> This will energize if P8-01 = 2 and the suction pressure drops below the Low Suction Pressure Detection Level (P8-07) for more that the Low Suction Pressure Delay Time (P8-08), of if there is a LOSUC - Low Suction Pressure Fault.	0 ~ 57	41	Programming
			Analog Inputs			
H3-02 ♦	0411	Terminal A1 Gain Setting **Terminal A1 Gain**	Sets the speed command when 10 V is input, as a percentage of the maximum output frequency (E1-04).	0.0 ~ 1000.0 %	100.0 %	Programming
H3-03 ♦	0412	Terminal A1 Bias Setting **Terminal A1 Bias**	Sets the speed command when 0 V is input, as a percentage of the maximum output frequency (E1-04).	−100.0 ~ +100.0 %	0.0 %	Programming
H3-08	0417	Terminal A2 Signal Level Selection **Term A2 Signal**	Selects the signal level of Terminal A2. 0: 0 - 10 Vdc (switch S1-2 must be in the off position) 2: 4 - 20 mA (switch S1-2 must be in the on position) 3: 0- 20 mA	0 or 2	2	Programming
H3-09	0418	Aux Terminal Function Selection **Terminal A2 Sel**	Selects what effect the aux terminal has on the drive. 0: Frequency Bias - 0 - 100 % bias 2: Aux Reference B: PI Feedback D: Frequency Bias 2 - 0 - 100 % bias E: Motor Temperature - See parameters L1-03 & L1-04 16: PI Differential 20: Geothermal Mode <0035> 1F: Not Used	0 ~ 1F	B	Programming
H3-10 ♦	0419	Terminal A2 Gain Setting **Terminal A2 Gain**	Sets the percentage when 10 V (20 mA) is input.	0.0 ~ 1000.0 %	100.0 %	Programming
H3-11 ♦	041A	Terminal A2 Bias Setting **Terminal A2 Bias**	Sets the percentage when 0 V (4 mA) is input.	−100.0 ~ +100.0 %	0.0 %	Programming
H3-12	041B	Analog Input Filter Time Constant Filter Avg Time **Analog Input Fil Tim**	Used to "smooth" out erratic or noisy analog input signals.	0.00 ~ 2.00 sec	0.30 sec	Programming
H3-13	041C	Master Frequency Reference **Terminal Sel TA1/A2 Select**	Determines which terminal will be the main reference source. 0: Main Fref TA1 - Terminal TA1 is the main speed command and Terminal TA2 is the Aux speed command. 1: Main Fref TA2 - Terminal TA2 is the main speed command and Terminal TA1 is the Aux speed command. Only effective when H3-09 is set to 2 "Aux Reference".	0 ~ 1	0	Programming
♦ Denotes that parameter can be changed when the drive is running.						

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
			Analog Outputs			
H4-01	041D	Terminal FM Monitor Selection **Terminal FM Sel**	Selects which monitor will be output on Terminals FM and AC. 1: Frequency Ref (100 % = max. output frequency) 2: Output Freq (100 % = max. output frequency) 3: Output Current (100 % = drive rated current) 6: Output Voltage (100 % = 230 V or 100 % = 460 V) 7: DC Bus Voltage (100 % = 400 V or 100 % = 800 V) 8: Output kWatts (100 % = drive rated power) 15: Term A1 Level 16: Term A2 Level 18: Mot SEC Current (100 % = Motor rated secondary current) 20: SFS Output (100 % = max. output frequency) 24: PI Feedback 31: Not Used 36: PI Input 37: PI Output (100% = max. output frequency) 38: PI Set-point **Note:** 100% = 10 V DC output x FM gain setting (H4-02).	1 ~ 38 <0032>	2	Programming
H4-02 ♦	041E	Terminal FM Gain Setting **Terminal FM Gain**	Sets Terminal FM output voltage (in percent of 10 V) when selected monitor is at 100 % output.	0.0 ~ 1000.0 %	100.0 %	Programming
H4-03 ♦	041F	Terminal FM Bias Setting **Terminal FM Bias**	Sets Terminal FM output voltage (in percent of 10 V) when selected monitor is at 0 % output.	−110.0 ~ +110.0 %	0.0 %	Programming
H4-04	0420	Terminal AM Monitor Selection **Terminal AM Sel**	Selects which monitor will be output on Terminals AM and AC. 1: Frequency Ref (100 % = max. output frequency) 2: Output Freq (100 % = max. output frequency) 3: Output Current (100 % = drive rated current) 6: Output Voltage (100 % = 230 V or 100 % = 460 V) 7: DC Bus Voltage (100 % = 400 V or 100% = 800 V) 8: Output kWatts (100 % = drive rated power) 15: Term A1 Level 16: Term A2 Level 18: Mot SEC Current (100 % = Motor rated secondary current) 20: SFS Output (100 % = max. output frequency) 24: PI Feedback 31: Not Used 36: PI Input 37: PI Output (100 % % = max. output frequency) 38: PI Set-point **Note:** 100 % = 10 V DC output x AM gain setting (H4-05).	1 ~ 38 <0032>	8	Programming
H4-05 ♦	0421	Terminal AM Gain Setting **Terminal AM Gain**	Sets Terminal AM output voltage (in percent of 10 V) when selected monitor is at 100 % output.	0.0 ~ 1000.0 %	50.0 %	Programming
H4-06 ♦	0422	Terminal AM Bias Setting **Terminal AM Bias**	Sets Terminal AM output voltage (in percent of 10 V) when selected monitor is at 0 % output.	−110.0 ~ +110.0 %	0.0 %	Programming
H4-07	0423	Terminal FM Signal Level Selection **AO Level Select1**	0: 0 - 10 Vdc 2: 4 - 20 mA*	0 or 2	0	Programming
H4-08	0424	Terminal AM Signal Level Selection **AO Level Select2**	0: 0 - 10 Vdc 2: 4 - 20 mA*	0 or 2	0	Programming
♦ Denotes that parameter can be changed when the drive is running. * An analog output of 4 - 20 mA cannot be used with the standard terminal board. Therefore an optional terminal board (with shunt connector CN15) is needed.						
			Serial Communication Setup			
H5-01	0425	Drive Node Address **Serial Com Adr**	Selects drive station node number (address) for Terminals R+, R-, S+, S-. **Note:** An address of "0" disables serial com. Drive power must be cycled before the changes will take effect. *Range is dependent on P9-25, if P1-01 = 3. <0034>	0 ~ 20*	1F	Programming
H5-02	0426	Communication Speed Selection **Serial Baud Rate**	Selects the baud rate for Terminals R+, R-, S+ and S-. 0: 1200 Baud 1: 2400 Baud 2: 4800 Baud (APOGEE FLN) 3: 9600 Baud (Metasys N2) 4: 19200 Baud **Note:** Drive power must be cycled before the changes will take effect. <0034>	0 ~ 4	3	Programming

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
H5-03	0427	Communication Parity Selection **Serial Com Sel**	Selects the communication parity for Terminals R+, R-, S+ and S-. 0: No Parity 1: Even Parity 2: Odd Parity **Note:** Drive power must be cycled before the changes will take effect. <0034>	0 ~ 2	0	Programming
H5-04	0428	Stopping Method after Communication Error **Serial Flt Sel**	Selects the stopping method when a communication error is detected. 0: Ramp to Stop 1: Coast to Stop 2: Fast-Stop 3: Alarm Only	0 ~ 3	3	Programming
H5-05	0429	Communication Error Detection Selection **Serial Flt Dtct**	Enables or disables the communications timeout detection function. 0: Disabled - A communications loss will NOT cause a communications fault. 1: Enabled - If communications are lost for more than the time specified in parameter H5-09, a communications fault will occur.	0 ~ 1	1	Programming
H5-06	042A	Drive Transmit Wait Time **Transmit WaitTim**	Sets the time from when the drive receives data to when the drive sends data.	5 ~ 65 ms	5 ms	Programming
H5-07	042B	RTS Control Selection **RTS Control Sel**	Enables or disables "request to send" (RTS) control: 0: Disabled (RTS is always on) 1: Enabled (RTS turns on only when sending)	0 ~ 1	1	Programming
H5-08	042C	Communication Protocol Selection **Com Protocol Sel**	0: MEMOBUS/Modbus 1: N2 (Metasys) 2: FLN (APOGEE)	0 ~ 2	0	Programming
H5-09	0435	Communication Error Detection Time **CE Detect Time**	Determines how long communications must be lost before a fault is annunciated. Works in conjunction with parameters H5-05 and H5-04.	0.0 ~ 10.0 sec	2.0 sec	Programming
		Motor Overload				
L1-01	0480	Motor Overload Protection Selection **MOL Flt Sel**	Enables or disables the motor thermal overload protection. 0: Disabled 1: Std Fan Cooled (Enabled) 2: Std Blower Cooled 3: Vector Motor	0 ~ 1	1	Programming
L1-02	0481	Motor Overload Protection Time **MOL Time Const**	Determines how much time will elapse prior to a motor overload fault (OL1), when motor amps exceed the value set in parameter E2-01 by 10 %. Actual (OL1) trip time will vary depending on severity of overload.	0.1 ~ 20.0 min	8.0 min	Programming
L1-03	0482	Motor Overheat Alarm Operation Selection **Mtr OH Alarm Sel**	Operation selection when the motor temperature analog input (H3-09 = E) exceeds the OH3 alarm level (1.17 V) 0: Ramp to Stop 1: Coast to Stop 2: Fast-Stop 3: Alarm Only	0 ~ 3	3	Programming
L1-04	0483	Motor Overheat Fault Operation Selection **Mtr OH Fault Sel**	Stopping method when the motor temperature analog input (H3-09 = E) exceeds the OH4 level (2.34 V). 0: Ramp to Stop 1: Coast to Stop 2: Fast-Stop	0 ~ 2	1	Programming
L1-05	0484	Motor Temperature Input Filter Time **Mtr Temp Filter**	Delay Time applied to motor temperature analog input (H3-09 = E) for filtering purposes.	0.00 ~ 10.00 sec	0.20 sec	Programming

Parameter No.	Addr. Hex	Parameter Name / Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
			Power Loss Ridethru			
L2-01	0485	Momentary Power Loss Detection Selection **PwrL Selection**	Enables and disables the momentary power loss function. 0: Disabled - Drive trips on (Uv1) fault when power is lost. 1: PwrL Ride Thru t - Drive will restart if power returns within the time set in L2-02. If a second power loss occurs within one hour, the drive will trip on Uv1.* 2: CPU Power Active - Drive will restart if power returns prior to internal power supply shut down. If a second power loss occurs within one hour, the drive will remain in an undervoltage state for an additional 10-second delay after power returns. With each additional power loss occurrence, the time delay will increase. If the drive operates for one hour with no power loss conditions detected, the time delay is cleared.* * In order for a restart to occur, the run command must be maintained throughout the ride thru period.	0 ~ 2	2	Programming
L2-02	0486	Momentary Power Loss Ride-thru Time **PwrL Ridethru T**	Determines the power loss ride-thru time. This value is dependent on the capacity of the drive. Only effective when L2-01 = 1.	0.0 ~ 25.5 sec	kVA Dependent	Programming
L2-03	0487	Momentary Power Loss Minimum Base Block Time **PwrL Baseblock T**	Used to allow the residual motor voltage to decay before the drive output turns back on. After a power loss, if L2-03 is greater than L2-02, operation resumes after the time set in L2-03.	0.1 ~ 5.0 sec	kVA Dependent	Programming
L2-04	0488	Momentary Power Loss Voltage Recovery Ramp Time **PwrL V/f Ramp T**	The time it takes the output voltage to return to the preset V/f pattern after speed search (current detection mode) is complete.	0.0 ~ 5.0 sec	kVA Dependent	Programming
L2-05	0489	Undervoltage Detection Level **PUV Det Level**	Sets the drive's DC Bus undervoltage trip level. If this is set lower than the factory setting, additional AC input reactance or DC bus reactance may be necessary.	Voltage Class Dependent	Voltage Class Dependent	Programming
			Stall Prevention			
L3-01	048F	Stall Prevention Selection During Accel **StallP Accel Sel**	0: Disabled (Motor accelerates at active acceleration, C1-01 or C1-03. The motor may stall if load is too heavy or accel time is too short.) 1: General Purpose (When output current exceeds L3-02 level, acceleration stops. It starts to accelerate at current value recovery.) 2: Intelligent (The active acceleration rate, C1-01 or C1-02, is ignored. Acceleration is completed in the shortest amount of time w/o exceeding the current value set in L3-02.	0 ~ 2	1	Programming
L3-02	0490	Stall Prevention Level During Accel **StallP Accel Lvl**	This function is enabled when L3-01 is "1" or "2". Drive rated current is 100 %. Decrease the set value if stalling occurs at factory setting.	0 ~ 200 %	120 %	Programming
L3-04	0492	Stall Prevention Selection During Decel **StallP Decel Sel**	0: Disabled (The drive decelerates at the active deceleration rate, C1-02 or C1-04. If the load is too large or the deceleration time is too short, an OV fault may occur.) 1: General Purpose (The drive decelerates at the active deceleration rate, C1-02 or C1-04, but if the main circuit DC bus voltage reaches the stall prevention level the output frequency will clamp. Deceleration will continue once the DC bus level drops below the stall prevention level.) 2: Intelligent (The active deceleration rate is ignored and the drive decelerates as fast as possible w/o hitting OV fault level.)	0 ~ 3	1	Programming
L3-05	0493	Stall Prevention Level During Decel **StallP Run Sel**	0: Disabled (drive runs a set frequency.) A heavy load may cause the drive to trip on an OC fault. 1: Decel Time 1 (In order to avoid stalling during heavy loading, the drive will start to decelerate at Decel time 1 (C1-02) if the output current exceeds the level set by L3-06. Once the current level drops below the L3-06 level the drive will accelerate back to its set frequency at the active acceleration rate.) 2: Decel Time 2 (Same as setting 1 except the drive decelerates at Decel Time 2 (C1-04).) For 6 Hz or less frequency, stall prevention function during run is disabled regardless of L3-05 set.	0 ~ 2	1	Programming
L3-06	0494	Stall Prevention Level During Running **StallP Run Level**	This function is enabled when L3-05 is "1" or "2". Drive rated current is set as 100 %. Normally, changing the setting is not required. Decrease the set value if stalling occurs at factory setting.	30 ~ 200 %	120 %	Programming

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
			Reference Detection			
L4-01	0499	Speed Agreement Detection Level **Spd Agree Level**	L4-01 and L4-02 are used in conjunction with the multi-function outputs, (H2-01and H2-02) as a setpoint and hysteresis for a contact closure.	0.0 ~ 200.0 Hz	0.0 Hz	Programming
L4-02	049A	Speed Agreement Detection Width **Spd Agree Width**		0.0 ~ 20.0 Hz	2.0 Hz	Programming
L4-05	049D	Frequency Reference Loss Detection Selection **Ref Loss Sel**	Determines how the drive will react when the frequency reference is lost. 0: Stop (Disabled) - Drive will not run at the frequency reference. 1: Enabled @ % of PrevRef - Drive will run at a percentage (L4-06) of the frequency reference level at the time frequency reference was lost. **Note:** Only available in the Hand Mode (P5-01 = 0).	0 ~ 1	0	Programming
L4-06	04C2	Frequency Reference Level at Loss Frequency **Fref at Freq loss**	If Frequency Reference loss function is enabled (L4-05 = 1) and Frequency Reference is lost, then the drive will run at reduced frequency reference determined by L4-06. New Fref=Fref at time of loss x L4-06. **Note:** Only available in the Hand Mode (P5-01 = 0)	0 ~ 1	0	Programming
			Fault Restart			
L5-01	049E	Number of Auto Restart Attempts **Num of Restarts**	Determines the number of times the drive will perform an automatic restart.	0 ~ 10	5	Programming
L5-02	049F	Auto Restart Operation Selection **Restart Sel**	Determines if the fault contact activates during an automatic restart attempt. 0: No Flt Relay - fault contact will not activate during an automatic restart. 1: Flt Relay Active - fault contact will activate during an automatic restart.	0 ~ 1	0	Programming
L5-03	04A0	Maximum Restart Time After Fault **Max Restart Time**	If the restart fails (or is not attempted due to a continuing fault condition, e.g. an OV fault) the drive waits the Maximum Restart Time After Fault (L5-03) before attempting another restart. This parameter is not applicable to Loss of Prime Fault.	10.0 ~ 3600.0 sec <0032>	20.0 sec	Programming

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
			Torque Detection			
L6-01	04A1	Torque Detection Selection 1 **Load Detection**	Determines the drive's response to an overtorque/undertorque condition. Overtorque and Undertorque are determined by the settings in parameters L6-02 and L6-03. 0: Disabled 1: OL@SpdAgree - Alm (Overtorque Detection only active during Speed Agree and Operation continues after detection) 2: OL At RUN - Alm (Overtorque Detection is always active and operation continues after detection) 3: OL@SpdAgree - Flt (Overtorque Detection only active during Speed Agree and drive output will shut down on an OL3 fault.) 4: OL At RUN - Flt (Overtorque Detection is always active and drive output will shut down on an OL3 fault.) 5: LL@SpdAgree - Alm (Undertorque Detection is only active during Speed Agree and operation continues after detection.) 6: LL at RUN - Alm (Undertorque Detection is always active and operation continues after detection.) 7: LL @ SpdAgree - Flt (Undertorque Detection only active during Speed Agree and drive output will shut down on an OL3 fault.) 8: LL At RUN - Flt (Undertorque Detection is always active and drive output will shut down on an OL3 fault.)	0 ~ 8	0	Programming
L6-02	04A2	Torque Detection Level 1 **Load Det Lvl**	Sets the overtorque/undertorque detection level as a percentage of drive rated current.	0 ~ 300 %	15 %	Programming
L6-03	04A3	Torque Detection Time 1 **Loss Det Time**	Sets the length of time an overtorque/undertorque condition must exist before being recognized by the drive. OL3 is then displayed.	0.0 ~ 10.0 sec	10.0 sec	Programming
			Hardware Protection			
L8-01	04AD	Internal Dynamic Braking Resistor Protection Selection **DB Resistor Prot**	0: Not Provided 1: Provided	0 ~ 1	0	Programming
L8-02	04AE	Overheat Pre-Alarm Level **OH Pre-Alarm Lvl**	When the cooling fin temperature exceeds the value set in this parameter, an overheat pre-alarm (OH) will occur.	50 ~ 130 °C	95 °C	Programming
L8-03	04AF	Overheat Pre-Alarm Operation Selection **OH Pre-Alarm Sel**	Drive Operation upon OH Pre Alarm Detection. 0: Ramp to Stop (Decel Time C1-02). 1: Coast to Stop 2: Fast-Stop (Decel Time = C1-09). 3: Alarm Only *0 to 2 is recognized as fault detection, and 3 is recognized as alarm. (For the fault detection, the fault contact operates.) 4: OH Alarm & Reduce (Continue operation and reduce output frequency by L8-19)	0 ~ 4	4	Programming
L8-05 <0033>	04B1	Input Phase Loss Protection Selection **Ph Loss In Sel**	Selects the detection of input current phase loss, power supply voltage imbalance, or main circuit electrostatic capacitor deterioration. 0: Disabled 1: Enabled	0 ~ 1	1	Programming
L8-06	04B2	Input Phase Loss Detection Level **Ph Loss In Lvl**	Monitors the DC Bus current ripple and activates when one of the input phases is lost (PF).	0.0 ~ 25.0	kVA Dependent	Programming
L8-07 <0033>	04B3	Output Phase Loss Protection Selection **Ph Loss Out Sel**	Selects the detection of output current open-phase. When applied motor capacity is too small for drive capacity, output phase loss may be detected inadvertently. In this case, set to 0. 0: Disabled 1: Enabled	0 ~ 1	1	Programming
L8-09	04B5	Output Ground Fault Detection Selection **Ground Fault Sel**	Enables and disables drive output ground fault detection. 0: Disabled 1: Enabled	0 ~ 1	1	Programming
L8-10	04B6	Heatsink Cooling Fan Operation Selection **Fan On/Off Sel**	Controls the Heatsink Cooling Fan Operation. 0: Fan On-Run Mode (Fan will operate only when drive is running and for L8-11 seconds after RUN is removed). 1: Fan Always On (Cooling fan operates whenever drive is powered up.)	0 ~ 1	0	Programming
L8-11 <0032>	04B7	Heatsink Cooling Fan Operation Delay Time **Fan Delay Time**	When L8-10=0 this parameter sets a delay time for Cooling Fan de-energization after the run command is removed or baseblock enabled.	0 ~ 300 sec	300 sec	Programming
L8-12	04B8	Ambient Temperature Setting **Ambient Temp**	When the drive is installed in an ambient temperature exceeding its rating, drive overload (OL2) protection level is reduced.	45 ~ 60 °C	45 °C	Programming

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
L8-15	04BB	OL2 Characteristic Selection at Low Speeds **OL2 Sel @ L-Spd**	This parameter assists in protecting the output transistor junctions from overheating when output current is high and output frequency is low. 0: Disabled 1: Enabled (L8-18 is active)	0 ~ 1	1	Programming
L8-18	04BE	Soft CLA Selection **Soft CLA Sel**	Enables and disables current limit "A". 0: Disabled 1: Enabled	0 ~ 1	1	Programming
L8-19	04BF	OH Frequency Reference Reduction Level **Fref During OH**	Sets the amount of frequency reference reduction when an Overheat Pre-alarm (OH) is detected.	0.0 ~ 100.0 %	20.0 %	Programming
			Hunting Prevention			
n1-01	0580	Hunting Prevention Selection **Hunt Prev Select**	0: Disabled (Hunting prevention function disabled.) 1: Enabled (Hunting prevention function enabled.) If the motor vibrates while lightly loaded, hunting prevention may reduce the vibration. There is a loss of responsiveness if hunting prevention is enabled.	0 ~ 1	1	Programming
n1-02	0581	Hunting Prevention Gain Setting **Hunt Prev Gain**	Gain setting for the Hunting Prevention Function. If the motor vibrates while lightly loaded and n1-01 = 1, increase the gain by 0.1 until vibration ceases. If the motor stalls while n1-01 = 1 decrease the gain by 0.1 until the stalling ceases.	0.00 ~ 2.50	1.00	Programming
			High-Slip Braking			
n3-01	0588	High-Slip Braking Deceleration Frequency Width **HSB Decel Width**	Sets how aggressively the drive decreases the output frequency as it stops the motor. If overvoltage (OV) faults occur during HSB, this parameter may need to be increased. **Note:** Function Deactivated	1.0 ~ 20.0 %	5 %	Programming
n3-02	0589	High-Slip Braking Current Limit **HSB Current Ref**	Sets the maximum current to be drawn during a HSB stop. Higher n3-02 settings will shorten motor stopping times but cause increased motor current and therefore, increased motor heating. **Note:** Function Deactivated	100.0 ~ 200.0 %	150 %	Programming
n3-03	058A	High-Slip Braking Dwell Time at Stop **HSB DwelTim@ Stp**	Sets the amount of time the drive will dwell at E1-09 (Minimum Frequency). If this time is set too low, the machine inertia can cause the motor to rotate slightly after the HSB stop is complete and drive output is shut off. **Note:** Function Deactivated	0.00 ~ 10.0 sec	1.0 sec	Programming
n3-04	058B	High-Slip Braking Overload Time **HSB OL Time**	Sets the time required for a HSB Overload Fault to occur when the drive output frequency does not change for some reason during a HSB stop. Normally this does not need to be adjusted. **Note:** Function Deactivated	30.0 ~ 1200.0 sec	40 sec	Programming
			Monitor Select			
o1-01 ♦	0500	User Monitor Selection **User Monitor Sel**	Selects which monitor will be displayed upon power-up when o1-02 = 4.	6 ~ 94	6	Programming
o1-02	0501	User Monitor Selection After Power-Up **Power-On Monitor**	Selects which monitor will be displayed upon power-up. 1: Auto: Set-point 2: Output Freq 3: Output Current 4: User Monitor (set by o1-01)	1 ~ 4	1	Programming
o1-05	0504	LCD Brightness Adjustment **LCD Contrast**	<table><tr><th>Set Value</th><th>Description</th></tr><tr><td>5</td><td>LCD display becomes dark</td></tr><tr><td>3</td><td>Standard setting</td></tr><tr><td>1</td><td>LCD display becomes light</td></tr></table>	0 ~ 5	3	Programming
o1-06	0517	User Monitor Selection Mode **Monitor Mode Sel**	Selects the "U1" monitors displayed on the 4th and 5th lines of the digital operator display. 0: 3 Mon Sequential (Displays the next 2 sequential U1 monitors.) 1: 3 Mon Selectable (Displays U1 monitors set by o1-07 and o1-08.)	0 ~ 1	1**	Programming

♦ Denotes that parameter can be changed when the drive is running.

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
o1-07	0518	Second Line User Monitor Selection **2nd Monitor Sel**	Sets the "U1" monitor always displayed on the 4th line of the digital operator display. Effective only when o1-06 = 1.	1 ~ 94	2	Programming
o1-08	0519	Third Line User Monitor Selection **3rd Monitor Sel**	Sets the "U1" monitor always displayed on the 5th line of the digital operator display. Effective only when o1-06 = 1.	1 ~ 94	91	Programming
			Key Selections			
o2-01	0505	Local/Remote Key Function Selection **Local/Remote Key**	Has no function when HOA operator is connected. 0: Disabled 1: Enabled	0 ~ 1	1	Programming
o2-02	0506	OFF Key Function During Auto Run **Oper OFF Key**	Determines if the off key on the digital operator will stop the drive when drive is operating from external terminals or serial communications. 0: Disabled 1: Enabled	0 ~ 1	1	Programming
o2-03	0507	User Parameter Default Value **User Defaults**	Allows storing of current parameter values as a User Initialization Selection at parameter A1-03. 0: No Change (No user parameter set active). 1: Set Defaults (Saves current parameter settings as user initialization. A1-03 now allows selecting <1110> for user initialization. 2: Clear All (Clears the currently saved user initialization. A1-03 no longer allows selecting <1110>.	0 ~ 2	0	Programming
o2-04	0508	Drive/kVA Selection **Inverter Model #**	Sets the kVA of the drive. Enter the number based on drive model #. Use the ☐☐☐☐ portion of the CIMR-P7☐☐☐☐-107 Model Number.	0 ~ FF	kVA Dependent	Programming
o2-05	0509	Frequency Reference Setting Method Selection **Operator M.O.P.**	Determines if the Data/Enter key must be used to input a frequency reference from the digital operator. 0: Disabled - Data/Enter key must be pressed to enter a frequency reference. 1: Enabled: -Data/Enter key is not required. The frequency reference is adjusted by the up and down arrow keys on the digital operator without having to press the data/enter key.	0 ~ 1	0	Programming
o2-06	050A	Operation Selection when Digital Operator is Disconnected **Oper Detection**	Determines if the drive will stop when the digital operator is removed. 0: Disabled - The drive will not stop when the digital operator is removed. 1: Enabled - The drive will fault (OPR) and coast to stop when the operator is removed.	0 ~ 1	1	Programming
o2-07	050B	Cumulative Operation Time Setting **Elapsed Time Set**	Sets the initial value of the elapsed operation timer.	0 ~ 65535 hr	0 hr	Programming
o2-08	050C	Cumulative Operation Time Selection **Elapsed Time Run**	Sets how time is accumulated for the elapsed timer (o2-07). 0: Power-On Time (Time accumulates whenever drive is powered). 1: Running Time (Time accumulates only when drive is running)	0 ~ 1	1	Programming
o2-10	050E	Cumulative Cooling Fan Operation Time Setting **Fan ON Time Set**	Sets the initial value of the heatsink fan operation time.	0 ~ 65535 hr	0 hr	Programming
o2-12	0510	Fault Trace/Fault History Clear Function **FLT Trace Init**	Clears the fault memory contained in the U2 and U3 monitors. 0: Disabled (no effect). 1: Enabled - resets U2 and U3 monitors, and returns o2-12 to zero.	0 ~ 1	0	Programming
o2-14	0512	kWh User Monitor (U1-29) Initialization **kWh MonitorClear**	Used to reset the kilowatt Hour monitor to zero 0: Disabled (no change) 1: Clear all - Resets U1-29 to zero and returns o2-14 to zero.	0 ~ 1	0	Programming
			Copy Function			
o3-01	0515	Copy Function Selection **Copy Function Sel**	This parameter controls the copying of parameters to and from the digital operator. 0: COPY SELECT (no function) 1: INV -> OP READ - All parameters are copied from the drive to the digital operator. 2: OP -> INV WRITE - All parameters are copied from the digital operator into the drive. 3: OP <--> INV VERIFY - Parameter settings in the drive are compared to those in the digital operator. **Note:** When using the copy function, the drive model number and software number (U1-14) must match or an error will occur.	0 ~ 3	0	Programming
o3-02	0516	Read Allowed Selection **Read Allowable**	Enables and disables all digital operator copy functions. 0: Disabled - No digital operator copy functions are allowed. 1: Enabled - Copying allowed	0 ~ 1	0	Programming

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
			Pump Basic			
P1-01	0600	Pump Mode **Pump Mode**	Select type of control operation. 0: Drive Only (Simplex) 1: Drive + 1 Pump 2: Drive + 2 Pumps 3: Memobus network <0034>	0 ~ 3	0	Programming
P1-02	0601	System Units **System Units**	0: WC:InchOfWater 1: psi:lb/SqrInch 2: GPM:Gallons/min 3: F:DegFarenheit 4: CFM:Cubic ft/min 5: CMH:Cubic m/hr 6: LPH:Liters/hr 7: LPS:Liters/s 8: Bar:Bar 9: Pa:Pascals 10: C:DegCelsius 11: Ft: Feet <0032> 12:%: Percent 13: rpm: Revs/min (Note 1) <0034> 14: Hz: Hertz (Note 1) <0034>	0 ~ 14	1	Programming
P1-03	0602	Feedback Device Scaling **Fb Dev Scaling**	Scaling of feedback device in user units (P1-02=1, e.g. 150 psi). Digits 1 through 4 set the maximum feedback number. Digit 5 determines the number of decimal places. Digit 5 = 0: Number format is XXXX Digit 5 = 1: Number format is XXX.X Digit 5 = 2: Number format is XX.XX Digit 5 = 3: Number format is X.XXX **Examples:** 01000 = 1000 13000 = 300.0 25000 = 50.00 32000 = 2.000	1 ~ 36000 (system units P1-02)	00145	Programming
P1-04 ♦	0603	Start Level **Start Level**	Drive starts when the feedback level drops below the start level for a time specified in P1-05. This level also specifies the wake up level when the drive is in Sleep Mode. If set to a negative value, the feedback level must drop by this amount below the setpoint. <0034> **Note:** When PID operates in the reverse mode, the feedback value has to rise above the start level for the time programmed in P1-05 for the system to start. A value of 0 disables this function. If P1-01 = 3, the function is active only on the first drive in the network. <0034>	- 999.9 ~ 999.9 (system units P1-02)	0.0 (system units P1-02)	Pump Quick Setup
P1-05 ♦	0604	Start Level Delay Time **S-Lvl Delay Time**	Drive starts when the feedback level drops below the start level for a time specified in P1-05.	0 ~ 3600 sec	1 sec	Programming
P1-06 ♦	0605	Minimum Pump Frequency **Min. Pump Freq**	Minimum drive frequency when operated in the auto mode. Programmed value will limit minimum PID output. Minimum value must be programmed to a value smaller than P3-09 and P3-10 when drive is operating in the multiplex mode (P1-01).	0.0 ~ 120.0 Hz	40.0 Hz	Pump Quick Setup
P1-07 ♦	0606	Low Feedback Level **Low FB Level**	The drive will display a "Low Feedback (LFB)" alarm when the feedback level falls below the programmed level. The alarm will turn off when the feedback level rises above the programmed Low Feedback Level plus the Hysteresis Level (P1-13). A value of 0 disables this function. This function is only active during running while operating in the auto mode.	0.0 ~ 6000.0 (system units P1-02)	0.0 (system units P1-02)	Programming
P1-08 ♦	0607	Low Feedback Level Fault Delay Time **Low Lvl Flt Time**	The drive will display a "Low Feedback/Water (LFB/LW)" alarm when the feedback level falls below the programmed level for a time specified in P1-08. The drive will coast to a stop when a fault occurs. A value of 0 disables this function. This function is only active during running while operating in the auto mode. If P1-01 = 3, the function will stop all drives running on the network when the system fault occurs. <0034>	0 ~ 3600 sec	5 sec	Programming

♦ Denotes that parameter can be changed when the drive is running.
Note 1: When P1-02 = 3, parameter P1-03 must be set to (120 x E1-04/E2-04) for proper display. When P1-02 = 14, parameter P1-03 must be set to the same value as E1-04 for proper display.

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
P1-09 ♦	0608	High Feedback Level **High FB Level**	The drive will display a "High Feedback Level (HFB)" alarm when the feedback level rises above the programmed level. The alarm will turn off when the feedback level falls below the programmed High Feedback Level minus the Hysteresis Level (P1-13). This function is active during running in the hand mode, auto mode, pre-charge and thrust-bearing mode. If P1-01 = 3, parameter P9-18 uses this value to calculate the quick de-stage feedback level. <0034>	0.0 ~ 6000.0 (system units P1-02)	155.0 (system units P1-02)	Programming
P1-10 ♦	0609	High Feedback Level Fault Delay Time **Hgh Lvl Flt Time**	The drive will initiate a "High Feedback Fault (HFB)" when the feedback level rises above the programmed level for a time specified in P1-10. The drive will coast to a stop when a fault occurs. This function is active during running in all operation modes. If P1-01 = 3, the function will stop all drives running on the network when the system fault occurs. <0034>	0 ~ 3600 sec	2 sec	Programming
P1-11 ♦ <0032>	0106	Maximum SetPoint Difference **Max Set-point Diff**	When the drive is running and the difference between the setpoint and the feedback exceeds the level in P1-11 for the time specified in P1-12, the drive will trip on a "Not Maintaining Set-point (NMS)". The drive will coast to a stop when a fault occurs. A value of 0 disables this function. This function is only active during running while operating in auto mode. If P1-01 = 3, the function is active on the lead drive, but will stop all drives running on the network when the system fault occurs. <0034>	0.0 ~ 6000.0 (system units P1-02)	0.0 (system units P1-02)	Programming
P1-12 ♦ <0032>	0107	Not Maintaining Set-point Time **Not Maint SP Tm**	Delay time before a Not Maintaining Set-point fault occurs. Pump protection criteria specified in P1-11 must be met for the drive to fault. The drive will coast to a stop when a fault occurs. A value of 0 disables Not Maintaining Set-point fault.	0 ~ 3600 sec	60 sec	Programming
P1-13 ♦	0108	Hysteresis Level **Hysteresis Level**	Hysteresis Level used for low and high feedback alarm detection. See function P1-07 and P1-09.	0.0 ~ 100.0 (system units P1-02)	0.0 (system units P1-02)	Programming
P1-14 ♦	0109	Prime Loss Level **Prime Loss Level**	Used to detect loss of prime in the pump. If output current drops below this level for the time specified in P1-12 and the output frequency is at fmax, a "Loss Of Prime" fault occurs. The drive will coast to a stop when a fault occurs. If P1-01 = 3, the function is active on the lead drive, but will stop all drives running on the network when the system fault occurs. <0034>	0.0 ~ 1000.0 A	0.0 A	Programming
P1-15 ♦	010A	Low/Hi Water Digital Input Configuration **Water DI Config** <0034>	Sets the type of control operation 0: Low N.O. - Hi N.O. (Low Water Normally Open, High Water Normally Open) <0034> 1: Low N.C. - Hi N.O. (Low Water Normally Closed, High Water Normally Open) <0034> 2: Low N.O. - Hi N.C. (Low Water Normally Open, High Water Normally Closed) <0034> 3: Low N.C. - Hi N.C.(Low Water Normally Closed, High Water Normally Closed) <0034> To use the low water function one of the digital inputs (H1-□□=85) must be programmed. The low water input can be used for a low water condition or in combination with the pre-charge function to indicate the reservoir is filled. The low water input fault is only active during running while operating in auto mode.	0 ~ 3	0	Programming
P1-16 ♦ <0034>	87F	Loss of Prime Time **Prime Loss Time**	Delay time before a Loss of Prime fault occurs. Pump protection criteria specified P1-14 must be met for the drive to fault. On fault the drive will coast to a stop.	1 ~ 600 sec	20 sec	Programming
♦ Denotes that parameter can be changed when the drive is running.						
			Pump Protection			
P2-01	060A	Sleep Level Type **Sleep Lvl Type**	Sets the sleep type. 0: Output Frequency 1: Output Current 2: Feedback 3: Output Speed (rpm) <0034> 4: Low Flow (Terminal A1 - Flow meter required) <0034> **Note:** Feedback depends on PID direction operation. Displays a "Sleep" Alarm when active.	0 ~ 4	0	Programming

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
P2-02 ♦	060B	Sleep Level **Sleep Level**	Sleep activates when selected level (P2-01) reaches programmed sleep level for time specified in P2-03. The level type is determined by P2-01. A value of 0 disables this function. This function is only active during running while operating in auto mode. If P1-01 = 3, the function is active when there is only one drive running on the network. <0034> Display Units for Sleep Level P2-02 when P2-01 is programmed for the following: P2-01=0: Display based on "Hz" P2-01=1: Display based on "A" P2-01=2: Display based on P1-02 Selection P2-01=3: Display based on "rpm" <0034> P2-01=4: Display based on P6-02 Selection <0034> **Note:** When P2-01 is set for a value of 2, display units will be dependent on P1-02 setting. If P2-02 = 0, pump will sleep at minimum speed.	0.0 ~ 6000.0	0.0	Programming
P2-03 ♦	060C	Sleep Delay Time **Sleep Delay Time**	Delay time before drive enters sleep mode when criteria is met as defined by parameter P2-02.	0 ~ 3600 sec	5 sec	Programming
P2-04 ♦	060D	Delta Sleep Feedback Drop Level **D Fb Drop Level**	When the drive enters sleep mode, the software monitors the feedback to detect a flow-no flow condition. If the PID Error (setpoint minus feedback) exceeds the programmed level P2-04 within the programmed time (P2-05) and the output frequency is greater than the minimum frequency (P1-06), the sleep operation deactivates and the drive returns to normal operation. A value of 0 disables this function.	0.0 ~ 6000.0 (system units P1-02)	0.0 (system units P1-02)	Programming
P2-05 ♦	060E	Feedback detection drop time. **FB Drop DetTime**	Defines the time window in which the software monitors the feedback to detect a flow-no flow condition. Works in conjunction with parameter P2-04.	0 ~ 3600 sec	10 sec	Programming
P2-06 ♦	060F	Sleep Mode: Cycling Protection **Cycle Protection**	Maximum number of cycles allowed within the time specified in P2-07 before the drive initiates a "Pump Cycle Fault (PCF)". One Cycle is defined when the drive transfers from normal operation in auto mode to sleep mode. A value of 0 disables this function. If P1-01 = 3, the function is active when there is only one drive running on the network. <0034>	0 ~ 10	0	Programming
P2-07 ♦	0610	Sleep Mode: Maximum Cycling Protection Time **Max. Cycle Time**	Maximum time allowed between cycles. When no cycling occurs within the programmed time, the drive will reset the internal cycle register. Works in conjunction with P2-06.	0 ~ 3600 sec	300 sec	Programming
P2-08	0611	Over Cycling Mode **Over Cycle Mode**	Sets the Over Cycle Mode: 0: Disabled 1: Alarm 2: Pump Over Cycle Fault (POC) 3: Auto Compensation	0 ~ 3	0	Programming
P2-09	0612	Set-point Compensation **Set-point Comp**	Allows for the software to automatically compensate the setpoint in case of excessive cycling.	0.0 ~ 6000.0 (system units P1-02)	0.0 (system units P1-02)	Programming
P2-10	0613	Maximum Set-point Compensation **Max. SP Comp**	Maximum allowable setpoint compensation for the over-cycling function.	0.0 ~ 6000.0 (system units P1-02)	0.0 (system units P1-02)	Pump Quick Setup
P2-11	010B	No-Flow Activation Level **NF Act. Level**	When the motor rpm falls below the programmed level in P2-12, the no-flow detection will activate. A value of 0 disables this function. If P1-01 = 3, the function is active on the lead drive. <0034>	0 ~ 24000 rpm	0 rpm	Programming
P2-12	010C	No-Flow Detection Bandwidth **NF Det.Bandwidth**	Sets the motor rpm fluctuation bandwidth. No-flow activates when the motor rpm remains within the programmed bandwidth in P2-12 for a time specified in parameter P2-13.	0 ~ 1000 rpm	15 rpm	Programming
P2-13	010D	No-Flow Detection Time **NF Detect Time**	No-flow activates when the motor rpm remains within the programmed bandwidth (P2-12) for a time specified in parameter P2-13.	0.0 ~ 1000.0 sec	5.0 sec	Programming
P2-14	010E	No-Flow Stabilization Time **NF StabilizeTime**	Time delay when setpoint returns to the original setting after being changed for no-flow detection.	0.0 ~ 1000.0 sec	5.0 sec	Programming
♦ Denotes that parameter can be changed when the drive is running.						

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
P2-15	010F	No-Flow Delta Feedback Level **NF FB Level**	No-flow feedback (PID-Error: setpoint minus feedback) level used to detect no-flow condition based on feedback value. Delta feedback (setpoint minus feedback) has to exceed the programmed level for the time programmed in P2-17 to detect a no-flow condition.	0.0 ~ 6000.0 (system units P1-02)	1.0 (system units P1-02)	Programming
P2-16	011F	No-Flow Set-point Compensation **NF SP Comp**	Set-point compensation used in the no-flow detection function.	0.0 ~ 6000.0 (system units P1-02)	1.5 (system units P1-02)	Programming
P2-17	0120	No-Flow Feedback Delay Time **NF Fdbk Delay Time**	Delay timer used in combination with the no-flow feedback (PID-Error: setpoint minus feedback) level (P2-15) used to detect the no-flow condition based on the feedback value. Delta feedback (Set-point minus feedback) has to exceed the programmed level (P2-15) for the time programmed to detect a no-flow condition.	0.0 ~ 1000.0 sec	2.0 sec	Programming
P2-18	0121	No-Flow Motor RPM Sample Time **NF RPM Sample Tm**	No-flow detection motor rpm sample rate.	0.1 ~ 1000.0 sec	2.0 sec	Programming
P2-19	0122	No-Flow Feedback Detection Direction **NF Fdbk Det Direct**	Direction of feedback detection upon return of no-flow detection. 0: Outside Bandwidth (P2-15) 1: Inside Bandwidth (P2-15)	0 ~ 1	0	Programming
P2-20 ♦	0123	Alternative Sleep Activate Level **SLP Act Level**	When P2-01 Sleep Level Type is set for 0 (Output Frequency) or 3 (Output Speed), the sleep function becomes active when the output frequency is greater or equal to the level in P2-20. When programmed to 0, the sleep function will become active above the P2-02 Sleep. Level.Display Units for Sleep Activate Level P2-20 when P2-01 is programmed for the following:<0034> P2-01=0: Display based on "Hz" P2-01=1: Display based on "Hz" P2-01=2: Display based on "Hz" P2-01=3: Display based on "rpm" P2-01=4: Display based on "Hz" A value of 0 disables this function.	0.0 ~ 6000.0	0.0	Programming
P2-21 <0034>	820	Sleep Boost Level **Sleep Boost Lvl**	Sets the amount of boost applied to the setpoint just before going to sleep. A setting of 0.0 disables the sleep boost function. (Internally limited to 25 % of P1-03.)	0.0 ~ 6000.0 (system units P1-02)	0.0	Programming
P2-22 <0034>	821	Sleep Boost Maximum Time **Sleep Boost Time**	Sets the amount of time the system (feedback) has to reach the "boosted" setpoint. If more than this time elapses, the drive will go to sleep	1.0 ~ 160.0 sec	5.0 sec	Programming
P2-23 ♦ <0034>	822	Anti-No-Flow Bandwidth **ANF Bandwidth**	Sets the amount of PI "Error" bandwidth used to detect the no-flow condition. Operation can become less stable if this value is set too high. A setting of 0.00 % disables this feature.	0.00 ~ 2.00 %	0.40 %	Programming
P2-24 ♦ <0034>	823	Anti-No-Flow Detection Time **ANF Det Time**	Sets the time delay after no-flow is detected before the drive starts its increased deceleration rate.	1.0 ~ 60.0 sec	10.0 sec	Programming
P2-25 ♦ <0034>	824	Anti-No-Flow Release Level **ANF Release Lvl**	Once the Anti-No-Flow activates (after the P2-24 time), the feedback must drop this amount below the setpoint for the Anti-No-Flow to disengage and return to normal PI operation.	0.0 ~ 100.0 psi	3.0 psi	Programming
♦ Denotes that parameter can be changed when the drive is running.						
			Pump Multiplex			
P3-01	0614	Lead-Lag Control **Lead-Lag Control**	Selects lead-lag detection operation. 0: Output Frequency (Output Frequency). 0: Uses P3-02, P3-04, P3-06, P3-09, P3-10. 1: Feedback (Feedback Level). 1: Uses P3-03, P3-04, P3-05, P3-06. 2: Feedback + Fout (Feedback Level and Output Frequency). 2: Uses P3-02, P3-03, P3-05, P3-06, P3-07, P3-08, P3-10. Works in conjunction with parameters P2-11 to P2-19.	0 ~ 2	0	Programming

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
P3-02 ♦	0615	Drive Multi/Maximum Level **Max-Multi Level**	Sets the maximum level used for multiplex pumping operation. Parameter is active when P3-01 = 0 or P3-01 = 2 is selected. **P3-01 = 0:** When the output frequency rises above the level programmed in P3-02 for a time specified in P3-04, the next available pump will be added to the system by means of a multi-function digital output closure (H2-□□ = 40, 41). **P3-01 = 1:** Not Used. **P3-01 = 2:** When the output frequency rises above level programmed in P3-02 and the delta feedback (setpoint minus feedback) has exceeded the level programmed in P3-03 for a time specified in P3-04, the next available pump will be added to the system by means of a multi-function digital output closure (H2-□□ = 40, 41).	0.0 ~ 120.00 Hz	59.0 Hz	Programming
P3-03 ♦	0616	Add Pump Delta Level **Add Pump D-Lvl**	Sets the level used for multiplex pumping operation. The parameter is active when P3-01 =1 or P3-01 = 2 is selected. **P3-01 = 0:** Not Used **P3-01 = 1:** When the delta feedback (setpoint minus feedback) has exceeded the level programmed in P3-03 for a time specified in P3-04, the next available pump will be added to the system by means of a multi-function digital output closure. (H2-□□ = 40, 41). **P3-01 = 2:** When the output frequency rises above level programmed in P3-02 and the delta feedback (Set-point minus feedback) has exceeded the level programmed in P3-03 for a time specified in P3-04, the next available pump will be added to the system by means of a multi-function digital output closure. (H2-□□ = 40, 41). **Note:** Do not program this level too close to the system setpoint or excessive cycling of the pump system may occur.	0.0 ~ 6000.0 (system units P1-02)	0.0 (system units P1-02)	Programming
P3-04 ♦	0617	Add Pump Delay Time **Add Pump Dly Tm**	Sets the delay time before a pump is added to the system. Works in conjunction with parameters P3-02, P3-03, and P2-11 to P2-19.	0 ~ 3600 sec	2 sec	Programming
P3-05 ♦	0618	Shutdown Pump Delta Level **Shdn Pump D-Lvl**	Sets the level used for multiplex pumping operation. Parameter is active when P3-01 = 1 or P3-01 = 2 is selected. **P3-01 = 0:** Not Used **P3-01 =1 :** When the delta feedback (feedback minus setpoint) has exceeded the level programmed in P3-05 for a time specified in P3-06, the last pump that was brought online will be shutdown by means of a multi-function digital output opening. (H2-□□ = 40, 41). **P3-01 = 2:** When the output frequency drops below level programmed in P3-09 or P3-10 (depends on last pump running) and the delta feedback (feedback minus setpoint) has exceeded the level programmed in P3-05 for a time specified in P3-06, the last pump that was brought online will be shutdown by means of a multi-function digital output opening. (H2-□□ = 40, 41). **Note:** Do not program this level too close to the system setpoint or excessive cycling of the pump system may occur.	0.0 ~ 6000.0 (system units P1-02)	0.0 (system units P1-02)	Programming
P3-06 ♦	0619	Shutdown Pump Delay Time **Shdn Pump Dly Tm**	Sets the delay time before one of the additional across the line pumps is shutdown. Works in conjunction with parameters P3-02 and P3-03.	0 ~ 3600 sec	5 sec	Programming
P3-07 ♦	061A	Multi Pump Set-point Increase **MP Set-point Incr**	Sets the amount the drive's setpoint will decrease for each time a new pump is brought offline. Pump 1: Set-point Pump 1+2: Set-point + P3-07 Pump 1+2+3: Set-point + (2 x P3-07)	0.0 ~ 6000.0 (system units P1-02)	0.0 (system units P1-02)	Programming
P3-08 ♦	061B	Multi Pump Set-point Decrease **MP Set-point Decr**	Sets the amount the drive's setpoint will increase for each time a new pump is brought online. Pump 1: Set-point Pump 1+2: Set-point - P3-08 Pump 1+2+3: Set-point - (2 x P3-08)	0.0 ~ 6000.0 (system units P1-02)	0.0 (system units P1-02)	Programming
♦ Denotes that parameter can be changed when the drive is running.						

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
P3-09 ♦	061C	Pump 2 Frequency Shutdown Level **P2 Freq Shd Lvl**	Sets the level used for multiplex pumping operation. Parameter is active when P3-01 = 0 or P3-01 = 2 is selected. **P3-0 1= 0:** When the output frequency falls below the level programmed in P3-09 for a time specified in P3-06 and a total of 2 pumps are running, the last pump (Pump 2) that was brought online will be shutdown by means of a multi-function digital output opening (H2-□□ = 40, 41). **P3-01 = 1:** Not Used **P3-01 = 2:** When the output frequency falls below the level programmed in P3-09 and a total of 2 pumps are running and the delta feedback (feedback minus setpoint) has exceeded the level programmed in P3-05 for a time specified in P3-06, the last pump (Pump 2) that was brought online will be shutdown by means of a multi-function digital output opening (H2-□□ = 40, 41).	0.0 ~ 120.0 Hz	40.0 Hz	Programming
P3-10 ♦	061D	Pump 3 Frequency Shutdown Level **P3 Freq Shd Lvl**	Sets the level used for multiplex pumping operation. Parameter is active when P3-01 = 0 or P3-01 = 2 is selected. **P3-01 = 0:** When the output frequency falls below the level programmed in P3-10 for a time specified in P3-06 and a total of 3 pumps are running, the last pump (Pump 3) that was brought online will be shutdown by means of a multi-function digital output opening (H2-□□ = 40, 41). **P3-01 = 1:** Not Used **P3-01 = 2:** When the output frequency falls below the level programmed in P3-10 and a total of 3pumps are running and the delta feedback (feedback minus setpoint) has exceeded the level programmed in P3-05 for a time specified in P3-06, the last pump (Pump 3) that was brought online will be shutdown by means of a multi-function digital output opening (H2-□□ = 40, 41).	0.0 ~ 120.0 Hz	40.0 Hz	Programming
P3-11 ♦	0110	Multiplex Stabilization Time **M-Stabilize Time**	Sets the time used to stabilize system when a pump is added (brought online) or shutdown during multiplex operation. When a pump is added, the stabilize timer temporarily disables the lead/lag functionality for the programmed time to prevent pump cycling. **Note:** This function only active in the multiplex mode when P1-01 is greater than 0. During the stabilization time, the pump protection and lead-lag control is suspended.	0 ~ 3600 sec	2 sec	Programming
P3-12 ♦	0111	Delta Set-point Feedback Acc/Dec Changeover **SP ACC/DEC Hyst.**	Sets the level when the acceleration and deceleration times change over to the values programmed in C1-05 and C1-06 respectively. This function will activate when the difference between the delta setpoint and feedback are within the level programmed in P3-12. This function is used to improve the pump regulation.A value of 0 disables this function.	0.0 ~ 6000.0 (system units P1-02)	0.0 (system units P1-02)	Programming
P3-13 ♦	0112	Friction Compensation start Frequency **Fric. Comp Lvl**	Sets the level when the setpoint will be adjusted to compensate for the friction losses. This function will activate when the output frequency rises above the level programmed in P3-13. The maximum compensation at maximum output frequency (E1-04) is specified by maximum setpoint frequency (P2-10). **Note:** This function is only active in simplex mode when P1-01 = 0.	0.0 ~ 120.0 Hz	0.0 Hz	Programming
P3-14 ♦	0113	Maximum Friction Increase at Maximum Frequency **Friction Inc**	Sets the maximum setpoint friction compensation at maximum output frequency (E1-04). This function is a linear calculation with P3-13 as its starting frequency. Example: P3-13 = 30.0 Hz, P3-14 = 10.0 psi, output frequency = 45.0 Hz and maximum frequency = 60.0 Hz Set-point Increase = (45-30 Hz) x 10 psi/(60 Hz – 30 Hz) ≥ 5.0 psi **Note:** This function is only active in simplex mode when P1-01 = 0.	0.0 ~ 6000.0 (system units P1-02)	0.0 (system units P1-02)	Programming

♦ Denotes that parameter can be changed when the drive is running.

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
			Pump Advanced			
P4-01 ♦	0115	Pre-charge Level **Pre-charge Level**	Sets the level when the drive will run at the pre-charge frequency (P4-02). The drive will stop when one of the following conditions occurs: Feedback signal rises above P4-01 level, pre-charge timer P4-03 expires, or low water digital input is deactivated (H1-□□ = 85). The pre-charge function can only be activated while in a stop condition. The function is enabled by setting P4-03 to a value greater than 0. When the function is activated, the drive's operator display indicates a "Pre-charge" alarm. **Note:** This function is only active in the stopped mode. If P1-01 = 3, the function is active when there is only one drive running on the network.<0034> **Thrust Mode:** The pre-charge level is used when the thrust mode is active for the feedback check. The thrust mode is deactivated when the feedback exceeds the programmed level in P4-01. A value of 0 disables the thrust mode feedback check function.	0.0 ~ 6000.0 (system units P1-02)	0.0 (system units P1-02)	Programming
P4-02 ♦	0116	Pre-charge Frequency **Pre-charge Freq**	Sets the frequency reference used when the pre-charge function is active.	0.00 ~ 120.00 Hz	0.00 Hz	Programming
P4-03 ♦	0117	Pre-charge Time **Pre-charge Time**	Sets the maximum allowed pre-charge time. A value of 0 disables this function. If P1-01 = 3, the function is active when there is only one drive running on the network.<0034>	0.0 ~ 3600.0 min	0.0 min	Programming
P4-04 ♦	0118	Thrust Bearing Acceleration Time **Thrust Acce Time**	Sets the thrust bearing acceleration time. When enabled (P4-05 > 0), the drive output frequency will ramp up to the specified thrust bearing frequency reference in P4-05 using an acceleration time as specified in P4-04. The PI mode is automatically disabled. Once the output frequency reaches the programmed thrust bearing frequency, the drive automatically switches to PI control and the original acceleration time (C1-01), and will continue in the normal operation (auto) mode, unless Pre-charge is enabled, in which case Pre-charge mode occurs. This function active in the Hand Mode and Auto Mode. **Note:** In **Auto Mode**, the Minimum Pump Frequency will become the thrust bearing frequency if smaller than the thrust bearing frequency in P4-05. In **Hand Mode**, the minimum frequency is P4-05 when the thrust mode is enabled. The Pre-charge level is not active in the hand mode.	0.0 ~ 600.0 sec	1.0 sec	Programming
P4-05 ♦	0119	Thrust Bearing Frequency **Thrust Freq**	Sets the frequency reference used when the thrust bearing function is active. A value of 0 disables this function.	0.0 ~ 120.0 Hz	30.0 Hz	Programming
P4-06 ♦ <0032>	011A	Thrust Bearing Deceleration Time **Thrust Dec Time**	This deceleration time will be used to bring the drive from Thrust Frequency (P4-05) to stop when Thrust Mode is active. Any time the Run Command is removed while the drive is operating in the Thrust Mode above the Thrust Frequency, this deceleration time will be used once the frequency reference is at or below the Thrust Frequency. **Note:** In **Auto Mode**, the Minimum Pump Frequency (P1-06) will become the thrust bearing frequency if smaller than the thrust bearing frequency in P4-05. In **Hand Mode**, the minimum frequency is P4-05 when the thrust mode is enabled. The Pre-charge level is not active in the hand mode.	0.0 ~ 600.0 sec	1.0 sec	Programming
P4-07 <0032>	011B	Feedback Fault Auto Restart Enable **Fdback Flt Rstrt**	Setting to enable/disable Auto Restart for the following iQpump transducer/feedback faults (N = disable/Y = enable): LL: Low Level Feedback (P1-07) HL: High Level Feedback (P1-09) TL: Transducer Loss (b5-12) 0: TL = N HL = N LL = N 1: TL = N HL = N LL = Y 2: TL = N HL = Y LL = N 3: TL = N HL = Y LL = Y 4: TL = Y HL = N LL = N 5: TL = Y HL = N LL = Y 6: TL = Y HL = Y LL = N 7: TL = Y HL = Y LL = Y **Note:** Parameter L5-01 must be set to "1" and program L5-03 must be set to the applicable time.	0 ~ 7	0	Programming
♦ Denotes that parameter can be changed when the drive is running.						

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
P4-08 <0032>	011C	Protection Fault Auto Restart Enable **Prot Flt Restrt**	Setting to enable/disable Auto Restart for the following iQpump protection faults (N = disable/Y = enable): SP: Not Maintaining SetPoint (P1-11) LOP: Loss of Prime (P1-16) POC: Pump Over Cycling (P2-08)) 0: POC = N LOP = N SP = N 1: POC = N LOP = N SP = Y 2: POC = N LOP = Y SP = N 3: POC = N LOP = Y SP = Y 4: POC = Y LOP = N SP = N 5: POC = Y LOP = N SP = Y 6: POC = Y LOP = Y SP = N 7: POC = Y LOP = Y SP = Y **Note:** Parameter L5-01 must be set to "1" and program L5-03 must be set to the applicable time.	0 ~ 7	0	Programming
P4-09 <0032>	011D	Loss of Prime Maximum Restart Time After Fault **LOP Max Rstrt T**	If the restart fails (or is not attempted due to a continuing fault condition) the drive waits this many minutes before attempting another restart. **Note:** This parameter will take the place of L5-03 during a Loss of Prime Fault restart.	0.2 ~ 6000.0 min	0.2 min	Programming
P4-10 ♦	011E	Auto Mode Operator Run Power Down Storage. **AMO PwDn-Storage**	Stores the run status in the Auto mode when operating from digital operator (b1-02 = 0). 0: Disabled. 1: Enabled. ⚠ **WARNING** When the drive is powered down while running, then upon power-up it will automatically initiate an internal run command.	0 ~ 1	0	Pump Quick Setup
P4-11 ♦ <0034>	82A	Utility Start Delay **Utility Delay**	Sets the amount of time the drive will delay starting if a run command is present at power up. A setting of 0.0 disables this function. If P1-01 = 3, the drive is unavailable to the network (Pump Off Network) when the function is active. <0034>	0.0 ~ 1000.0 min	0.2 min	Programming
P4-12 ♦ <0034>	82B	Pre-charge Frequency 2 **Pre-charge Freq2**	Frequency reference used when Pre-charge 2 function is active. A value of 0.00 disables this function.	0.00 ~ 120.00 Hz	0.00 Hz	Programming
P4-13 ♦ <0034>	82C	Pre-charge Time 2 **Pre-charge Time2**	Time at which the drive will spend at the Pre-charge Frequency 2 (P4-12) speed during pre-charge. A value of 0.0 disables this function.	0 ~ 3600.0 min	0.0 min	Programming
P4-14 <0034>	82D	Two Motor Alternation Selection **Mot 2 Alternate**	Selects if the alternation feature is enabled. 0: Disabled 1: Enabled 2: Motor 1 Only 3: Motor 2 Only	0 ~ 3	0	Programming
P4-15 <0034>	82E	Alternation Operation Selection **Alternation Oper**	Selects the drive behavior when the internal alternation timer expires. 0: Wait For Stop 1: Immediate	0 ~ 1	0	Programming
P4-16 <0034>	82F	Alternation Time **Alternation Time**	Selects the amount of time each motor will run before the drive switches to the other motor.	1.0 ~ 100.0 hr	24.0 hr	Programming
P4-17 <0034>	830	Dual Zone PID Feedback Bandwidth Range **Dual Zone Range**	Determines the detection bandwidth for the dual zone PI control.	0 ~ 6000.0 (system units P1-02)	10.0 (system units P1-02)	Programming
P4-18 ♦ <0034>	831	Run-Stop Control Run Time **R-S Run Time**	This parameter sets the amount of time the drive will run for when the run-stop control is enabled. It will also set the "timed" run time when enabled (b1-02 = 5).	0.0 ~ 6000.0 min	0.0 min	Programming
P4-19 ♦ <0034>	832	Run-Stop Control Stop Time **R-S Stop Time**	This parameter sets the amount of time the drive will stop for when the run-stop control is enabled.	0.0 ~ 6000.0 min	0.0 min	Programming
P4-20 ♦ <0034>	833	Run-Stop Control Cycles **R-S Cycle Count**	This parameter determines how many run-stop cycles the drive will execute before staying stopped.	0 ~ 1000	0	Programming

♦ Denotes that parameter can be changed when the drive is running.

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
P4-21 <0034>	834	Low City Pressure Input Select **Low City In Sel**	Selects the type of pressure switch connected to the "Low City Pressure" digital input (H1-0x = 73). 0: Normally Open (closed indicates the "Low City Pressure" condition) 1: Normally Closed (open indicates the "Low City Pressure" condition)	0 ~ 1	1	Programming
P4-22 ♦ <0034>	835	Low City Pressure Input Delay **Low City Delay**	Sets the amount of time a "Low City Pressure" condition must be present before the drives will stop. Also sets the amount of time that the pressure must be adequate before the drive system will re-start.	1 ~ 1000 sec	10 sec	Programming
P4-23 ♦ <0034>	836	Lube Pump Delay Timer **Lube Pump Time**	Sets the amount of time the drive's output will be delayed and the Lube Pump digital output (H2-0x = 55) will be energized. A setting of zero will disable this feature.	0.0 ~ 300.0 sec	0.0 sec	Programming
P4-24 <0035>	837	Remote Drive Disable Selection **Rem Drv Dis Sel**	Selects the type of pressure switch connected to the "Remote Drv Disbl" digital input (H1-0☐=72). 0: Normally Open (closed indicates the "Remote Drive Disable" condition). 1: Normally Closed (open indicates the "Remote Drive Disable" condition).	0.0 ~ 1	0.0 sec	Programming
P4-25 ♦ <0035>	838	Remote Drive Disable On-Delay **Drv Dis On-Delay**	Sets the amount of time a "Remote Drive Disable" condition must be present before the drive will stop.	0 ~ 1000 sec	0 sec	Programming
P4-26 ♦ <0035>	839	Remote Drive Disable Off-Delay **Drv Dis Off-Delay**	Sets the amount of time a "Remote Drive Disable" condition must be absent before the drive will be allowed to run.	0 ~ 1000 sec	0 sec	Programming
P4-27 ♦ <0035>	83	Low City Alarm Text **Low Cty Alrm Txt**	Selects the alarm message that will be displayed when a Low City condition is detected. 0: Low City Pressure 1: Low Suction Pressure 2: Low Water in Tank	0 ~ 2	0 sec	Programming
Parameter functionality stated below only applies when b1-01 = 5 (Geothermal Mode)						
P4-31 <0035>	83B	Minimum Geothermal Temperature Inpu **MinGeothrm Scale**	Sets the temperature that corresponds to a 0V (or 4 mA) analog input.	-110.0 ~ 440.0 °F	0.0	Programming
P4-32 <0035>	83C	Maximum Geothermal Temperature Inpu **MaxGeothrm Scale**	Sets the temperature that corresponds to a 10V (or 20 mA) analog input.	-110.0 ~ 450.0 °F	150.0	Programming
P4-33 ♦ <0035>	83D	Minimum Geothermal Speed **MinGeothrm Speed**	Frequency Reference (Hz) P4-34 P4-33 P4-35 P4-36 P4-36 P4-38 Temperature (°F)	0.00 ~ 120.00Hz	40.00 Hz	Programming
P4-34 ♦ <0035>	83E	Maximum Geothermal Speed **MaxGeothrm Speed**		0.00 ~ 120.00Hz	60.00 Hz	Programming
P4-35 ♦ <0035>	83F	Low Temperature to Run at Maximum Geothermal Speed **Low Temp @ Max**		-110.0 ~ 450.0 °F	55.0	Programming
P4-36 ♦ <0035>	85B	Low Temperature to Run at Minimum Geothermal Speed **Low Temp @ Min**		-110.0 ~ 450.0 °F	65.0	Programming
P4-37 ♦ <0035>	85C	Low Temperature to Run at Minimum Geothermal Speed **Low Temp @ Min**		-110.0 ~ 450.0 °F	75.0	Programming
P4-38 ♦ <0035>	85D	High Temperature to Run at Maximum Geothermal Speed **High Temp @ Max**	Sets the frequency reference characteristics based on the set temperature points and the corresponding frequency. For proper operation, P4-34>P4-33 and P4-38>P4-37>P4-36>P4-35. See Function Description for more information.	-110.0 ~ 450.0 °F	85.0	Programming
P4-39 <0035>	85E	Geothermal Temperature Loss Detection **Geotherm Loss Det**	Selects the drive action when the signal from Terminal A2 has gone below 3 mA or above 21 mA. Only effective when H3-08 = 2 (4-20 mA) and H3-09 = 20 (Geothermal Temp). 0: Disabled 1: Alarm 2: Fault	0 ~ 2	1	Programming

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
			Hand Mode			
P5-01 ♦	0124	Hand Mode Reference Source **Hand Mode Ref**	Sets the hand mode reference source. 0: Analog Input A1 (0-10 V) 1: Hand reference (P5-02)	0 ~ 1	1	Programming
P5-02 ♦	0125	Hand Reference **Hand Reference**	Sets the frequency reference used when the hand mode is active and P5-01 is programmed to 1.	0.00 ~ 120.00 Hz	40.00 Hz	Programming
P5-03 <0032>	0114	HAND/AUTO During Run Selection **HAND/AUTO @Run**	Selects if the drive will permit switching between HAND and AUTO modes while running. 0: Disabled 1: Enabled Switching from HAND to AUTO is not permitted when the drive output frequency is less than the PID minimum speed. Switching from AUTO to HAND is not permitted when the drive is running in the multiplex mode with auxiliary drives enabled.	0 ~ 1	0	Programming
P5-04 <0032>	0513	Hand Key Function Selection **Oper HAND Key**	Enables or disables the "HAND" key on the digital operator. 0: Disabled 1: Enabled	0 ~ 1	1	Pump Quick Setup
			Flow Meter Setup			
P6-01 <0034>	840	Flow Meter Scaling **Flow Meter Scale**	Sets the scaling for the flow meter connected to Terminal A1. Enter the gal/min when the flow meter is at it's rated output. A setting of 0.0 disables all flow meter functions.	0.0 ~ 6000.0 Gpm	0.0 Gpm	Programming
P6-02 <0034>	841	Water Flow Units **Water Flow Units**	Sets the units displayed for monitor U1-95. Also sets units for parameters P2-02 and P6-04, P9-41 and P9-42. 0: U.S. Gallons/min (GPM) 1: U.S. Gallons/hr (GPH) 2: U.S. Barrels/min (BPM) 3: U.S. Barrels/hr (BPH) 4: U.S. Barrels/Day (BPD)	0 ~ 4	0	Programming
P6-03 ♦ <0034>	842	Flow Accumulation Reset **Flow Accum Reset**	Resets the accumulated flow and returns the monitors U1-96 and U1-97 to zero. 0: No Reset 7770: Reset Accum All other settings will have no effect. **Note:** After this parameter is changed it will automatically return to a "0".	0 ~ 65535	0	Programming
P6-04 ♦ <0034>	843	Low Flow Level **Low Flow Level**	If the drive is running and the flow goes below this level for more than the P6-05 time, a Low Flow fault or alarm will occur. A setting of 0 disables the low flow detection. If P1-03 = 3, a LOWFL fault will stop all drives running on the network.	0.0 ~ 6000.0 (*n1)	0.0	Programming
P6-05 ♦ <0034>	844	Low Flow Detection Delay Time When Already Running **Low Flow Tim Run**	Sets the amount of time the flow rate must be below the P6-04 level before a Low Flow condition is detected.	0 ~ 6000 sec	10 sec	Programming
P6-06 ♦ <0034>	845	Low Flow Detection Wait Time At Start **Low Flow Time St**	Sets the time the drive will wait after coming out of a zero speed condition before activating Low Flow detection.	0.0 ~ 3600.0 min	0.0 min	Programming

(*n1) Displayed units are determined by parameter P6-02.
♦ Denotes that parameter can be changed when the drive is running.

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
P6-07 <0034>	846	Low Flow Select **Low Flow Sel**	Sets the behavior of the drive when a "Low Flow" condition is detected. 0: No Display 1: Alarm Only 2: Fault 3: Auto-Restart (time set by P6-08)	0 ~ 3	1	Programming
P6-08 <0034>	847	Low Flow Auto-Restart Time **Low Flow Rstrt**	Sets the amount of time the drive will wait before attempting an auto-restart of the "Low Flow" fault. Effective only when P6-07 = 3.	0.1 ~ 6000.0 min	3.0 min	Programming
P6-09 ♦ <0034>	848	Accumulation Level Fine **Accum Lvl Fine**	Sets the accumulated volume that will trigger the Accum Level alarm. Accum Level fault, or Accum Level digital output. Total Accum Level can be calculated as follows: Total Accum Level = P6-10 x 1000 + P6-09. If P1-01 = 3, an ACCUM fault will stop all drives running on the network.	0.0 ~ 999.0 gal	0.0 gal	Programming

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
P6-10 ♦ <0034>	849	Accumulation Level Course **Accum Lvl Course**	Sets the accumulated volume that will trigger the Accum Level alarm. Accum Level fault, or Accum Level digital output. Total Accum Level can be calculated as follows: Total Accum Level = P6-10 x 1000 + P6-09. If P1-01 = 3, an ACCUM fault will stop all drives running on the network.	0 ~ 61036 kgl	0 kgl	Programming
P6-11 ♦ <0034>	84A	Accumulation Behavior **Accum Behavior**	Sets how the drive will respond when the accumulated volume reaches the P6-09 and P6-10 level. 0: No Display 1: Alarm Only 2: Fault 3: Fault - Auto Flow Accum Reset	0 ~ 3	1	Programming
P6-12 ♦ <0034>	84B	High Flow Level **High Flow Level**	If the drive is running and the flow goes above this level for more than the P6-13 time, a High Flow fault or alarm will occur. A setting of 0 disables the High Flow detection. If P1-01 = 3, a HIFLO fault will stop all drives running on the network.	0.0 ~ 6000.0 (*n1)	0.0	Programming
P6-13 ♦ <0034>	84C	High Flow Detection Delay Time **High Flow Time**	Sets the amount of time the flow rate must be above the P6-12 level before a High Flow condition is detected.	1 ~ 6000 sec	10 sec	Programming
P6-14 <0034>	84D	High Flow Select **High Flow Sel**	Sets the behavior of the drive when a "High Flow" condition is detected. 0: No Display 1: Alarm Only 2: Fault 3: Auto-Restart (time set by L5-03)	0 ~ 3	1	Programming
(*n1) Displayed units are determined by parameter P6-02.						
			Anti-Jam/De-Scale			
P7-01 <0034>	84F	Anti-Jam/De-Scale Operation Selection **Anti-Jam/De-Scale**	Selects if the Anti-Jam or De-Scale functions are enabled. 0: Disabled 1: Anti-Jam Enabled 2: De-Scale Enabled. 3: Force De-Scale	0 ~ 3	0	Programming
P7-02 ♦ <0034>	850	Anti-Jam/De-Scale Cycle Count **A-J Cycle Count**	This parameter sets the maximum number of cycles attempted before the Anti-Jam fault occurs and also sets the number of fwd/rev cycles for the De-Scale function.	1 ~ 100	1	Programming
P7-03 ♦ <0034>	851	Anti-Jam Detection Current Level **A-J Detection Level**	Sets the current level (at start) that will trigger the Anti-Jam function. Set as a percentage of motor rated current.	50 ~ 200 %	120 %	Programming
P7-04 ♦ <0034>	852	Anti-Jam Detection Time **A-J Det. Time**	Sets the amount of time the current must be above the P7-03 level to trigger the Anti-Jam function.	0.1 ~ 2.0 sec	0.3 sec	Programming
P7-05 ♦ <0034>	853	Anti-Jam/De-Scale Frequency Reference **AJ/De-Scale Freq**	Sets the speed during the De-Scale operation and during reverse operation of the Anti-Jam function.	0.00 ~ 120.00 Hz	25.00 Hz	Programming
P7-06 ♦ <0034>	854	De-Scale Forward Run Time **De-Scale Fwd Run**	Sets the amount of time the drive will run in the forward time each cycle during the De-Scale function.	1 ~ 6000 sec	10 sec	Programming
P7-07 ♦ <0034>	855	De-Scale Reverse Run Time **De-Scale Rev Run**	Sets the amount of time the drive will run in the reverse time each cycle during the De-Scale function.	1 ~ 6000 sec	10 sec	Programming
♦ Denotes that parameter can be changed when the drive is running.						
P7-08 ♦ <0034>	856	De-Scale Acceleration Time **De-Scale Accel**	Sets the amount of time it will take the drive to accelerate from zero to the De-Scale frequency reference P7-05 (internally limited 0.1 ~ 6000.0 sec).	0.0 ~ 600.0 sec	2.0 sec	Programming
P7-09 ♦ <0034>	857	De-Scale Deceleration Time **De-Scale Decel**	Sets the amount of time it will take the drive to decelerate from the De-Scale frequency reference P7-05 to zero (internally limited 0.1 ~ 6000.0 sec).	0.0 ~ 600.0 sec	2.0 sec	Programming
P7-10 ♦ <0034>	858	De-Scale Pump Run Time **De-Scale Time**	Sets the number of pump operating hours (pump speed > 0) before a De-Scale routine will run.	1.0 ~ 2000.0 hr	168.0 hr	Programming
P7-11 ♦ <0034>	859	Anti-Jam Release Time **Anti-Jam Release**	Sets the amount of time that the current must be below the P7-03 level in order to resume normal operation.	0.5 ~ 10.0 sec	2.0 sec	Programming

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
			Pressure and Level Control			
●Applies when P8-01 = 0 or 1 ■Applies when P8-01 = 2						
P8-01 <0034>	860	Water Level/Suction Pressure Selection **WtrLvl/SuctnPres**	Sets the mode of operation for the Water Level/Suction Control function: 0: Disabled 1: Water Level Control 2: Suction Control <0035>	0 ~ 2	0	Programming
●P8-02 <0034>	861	Water Level Scaling **Water Lvl Scale**	Sets the full scale (20 mA) output of the pressure transducer connected to Terminal A1.	5 ~ 500 psi	100 psi	Programming
■P8-02 <0035>	861	Suction Transducer Scaling **Suction Scaling**	Sets the full scale (20 mA) output of the pressure transducer connected to Terminal A1.	5 ~ 500 psi	100 psi	Programming
●P8-03 ♦ <0034>	862	Water Level Set-point **Water Lvl Setpnt**	Sets the amount of water above the sensor that the drive will attempt to regulate to.	0.0 ~ 1200.0 ft	20.0 ft	Programming
■P8-03 ♦ <0035>	862	Suction Pressure Set-point **Suction Setpoint**	Sets the amount of suction pressure that the drive will attempt to regulate to.	0.0 ~ 1200.0 psi	20.0 ft	Programming
●P8-04 ♦ <0034>	863	Minimum Water Level **Min Water Level**	When the amount of water above the sensor drops below this level for more than the P2-03 time, the drive will go to sleep.	0.0 ~ 1200.0 ft	10.0 ft	Programming
■P8-04 ♦ <0035>	863	Minimum Suction Pressure **Min Suction Pres**	When the suction pressure drops to below this level for more than the P2-03 time, the drive will go to sleep and turn off all lag pumps.	0.0 ~ 1200.0 psi	10.0 ft	Programming
●P8-05 ♦ <0034>	864	Wake-Up Water Level **Wake-Up Level**	If the drive has been forced to sleep based upon the minimum water level (P8-04), the water must go above this level for more than the P8-13 time in order to wake up.	0.0 ~ 1200.0 ft	30.0 ft	Programming
■P8-05 ♦ <0035>	864	Wake-Up Suction Pressure **Wake-Up Pres**	If the drive has been forced to sleep based upon the minimum suction pressure (P8-04), the suction pressure must go above this level for more than the P8-13 time in order to wake up.	0.0 ~ 1200.0 psi	30.0 ft	Programming
●P8-06 ♦ <0034>	865	Level Control Minimum Speed **Level Min Spd**	This parameter sets the minimum speed the drive will be allowed to run at when the drive is controlling the water level. When the drive is controlling pressure or this parameter is set less than P1-06 and P4-05, P1-06 and P4-05 will be used as the minimum speed.	0.00 ~ 120.00 Hz	0.00 Hz	Programming
■P8-06 ♦ <0035>	865	Suction Control Minimum Speed **Suction Min Spd**	This parameter sets the minimum speed the drive will be allowed to run at when the drive is controlling suction pressure. When the drive is controlling outlet pressure or this parameter is set less than P1-06 and P4-05, P1-06 and P4-05 will be used as the minimum speed.	0.00 ~ 120.00 Hz	0.00 Hz	Programming
●P8-07 ♦ <0034>	866	Low Level Detection Level **Low Level Detection**	When the amount of water above the sensor drops below the level for more than the P8-08 time, the drive will respond depending on the P8-09 setting. A setting of 0.0 disables this detection.	0.0 ~ 1200.0 ft	0.0 ft	Programming
■P8-07 ♦ <0035>	866	Low Suction Pressure Detection Level **Low Pres Detection**	When the amount of suction pressure drops below this level for more than the P8-08 time, the drive will respond depending on the P8-09 setting. A setting of 0.0 disables this detection.	0.0 ~ 1200.0 psi	0.0 ft	Programming
●P8-08 ♦ <0034>	867	Low Level Detection Time Delay **Low Lvl Det Tm**	Sets the amount of time delay that the water level must drop below the P8-07 level before the drive will react.	0.0 ~ 300.0 (P8-14 units)	0.1 min	Programming
■P8-08 ♦ <0035>	867	Low Suction Pressure Time Delay **Low Pres Det Tm**	Sets the amount of time delay that the suction pressure must drop below the P8-07 level before the drive will react. Time unit is defined by P8-14.	0.0 ~ 300.0 (P8-14 units)	0.1 min	Programming
●P8-09 <0034>	868	Low Level Behavior **Low Lvl Behavior**	Sets how the drive will respond when the water level in the well drops below the P8-07 level for more than the P8-08 time. 0: No Display (Digital Output Only) 1: Alarm Only 2: Fault 3: Auto-Restart (time set by P8-12)	0 ~ 3	1	Programming
■P8-09 <0035>	868	Low Suction Pressure Behavior Select **Low Pressure Sel**	Sets how the drive will respond when the suction pressure drops below the P8-07 level for more than the P8-08 time. 0: No Display (Digital Output Only) 1: Alarm Only 2: Fault 3: Auto-Restrart (time set by P8-12)	0 ~ 3	1	Programming

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
●P8-10 ♦ <0034>	869	Level Control Proportional Gain **Lvl Ctrl P Gain**	Sets the proportional gain for the water level control.	0.00 ~ 25.00	2.00	Programming
■P8-10 ♦ <0035>	869	Suction Control Proportional Gain **Suction P Gain**	Sets the proportional gain for the suction pressure control.	0.00 ~ 25.00	2.00	Programming
●P8-11 ♦ <0034>	86A	Level Control Integral Time **Lvl Ctrl I Time**	Sets the integral time for the water level control. A setting of zero disables the water level control integrator.	0.0 ~ 360.0 sec	5.0 sec	Programming
■P8-11 ♦ <0035>	86A	Suction Control Integral Time **Suction I Time**	Sets the integral time for the suction pressure control. A setting of zero disables the suction pressure control integrator.	0.0 ~ 360.0 sec	5.0 sec	Programming
●P8-12 <0034>	86B	Water Level Control Auto-Restart Time **WtrLvl Restart**	Sets the amount of time the drive will wait before attempting to auto-restart of the "Low Water Level" fault. Effective only when P8-09 = 3 & L5-01>0.	0.1 ~ 6000.0 min	5.0 min	Programming
■P8-12 <0035 only>	86B	Suction Pressure Auto-Restart Time **Suction Restart**	Sets the amount of time the drive will wait before attempting to auto-restart of the "Low Suction" fault. Effective only when P8-09 = 3 & L5-01>0.	0.1 ~ 6000.0 min	5.0 min	Programming
●P8-13 <0034>	86C	Water Level Control Sleep Wake-up Time **WL Wake-up Time**	If the drive has been forced to sleep based upon the minimum water level (P8-04), the water must go above the P8-05 level for more than this time in order to wake up.	0.0 ~ 3600 sec	1 sec	Programming
■P8-13 <0035 only>	86C	Suction Pressure Sleep Wake-up Time **SP Wake-up Time**	If the drive has been forced to sleep based upon the minimum suction pressure (P8-04), the pressure must go above the P8-05 level for more than this time in order to wake up.	0.0 ~ 3600 sec	1 sec	Programming
●P8-14 <0034>	86D	Low Water Level Detection Time Unit **Low Lvl Det Unit**	Defines the time unit for P8-08. 0: Minutes (min) 1: Seconds (sec)	0 ~ 1	0	Programming
■P8-14 <0035 only>	86D	Low Suction Pressure Detection Time Unit **Low Pres Det Unit**	Defines the time unit for P8-08. 0: Minutes (min) 1: Seconds (sec)	0 ~ 1	0	Programming
			Network Options			
			Parameter functionality stated below only applies when P1-01 = 3 (Memobus Network)			
P9-01 <0034>	0880	Lead Drive Selection **Lead Drive Sel**	Specifies how the next Lead Drive is selected. 0: Next Available 1: Lowest Runtime 2: Stop History <0035>	0 ~ 2	1	Programming
P9-02 <0034>	0881	Feedback Source **Feedback Source**	Defines which signal to use for PI Feedback when P1-01 = 3. 0: Analog Only 1: Ana->Net, No Alarm. 2: Ana->Net, Alarm 3: Network Only Setting has no effect when P1-01 = 3.	0 ~ 3	0	Programming
P9-03 ♦ <0034>	0882	Alternation Time **Alternation Time**	Specifies the time for a drive to request alternation, influenced by the Alternation Mode P9-04. The alternation feature is disabled when this parameter is set to 0.	0 ~ 1000 hr	24 hr	Programming
♦ Denotes that parameter can be changed when the drive is running.						
P9-04 <0034>	0883	Alternation Mode **Alternation Mode**	Determines how alternation is performed: 0: FIFO Auto 1: FIFO Forced 2: LIFO	0 ~ 2	0	Programming
P9-05 <0034>	0884	Lag Drive Mode **Lag Drive Mode**	Determines how the lag drives function. 0: Fixed Speed - Runs at the P9-06 setting. 1: PI Regulation - Uses PI to determine speed. 2: Turn Off: Drive stops running when it switches to a lag drive after the P9-07 time expires. 3: Follow Lead Spd: The drive will follow the speed of the current Lead drive applying P9-30 gain and P9-31 bias. <0035>	0 ~ 3	0	Programming
P9-06 ♦ <0034>	0885	Lag Fixed Speed **Lag Fixed Speed**	When the drive changes from a lead to a lag and P9-05 = 0, the drive will run at this speed after P9-07 delay time expires.	0.0 ~ 120.0 Hz	55.0 Hz	Programming
P9-07 ♦ <0034>	0886	Lag Fixed Speed Delay **Lag Fixed Spd Dly**	When the drive changes from a lead to a lag and P9-05 ≠ 1, this time specifies how long the speed is latched before doing one of the following: <0035> (1) P9-05 = 0: Run at P9-06 (2) P9-05 = 2: Turn off (3) P9-05 = 3: Follow the Lead Drive's speed.	0 ~ 1000 sec	5 sec	Programming

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
P9-08 <0034>	0887	Add Pump Mode **Add Pump Mode**	Selects the detection method for staging a new pump: 0: Output Frequency 1: Feedback 2: Feedback + Fout 3: Flow Meter <0035>	0 ~ 3	0	Programming
P9-09 ♦ <0034>	0888	Add Freq Level **Add Freq Lvl**	When P9-08 = 0 and the output frequency rises above this level for the time set in P9-11, the lead drive will request for a new lead drive through the iQpump Memobus Network. When P9-08 = 2 and the output frequency rises above this level the delta feedback (setpoint - feedback) has exceeded the level set in P9-10 for the time set in P9-11, the lead drive will request for a new lead drive through the iQpump Memobus network.	0.0 ~ 120.0 Hz	56.0 Hz	Programming
P9-10 ♦ <0034>	088A	Add Delta Level **Add Delta Lvl**	When P9-08 = 1 and the delta feedback (setpoint - feedback) has exceeded this level for the time set in P9-11, the lead drive will request for a new lead drive through the iQpump Memobus Network. When P9-08 = 2 and the delta feedback (setpoint - feedback) has exceeded this level and the output frequency is above P9-09 for the time set in P9-11, the lead drive will request for a new lead drive through the iQpump Memobus network.	0 ~ 6000.0 (system units P1-02)	0.0 (system units P1-02)	Programming
P9-11 ♦ <0034>	088A	Add Delay Time **Add Dly Time**	Delay time before a new lead drive is added to the system.	0 ~ 3600 sec	10 sec	Programming
P9-12 <0034>	088B	Remove Pump Mode **Remove Pump Mode**	Selects the detection method for de-staging to the previous lead pump: 0: Output Frequency 1: Feedback 2: Feedback + Fout 3: Flow Meter <0035>	0 ~ 3	0	Programming
P9-13 ♦ <0034>	088C	Remove Freq Level **Remove Freq Lvl**	When P9-12 = 0 and the output frequency drops below this level for the time set in P9-15, the lead drive will request to be removed from the system through the iQpump Memobus network. When P9-12 = 2 and the output frequency drops below this level and the delta feedback (feedback - setpoint) has exceeded the level set in P9-14 for the time set in P9-15, the lead drive will request to be removed from the system through the iQpump Memobus network.	0.0 ~ 120.0 Hz	40.0 Hz	Programming
P9-14 ♦ <0034><0034>	088D	Remove Delta Level **Remove Delta Lvl**	When P9-12 = 1 and the delta feedback (feedback - setpoint) has exceeded this level for the time set in P9-15, the lead drive will request to be removed from the system through the iQpump Memobus network. When P9-12 = 2 and the delta feedback (feedback - setpoint) has exceeded this level and the output frequency is below P9-13 for the time set in P9-15, the lead drive will request to be removed from the system through the iQpump Memobus network.	0 ~ 6000.0 (system units P1-02)	0.0 (system units P1-02)	Programming
P9-15 ♦ <0034>	088E	Remove Delay Time **Remove Dly Time**	Delay time before the lead drive is removed from the system.	0 ~ 3600 sec	10 sec	Programming
P9-16 ♦ <0034>	088F	Stabilization Time **Stabilization Time**	Time used to stabilize the system when a pump is staged or de-staged. Lead-lag control and pump protection is suspended during this time.	0 ~ 3600 sec	3 sec	Programming
♦ Denotes that parameter can be changed when the drive is running.						
P9-17 ♦ <0034>	0890	Setpoint Modifier **Set-pt Modifier**	System Set-point is incremented with this value depending on the number of pumps running. Pump 1: Set-point Pump X: Set-point + {(X-1) (P9-17)}	-6000.0 ~ 6000.0 (system units P1-02)	0.0 (system units P1-02)	Programming
P9-18 ♦ <0034>	0891	High Feedback Quick De-Stage **High FB De-stage**	Determines the feedback level to trigger a quick de-stage, set as a percentage of parameter P1-09. The quick de-stage ignores parameters P9-12 to P9-15 and only uses an internal 2 second delay.	0.0 ~ 100.0 %	90.0 %	Programming
P9-19 ♦	0892	Alternation Unit **Alternation Unit**	Selects the unit for P9-03 0: Hours (hr) 1: Minutes (min)	0 ~ 1	0	Programming

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
P9-20	0893	Allow Network Run **Allow Net Run**	Specifies when a network run command is allowed: 0: Always 1: First/Alternation 2: First Only 3: Alternation Only	0 ~ 3	0	Programming
P9-21 ♦	0894	Run Priority **Run Priority**	Sets the Lead Drive selection priority overriding the P9-01 selection. If multiple drives have the lowest P9-21 value, then P9-01 determines which drive becomes the Lead.	1 ~ 16	8	Programming
P9-22 ♦ <0034>	0895	System Fault Retry **System Flt Retry**	Determines the number of times the iQpump Memobus Network will allow automatic restarts of system faults. The drive uses parameter L5-03 in determining when to attempt a system fault restart. For proper operation, this parameter should be set the same for all network drives.	0 ~ 10	5	Programming
P9-23 ♦ <0034>	0896	Max Number of Running Pumps **MaxPumps Running**	Limits the maximum number of pumps that can run on the system.	1 ~ 8	8	Programming
P9-24 ♦ <0034>	0897	Lead Swap @ Sleep **Lead Swap @ Sleep**	When the Lead DRive has been in Sleep for this amount of time and there is another drive available with a lower P9-21, then this drive will request for a swap. A setting of 0 disables this function.	0 ~ 7200 sec	0 sec	Programming
P9-25 <0034>	0898	Highest Node Address **Highest Node Adr**	Defines the highest possible node address in the Memobus network. To yield optimal network performance, it is recommended to set the serial communication address H5-01 starting from 01h and then consecutively up to the last drive and then setting this parameter to that H5-01 address.	02h ~ 8h	08 h	Programming
P9-26 <0034>	0899	Master Time-Out **Master Time-0ut**	Sets the minimum amount of time that the slave drives will wait for a message from the master before performing the action set in P9-27.	3.0 ~ 10.0 sec	4.0 sec	Programming
P9-27 <0034>	089A	Network Recovery **Network Recovery**	When no messages are received from the master for the time set in P9-26, the slave drive will act according to this setting: 0: Automatic - drive will attempt to assume master functionality. 1: Slave/Resume - drive will continue running when the master is lost and will wait for a master to come on-line. 2: Slave/Stop - drive will stop running when the master is lost and will wait for a master to come on-line. 3: Fault MSL - fault the drive with an MSL (Master Lost).	0 ~ 3	0	Programming
P9-28 <0034>	089B	NETSCAN Alarm Time **NETSCAN Alrm Time**	Sets the amount of time that the slave drives will wait for a message from the master before displaying a NETSCAN alarm.	1.0 ~ 10.0 sec	2.0 sec	Programming
P9-29 ♦ <0034>	089C	Net Start Delay **Net Start Delay**	After the first drive on the network has been put on Auto mode, the network will wait this amount of time before selecting and starting the Lead Drive.	0.0 ~ 60.0 sec	2.0 sec	Programming
P9-30 ♦ <0035>	0876	Lag Drive Speed Follower Gain **Lag Follower Gain**	When P9-05 = 3, the drive will follow the speed of the current lead drive applying this gain and the P9-31 bias.	0.0 ~ 300.0%	100.0%	Programming
P9-31 ♦ <0035>	0877	Lag Drive Speed Follower Bias **Lag Follower Bias**	When P9-05 = 3, the drive will follow the speed of the current lead drive applying the P9-30 gain and this bias.	-60.0 ~ 60.0Hz	0.00Hz	Programming
P9-32 ♦ <0036>	0871	Lag Follower Deceleration Time **Lag Follower Dcel**	When the P9-33 timer is running, and the drive is running as Lag Drive Speed Follower (P9-05 = 3), then the deceleration time is set to this value.	0.0 ~ 1000.0 sec	60.0 sec	Programming
P9-33 ♦ <0036>	0872	Lag Follower Deceleration Time Active Time **Lag Follower Dtim**	The P9-32 deceleration time is effective during this time window. The drive will use the standard deceleration rates when it expires. A setting of 0.0 sec will disable the Lag Follower deceleration time switching.	0.0 ~ 360.0 sec	0.0 sec	Programming
P9-40 ♦ <0035>	089D	Flow Rate Source **Flow Rate Source**	Defines the Flow Meter input source when P1-01=3: 0: Analog 1: Network	0 ~ 1	0	Programming
P9-41 ♦ <0035>	089E	Add Flow Rate Level **Add Flow Lvl**	When P9-08=3 and the Flow Rate is above this level x no. of pumps running for the time set in P9-11, the lead drive will request for a new lead drive through the iQpump Memobus network. Note: (*n1) Displayed units are determined by parameter P6-02.	0.0 ~ 6000.0 (*n1)	0	Programming
P9-42 ♦ <0035>	089F	Remove Flow Rate Level **Remove Flow Lvl**	When P9-12=3 and the Flow Rate is above this level x (no. of pumps running -1) for the time set in P5-15, the lead drive will request to be removed from the system through the iQpump Memobus network. Note: (*n1) Displayed units are determined by parameter P6-02.	0.0 ~ 6000.0 (*n1)	0	Programming

● Applies when P8-01 = 0 or 1
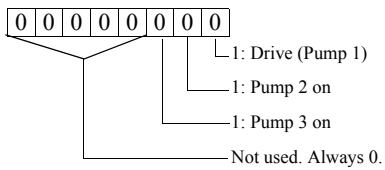■ Applies when P8-01 = 2

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
●P9-50 <0034>	0878	Water Level Source **Water Lvl Source**	Defines which signal to use for Water Level Control (P8-☐☐) when P1-01 = 3. 0: Analog Only 1: Ana->Net, No Alrm 2: Ana->Net, Alarm 3: Network Only Setting has no effect when P1-01 ≠3	0 ~ 3	0	Programming
■P9-50 <0035>	0878	Suction Pressure Source **Suction Pres Src**	Defines which signal to use for Suction Pressure Control (P8-☐☐) when P1-01 = 3. 0: Analog Only 1: Ana->Net, No Alrm 2: Ana->Net, Alarm 3: Network Only Setting has no effect when P1-01 ≠3	0 ~ 3	0	Programming
P9-99 <0036>	0875	Network Compatibility Selection **Network Comp Sel**	Determines the communication compatibility for the iQpump Memobus Network 0: A-Version 30034 Use this mode if (ONE or MORE) iQpump Controllers on the network have software version monitor U1-14=30034 and nameplate PRG: 0034. 1: B-Version 30035+ Use this mode if (NONE) of the iQpump Controllers on the network have software version monitor U1-14=30034 and nameplate PRG: 0034.	0 ~ 1	1	Programming
		Auto-Tuning				
T1-02	0702	Motor Rated Power **Mtr Rated Power**	Sets the motor rated power in kW. **Note:** T1-02 should be left at the default value (last 3 digits of the drive model number).	0.00 ~ 650.0	kVA Dependent	Auto-Tuning
T1-04	0704	Motor Rated Current **Rated Current**	Sets the motor rated current. (Used only during an auto-tune.)	kVA Dependent	kVA Dependent	Auto-Tuning

♦ Denotes that parameter can be changed when the drive is running.

Monitor List

Table 2 Monitor List

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description
			Monitor
U1-01	0040	Auto Set-point Reference **Auto: Set-point**	Auto Set-point Reference (speed command) monitor when in auto mode, frequency reference (speed command) setting location when in hand mode. Units changeable via P1-02.
U1-02	0041	Output Frequency **Output Freq**	Output frequency monitor in Hz.
U1-03	0042	Output Current **Output Current**	Output current monitor.
U1-06	0045	Output Voltage **Output Voltage**	Displays drive output voltage.
U1-07	0046	DC Bus Voltage **DC Bus Voltage**	Displays DC bus voltage.
U1-08	0047	Output Power **Output kWatts**	Displays drive output power.
U1-10	0049	Input Terminal Status **Input Term Sts**	Displays drive input terminal status. 1: FWD. run (Terminal S1) is ON. 1: REV. run (Terminal S2) is ON. 1: Multi-function input 1 (Terminal S3) is ON. 1: Multi-function input 2 (Terminal S4) is ON. 1: Multi-function input 3 (Terminal S5) is ON. 1: Multi-function input 4 (Terminal S6) is ON. 1: Multi-function input 5 (Terminal S7) is ON.
U1-11	004A	Output Terminal Status **Output Term Sts**	Output terminal ON/OFF check. 1: Multi-function Contact 1 output 1 (Terminal M1-M2) is ON. 1: Multi-function Contact 2 output 1 (Terminal M3-M4) is ON. Not used. Not used. 1: Fault output (Terminal MA/MB-MC) is ON.
U1-12	004B	Drive Operation Status **Int Ctl Sts 1**	1: During running. 1: During zero speed. 1: During reverse. 1: During reset signal input. 1: During speed agree. 1: Drive operation ready. 1: During fault detection (Minor fault). 1: During fault detection (Major fault).
U1-13	004C	Cumulative Operation Time **Elapsed Time**	Displays total operating or power-on time of the drive.
U1-14	004D	Software Number **FLASH ID**	Displays drive's software number.
U1-15	004E	Terminal A1 Input Voltage **Term A1 Level**	Displays the input voltage on Terminal A1, as a percentage of 10 Vdc.

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description
			Monitor
U1-16	004F	Terminal A2 Input Voltage **Term A2 level**	Displays the input current (or voltage) on Terminal A2, as a percentage of 20 mA (or 10 Vdc).
U1-18	0051	Motor Secondary Current (Iq) **Mot SEC Current**	Displays the amount of current being used by the motor to produce torque (Iq).
U1-20	0053	Output Frequency After Soft Start **SFS Output**	Displays the frequency reference (speed command) after the accel and decel ramps.
U1-24	0057	PI Feedback Value **PI Feedback**	Displays the feedback signal when PI control is used.
U1-28	005B	CPU Number **CPU ID**	Displays control board hardware revision.
U1-29	005C	kWh **kWh Lo 4 Digits**	Displays the accumulated kWh.
U1-30	005D	MWh **kWh Hi 5 Digits**	Displays the accumulated MWh.
U1-34	0061	First Parameter Causing an OPE **OPE Detected**	Displays the parameter number causing an "OPE" fault.
U1-36	0063	PI Input **PI Input**	Displays the "error" in the PI regulator. (U1-36 = PI Set-point - PI Feedback).
U1-37	0064	PI Output **PI Output**	Displays the output of the PI as a percentage of maximum frequency (E1-04).
U1-38	0065	PI Set-point **PI Set-point**	Displays the setpoint of the PI regulator (U1-38 = PI reference + PI bias).
U1-39	0066	Memobus Communication Error Code **Transmit Err**	0 0 0 0 0 0 0 0 1: CRC error 1: Data length error Not used. Always 0. 1: Parity error 1: Overrun error 1: Framing error 1: Timeover Not used. Always 0.
U1-40	0067	Heatsink Cooling Fan Operation Time **FAN Elapsed Time**	Displays total operating time of the heatsink cooling fan.
U1-62	007D	Running Queue No **Running Queue No**	Position in the iQpump Memobus Multiplex Running Queue
U1-67	009B	Network Activity **Network Activity**	Shows network traffic. A fluctuating number from 0 to 1000 denotes activity, while a relatively constant 0 denotes no activity. Unit changes based on network status: <->: Drive can not communicate to other drives <+>: Drive is a Node on a network <M>: Drive is a Master on an iQpump Network
U1-68	0009C	Time to Alternate **Time to Alternate**	Time remaining before a drive requests alternation which is dependent on P9-04.
U1-80 <0035>	009Dh	Geothermal Temperature Input **Geothermal Temp**	Geothermal temperature input after the gain and bias has been applied. This is the temperature used by the Geothermal Function to determine what frequency to run the drive. Internally limited to -999.9°F and 999.9°F. Only shown when B1-05 = 5 Units 0.1°F
U1-90	0720	Pump Set-point **Pump Set-point**	Displays drive setpoint. Resolution 0.1 **Note:** Does not include setpoint compensation (U1-93).

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description
			Monitor
U1-91	0721	Pump Feedback **Pump Feedback**	Displays scaled feedback. Resolution 0.1
U1-92	0722	Pump Status **Pump Status**	Display pump running status. `0 0 0 0 0 0 0 0` 1: Drive (Pump 1) 1: Pump 2 on 1: Pump 3 on Not used. Always 0.
U1-93	723	Total Set-point Compensation **Total SP Comp.**	Displays total absolute setpoint compensation. Resolution 1.
U1-94	724	Motor Speed **Motor Speed**	Displays motor speed (rpm). Used for no-flow detection (P2 Group).
U1-95	725	Flow Rate **Flow Rate**	Displays the flow rate, based upon the voltage present on Terminal A1 and parameters P6-01 and P6-02. A two second 1st order filter will be applied to this monitor.
U1-96	72A	Volume Accumulated (fine) **Volume (fine)**	Displays the volume that has been measured by Terminal A1. Total volume can be calculated as follows: Total Volume = U1-97 x 1000 + U1-96. Value retained in EEPROM.
U1-97	72B	Volume Accumulated (course) **Volume (course)**	Displays the volume that has been measured by Terminal A1. Total volume can be calculated as follows: Total Volume = U1-97 x 1000 + U1-96. Value retained in EEPROM.

● Applies when P8-01 = 0 or 1
■ Applies when P8-01 = 2

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description
●U1-98	72C	Water Level **Water Level**	Displays the amount of water above the water level sensor.
■U1-98 <0035>	72C	Water Level **Suction Pressure**	Displays the amount of suction pressure.
U1-99	72D	Anti-No-Flow Timer **ANF Timer**	When this value reaches the P2-24 setting, the Anti-No-Flow feature begins to reduce the output frequency.

Fault Trace List

Table 3 Fault Trace List

Parameter No.	Addr. Hex	Fault Trace
U2-01	0080	Current Fault **Current Fault**
U2-02	0081	Previous Fault **Last Fault**
U2-03	0082	Frequency Reference at Most Recent Fault **Frequency Ref**
U2-04	0083	Output Frequency at Most Recent Fault **Output Freq**
U2-05	0084	Output Current at Most Recent Fault **Output Current**
U2-07	0086	Output Voltage at Most Recent Fault **Output Voltage**
U2-08	0087	DC Bus Voltage at Most Recent Fault **DC Bus Voltage**
U2-09	0088	Output Power at Most Recent Fault **Output kWatts**
U2-11	008A	Input Terminal Status at Most Recent Fault. The format is the same as for U1-10. **Input Term Sts**
U2-12	008B	Output Terminal Status at Most Recent Fault. The format is the same as for U1-11. **Output Term Sts**
U2-13	008C	Drive Operation Status at Most Recent Fault. The format is the same as for U1-12. **Inverter Status**
U2-14	008D	Cumulative Operation Time at Most Recent Fault **Elapsed time**
Note: Fault trace is not executed at CPF00, CPF01, CPF03, UVI and UV2.		

Fault History List

Table 4 Fault History List

Parameter No.	Addr. Hex	Fault History
U3-01	0090	Most Recent Fault **Last Fault**
U3-02	0091	2nd Most Recent Fault **Fault Message 2**
U3-03	0092	3rd Most Recent Fault **Fault Message 3**
U3-04	0093	4th Most Recent Fault **Fault Message 4**
U3-05	0094	Cumulative Operation Time at Most Recent Fault **Elapsed Time 1**
U3-06	0095	Cumulative Operation Time at 2nd Most Recent Fault **Elapsed Time 2**
U3-07	009B	Cumulative Operation Time at 3rd Most Recent Fault **Elapsed Time 3**
U3-08	0097	Cumulative Operation Time at 4th Most Recent Fault **Elapsed Time 4**
U3-09	0804	5th Most Recent Fault **Fault Message 5**
U3-10	0805	6th Most Recent Fault **Fault Message 6**
U3-11	0806	7th Most Recent Fault **Fault Message 7**
U3-12	0807	8th Most Recent Fault **Fault Message 8**
U3-13	0808	9th Most Recent Fault **Fault Message 9**
U3-14	0809	10th Most Recent Fault **Fault Message 10**
U3-15	080E	Cumulative Operation Time at 5th Most Recent Fault **Elapsed Time 5**
U3-16	080F	Cumulative Operation Time at 6th Most Recent Fault **Elapsed Time 6**
U3-17	0810	Cumulative Operation Time at 7th Most Recent Fault **Elapsed Time 7**
U3-18	0811	Cumulative Operation Time at 8th Most Recent Fault **Elapsed Time 8**
U3-19	0812	Cumulative Operation Time at 9th Most Recent Fault **Elapsed Time 9**
U3-20	0813	Cumulative Operation Time at 10th Most Recent Fault **Elapsed Time 10**
Note: Faults such as CPF00, CPF01, CPF02, CPF03, UV1, and UV02 are not stored in fault history.		

Table 5 Decimal to Hex Conversion

Decimal	Hex	Decimal	Hex
1	1	51	33
2	2	52	34
3	3	53	35
4	4	54	36
5	5	55	37
6	6	56	38
7	7	57	39
8	8	58	3A
9	9	59	3B
10	A	60	3C
11	B	61	3D
12	C	62	3E
13	D	63	3F
14	E	64	40
15	F	65	41
16	10	66	42
17	11	67	43
18	12	68	44
19	13	69	45
20	14	70	46
21	15	71	47
22	16	72	48
23	17	73	49
24	18	74	4A
25	19	75	4B
26	1A	76	4C
27	1B	77	4D
28	1C	78	4E
29	1D	79	4F
30	1E	80	50
31	1F	81	51
32	20	82	52
33	21	83	53
34	22	84	54
35	23	85	55
36	24	86	56
37	25	87	57
38	26	88	58
39	27	89	59
40	28	90	5A
41	29	91	5B
42	2A	92	5C
43	2B	93	5D
44	2C	94	5E
45	2D	95	5F
46	2E	96	60
47	2F	97	61
48	30	98	62
49	31	99	63
50	32	100	64

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