YASKAWA

iQpump Controller
Programming Manual

Document Number: TM.iQp.07   PRG: 0034 ~ 003X

◆ Quick Reference for iQpump (P7U) <0034>

Parameter Number	Factory Setting	User Setting
A1-00	0	
A1-01	2	
A1-03	0	
A1-04	0	
A1-05	0	
b1-01	0	
b1-02	0	
b1-03	0	
b1-07	0	
b1-08	0	
b1-11	0 s	
b2-01	0.5 Hz	
b2-02	50 %	
b2-03	0.00 s	
b2-04	0.50 s	
b2-09	0 %	
b3-01	2	
b3-02	120 %	
b3-03	2.0 s	
b3-05	0.2 s	
b3-14	1	
b4-01	0.0 s	
b4-02	0.0 s	
b5-01	1	
b5-02	2.00	
b5-03	3.0 s	
b5-04	100.0 %	
b5-06	100.00 %	
b5-07	0.0 %	
b5-08	0.00 s	
b5-09	0	
b5-10	1.0	
b5-12	2	
b5-13	0 %	
b5-14	2.0 s	
b5-17	0.0 s	
b5-32	0.0 Hz	
b8-01	0	
b8-04	kVA Dep.	
b8-05	20 ms	
b8-06	0 %	
C1-01	20.0 s	
C1-02	10.0 s	
C1-03	10.0 s	
C1-04	10.0 s	
C1-05	50.0 s	
C1-06	50.0 s	
C1-09	10.0 s	
C1-11	0.0 Hz	
C2-01	0.20 s	
C2-02	0.20 s	
C4-01	1.00	
C4-02	200 ms	
C6-02	kVA Dep	

Parameter Number	Factory Setting	User Setting
C6-03	kVA Dep	
d1-01	0.00	
d1-02	0.00	
d1-03	0.00	
d1-04	0.00	
d1-17	0.00	
d2-01	100.0 %	
d2-02	0.0 %	
d2-03	0.0 %	
d3-01	0.0 Hz	
d3-02	0.0 Hz	
d3-03	0.0 Hz	
d3-04	1.0 Hz	
E1-01	240 V 480 V	
E1-03	F	
E1-04	60.0 Hz	
E1-05	230 V 460 V	
E1-06	60.0 Hz	
E1-07	3.0 Hz	
E1-08	17.2 Vac 34.5 Vac	
E1-09	1.5 Hz	
E1-10	10.3 Vac 20.7 Vac	
E1-11	0.0 Hz	
E1-12	0.0 Vac	
E1-13	0.0 Vac	
E2-01	kVA Dep	
E2-03	kVA Dep	
E2-04	2	
E2-05	kVA Dep	
F6-01	1	
F6-02	0	
F6-03	1	
F6-05	0	
H1-01	24	
H1-02	14	
H1-03	3: 2-wire 0: 3-wire	
H1-04	80	
H1-05	84	
H1-12	0.00 s	
H1-13	0.00 s	
H1-14	0.00 s	
H1-15	0.00 s	
H1-16	0.00 s	
H2-01	40	
H2-02	41	
H3-02	100.0 %	
H3-03	0.0 %	

Parameter Number	Factory Setting	User Setting
H3-08	2	
H3-09	B**	
H3-10	100.0 %	
H3-11	0.0 %	
H3-12	0.30 s	
H3-13	0	
H4-01	2	
H4-02	100.0 %	
H4-03	0.0 %	
H4-04	8	
H4-05	50.0 %	
H4-06	0.0 %	
H4-07	0	
H4-08	0	
H5-01	1F	
H5-02	3	
H5-03	0	
H5-04	3	
H5-05	1	
H5-06	5 ms	
H5-07	1	
H5-08	0	
H5-09	2.0 s	
L1-01	1	
L1-02	8.0 min	
L1-03	3	
L1-04	1	
L1-05	0.20 s	
L2-01	2	
L2-02	kVA Dep	
L2-03	kVA Dep	
L2-04	kVA Dep	
L2-05	Voltage Class Dep	
L3-01	1	
L3-02	120 %	
L3-04	1	
L3-05	1	
L3-06	120 %	
L4-01	0.0 Hz	
L4-02	2.0 Hz	
L4-05	0	
L4-06	0	
L5-01	5	
L5-02	0	
L5-03	20.0 s	
L6-01	0	
L6-02	15 %	
L6-03	10.0 s	
L8-01	0	
L8-02	95 ºC	
L8-03	4	
L8-05	1	
L8-06	kVA Dep	
L8-07	1	

Parameter Number	Factory Setting	User Setting
L8-09	1	
L8-10	0	
L8-11	300 s	
L8-12	45 ºC	
L8-15	1	
L8-18	1	
L8-19	20.0 %	
n1-01	1	
n1-02	1.00	
n3-01	5 %	
n3-02	150 %	
n3-03	1.0 s	
n3-04	40 s	
o1-01	6	
o1-02	1	
o1-05	3	
o1-06	1**	
o1-07	2**	
o1-08	91**	
o2-01	1	
o2-02	1	
o2-03	0	
o2-04	kVA Dep	
o2-05	0	
o2-06	1	
o2-07	0 hr	
o2-08	1	
o2-10	0 hr	
o2-12	0	
o2-14	0	
o3-01	0	
o3-02	0	
P1-01	0	
P1-02	1	
P1-03	00145	
P1-04	0.0 (system units P1-02)	
P1-05	1 s	
P1-06	40.0 Hz	
P1-07	0.0 (system units P1-02)	
P1-08	5 s	
P1-09	155.0 (system units P1-02)	
P1-10	2 s	
P1-11	0.0 (system units P1-02)	
P1-12	60 s	
P1-13	0.0 (system units P1-02)	
P1-14	0.0 A	
P1-15	0	
P1-16	20 s	
P2-01	0	
P2-02	0.0	

Parameter Number	Factory Setting	User Setting
P2-03	5 s	
P2-04	0.0 (system units P1-02)	
P2-05	10 s	
P2-06	0	
P2-07	300 s	
P2-08	0	
P2-09	0.0 (system units P1-02)	
P2-10	0.0 (system units P1-02)	
P2-11	0 rpm	
P2-12	15 rpm	
P2-13	5.0 s	
P2-14	5.0 s	
P2-15	1.0 (system units P1-02)	
P2-16	1.5 (system units P1-02)	
P2-17	2.0 s	
P2-18	2.0 s	
P2-19	0	
P2-20	0.0	
P2-21	0.0	
P2-22	5.0 s	
P2-23	0.40 %	
P2-24	10.0 s	
P2-25	3.0 psi	
P3-01	0	
P3-02	59.0 Hz	
P3-03	0.0 (system units P1-02)	
P3-04	2 s	
P3-05	0.0 (system units P1-02)	
P3-06	5 s	
P3-07	0.0 (system units P1-02)	

Parameter Number	Factory Setting	User Setting
P3-08	0.0 (system units P1-02)	
P3-09	40.0 Hz	
P3-10	40.0 Hz	
P3-11	2 s	
P3-12	0.0 (system units P1-02)	
P3-13	0.0 Hz	
P3-14	0.0 (system units P1-02)	
P4-01	0.0 (system units P1-02)	
P4-02	0.00 Hz	
P4-03	0.0 min	
P4-04	1.0 s	
P4-05	30.0 Hz	
P4-06	1.0 s	
P4-07	0	
P4-08	0	
P4-09	0.2 min	
P4-10	0	
P4-11	0.2 min	
P4-12	0.00 Hz	
P4-13	0.0 min	
P4-14	0	
P4-15	0	
P4-16	24.0 hr	
P4-17	10.0 (system units P1-02)	
P4-18	0.0 min	
P4-19	0.0 min	
P4-20	0	
P4-21	1	
P4-22	10 s	
P4-23	0.0 s	
P5-01	1	

Parameter Number	Factory Setting	User Setting
P5-02	40.00 Hz	
P5-03	0	
P5-04	1	
P6-01	0.0 Gpm	
P6-02	0	
P6-03	0	
P6-04	0.0	
P6-05	10 s	
P6-06	0.0 min	
P6-07	1	
P6-08	3.0 min	
P6-09	0.0 gal	
P6-10	0 kgl	
P6-11	1	
P6-12	0.0	
P6-13	10 s	
P6-14	1	
P7-01	0	
P7-02	1	
P7-03	120 %	
P7-04	0.3 s	
P7-05	25.00 Hz	
P7-06	10 s	
P7-07	10 s	
P7-08	2.0 s	
P7-09	2.0 s	
P7-10	168.0 hr	
P7-11	2.0 s	
P8-01	0	
P8-02	100 psi	
P8-03	20.0 ft	
P8-04	10.0 ft	
P8-05	30.0 ft	
P8-06	0.00 Hz	
P8-07	0.0 ft	
P8-08	0.1 min	

Parameter Number	Factory Setting	User Setting
P8-09	1	
P8-10	2.00	
P8-11	5.0 s	
P9-02	0	
P9-03	24 hr	
P9-04	0	
P9-05	0	
P9-06	55.0 Hz	
P9-07	5 s	
P9-08	0	
P9-09	56.0 Hz	
P9-10	0.0 (system units P1-02)	
P9-11	10 s	
P9-12	0	
P9-13	40.0 Hz	
P9-14	0.0 (system units P1-02)	
P9-15	10 s	
P9-16	3 s	
P9-17	0.0 (system units P1-02)	
P9-18	90.0 %	
P9-19	0	
P9-20	0	
P9-21	8	
P9-22	5	
P9-23	16	
P9-24	0 s	
P9-25	08 h	
P9-26	4.0 s	
P9-27	0	
P9-28	2.0 s	
P9-29	2.0 s	
T1-02	kVA Dep	
T1-04	kVA Dep	

* Factory Setting changes to “B” when b5-01 = 1.

** Factory Setting changes to “B” when b5-01 = 1 as follows: o1-06 = 1, o1-07 = 38, o1-08 = 24.

Table of Contents

Warnings and Cautions

This Section provides warnings and cautions pertinent to this product, that if not heeded, may result in personal injury, fatality, or equipment damage. Yaskawa is not responsible for consequences of ignoring these instructions.

WARNING
YASKAWA manufactures component parts that can be used in a wide variety of industrial applications. The selection and application of YASKAWA products remain the responsibility of the equipment designer 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 products designed to incorporate a component part manufactured by YASKAWA must be supplied to the end user with appropriate warnings and instructions as to that part's safe use and operation. 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, EXPRESS OR IMPLIED, IS OFFERED. YASKAWA assumes no liability for any personal injury, property damage, losses, or claims arising from misapplication of its products.

⚠ WARNING

- Read and understand this manual before installing, operating, or servicing this drive. All warnings, cautions, and instructions must be followed. All activity must be performed by qualified personnel. The iQpump drive must be installed according to this manual and local codes.
- Do not connect or disconnect wiring while the power is on. Do not remove covers or touch circuit boards while the power is on. Do not remove or insert the digital operator while power is on.
- Before servicing, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. Status indicator LEDs and Digital Operator display will be extinguished when the DC bus voltage is below 50 Vdc. To prevent electric shock, wait at least five minutes after all indicators are OFF and measure DC bus voltage level to confirm safe level.
- Do not perform a withstand voltage test on any part of the unit. This equipment uses sensitive devices and may be damaged by high voltage.
- The iQpump drive is not suitable for circuits capable of delivering more than 100,000 RMS symmetrical amperes. Install adequate branch short circuit protection per applicable codes. Refer to the specification. Failure to do so may result in equipment damage and/or personal injury.
- Do not connect unapproved LC or RC interference suppression filters, capacitors, or overvoltage protection devices to the output of the drive. These devices may generate peak currents that exceed iQpump drive specifications.
- To avoid unnecessary fault displays caused by contactors or output switches placed between iQpump drive and motor, auxiliary contacts must be properly integrated into the control logic circuit.
- YASKAWA is not responsible for any modification of the product made by the user; doing so will void the warranty. This product must not be modified.
- Verify that the rated voltage of the iQpump drive matches the voltage of the incoming power supply before applying power.
- To meet CE directives, proper line filters and proper installation are required.
- Some drawings in this manual may be shown with protective covers or shields removed, to describe details. These must be replaced before operation.
- Observe electrostatic discharge procedures when handling circuit cards to prevent ESD damage.
- The equipment may start unexpectedly upon application of power. Clear all personnel from the drive, motor, and machine area before applying power. Secure covers, couplings, shaft keys, and machine loads before energizing the drive.
- Please do not connect or operate any equipment with visible damage or missing parts. The operating company is responsible for any injuries or equipment damage resulting from failure to heed the warnings in this manual.

◆ Intended Use

Drives are intended for installation in electrical systems or machinery.

For use in the European Union, the installation in machinery and systems must conform to the following product standards of the Low Voltage Directive:

- EN 50178, 1997-10, Equipping of Power Systems with Electronic Devices
- EN 60201-1, 1997-12 Machine Safety and Equipping with Electrical Devices
- Part 1: General Requirements (IEC 60204-1:1997)
- EN 61010, 1997-11 Safety Requirements for Information Technology Equipment
- (IEC 950:1991 + A1:1992 + A2:1993 + A3:1995 + A4:1996, modified)

◆ Other

The iQpump (P7U) drive is suitable for use on a circuit capable of delivering not more than 100,000 RMS symmetrical amperes, 240 Vac maximum (240 V Class) and 480 Vac maximum (480 V Class).

Introduction

This Section describes the applicability of this manual.

The iQpump (P7U) is a Pulse Width Modulated drive for 3-Phase AC induction motors. This type of drive is also known as an Adjustable Frequency Drive, Variable Frequency Drive, AC Drive, AFD, ASD, VFD, and Inverter.

The iQpump (P7U) is a variable torque AC drive, designed specifically for Simplex and Multiplex pumping applications. The pump applications include Booster Systems, Submersible Deep Well, Fluid Storage Tanks, Metering Pumps, Commercial and Residential Irrigation Systems.

The iQpump (P7U) sets a new benchmark for size, cost, performance, ease-of-use benefits, comprehensive pump, motor protection features, and quality. The iQpump includes numerous built-in features such as H/O/A Operation, Selectable Pump Control Engineering Units, PI Control, Pump Basic Control, Pump Protection, Multi-Pump Control (Lead/Lag), and Pump Messaging Terminology.

The LCD keypad/operator is equipped with Hand/Off/Auto functions, copy feature, and 5 lines of display with 16 characters per line.

Built-in PI and pump-specific functions and parameters allow the operator to setup specific control values for a wide range of applications. The iQpump (P7U) will optimize the pump performance by automatically adjusting the pump controller based on operating conditions of the pump, such as process variable changes and pump protection requirements. The P Group programming parameters are dedicated for pumping applications and help facilitate setup.

The iQpump (P7U) drive offers energy savings by controlling the flow rate and the number of operating pumps on the system. The iQpump (P7U) can be configured using the most popular system control configurations including Simplex, Duplex, and Triplex pumps systems. The iQpump is the master controller with the ability to add additional pumps on-line by controlling the digital I/O to each individual motor starter.

The iQpump (P7U) has an optional feature to replace the motors starters with additional drives for a more precise pump control system.

This manual is applicable to the iQpump (P7U) Drives defined by models CIMR-P7U☐☐☐☐☐ - 107.

This manual is subject to change as product improvements occur. The latest version of the manual can be obtained from Yaskawa. The date shown on the rear cover is changed when revisions are made.

This manual may describe trademarked equipment, which is the property of other companies. These trademarks are the property of the registered owner companies and may include the following:

• Modbus®, trademark of Schneider Automation, Inc.

Other documents and manuals are available to support special use or installation of this product. These documents may be provided with the product or upon request. Contact Yaskawa Electric America, Inc. as required. Documents may include the following:

• TM.iQp.06 Users Manual
• TM.iQp.11 Modbus Manual
• PumpScada Software and Manual included on CD ROM with product
• Option Instructions included on CD ROM with product

0.1 Conventions Used in this Manual

◆ Software Versions

Yaskawa recognizes the need to continuously improve product quality. This iQpump drive may receive feature enhancements in the form of software or hardware changes in the future, and new functions may be added to the drive. When a new feature or function is added, the **software version <####>** will be placed next to the feature or function.

EXAMPLE:

A1-00 Language Selection

Setting	Description
0	English *(factory default)*
1	Japanese
2	Deutsche **<0034>**
3	Francais **<0034>**
4	Italiano **<0034>**
5	Espanol **<0034>**
6	Portugues **<0034>**

The example above shows that settings 2, 3, 4, 5, and 6 are added to parameter A1-00 for drive software version PRG: <0034>.

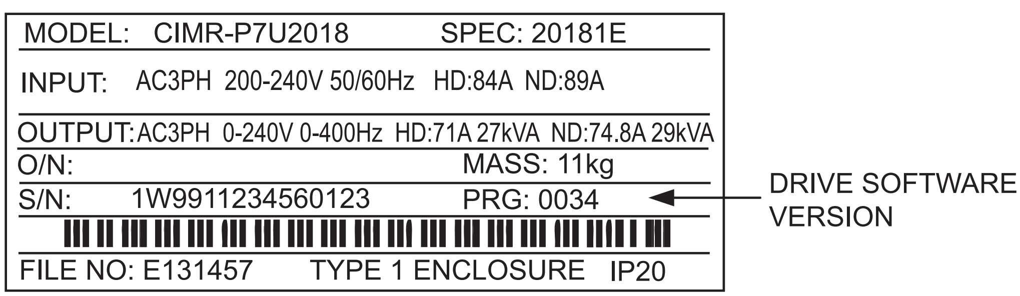


Figure 1 Nameplate with PRG software number

The “PRG:” number on the drive nameplate reflects the software version. The software version normally increases to a higher number with newer versions.

1

Programming

This chapter contains descriptions of all user accessible parameters contained in the drive. Parameters are listed in alpha-numerical order. Parameter number and name, along with a detailed description and its settings are described on the following pages.

iQpump Drive Basic Programming Parameters

The initialization group contains parameters associated with initial drive setup. Parameters involving the display language, access levels, initialization, and password are located in this group.

◆ A1 Initialization

■ A1-00 Language Selection

Setting	Description
0	English (***factory default***)
2	Deutsch
3	Francais
4	Italiano
5	Espanol
6	Portugues
*Not returned to factory setting by initialization	

■ A1-01 Access Level Selection

Setting	Description
0	Operation Only
2	Advanced Level (***factory default***)

If the iQpump drive is programmed for Operation Only (A1-01 = “0: Operation Only”), then only the OPERATION and the PROGRAMMING menus are accessible. Within the PROGRAMMING menu only parameters A1-01 and A1-04 are adjustable.

If A1-01 is configured for Advanced Access (A1-01 = “2: Advanced Level”), then all menus and all parameters are shown. If the Access Level Selection is set to Advanced, all parameters should be adjustable unless:

The iQpump drive parameters are password protected (A1-04) which will prevent access to A1-00 through A1-03 and all A2 parameters.

A digital input has been configured as a Program Lockout (H1-0x = 1B) is active.

During serial communication writing, if a parameter change is also attempted via the digital operator, a “BUSY - WRITE PROTECTED” message will display. Parameter change will not be possible from the digital operator until an Enter command is received via the serial communication to finish the serial writing process.

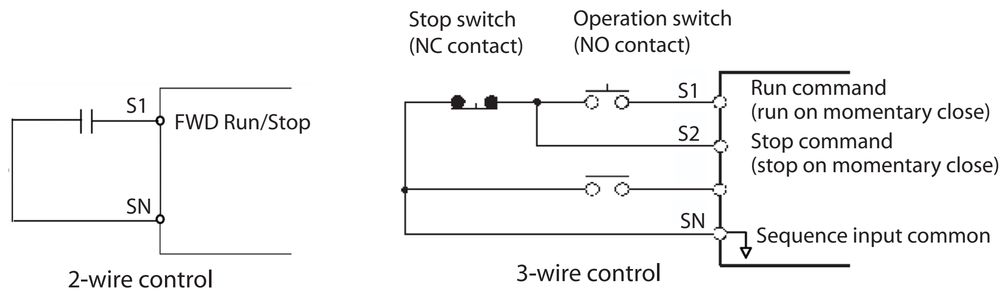
■ A1-03 Initialize Parameters

Setting	Description
0	No Initialize (***factory default***)
1110	User Initialize
2220	2-Wire Initialize
3330	3-Wire Initialize

The iQpump drive can be set back to one of three default states via the A1-03 parameter.

1. User Initialization – 1110: The modified iQpump drive parameters are returned to the values selected as user settings. User settings are stored when parameter o2-03 = “1: Set Defaults”.
2. 2-Wire Initialization – 2220: The iQpump drive parameters are returned to factory default values with digital inputs S1and S2 configured as Forward Run.
3. 3-Wire Initialization – 3330: The iQpump drive parameters are returned to factory default values with digital inputs S1, S2, and S5 configured as Run, Stop, and Forward / Reverse respectively.

After an initialization is performed, parameter A1-03 will automatically be set back to 0.



Note: 2-Wire Control is the most commonly used.

Figure 1. 2 and 3-Wire Control Wiring Examples

Important: Some parameters are unaffected by either the 2-Wire or 3-Wire initialization. The following parameters will not be reset when parameter A1-03 = 2220 or 3330:

A1-00	Language Selection
E1-03	V/f Pattern Selection
o2-04	kVA Selection

■ A1-04 Password Entry

Setting Range: 0 ~ 9999

Factory Default: 0

If parameters A1-01 through A1-03 are locked (unchangeable), they can be unlocked by entering the correct password number into A1-04.

Once the correct password number is entered and the specified parameters are unlocked, a 2-Wire or 3-Wire initialization will reset the password to 0000.

Note: A1-04 will return to “0000” when the password has been entered.

■ A1-05 Select Password

Setting Range: 0 ~ 9999

Factory Default: 0

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. All other parameters determined by A1-01 can be changed. Parameter A1-05 can be accessed by displaying parameter A1-04, then press and hold the RESET key along with the MENU key simultaneously.

b1 Sequence

The Sequence Group contains parameters associated with starting and stopping the drive. Parameters involving the Run Command, Speed Reference location, Stopping Method and Hand / Auto changeover are located in this group.

◆ b1-01 Reference (Auto Setpoint) Source Selection

Setting	Description
0	Operator - Digital Preset Setpoint 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

In order to run the iQpump drive and motor, the iQpump drive must receive a Run command and a Auto Setpoint command. Parameter b1-01 specifies from where the Auto Setpoint is received when in the “Auto” mode. Switching into the “Auto” mode can be done by pressing the AUTO button on the digital operator while the iQpump drive is stopped.

Important: If a Run command is input to the iQpump drive but no corresponding Auto Setpoint is input, the Run indicator on the digital operator will turn on and the STOP indicator on the digital operator will blink.

To configure the iQpump drive to follow the “Hand Reference” set by the digital operator: Use the “Hand” mode by pressing the hand key and set P5-01 = “1: Hand Reference (P5-02)”. The hand reference can then be entered into the P5-02 parameter.

The iQpump drive offers the ability to provide four types of “Auto Setpoint” reference sources. These Auto Setpoint reference sources are determined by the setting of b1-01 and the drive set to “Auto” mode by pressing the Auto key on the digital operation.

Note: Prior to programming, it is recommended to first select the system units (P1-02) and the feedback device, Scaling (P1-03). P1-03 will automatically scale the iQpump Setpoint.

Example:
P1-02 = 1: psi
P1-03 = 200, feedback range = 200 psi.

To configure the iQpump drive to follow an “Auto Setpoint” set by the digital operator: Set b1-01 = “0: Operator” (factory default), The Auto Setpoint can then be entered into the U1-01 monitor parameter in the “-DRIVE-” menu.

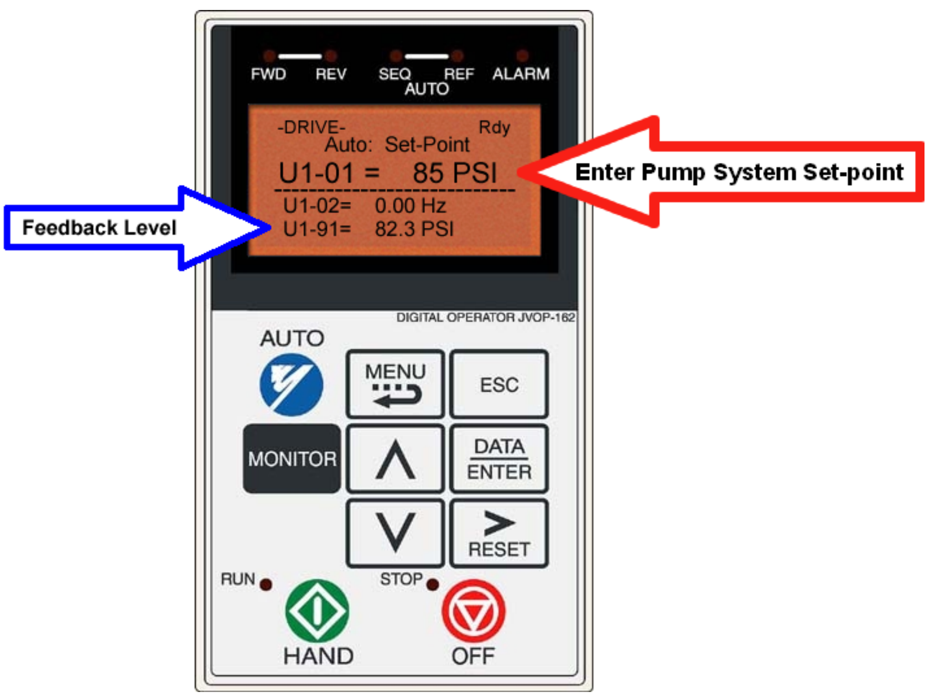


Figure 2. Digital Operator Auto Setpoint

To configure the iQpump drive to follow an “Auto Setpoint” set by the analog input: Set b1-01 = “1: Terminals,” and connect a potentiometer or external signal to the iQpump drive. Refer to *Figure 3.* for connection diagram for the setpoint potentiometer.

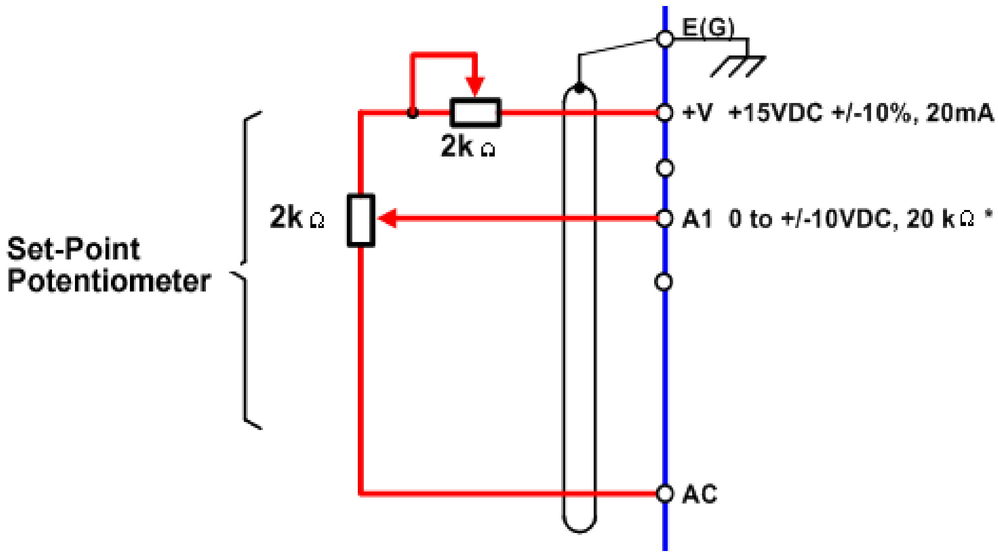


Figure 3. Setpoint Potentiometer Connection Diagram

Refer to *Figure 4.* for the connection diagram for an external analog signal setpoint reference.

Note: When b1-01 = 1 (terminals) and P5-01 = 0 (hand mode reference source), the setpoint and the hand reference are determined by the external analog signal.

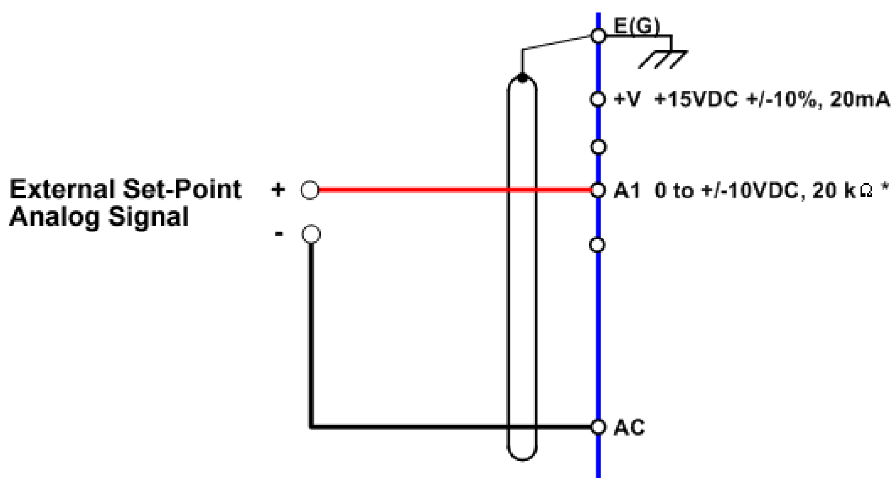


Figure 4. External Analog Signal Setpoint Reference

Setting the iQpump drive to receive the "Auto Setpoint" from serial communication: Set b1-01 = "2: Serial Com," and connect the RS-485 / 422 serial communications cable to terminals R+, R-, S+, and S- on the control I/O terminal block.

Refer to *Figure 5.* for the connection diagram using a PC to provide the auto setpoint reference to the iQpump drive. Further information regarding communication protocols are referenced in *Appendix A*.

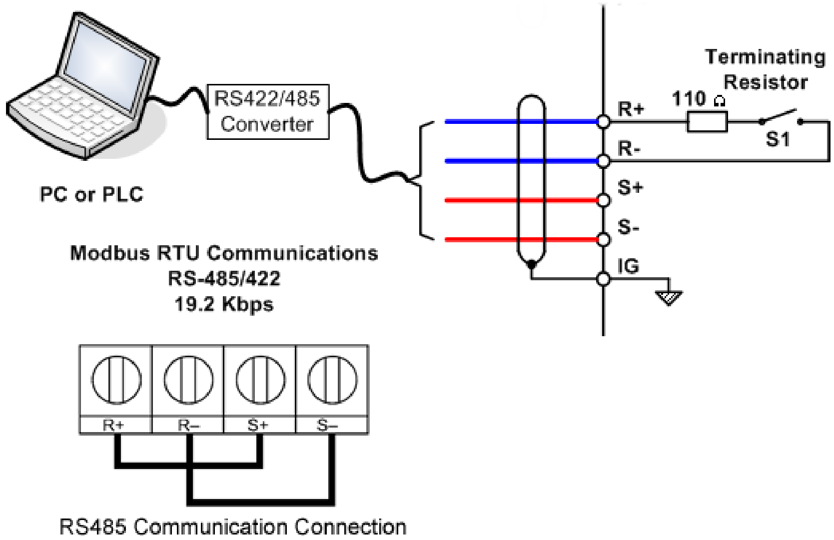


Figure 5. Connection Diagram of PC or PLC

To configure the iQpump drive to receive the "Auto Setpoint" for a network communication option card: Set b1-01= "3: Option PCB," and plug a network option board (p/n SI-J) into the 2CN port on the iQpump drive Control PCB. Consult the manual supplied with the option board for instructions on integrating the iQpump drive into the network system.

The iQpump drive can support the following network communication options. Refer to the appropriate Installation Guide (IG) and Technical Manual (TM) for further details. These network communications documents can be located at http://iQpump.yaskawa.com.

Profibus DP Option Card CM061	Manual: IG.AFD.12
DeviceNet Option Card CM05X	Manual: IG.AFD.14
Modbus Plus Option Card CM071	Manual: IG.AFD.17
Modbus TCP/IP Option Card CM090	Manual: IG.AFD.25
EtherNet/IP Option Card CM092	Manual: IG.AFD.26

Important: If b1-01 = "3: Option PCB" but a network card is not installed in 2CN, an OPE05 Operator Programming Error will be displayed on the digital operator and the iQpump drive will not run.

■ Start / Stop from Comm. Option Card (Parameter b1-01 = 3):

The iQpump Controller allows for the setpoint reference to be set via any of the following communication option cards:

Profibus DP Option Card CM061	Manual: IG.AFD.12
DeviceNet Option Card CM05X	Manual: IG.AFD.14
Modbus Plus Option Card CM071	Manual: IG.AFD.17
Modbus TCP / IP Option Card CM090	Manual: IG.AFD.25
EtherNet / IP Option Card CM092	Manual: IG.AFD.26

◆ b1-02 Run Command Selection

Setting	Description
0	Operator (*factory default*)
1	Terminals
2	Serial Com
3	Option PCB
5	Timed Run

b1-02 = 0, Operator (factory default).

The iQpump drive comes factory programmed for Start and Stop from the Keypad.

The iQpump drive can be programmed to receiver a Run command from four different inputs: digital operator, terminals, serial communications, or an option PCB.

If the Run command input is determined by the digital operator: Set b1-02 = "0: Operator," and the HAND and OFF keys will be used to provide the Run command to the iQpump drive.

b1-02 = 1, Terminals

If the Run command input is determined by the external terminals: Set b1-02 = "1: Terminals" and initiate an external Run command by a contact closure between terminals S1 and SN. Refer to *Figure 8.* for the connection diagram of the external Run command.

Note: To use the external terminals requires the iQpump drive to be set to "Auto" mode by pressing the Auto key.

Select between 2-wire and 3-wire control operation by doing the following:

2-Wire Control The factory default setting is for 2-wire operation. In the 2-wire configuration a closure between S1 and SN will be interpreted as a Forward Run command by the drive.

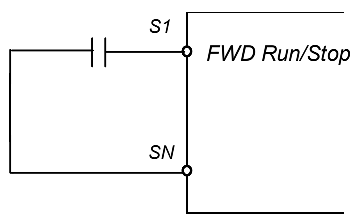


Figure 6. 2-Wire Control

3-Wire Control When any of the multi-function digital input parameters, H1-01 through H1-05, is set to 0, terminals S1 and S2 become Run and Stop, respectively. The multi-function digital input that was set to 0 will function as a Forward / Reverse input for the iQpump drive. When the Forward / Reverse input is open the iQpump drive will run in the Forward direction and when the input is closed, the iQpump drive will run in the Reverse direction.

In 3-wire operation a momentary closure (> 50mS) of S1 will cause the iQpump drive to run provided that S2 is held closed. The iQpump drive will stop anytime the S2-SN connection is broken. If the 3-wire configuration is implemented via a 3-wire Initialization (A1-03 = "3330: 3-Wire Initial"), then terminal S3 becomes the Forward / Reverse input.

Note: Reverse operation is disabled in the iQpump drive; however, in 3-wire control, one of the multi-function digital inputs needs to be programmed to 0. Otherwise, the 3-wire control will not work.

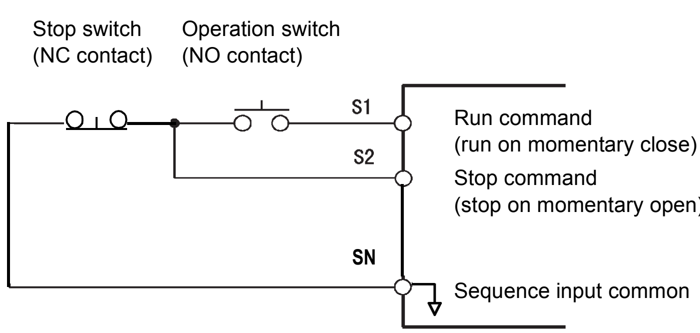


Figure 7. 3-Wire Control

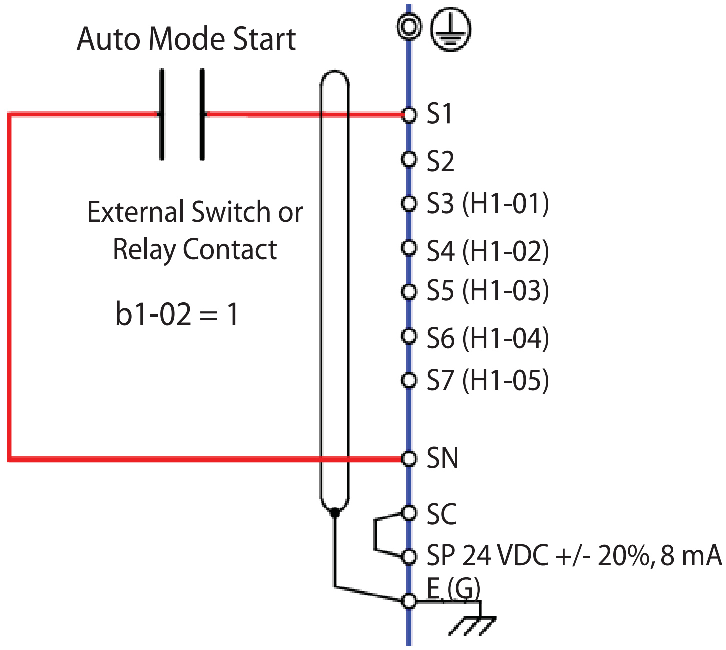


Figure 8. Connection Diagram of External Start / Stop Switch

b1-02 = 2, Serial Com

If the Run command is determined by Serial Communication:"b1-02 = 2: Serial Communications," and initiate the Run command through the serial communications. Refer to *Figure 8.* (in the previous b1 sequence section) for the connection diagram for serial communications through the RS232 / 485 terminals to R+, R-, S+ and S-. The following is a simple setup procedure for programming the iQpump drive and PC Serial communications to initiate Run and Stop commands through serial communications.

1. Program b1-02 = "2: Serial communications".
2. Program the following H5 parameters:
   H5-01 Serial Communication Address: 31
   H5-02 Serial Baud Rate: 9600 Baud (setting 3).
   H5-03: Serial Communication Parity Selection: None (setting 0)
3. Initiate a Start / Stop command
   iQpump command register number: 0001
   Stop Command: Transmit value of **0000** (16 bit) to iQpump command address.
   Start Command: Transmit value of **0001** (16 bit) to iQpump command address.
   Reset Command: Transmit value of **0008** (16 bit) to iQpump command address.

b1-02 = 3, Option PCB

If the Run command input is determined by a network communications option PCB: "b1-02 = 3: Option PCB," and initiate the Run command through the available network communications option PCB listed below. The Installation Guides (IG) and Technical Manuals (TM) are available at http://iQpump.yaskawa.com.

The iQpump Controller allows for monitoring, diagnostics and control using any of the following communication option cards:

Profibus DP Option Card CM061	Manual: IG.AFD.12
DeviceNet Option Card CM05X	Manual: IG.AFD.14
Modbus Plus Option Card CM071	Manual: IG.AFD.17
Modbus TCP / IP Option Card CM090	Manual: IG.AFD.25
EtherNet / IP Option Card CM092	Manual: IG.AFD.26

Note: Refer to the communication card instruction manual or consult factory for installation and operation instructions.

b1-02 = 5, Timed Run

If the Run command input is determined by a Timed Run: "b1-02 = 5: Timed Run," when this feature is enabled, the drive will run at the HAND frequency reference for the time specified in parameter P4-18. Timed Run cannot be enabled when in multiplex mode (P1-01 > 0).

Run / Stop Control:

- Only enabled when all three Run / Stop Control parameters are set to a value greater than zero (P4-18 > 0, P4-19 > 0, and P4-20 > 0).
- Available only when in HAND or LOCAL mode.
- PI control is disabled.
- Will always start off running when a run command is given.
- A stop command, power loss or fault will reset all timers and counters associated with the Run / Stop Control.
- A stop command will result in a stopping method set by parameter b1-03.
- When the “Run” portion of the timer expires, the drive stop using the stopping method set by parameter b1-03.
- When stopped due to the “Run” timer expired, the standard “sleep” message will be displayed on the operator.
- When stopped because the final cycle count has been exceeded, the digital operator will display “Run / Stop Finished”. The display will be cleared when a stop command is given or power is lost.
- If a fault (not auto-restart) occurs during Run / Stop Control, all timers and counters are reset.
- If an auto-restart is in process, under most circumstances the Run / Stop Control will continue to operate. However, if the stop timer expires prior to the auto-restart expiring, the drive will wait until the auto-restart time expires before resuming normal Run / Stop Control.

When this feature is enabled and the drive is given a run command, the drive will run for the time specified in parameter P4-18, then stop for the time specified in parameter P4-19. It will do this the number of times programmed in parameter P4-20. (Refer to parameters P4-18, P4-19 and P4-20.) The display will show one of two messages if the drive is stopped due to this feature. Run-Stop control cannot be enabled when a multiplex mode (P1-01 > 0).

Timed Run:

If parameter b1-02 is set to 5 “Timed Run”, the timed run feature will be enabled. When “Timed Run” is enabled, Terminal S1 will be a normally open “start” input and Terminal S2 will be a normally closed “stop” input. The drive can be started by either causing a rising edge (open to close) on the S1 digital input when S2 is closed, or both S1 and S2 are closed when power is applied to the drive. The drive will then start running at the HAND frequency reference P5-02 and run for the time specified in parameter P4-18. If the drive needs to be stopped before the P4-18 timer expires, the circuit connected to Terminal S2 can be opened, or the Stop or Off keys on the digital operator can stop the drive. The drive can be re-started by simply causing another rising edge on Terminal S1. There will be no modified display or messages when the drive is stopped due to the Timed Run feature. If the drive is switched into HAND or LOCAL mode, the timed run feature will be disabled.

1. Wire-Break detection for Terminal A2 will be completely disabled during Timed Run control.
2. The pre-charge feature is disabled during Timed Run control.
3. Uses the “Hand” reference as the frequency reference. If P5-01 is set to 1, parameter P5-02 will be used as the reference. If P5-02 is set to 0, Terminal A1 will be used as the reference.
4. The “Not Maintaining Setpoint”, and “Low Feedback” faults are disabled during Timed Run control.
5. The “Loss of Prime” fault (if enabled) will become active when the output frequency comes to within 1 Hz of the frequency reference.
6. The Timed Run Control will take priority over the “Auto Mode Fixed Speed” mode (digital input).

When this feature is enabled, the drive will run at the “Hand” frequency reference for the time specified in parameter P4-18. Timed Run cannot be enabled when in Multiplex Mode (P1-01 > 0). (Refer to parameter P4-18.)

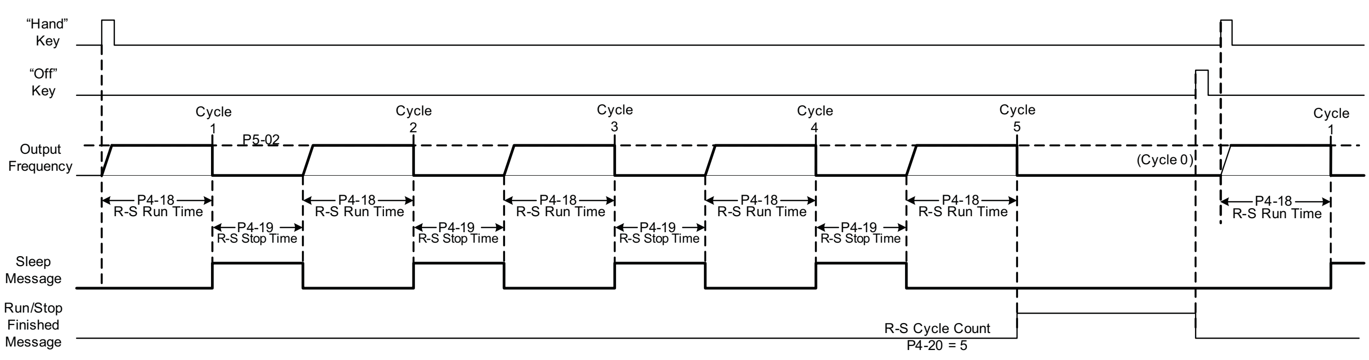


Figure 9. Run / Stop Control - HOA Operator JVOP162 - Coast to Stop

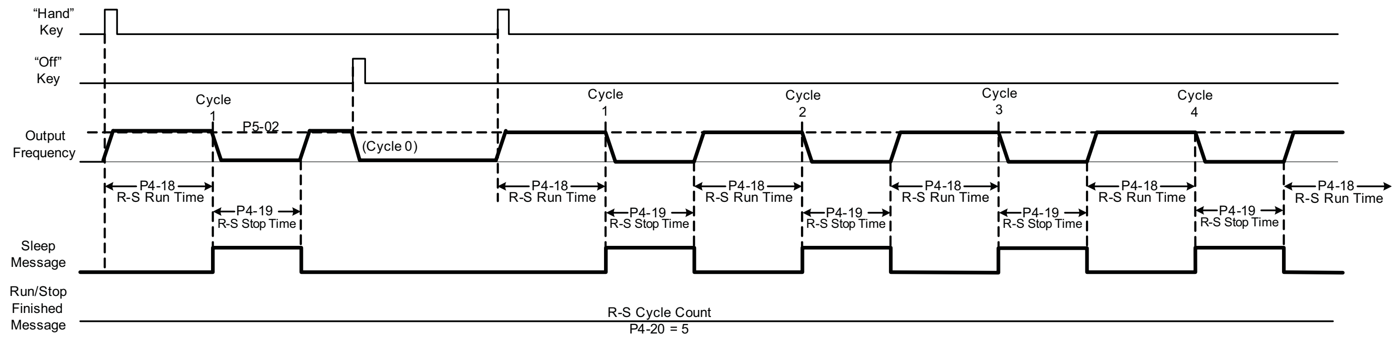


Figure 10. Run / Stop - HOA Operator JVOP162 - Ramp to Stop

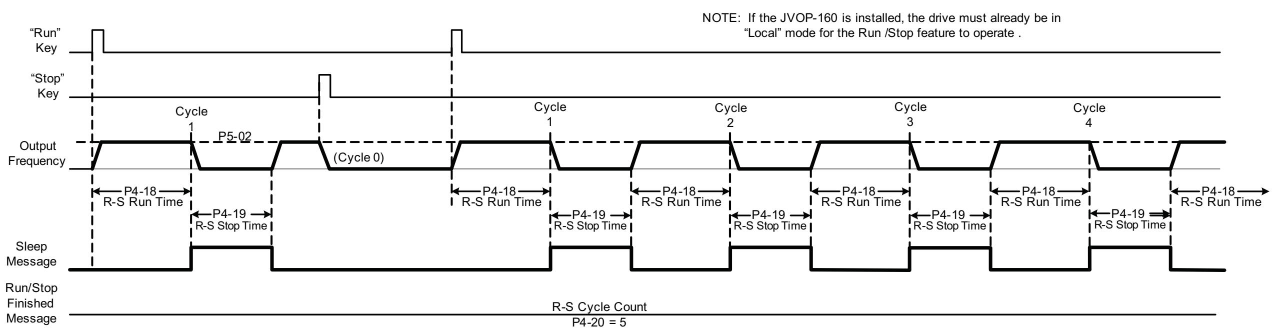


Figure 11. Run / Stop - HOA Operator JVOP160 - Ramp to Stop

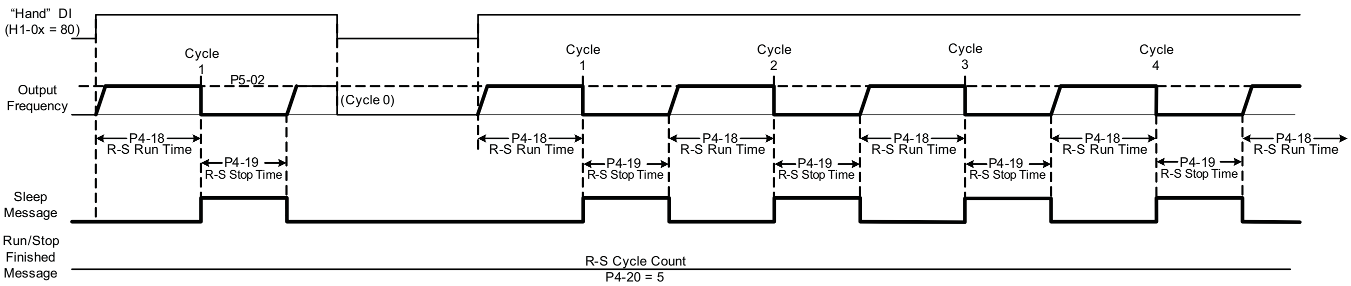


Figure 12. Run / Stop - HOA Operator JVOP160 - Coast to Stop

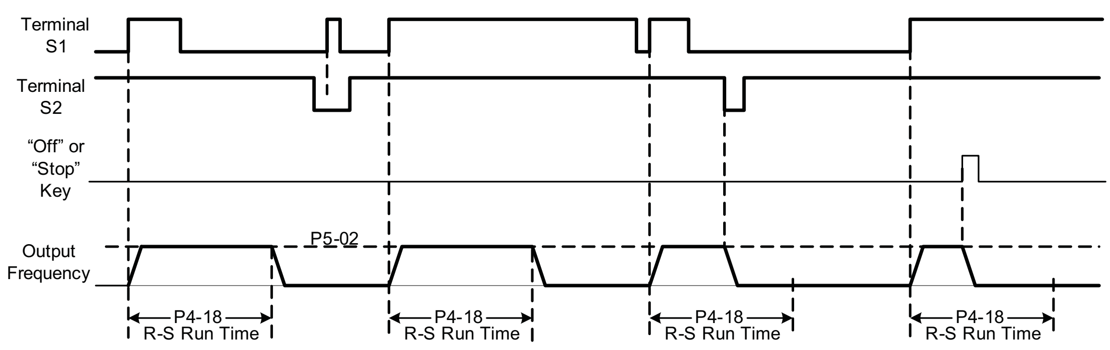


Figure 13. Timed Run Operation (b1-02 = 5)

Table 1 Related Parameters <0034>

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
P4-18 ♦	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 ♦	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 ♦	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.						

Table 2 Digital Operator Display

Description	Operator Display
When the Run / Stop function is enabled, the display will change as shown. The Run / Stop function is enabled by setting parameters P4-18, P4-19 and P4-20 to values greater than zero.	

Table 3 Fault <0034>

Fault Display	Description	Cause	Countermeasures
oPE15 Run / Stp-	Run / Stop or Timed Run enabled in multiplex mode.	Run / Stop Control has been enabled when in multiplex mode. (P1-01 > 0, P4-18 > 0, P4-19 > 0 and P4-20 > 0). OR Timed Run Control has been enabled when in multiplex mode. (P1-01 > 0 and b1-02 = 5).	Reprogram P1-01, P4-18 ~ P4-20, or b1-02.

Table 4 Message <0034>

Fault Display	Description	Cause	Countermeasures
Run / Stop Finished	Run / Stop Cycles have completed.	The number of Run / Stop Cycles since the last HAND command has completed.	Press “Off” to clear the message.

Table 5 Multi-Function Output Setting <0034>

Setting	Description
51	**Run / Stop - Stop** Closed: Drive is stopped due to the Run / Stop control (P4-18 and P4-19) OR Closed: Drive is stopped because the Run / Stop cycles have completed (P4-20).
52	**Run / Stop - Finish** Closed: Drive is stopped because the Run / Stop cycles have completed (P4-20).

◆ b1-03 Stopping Method

There are four methods of stopping the iQpump drive when the Run command is removed.

Setting	Description
0	Ramp to Stop (***factory default***)
1	Coast to Stop
2	DC Injection to Stop
3	Coast w / Timer

0: Ramp to stop: When the Run command is removed, the iQpump drive will decelerate the motor to 0 rpm. The rate of deceleration is determined by the active deceleration time. The factory default Decel Time is in parameter C1-02.

When the output frequency has dropped below the DC Injection Start Frequency in b2-01 (Default = 0.5 Hz) DC current will be injected in the motor at a level determined by b2-02 (50% Default). The DC Injection condition will occur for the time specified by b2-04 (0.0 Default), to establish the end point of the ramp. DC injection can be used to insure the motor is at zero rpm prior to the iQpump drive shutting off.

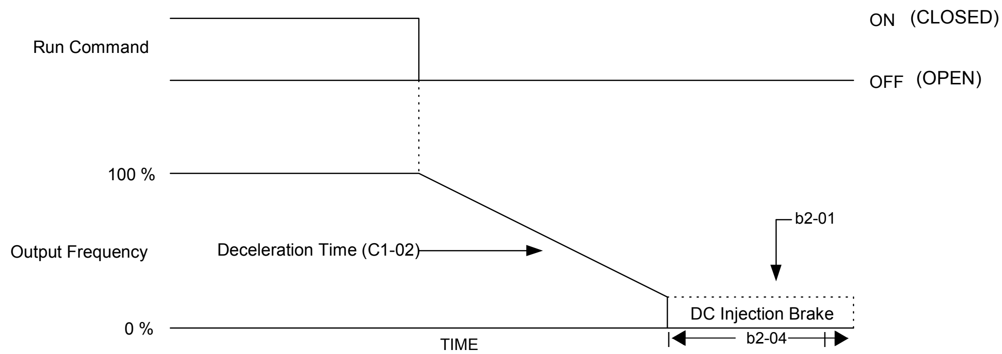


Figure 14. Deceleration to Stop

The actual deceleration time can be determined by the following formula.

$$\text{Time to Stop} = \frac{\text{Output Freq. at time of stop command}}{\text{Maximum Frequency (E1-04)}} \times \text{Setting of active Decel Time (C1-02 or C1-04)}$$

If S-Curve characteristics are specified by the iQpump drive programming, they will add to the total time to stop.

1: Coast to stop: When the Run command is removed, the iQpump drive will turn off its output and the motor will coast (uncontrolled deceleration). The friction of the driven equipment will eventually overcome any residual inertia of the system and the rotation will stop.

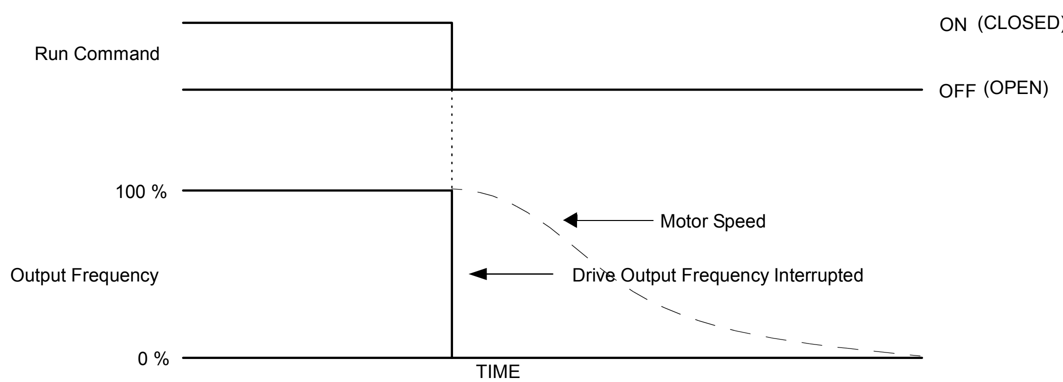


Figure 15. Coast to Stop

Important: After a stop is initiated, a subsequent Run commands input before the Minimum Baseblock Time (L2-03) has expired, will be ignored.

2: DCInj to Stop: When the Run command is removed, the iQpump drive will Baseblock (turn off its output) for the Minimum Baseblock Time (L2-03). Once the Minimum Baseblock Time has expired, the iQpump drive will inject DC current into the motor windings to lock the motor shaft. The stopping time will be reduced as compared to Coast to Stop. The level of DC Injection current is set by parameter b2-02 (50% Default). The DC Injection brake time is determined by the set value in b2-04 and the output frequency at the time the Run command is removed.

$$\text{DC Injection Brake Time} = \frac{(\text{b2 - 04}) \times 10 \times \text{Output Frequency}}{\text{Maximum Frequency (E1 - 04)}}$$

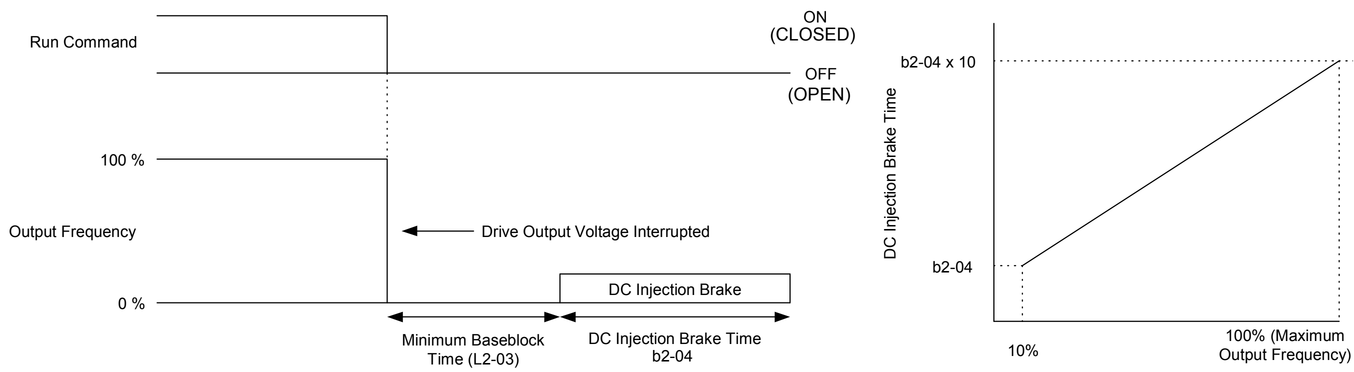


Figure 16. DC Injection Braking to Stop

Important: If an overcurrent (OC) fault occurs during DCInj to Stop, lengthen the Minimum Baseblock Time (L2-03) until the fault no longer occurs.

3: Coast w / Timer: When the Run command is removed, the iQpump drive will turn off its output and the motor will coast to a stop. If a Run command is input before time T (operation wait time) expires, the iQpump drive will not run and the Run command will need to be cycled before operation can occur. The time T (operation wait time) is determined by the output frequency when the Run command is removed and the active deceleration time (C1-02).

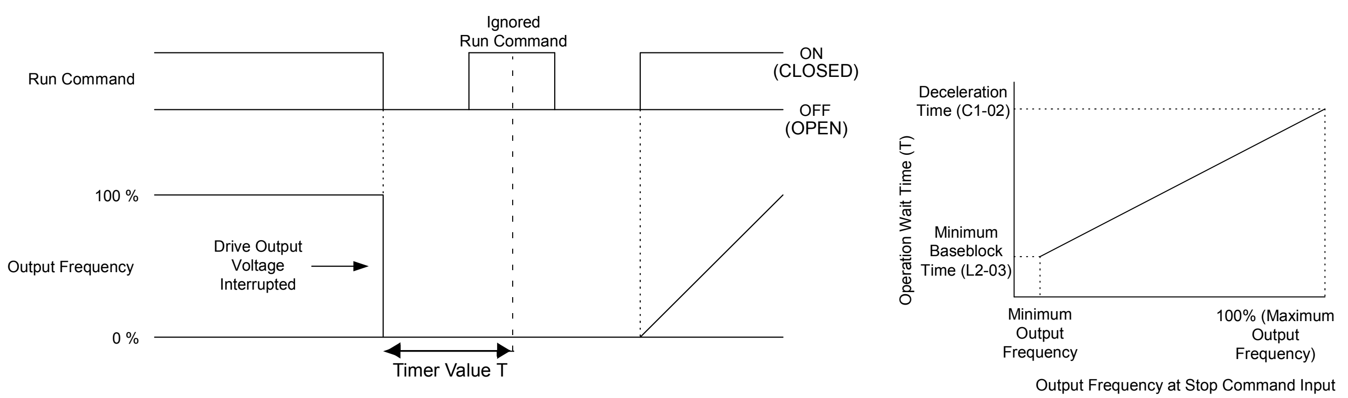


Figure 17. Coast to Stop with Timer

◆ b1-07 Local / Remote Run Selection

Setting	Description
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. (***factory default***)
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.

◆ b1-08 Run Command Selection During Programming

Setting	Description
0	Disabled (***factory default***)
1	Enabled

As a safety precaution, the iQpump drive will not normally respond to a Run input when the digital operator is being used to adjust parameters. If it is necessary that external Run commands be recognized even while the drive is being programmed, set b1-08 = “1: Enabled.”

◆ b1-11 Drive Delay Time Setting

Setting Range: 0 ~ 600 s

Factory Default: 0 s

If a time is set into parameter b1-11, the iQpump drive will delay executing any run command until the b1-11 time has expired. During iQpump drive delay time execution, the digital operator will display:

```
DDLY
Waiting to RUN
```

Both the ALARM and Run indicators will blink while the iQpump drive waits to execute the Run command.

b2 DC Braking

The DC Braking Group contains parameters associated with the DC injection braking feature. Parameters involving the starting frequency, current level, braking time, and motor pre heat current level are located here.

◆ b2-01 DC Injection Braking Start Frequency

Setting Range: 0.0 ~ 10.0 Hz

Factory Default: 0.5 Hz

Parameter b2-01 sets the output frequency where the iQpump drive begins DC Injection **during Ramp to stop** in order to lock the rotor of the motor and established the end point of the ramp. If b2-01 < E1-09 (Minimum Frequency), then DC Injection begins at E1-09.

Parameter b2-01 also determines the output frequency that the iQpump drive must be at or below before a Zero Speed condition is considered true. This affects any digital output configured as a Zero Speed signal (H2-0x = “1: Zero Speed”).

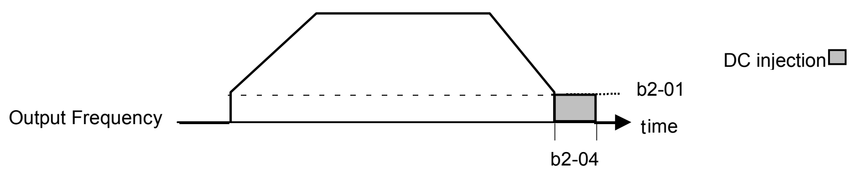


Figure 18. DC Injection Braking During Stopping

◆ b2-02 DC Injection Braking Current

Setting Range: 0 ~ 100%

Factory Default: 50%

The level of DC Injection Braking Current affects the strength of the magnetic field attempting to lock the motor shaft. Increasing the level of current will increase the amount of heat generated by the motor windings and should only be increased to the level necessary to hold the motor shaft. DC Injection current is set in percentage of the iQpump drive rated output current. iQpump drive rated output current is stated on the iQpump drive nameplate.

◆ b2-03 and b2-04 DC Injection Braking Time

Parameter No.	Parameter Name
b2-03	DC Injection Braking Time at Start
b2-04	DC Injection Braking Time at Stop

Setting Range: 0.00 ~ 10.00 s

Factory Defaults: b2-03 = 0.00 s and b2-04 = 0.50 s

The iQpump drive can be programmed to automatically DC Inject for a predetermined amount of time prior to accelerating to speed (b2-03) and / or at the end of a Ramp to stop (b2-04). Parameter b2-03 can be used to stop a rotating motor prior to attempting acceleration (i.e. a wind milling fan). If DC Injection braking at start or Speed Search is not enabled, attempting to drive a spinning motor may cause nuisance tripping.

Parameter b2-04 can be used to resist any residual motion of the load after the deceleration has finished.

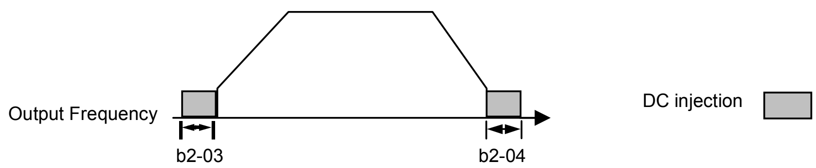


Figure 19. DC Injection Braking During Starting and Stopping

Parameter b2-04 also serves the function of affecting the length of time DC Injection to stop (b1-03 = "2: DC Injection to Stop") will occur.

◆ b2-09 Motor Pre-Heat Current

Setting Range: 0 ~ 100%

Factory Default: 0%

A DC current can be circulated within the motor windings while the motor is stopped. The current will produce heat within the motor and prevent condensation. Parameter b2-09 determines the percentage of the iQpump drive rated output current that will be used for the motor pre-heat function. This function can be useful in applications where the motor sits for extended periods of time in humid conditions. Motor pre-heating can only be initiated by closing a digital input programmed as a Motor Pre-heat Input (H1-0x = 60). Check with the motor manufacturer to determine the maximum acceptable current level the motor can withstand when stopped. Be sure not to exceed the motor manufacturers recommended level.

b3 Speed Search

The Speed Search function allows the iQpump drive to determine the speed of a motor shaft that is being driven by rotational inertia. Speed Search will allow the iQpump drive to determine the speed of the already rotating motor and begin to ramp the motor to a set speed without first having to bring it to a complete stop. When a momentary loss of supply power is experienced, the iQpump drive output is turned off. This results in a coasting motor. When power returns, the iQpump drive can determine the speed of the coasting motor and start without requiring it to be brought to minimum speed. Speed Search can be programmed to always be active by setting b3-01 or it can be commanded by remote contact closure by setting a digital input.

There are two forms of Speed Search in the drive, the speed estimation method and the current detection method.

Important: When setting the iQpump drive for remote Speed Search input, via a contact closure, the method of Speed Search is determined by the setting of b3-01. If b3-01 = "0: SpdsrchF Disable" then the remote input will initiate speed estimation method, and if b3-01 = "2: SpdsrchI Disable," then the remote input will start the current detection method.

Parameters L2-03 and L2-04 also affect the current detection method of Speed Search operation.

◆ b3-01 Speed Search Selection

This parameter is effective only when the iQpump drive is given a new Run command.

Setting	Description
0	SpdsrchF Disable
1	SpdsrchF Enable
2	SpdsrchI Disable (***factory default***)
3	SpdsrchI Enable

Speed Estimation: Method (b3-01 = 0 or 1) The speed estimation method will calculate the speed using measurements of residual motor fields. The speed estimation version is bi-directional and will determine both the motor speed and direction. To enable speed estimation Speed Search at start, set b3-01 = "1: SpdsrchF Enable".

Important: If the speed estimation method of Speed Search is to be used, then Auto-tuning must be performed prior to using Speed Search. If the length of cable between the iQpump drive and motor is ever changed after Auto-tuning then Auto-tuning should be performed again

Important: The speed estimation mode cannot be used when there are multiple motors operated by one iQpump drive or the motor is two or more frames smaller than the standard size motor per the iQpump drive capacity.

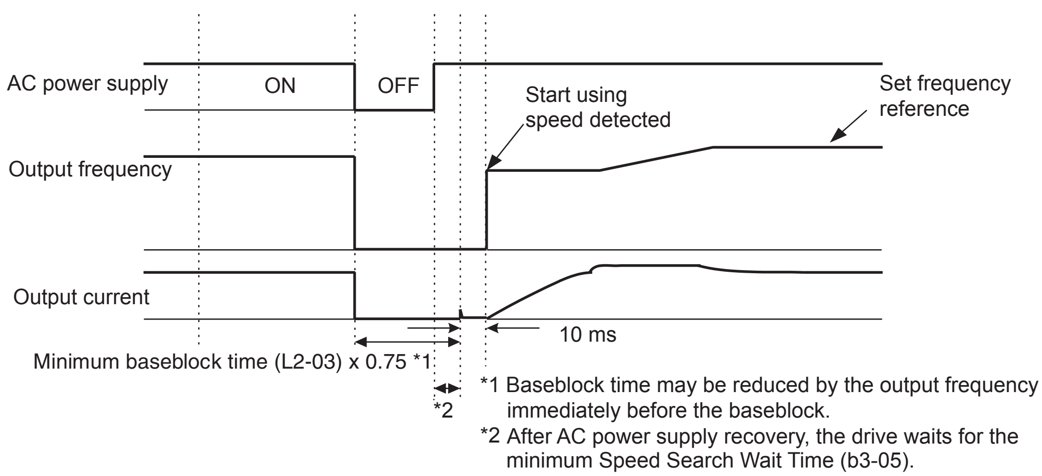
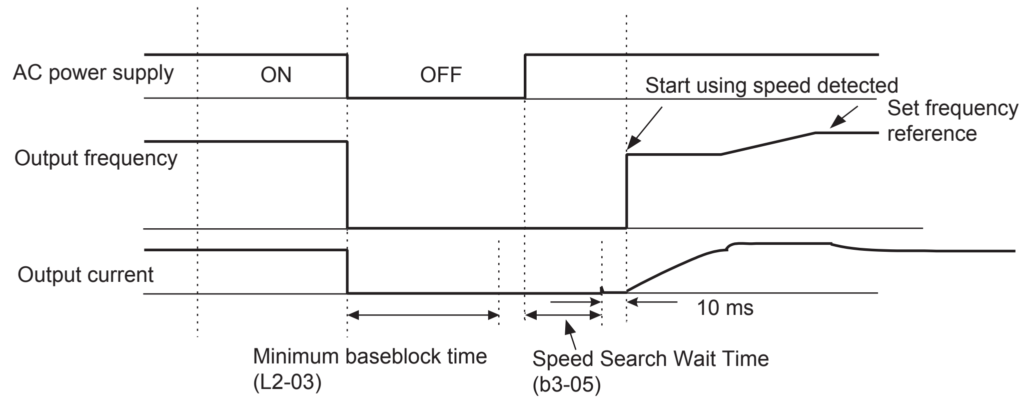


Figure 20. Speed Search (Estimated Speed Method) after momentary power loss where the power loss time is less than the minimum baseblock time



Note: If the frequency immediately before the baseblock is low or the power supply off time is long, operation may be the same as the search in case 1.

Figure 21. Speed Search (Estimated Speed Method) after momentary power loss where the power loss time exceeds the minimum baseblock time

Current Detection Method (b3-01 = 2 or 3): The current detection method starts searching from a predetermined frequency while monitoring the iQpump drive output current to determine when the rotor speed and the iQpump drive output speed (frequency) match. The current detection version is not bi-directional. To enable current detection Speed Search at start set b3-01 = "3: SpdscrhI enable" and program any digital input equal to Speed Search 1 (H1-0x = 61) or Speed Search 2 (H1-0x = 62). Speed Search 1 will start searching from the max. frequency (E1-04) and ramp down to meet the rotor speed. Speed Search 2 will start searching from the set frequency and ramp down to meet the rotor speed.

Important: If a UV1 fault occurs when current detection Speed Search is attempted, increase the setting of L2-04.

Important: If an OC fault occurs when Speed Search is attempted after power loss recovery, increase the setting of L2-03.

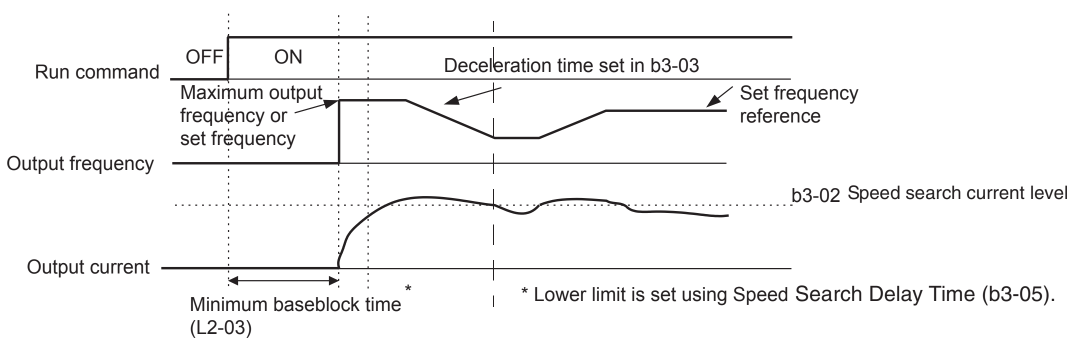


Figure 22. Speed Search (Current Detection Method) at Startup

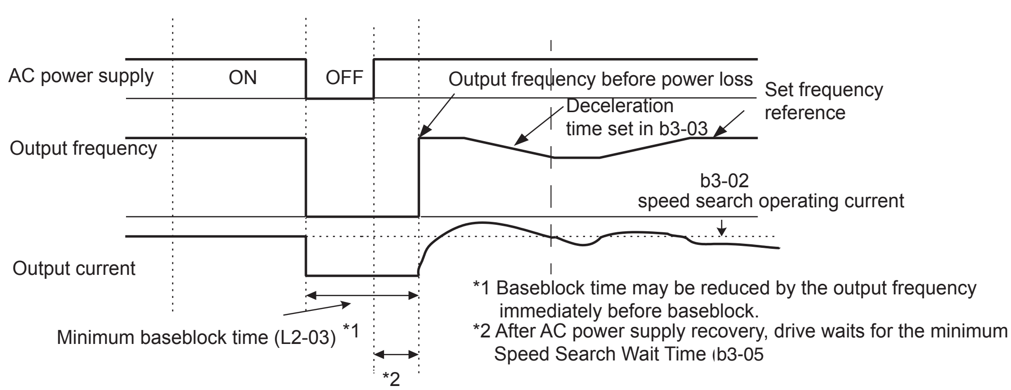


Figure 23. Speed Search (Current Detection Method) after momentary power loss where the power loss time is less than the minimum baseblock time

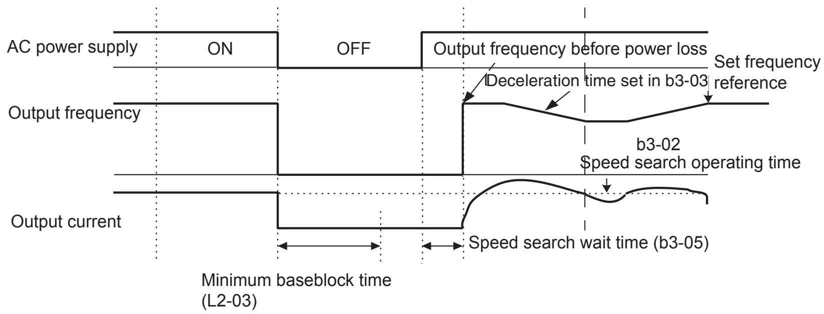


Figure 24. Speed Search (Current Detection Method) after momentary power loss where the power loss time exceeds the minimum baseblock time

Setting of b3-01	Automatic Speed Search for all RUN commands	Automatic Speed Search after momentary power loss and baseblock	Speed Search Used for Run with programmed multi-function input
0	No	Yes - Speed Estimation	Yes - Speed Estimation
1	Yes - Speed Estimation	Yes - Speed Estimation	Yes - Speed Estimation
2	No	Yes - Current Detection	Yes - Current Detection
3	Yes - Current Detection	Yes - Current Detection	Yes - Current Detection

◆ b3-02 Speed Search Deactivation Current

Setting Range: 0 ~ 200% of the iQpump drive rated output current

Factory Default: 120% of the iQpump drive rated output current

When using the current detection method of Speed Search, parameter b3-02 sets the current level that will determine when the search is complete and the rotor and output speeds match. When the output frequency is higher than the actual rotor speed, the slip causes the current to be high. As the output frequency is lowered, the closer it comes to the rotor speed, the lower the current draw will be. When the output current drops below the level as set in b3-02 (100% = iQpump drive Rated Current) the output frequency stops decreasing and normal operation resumes.

◆ b3-03 Speed Search Deceleration Time

Setting Range: 0.1 ~ 10.0 s

Factory Default: 2.0 s

Parameter b3-03 sets the deceleration ramp used by the current detection method of Speed Search when searching for the motor's rotor speed. Even if Speed Search 2 is selected, for Speed Search at start, the time entered into b3-03 will be the time to decelerate from maximum frequency (E1-04) to minimum frequency (E1-09).

◆ b3-05 Speed Search Delay Time

Setting Range: 0.0 ~ 20.0 s

Factory Default: 0.2 s

In cases where an output contactor is used between the iQpump drive and the motor, extra waiting time is provided after power returns and before Speed Search is performed. This extra time allows for the contactor to operate. When Speed Search at start is used, b3-05 will serve as the lower limit of the Minimum Baseblock Time (L2-03).

◆ b3-14 Bi-Directional Speed Search Selection

Setting	Description
0	Disabled
1	Enabled (***factory default***)

The b3-14 parameter can be used to turn off the bi-directional capabilities of the Speed Estimation form of Speed Search. By turning off the bi-directional capability, the speed search will only try to match the speed in the last known direction.

b4 Delay Timers

The iQpump drive has an internal timer function that operates independently from the drive. A digital input must be programmed to be a timer start input by setting H1-0x = 18. A digital output must be programmed as a timer output by setting H2-0x = 12. (Not to be confused with the “Wait to Run Time” in b1-11.)

◆ b4-01 Timer Function ON-Delay Time

Setting Range: 0.0 ~ 3000.0 s

Factory Default: 0.0 s

The timer start input (H1-0x = 18) must be held on for at least the time specified in parameter b4-01 before the digital output programmed as the timer output will close. See *Figure 25.* for timing details.

◆ b4-02 Timer Function OFF-Delay Time

Setting Range: 0.0 ~ 3000.0 s

Factory Default: 0.0 s

The timer start input (H1-0x = 18) must be held off for at least the time specified by b4-02 before the digital output programmed as the timer output will open. See *Figure 25.* for timing details.

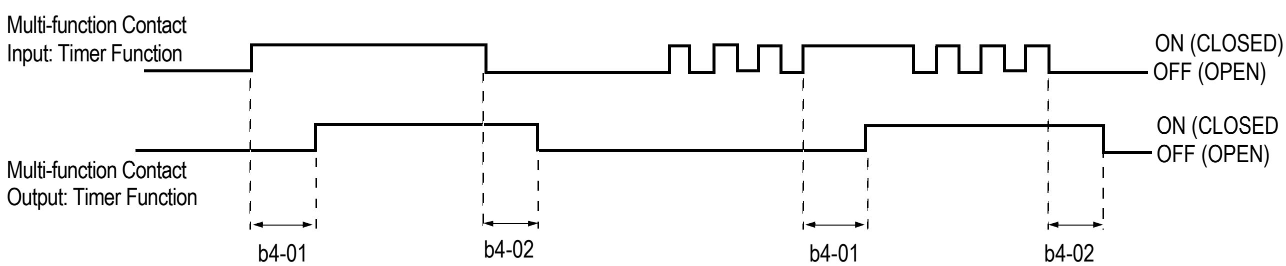


Figure 25. Timing Diagram of Timer Function

b5 PI Function

The capability to accept an analog signal as feedback for a PI (Proportional + Integral) control function is built into the drive.

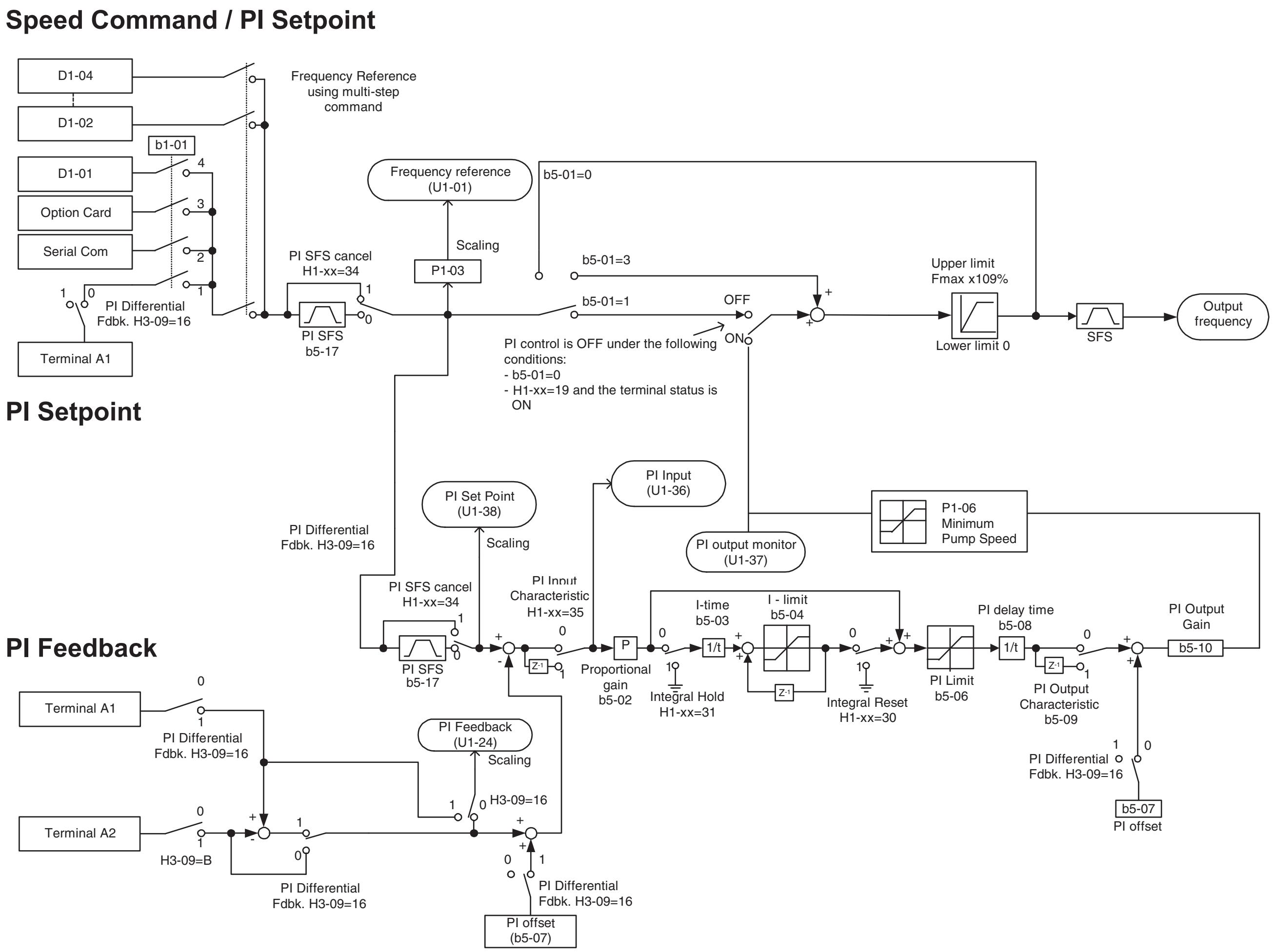


Figure 26. PI Block Diagram

The analog feedback to the iQpump drive for the PI control is via the A2 terminal. The iQpump drive must be programmed (H3-09 = “B: PI Feedback”) to use terminal A2 as feedback for the PI functionality of the drive.

The PI Setpoint can be configured to come from one of many different inputs or parameters. *Table 6 on page 32* describes the options for originating the PI Setpoint.

Table 6 PI Setpoint Options

The PI Setpoint will be read from:	If these conditions are true		
	Status of b5-18 =	**Status of MEMOBUS / Modbus Register 0Fh bit 1**	**Status of b1-01 =**
Parameter b5-19	1	N/A	N/A
MEMOBUS/Modbus Register 06H	0	ON	N/A
D1-01	0	OFF	0
Terminal A1	0	OFF	1
Serial Comm.	0	OFF	2
Option PCB	0	OFF	3

In some situations there are two feedback inputs. The drive can be programmed to maintain a set differential between two analog signals. If input A2 is configured as a “PI Differential Mode” (H3-09 = “16: PI Differential”), then the iQpump drive will maintain a set difference between the measurements read on inputs A1 and A2. This differential setpoint is programmed by parameter (b5-07).

◆ b5-01 PI Mode

Setting	Description
0	Disabled
1	Enabled (***factory default***)
2	Enabled - 2 Zone (dual zone PI enabled) <0034>

The iQpump drive can be used as a stand-alone PI controller. If PI functionality is selected by parameter b5-01, the iQpump drive will adjust its output to cause the feedback from a transmitter to match the PI Setpoint (b5-19). The setting of b5-01 will determine whether PI functionality is disabled (b5-01 = “0: Disabled”), enabled (b5-01 = “1: Enabled”), enabled - 2 zone (dual zone PI enabled) (b5-01 = 2).

b5-01 = 0, Disabled

PI functionality is disabled.

b5-01 = 1, Enabled (factory default)

PI functionality is enabled.

b5-01 = 2, Enabled - 2 Zone (dual zone PI enabled) <0034>

Enabled - 2 zone.

Provides automatic setpoint and feedback switching for dual zone pumping applications (geothermal).

- Terminal A1 is used as a feedback signal for “Zone 1”.
- Standard PI Feedback (H3-09 = B) as feedback for “Zone 2”.
- Based upon the two feedback levels, the drive determines which setpoint and feedback signal to use.

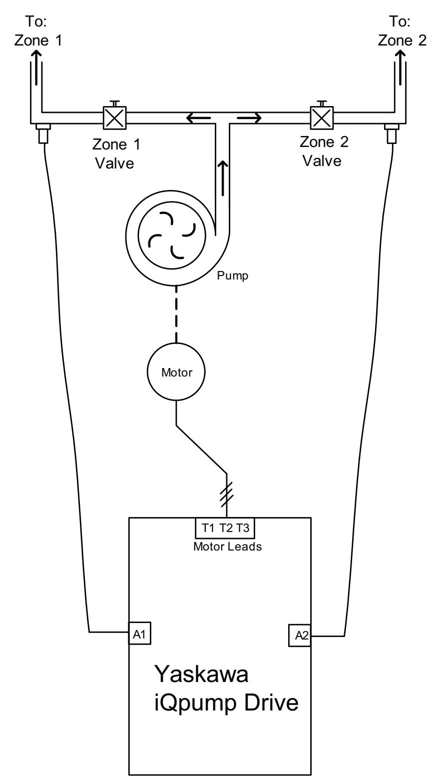


Figure 27. Dual Zone PI

Changes from standard product:

- When the Dual Zone PI is enabled (b5-01 = 2) Terminal A1 becomes the feedback signal for Zone 1.
- Multi-Step Frequency Reference Select digital inputs are ignored (H1-0x = 3 or 4) when the Dual Zone PI is enabled (b5-01 = 2).
- Transducer Loss Detection is enabled on Terminal A1 when b5-01 = 2.

Dual Zone PI Operation:

In order to enable the Dual Zone PI Operation:
b5-01 = 2 The PI Mode Setting Parameter must be set to “Enabled - 2 Zone”.
P1-01 = 0 **Simplex mode only**.
b5-09 = 0 Output Level Select set to “Normal Output” (Not Inverse PI Control).

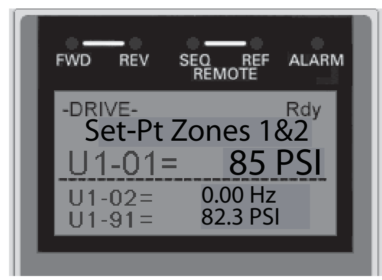
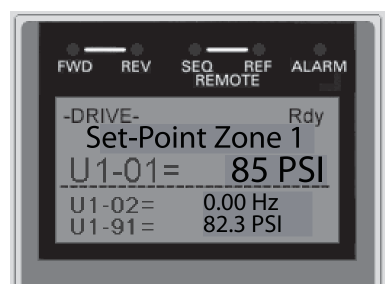
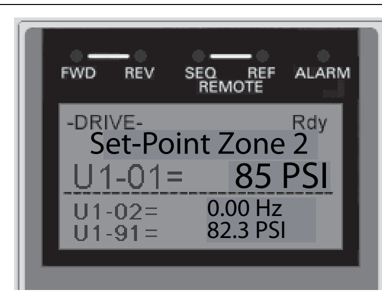
When Dual Zone PI Operation is enabled:

- When the drive is in auto mode, the digital operator display will change as noted in *Table 6 on page 32*.
- Terminal A1 becomes a PI feedback, assigned to Zone 1.
- Standard PI feedback is assigned to Zone 2 (requires H3-09 = B).
- If feedback on Terminal A1 within the P4-17 value of the feedback on Terminal A2, the drive will use the d1-04 parameter as the setpoint. It will use either Terminal A1 or Terminal A2 as feedback depending on which one is higher. The feedback signal(s) need to be different for more than 5 seconds before any switching between the two will occur.
- If the feedback on Terminal A1 is more than the feedback on Terminal A2 plus the P4-17 value for more than 5 seconds, the drive will then operate off of the Zone 1 setpoint (d1-02) and the Zone 1 feedback (Terminal A1).
- If the feedback on Terminal A2 is more than the feedback on Terminal A1 plus the P4-17 value for more than 5 seconds, the drive will then operate off of the Zone 2 setpoint (d1-03) and the Zone 2 feedback (Terminal A2).

From the main “Auto Mode” display see *Table 6 on page 32*, if the <Data / Enter> key is pressed, the currently active setpoint will be editable.

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

Table 7 Dual Zone PI

Pressure Condition	Feedback Signal	Setpoint Parameter Used	“Auto Mode” Digital Operator Display
Zone 1 = Zone 2 (+/- P4-17)	Whichever is higher (Terminal A1 or A2)	d1-04	
Zone 1 > Zone 2 + P4-17	Whichever is higher (Terminal A1 or A2)	d1-02	
Zone 1 < Zone 2 - P4-17	Whichever is higher (Terminal A1 or A2)	d1-03	

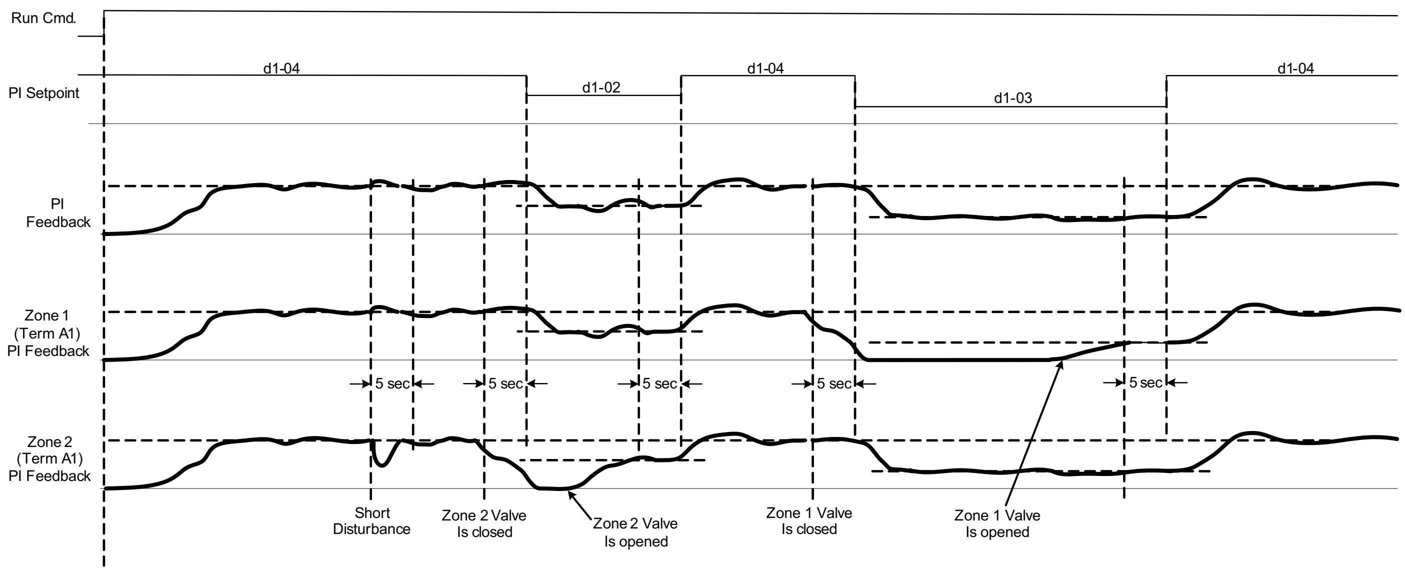


Figure 28. Dual Zone PI Operation

Table 8 Related Parameters <0034>

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
d1-02 ♦	281	Setpoint 2 **Setpoint 2**	Digital preset setpoint 2. Used when b1-01 = 0. Setting units are affected by P1-02 and P1-03. Also is the Zone 1 PI reference when b5-01 = 2.	0.00 ~ P1-02 value	0.00	Programming
d1-03 ♦	282	Setpoint 3 **Setpoint 3**	Digital preset setpoint 3. Used when b1-01 = 0. Setting units are affected by P1-02 and P1-03. Also is the Zone 2 PI reference when b5-01 = 2.	0.00 ~ P1-02 value	0.00	Programming
d1-04 ♦	283	Setpoint 4 **Setpoint 4**	Digital preset setpoint 4. Used when b1-01 = 0. Setting units are affected by P1-02 and P1-03. Also is the Zones 1 and 2 PI reference when b5-01 = 2.	0.00 ~ P1-02 value	0.00	Programming
♦ Denotes that parameter can be changed when the drive is running.						

Table 9 Parameters <0034>

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
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

Table 10 Fault <0034>

Fault Display	Description	Cause	Countermeasures
oPE13 Terminal A1	Programming error	Terminal A1 is being 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) - Level Control Enabled (P8-01 = 1)	Reprogram b1-01, b5-01, P6-01, or P8-01.

◆ b5-02 Proportional Gain Setting

Setting Range: 0.00 ~ 25.00

Factory Default: 2.00

The proportional gain will apply a straight multiplier to the calculated difference (error) between the PI Setpoint and the measured transmitter feedback at terminal A2. A large value will tend to reduce the error but may cause instability (oscillations) if too high. A small value may allow to much offset between the setpoint and feedback (See *Figure 29.* on following page).

◆ b5-03 Integral Time Setting

Setting Range: 0.0 ~ 360.0 s

Factory Default: 3.0 s

The Integral factor of PI functionality is a time-based gain that can be used to eliminate the error (difference between the setpoint and feedback at steady state). The smaller the Integral Time set into b5-03, the more aggressive the Integral factor will be. To turn off the Integral Time, set b5-03 = 0.00.

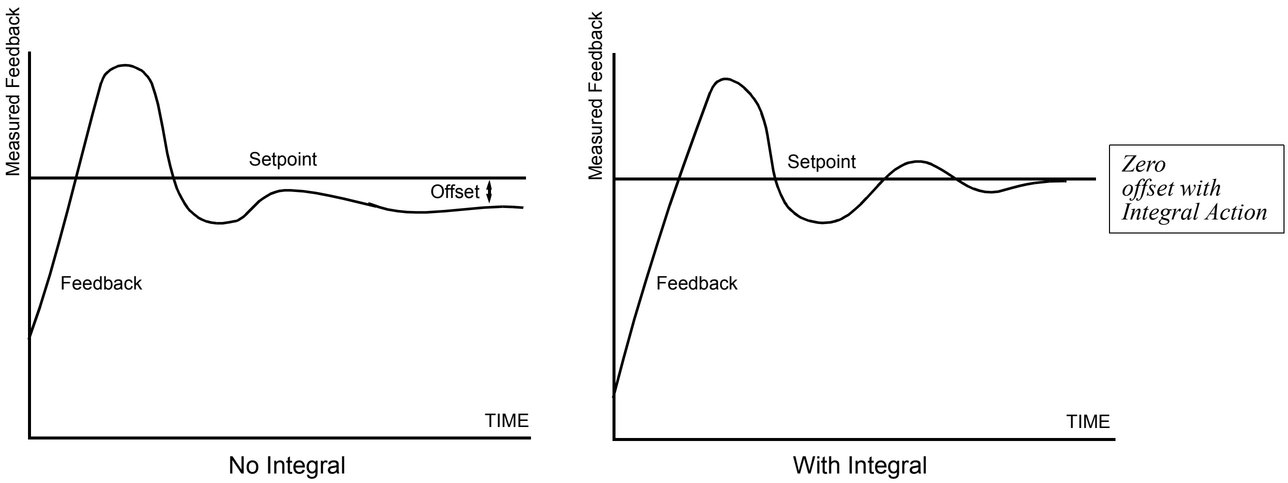


Figure 29. PI Feedback Response Characteristics

◆ b5-04 Integral Limit Setting

Setting Range: 0.0 ~ 100.0%

Factory Default: 100.0%

On some applications, especially those with rapidly varying loads, the output of the PI function may have large oscillations. To suppress these oscillations, a limit can be applied to the integral factor by programming b5-04.

◆ b5-06 PI Output Limit

Setting Range: 0.0 ~ 100.0%

Factory Default: 100.0%

Places a cap on the output of the PI function. Limiting the PI function may help to prevent large overshoots in the drive’s response to error (the difference between the setpoint and the feedback).

◆ b5-07 PI Offset Adjustment

Setting Range: -100.0% ~ +100.0%

Factory Default: 0.0%

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.

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 (b5-07) is summed with the PI output. This can be used to artificially kick-start a slow starting PI loop.

If the iQpump drive is configured for Differential PI Regulation (H3-09 = “16: PI differential”), then this parameter is the target setpoint for the differential to be maintained between the signal measured on analog input A1 and the signal measured on analog input A2.

◆ b5-08 PI Primary Delay Time Constant

Setting Range: 0.00 ~ 10.00 s

Factory Default: 0.00 s

Acts as a time based filter that lowers the responsiveness of the PI function, but also makes the function more stable when the setpoint varies rapidly or when the feedback is noisy.

◆ b5-09 PI Output Level Selection

Setting	Description
0	Normal Output (direct acting) (***factory default***)
1	Reverse Output (reverse acting)

Normally, the output of the PI function causes an increase in motor speed whenever the measured feedback is below the setpoint. This is referred to as direct acting response. However, if b5-09 = "1: Reverse Output," the output of the PI function causes the motor to slow down when the feedback is below the setpoint. This is referred to as reverse acting response.

◆ b5-10 PI Output Gain Setting

Setting Range: 0.0 ~ 25.0

Factory Default: 1.0

Applies a multiplier to the output of the PI function. Using the gain can be helpful when the PI function is used to trim the Speed Command. Increasing b5-10 causes the PI function to have a greater regulating affect on the speed command.

◆ b5-12 PI Feedback Reference Missing Detection Selection

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

Loss of feedback can cause problems to a PI application. The iQpump drive can be programmed to turn on a digital output whenever a loss of feedback occurs. Feedback Loss Detection (FBL) is turned on by b5-12. When b5-12 = "1: Alarm," the iQpump drive acknowledges the loss of feedback without stopping or turning on the fault output (MA-MB). If b5-12 = "2: Fault," the iQpump drive coasts to a stop and turns on the fault output if the feedback is determined to be lost.

The Feedback Loss Detection can be disabled during the following conditions:

- Pre-charge Level (P4-01) is set to 0.
- Thrust Bearing acceleration or deceleration.

Note: A Feedback Loss Detection (FBL) will occur when the Thrust Bearing function is enabled and a run command given, P1 Feedback Loss Detection Time (b5-14) is set to 0, and P1 Feedback is below Feedback Loss Detection Level (b5-13).

Function Description <0034>

This parameter also allows feedback loss detection to also function as a wire break detection when the signal type is 4 ~ 20mA. The Wire-break Feedback Loss Detection will still be active when b5-13 = 0%.

Wire break will be detected on Terminal A2 when:

- PI Feedback Loss Detection is enabled (b5-12 = 1 or 2)
- PI is enabled (b5-01 > 0)
- Terminal A2 9s set for PI Feedback (H3-09 = B)
- Terminal A2 is set for 4 ~ 20 mA (H3-08 = 2)
- PI is NOT disabled via Multi-Function Digital Input
- Signal on Terminal A2 goes below 3 mA or above 21 mA for more than 1 s.

Note: Wire break detection on Terminal A2 is unaffected by the gain / bias parameters H3-10 and H3-11.

Wire break will be detected on Terminal A1 when:

- PI Feedback Loss Detection is enabled (b5-12 = 1 or 2)

- PI is enabled (b5-01 > 0)
- Dual Zone PI is enabled (b5-01 = 2, P1-01 = 0, b5-09 = 0, and H3-09 = B)
- PI is NOT disabled via Multi-Function Digital Input
- Signal on Terminal A1 goes below -6.25% or above 106.25% for more than 1 s.

Note: Wire break detection on Terminal A1 occurs *after* the gain / bias parameters (h3-02 and H3-03) are applied.

Feedback Loss (wire-break):

The drive will then react depending on how parameter b5-12 is programmed. However, if b5-12 is set to “fault” (b5-12 = 2), the drive will only fault when running in “Auto” mode. A warning will only be displayed if the drive is not running, or is running in “Hand” mode.

Feedback Loss (standard):

The drive will then react depending on how parameter b5-12 is programmed. However, if b5-12 is set to “fault” (b5-12 = 2), the drive will only fault when running in “Auto” mode. A warning will only be displayed if the drive is running in “Hand” mode.

Note: To convert terminal A1 to a 4 ~ 20 mA signal, connect a 250 Ohm precision resistor (1/4 W or greater) between A1 and AC. Then program H3-02 = 231.2% and H3-03 = 25.0%.

Table 11 Related Parameters

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
b5-12	1B0	PI Feedback Reference Missing Detection Selection **Fb los Det Sel**	0: Disabled 1: Alarm 2: Fault	0 ~ 2	2	Programming
b5-13	1B1	PI Feedback Loss Detection Level **Fb los Det Lvl**	Sets the PI feedback lost detection level as a percentage of maximum frequency (E1-04).	0 ~ 100%	0%	Programming
b5-14	1B2	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 s	2.0 s	Programming

Table 12 Related Fault

Fault Display	Description	Cause	Countermeasure
FBL Feedback Loss	PI Feedback Loss	PI Feedback source is not installed correctly or is not working.	Check to insure the PI Feedback source is installed and working properly.

Table 13 Multi-Function Output Setting

Setting	Description
4A	**Transducer Loss** Closed: During a “Feedback Loss Alarm” Closed: During a “FBL - Feedback Loss Fault”

◆ b5-13 PI Feedback Loss Detection Level

Setting Range: 0 ~ 100%

Factory Default: 0%

Refer to parameter b5-13 in appendix A for description details.

◆ b5-14 PI Feedback Loss Detection Time

Setting Range: 0.0 ~ 25.0 s

Factory Default: 2.0 s

The iQpump drive interprets feedback loss whenever the feedback signal drops below the value of b5-13 and stays below that level for at least the time set into b5-14. See *Figure 1.30* for timing details.

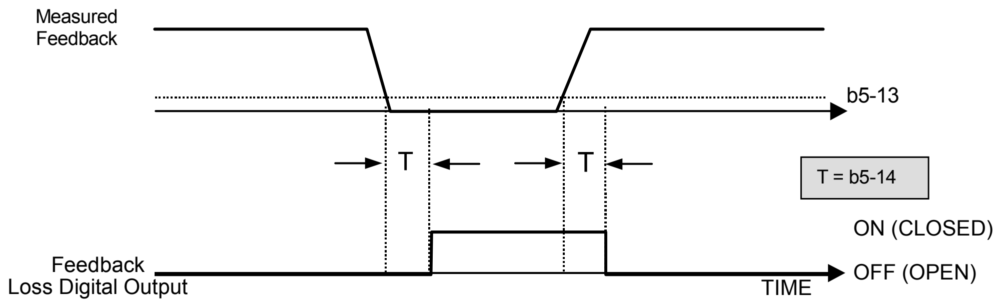


Figure 30. Loss of PI Feedback Feature

◆ b5-17 PI Accel / Decel Time

Setting Range: 0.0 ~ 25.5 s

Factory Default: 0.0 s

This is a soft start function that is applied to the PI Setpoint analog input. Instead of having nearly instantaneous changes in signal levels, there is a programmed ramp applied to level changes. When changing setpoints the error can be limited by gradually ramping the setpoint through the use of parameter b5-17.

◆ b5-32 Integrator Ramp Limit <0034>

The Integrator Ramp Limit provides a way to tune the PI loop so that it is less reactive to sudden spikes and dips in the feedback signal. Sometimes in a pressure regulated system with a very long piping system, pressure waves can develop which without this feature, can cause instability in the PI controller.

This feature only applies to the drive's standard PI Loop. It will not be applied to the PI Loop associated with water level control (Well Draw Down Control).

Function Description <0034>

Integrator Ramp Limit.

When the Integrator Ramp Limit is enabled, the PI Integrator is limited to +/- the b5-32 value of the soft starter output (output frequency without slip compensation). A b5-32 setting of zero disables this feature and the integrator is allowed to operate normally.

Table 14 Related Parameter

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
b5-32	85F	Integrator Ramp Limit **Int Ramp Lim**	When set to 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

b8 Energy Savings

The energy savings function improves overall system operating efficiency by operating the motor at its highest efficiency. This is accomplished by continuously monitoring the motor load and adjusting the motor terminal voltage so that the motor always operates near its rated slip frequency. A motor is most efficient when operating near rated slip conditions.

◆ b8-01 Energy Savings Selection

Setting	Description
0	Disabled (***factory default***)
1	Enabled

When the Energy Savings function is enabled (b8-01 = “1: Enabled”), the iQpump drive reduces the output voltage to the motor below the voltage value specified by the programmed V/f pattern whenever the motor load is light. Since torque is reduced during this voltage reduction, the voltage has to return to normal levels when the load returns. The energy savings is realized through improved motor efficiency. The reduced output voltage causes increased rotor slipping even with a light load. A motor is most efficient when operating fully loaded (i.e. operating at rated slip).

◆ b8-04 Energy Saving Coefficient Value

Setting Range: 0.0 ~ 655.0

Factory Default: Model Dependent

Parameter b8-04 is used in maximizing motor efficiency. The factory setting will be iQpump drive capacity dependant but can be adjusted in small amounts while viewing the kW monitor (U1-08) and running the iQpump drive to minimize the output kW. A larger value typically results in less voltage to the motor and less energy consumption. Too large a value will cause the motor to stall.

◆ b8-05 Power Detection Filter Time

Setting Range: 0 ~ 2000 ms

Factory Default: 20 ms

The Energy Saving function will search out the lowest output voltage in order to achieve minimum output power usage. Parameter b8-05 determines how often the output power (kW) is measured and the output voltage is adjusted.

◆ b8-06 Search Operation Voltage Limit

Setting Range: 0 ~ 100%

Factory Default: 0%

Once Energy Savings is enabled and the optimal energy saving coefficient value has been set, the programmer can have the iQpump drive further search out the proper voltage to achieve the lowest output power by making minute changes to the output voltage and measuring the output power every b8-05 ms. Parameter b8-06 sets limits to the range over which the voltage will be adjusted in order to minimize the power output. Settings too large a value may allow the motor to stall if the load is applied abruptly.

If b8-06 = 0, then the optimum voltage search operation is disabled (but not Energy Savings itself).

C1 Accel / Decel

◆ Acceleration Times

Parameter No.	Parameter Name
C1-01	Acceleration Time 1
C1-02	Deceleration Time 1
C1-03	Acceleration Time 2
C1-04	Deceleration Time 2
C1-05	Acceleration Time 3
C1-06	Deceleration Time 3

Setting Range: 0.0 ~ 6000.0 s

Factory Defaults: C1-01 20.0 s
C1-02, C1-03 and C1-04 10.0 s
C1-05 and C1-06 50.0 s

C1-01 (Acceleration Time 1) sets the time to accelerate from zero to maximum speed (E1-04). C1-02 (Deceleration Time 1) sets the time to decelerate from maximum speed to zero. C1-01 and C1-02 are the factory default active accel / decel "pair". Another accel / decel pair (C1-03 and C1-04) exists that can be activated by a multi-function digital input (H1-0x = 7), or specified by a switch over frequency as programmed in parameter C1-11.

C1-05 (Acceleration Time 3) and C1-06 (Deceleration Time 3) are used during the multiple pumping operation. Refer to P3-12 for more details.

Acceleration Time: This is the time it takes to accelerate from 0 Hz to Maximum Output Frequency defined by parameter E1-04.

Deceleration Time: This is the time it takes to decelerate from Maximum Output Frequency defined by parameter E1-04 to 0 Hz.

Example: C1-01 Acceleration Time 1 programmed for 30 seconds, E1-04 Maximum Output Frequency set to 60 Hz. It will take the iQpump Controller 20 seconds to accelerate from 0 to 40 Hz (40 Hz ÷ 60 Hz x 30 s = 20 s).

Example: C1-02 Deceleration Time 1 programmed for 50 seconds, E1-04 Maximum Output Frequency set to 60 Hz. It will take the iQpump Controller 10 seconds to decelerate from 60 to 30 Hz (30 Hz ÷ 60 Hz x 50 s = 25 s).

- Thrust Bearing Operation uses a separate acceleration time defined by parameter P4-04. Once Thrust frequency is reached, the iQpump drive returns to its normal acceleration time set by C1-01.
- Pre-charge mode uses C1-01 as its acceleration time.
- Hand Mode Operation uses C1-01 and C1-02 for acceleration and deceleration time.
- Auto Mode can use acceleration time C1-05 and deceleration time C1-06, depending on parameter P3-12 setting (see section. *P3-12 Delta Setpoint Feedback Acc / Dec Changeover on page 183*.)

◆ C1-09 Fast Stop Time

Setting Range: 0.0 ~ 6000.0 s

Factory Default: 10.0 s

A special deceleration parameter is available for use with emergency or fault operations. Parameter C1-09 will set a special deceleration that can be operated by closing a digital input configured as H1-0x = 15 or H1-0x = 17. A digital input configured as H1-0x = 15 will look for a switch closure before initiating the Fast Stop operation. A digital input configured as H1-0x = 17 will look for the switch opening before initiating the Fast Stop operation.

Unlike a standard deceleration time, once the Fast Stop operation is initiated even momentarily, the iQpump drive cannot be re-operated until the deceleration is complete, the Fast Stop input is cleared, and the Run command is cycled.

The C1-05 (Acceleration Time 3) and C1-06 (Deceleration Time 3) are used during the multiplex pumping operation. Refer to P3-12 for more details.

◆ C1-11 Accel / Decel Switch Frequency

Setting Range: 0.0 ~ 200.0 Hz

Factory Default: 0.0 Hz

The iQpump drive can be programmed to automatically switch between the two sets of Accel / Decel parameters on the fly. No digital input is required. If parameter C1-11 is set to a frequency other than zero, the iQpump drive will use Acceleration 1 and Deceleration 1 whenever the output frequency is equal to or above the value of C1-11 and use Acceleration 2 and Deceleration 2 whenever the output frequency is below the value of C1-11.

A multi-function input programmed as "Multi-Acc / Dec 1" will have priority over C1-11. For example, if the output frequency is greater than the value of C1-11 but a digital input configured as "Multi-Acc / Dec 1" is closed then Acceleration 2 and Deceleration2 are active.

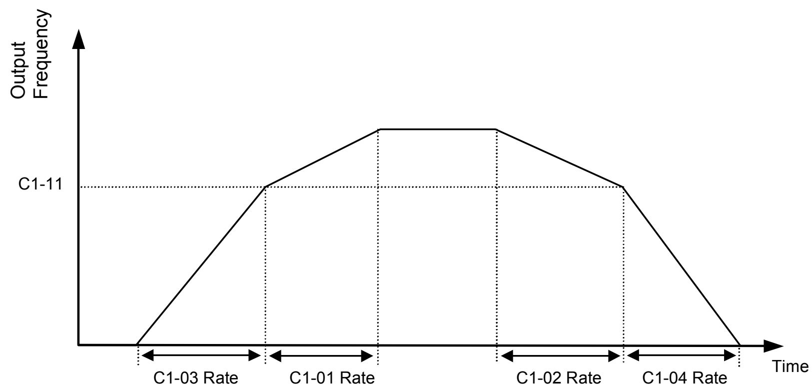


Figure 31. Accel / Decel Switch Frequency Operation

C2 S-Curve Acc

◆ S-Curve Characteristics

Parameter No.	Parameter Name
C2-01	S-Curve Characteristic at Start
C2-02	S-Curve Characteristic at Stop

Setting Range: 0.00 ~ 2.50 s

Factory Default: 0.20 s

Parameters C2-01 and C2-02 will affect the acceleration rate of the output frequency in order to reduce shock to the load. The S-curve addition to the acceleration profile can ramp the acceleration rate from a 0 to the rate specified by the active Acceleration Time (C1-01 or C1-03) and back to 0.

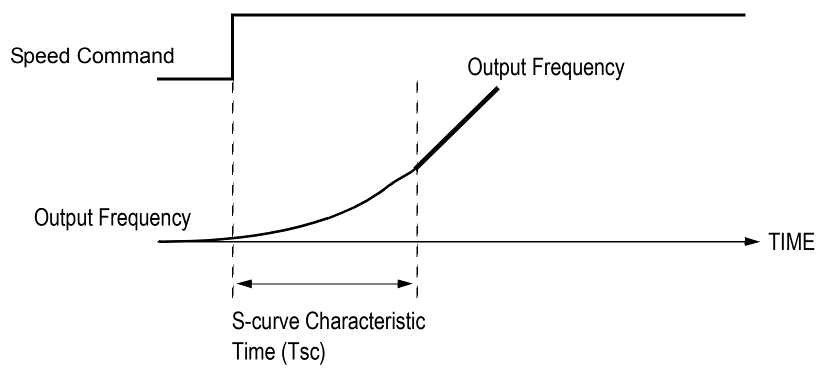


Figure 32. S-curve Characteristic Timing Diagram

The S-Curve transition into and out of the active acceleration rate can be programmed independently. C2-01 will ramp up the acceleration from no acceleration up to the rate of C1-01 or C1-03. C2-02 will ramp the acceleration rate from the rate of C1-01 or C1-03 back down to no acceleration (constant speed). The use of S-Curve characteristics will lengthen the overall acceleration time as follows:

$$\text{Overall Aceleration Time} = \text{Active Acceleration Time} + \frac{(\text{C2-01}) + (\text{C2-02})}{2}$$

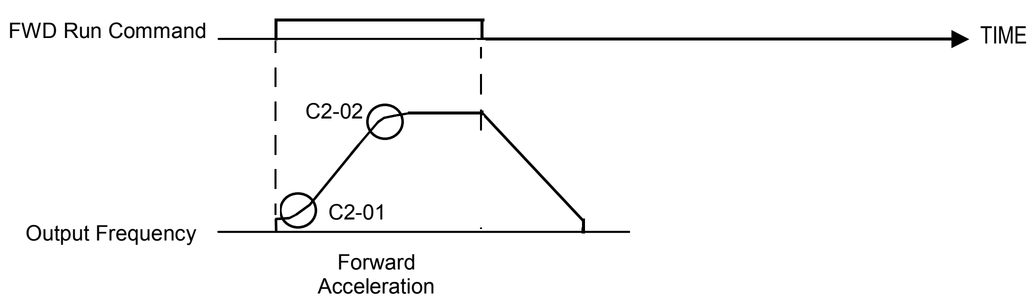


Figure 33. S-Curve Characteristic Timing Diagram

C4 Torque Comp

◆ C4-01 Torque Compensation Gain

Setting Range: 0.00 ~ 2.50

Factory Default: 1.00

Refer to parameter C4-01 in Appendix A for description details.

◆ C4-02 Torque Compensation Primary Delay Time

Setting Range: 0 ~ 10000 ms

Factory Default: 200 ms

The Torque Compensation function compensates for insufficient torque production at start-up and during low speed operation. The iQpump drive will detect increases in the motor load by monitoring the output current and compensate by increasing the output voltage. The increased output voltage leads to an increase in usable torque.

Parameter C4-01 sets the aggressiveness of the compensation for IR (resistive) and IL (inductive) losses in the motor windings, which are more pronounced at lower speeds. Normally C4-01 does not need to be changed but may require adjustment in the following cases:

- If the iQpump drive to motor cable is long, increase C4-01
- If the motor capacity is smaller than the iQpump drive capacity, increase C4-01
- If the low speed motor performance is unstable, decrease C4-01.
- If the output current level exceeds the drive's rated current while operating at low speeds, increase C4-01

Parameter C4-02 determines how quickly the Torque Compensation function will react to situations of insufficient torque. Again, C4-02 will not normally require adjustment except for the following situations:

- If the motor vibrates, increase C4-02
- If the motor response is sluggish (and possibly stalls), decrease C4-02

Important: Performing Auto-tuning can enhance low speed performance.

C6 Carrier Frequency

◆ C6-02 Carrier Frequency Selection

Setting	Description
0	Low Noise
1	Fc = 2.0 kHz
2	Fc = 5.1 kHz
3	Fc = 8.0 kHz
4	Fc = 10.0 kHz
F	Program
*The factory default setting is model dependent	

Parameter C6-02 sets the switching frequency of the drive's output transistors. It can be changed in order to reduce audible noise and also reduce leakage current. Cases that may require adjustment to the C6-02 are:

- If the wiring length between the iQpump drive and the motor is long, decrease the carrier frequency

Wiring Length	328 ft or less	Over 328 ft
C6-02 (carrier frequency) setting	1 ~ 4 (10 kHz max.)	1 ~ 2 (5 kHz max.)

- If speed and torque are inconsistent at low speeds, decrease the carrier frequency
- If leakage current from the iQpump drive is large, decrease the carrier frequency
- If the audible motor noise is too great, increase the carrier frequency (may require iQpump drive current derating)

When parameter C6-02 is set to "0: Low Noise" the iQpump drive uses a carrier frequency of 2 kHz and reduces the motor audible noise by approximately 5 db. over the conventional 2 kHz setting (C6-02 = 1). The iQpump drive modulates the nominal PWM pattern to achieve the lower noise. This setting is normally used with high starting torque loads that are frequently started and stopped or, applications where leakage current needs to be minimized and motor audible noise is important.

Carrier Frequency Parameter Factory Defaults:

208V – 240V Drives		
Model CIMR-P7	C6-02 Carrier Frequency (kHz)	C6-03 Carrier Frequency (kHz)
20P4	3	8.0 kHz*
20P7	3	8.0 kHz*
21P5	3	8.0 kHz*
22P2	3	8.0 kHz*
23P7	3	8.0 kHz*
25P5	3	8.0 kHz*
27P5	3	8.0 kHz*
2011	3	8.0 kHz*
2015	3	8.0 kHz*
2018	3	8.0 kHz*
2022	3	8.0 kHz*
2030	3	8.0 kHz*
2037	2	5.1 kHz
2045	2	5.1 kHz
2055	3	8.0 kHz*
2075	1	2.0 kHz
2090	1	2.0 kHz
2110	1	2.0 kHz

480V Drives		
Model CIMR-P7	C6-02 Carrier Frequency (kHz)	C6-03 Carrier Frequency (kHz)
40P4	3	8.0 kHz*
40P7	3	8.0 kHz*
41P5	3	8.0 kHz*
42P2	3	8.0 kHz*
43P7	3	8.0 kHz*
44P0	3	8.0 kHz*
45P5	3	8.0 kHz*
47P5	3	8.0 kHz*
49P0	3	8.0 kHz*
4011	3	8.0 kHz*
4015	3	8.0 kHz*
4018	3	8.0 kHz*
4022	3	8.0 kHz*
4024	3	8.0 kHz*
4030	3	8.0 kHz*
4037	3	8.0 kHz*
4045	3	8.0 kHz*
4055	2	5.1 kHz
4075	2	5.1 kHz
4090	3	8.0 kHz*
4110	2	5.1 kHz
4132	2	5.1 kHz
4160	2	5.1 kHz
4185	1	2.0 kHz
4220	1	2.0 kHz
4300	1	2.0 kHz

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

Figure 34. Carrier Frequency Parameter Factory Defaults

◆ Carrier Frequency Limit

Parameter No.	Parameter Name
C6-03	Carrier Frequency Upper Limit

Setting Range: 0.4 ~ 10.0 kHz

Factory Default: Model Dependent

d1 Setpoint and Jog References

◆ Setpoint References

Parameter No.	Parameter Name
d1-01	Setpoint Reference 1
d1-02	Setpoint Reference 2
d1-03	Setpoint Reference 3
d1-04	Setpoint Reference 4

Setting Range: 0.00 ~ P1-03 Value

Factory Default: 0.00

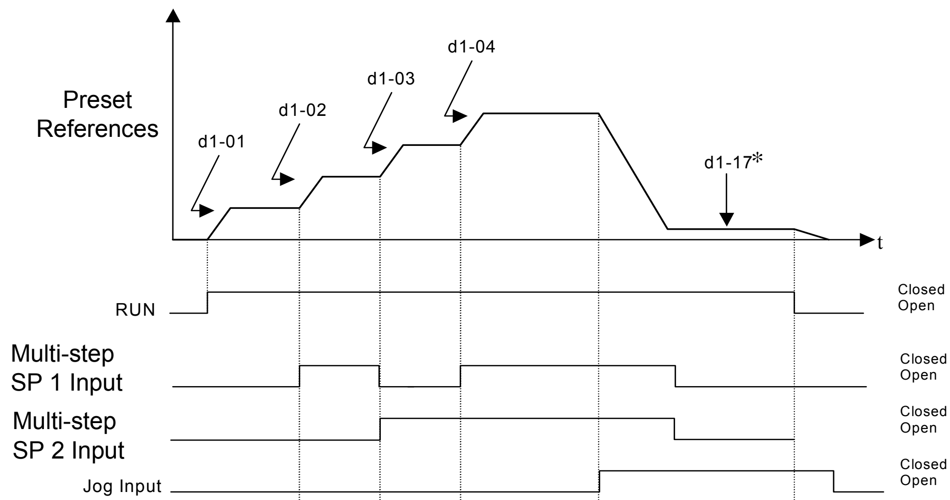


Figure 35. Setpoint and Jog Reference Timing Diagram

* Available only with an LCD operator (JVOP-160).

◆ d1-17 Jog Frequency Reference (LCD Operator Function Only JVOP-160)

Setting Range: 0.00 ~ E1-04 Value

Factory Default: 0.00 Hz

The iQpump drive can be programmed to utilize digital inputs to change between four setpoint and a jog references. It is a two-step process to set the iQpump drive up for setpoint point and jog references. First, d1-01 through d1-04 and d1-17 must be programmed with the desired setpoint references and the desired jog reference, respectively. Next, up to three of the drive's digital inputs (Terminals S3 through S7) need to be programmed (via parameters H1-01 to H1-05) and wired (to normally open contacts) as Multi-step SP1, Multi-step SP2, and Jog Frequency.

Table 15 Preset Speed Truth Table

Preset Reference	Terminal programmed as Multi-step SP1	Terminal programmed as Multi-step SP2	Details
1	OFF	OFF	Setpoint Reference 1 (d1-01) or analog input A1# (determined by b1-01, see page *47*)
2	ON	OFF	Setpoint Reference 2 (d1-02) or analog input A2# (determined by H3-09, see page *47*)
3	OFF	ON	Setpoint Reference 3 (d1-03)
4	ON	ON	Setpoint Reference 4 (d1-04)
# Shown for H3-13 = "0: Main Fref TA1"; A1 and A2 are reversed if H3-13 = "1: Main Fref TA2"			

As shown in *Table 15 on page 47*, it is possible to use analog inputs in place of Setpoint Reference 1 and Setpoint Reference 2.

- If b1-01 = “1: Terminals” then the analog input A1 will be used instead of Setpoint Reference 1 for the first preset Setpoint. If b1-01 = “0: Operator,” then Setpoint Reference 1 will be used.
- If H3-09 = “2: Aux Reference” then the analog input A2 will be used instead of Setpoint Reference 2 for the second preset Setpoint. If H3-09 = 2 then Setpoint Reference 2 will be used. This is only available when the iQpump drive is operating in the speed mode.

Important: The programming of d1-01 through d1-04 and d1-17 will be affected by the setting of P1-02 and o1-03, respectively. The programming of these parameters will be in the units specified by Display Scaling parameter (P1-02 and o1-03).

Note: This function is only used with the LCD operation, not used with HOA operator.

d2 Reference (Speed Command) Limits

◆ d2-01 Frequency Reference Upper Limit

Setting Range: 0.0 ~ 110.0%

Factory Default: 100.0%

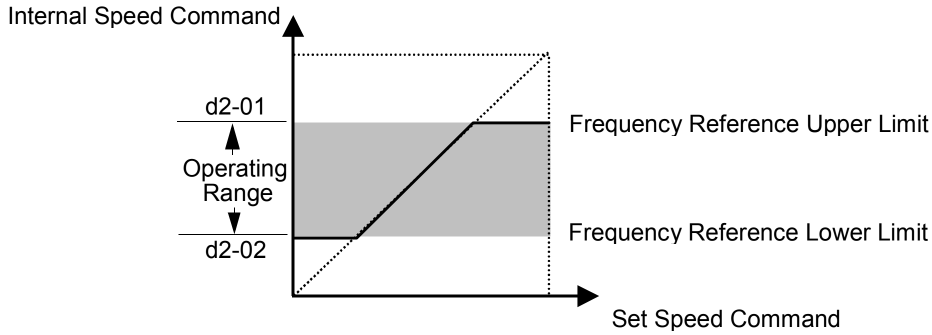
Refer to parameter d2-01 in Appendix A for description details.

◆ d2-02 Frequency Reference Lower Limit

Setting Range: 0.0 ~ 110.0%

Factory Default: 0.0%

The use of parameters d2-01 and d2-02 places limitations on the speed command that the iQpump drive will accept. The parameters are set in units of percentage of the maximum frequency (E1-04) and provide limits on any remote speed command input. By entering upper or lower frequency limits, the iQpump drive programmer can prevent operation of the iQpump drive above or below levels that may cause resonance, equipment damage or discomfort (see also parameter d3-0X). For example, limits may be needed to prevent low speed operation of: Cooling tower fans with gear boxes, pumps with pressure dependent seals, or AHUs with minimum delivery requirements.



Note: See also the "Sleep" function in Figure 1.19 for alternate "lower limit" implementation.

Figure 36. Frequency Reference Upper and Lower Limit Effects on the Speed Command

◆ d2-03 Master Speed Reference Lower Limit

Setting Range: 0.0 ~ 110.0%

Factory Default: 0.0%

Unlike Frequency Reference Lower Limit (d2-02) which will affect the speed command no matter where it is sourced from (i.e. analog input, preset speed, jog speed, etc.), the Master Speed Reference Lower Limit (d2-03) sets a low speed threshold that will only affect the analog input that is the active master speed frequency (as determined by parameter H3-13 and H3-09). This parameter allows a minimum speed to be programmed for the master reference while allowing a lower speed to be set as a jog reference. If the speed commanded by the active master speed frequency is below the setting of d2-03, then the iQpump drive will operate at the speed specified by d2-03.

d3 Jump Frequencies

◆ Jump Frequencies

Parameter No.	Parameter Name
d3-01	Jump Frequency 1
d3-02	Jump Frequency 2
d3-03	Jump Frequency 3

Setting Range: 0.0 ~ 200.0 Hz

Factory Default: 0.0 Hz

◆ d3-04 Jump Frequency Width

Setting Range: 0.0 ~ 20.0 Hz

Factory Default: 1.0 Hz

In order to avoid continuous operation at a speed that causes resonance in driven machinery, the iQpump drive can be programmed with jump frequencies that will not allow continued operation within specific frequency ranges. If a speed is commanded that falls within a dead band, or Jump Frequency, the iQpump drive will clamp the frequency reference just below the dead band and only accept higher speed commands when the commanded speed rises above the upper end of the dead band, for increasing references. Similarly, the iQpump drive will clamp the frequency reference just above the dead band and only accept lower speed commands when the command speed falls below the lower end of the dead band, for decreasing references.

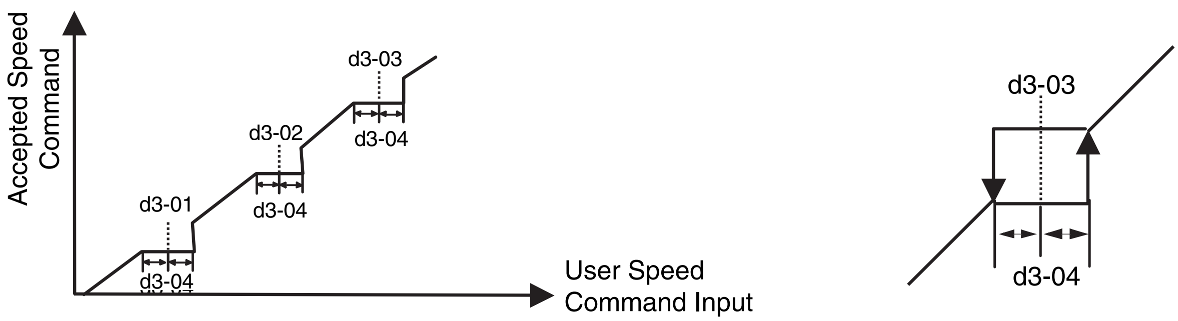


Figure 37. Jump Frequency Characteristics

Setting the center point of the dead band with the d3-01 through d3-03 parameters and setting the width of the dead band with parameter d3-04 determines the dead band characteristics. The programmer can set up to three Jump Frequencies. If multiple Jump Frequencies are programmed the following rule applies:

d3-01 < = d3-02 < = d3-03

E1 V/f Pattern

◆ E1-01 Input Voltage Setting

Setting Ranges: 155.0 V ~ 255.0 V (208 V / 240 V Models)
310.0 V ~ 510.0 V (480 V Models)

Factory Defaults: 208.0 V (208 V Models)
240.0 V (240 V Models)
480.0 V (480 V Models)

Set the Input Voltage parameter (E1-01) to the nominal voltage of the connected AC power supply. This parameter adjusts the levels of some protective features of the iQpump drive (i.e. Overvoltage, Stall Prevention, etc.). E1-01 also serves as the Maximum / Base Voltage used by the Preset V / Hz curves (E1-03 = 0 ~ D).

◆ E1-03 V/f Pattern Selection

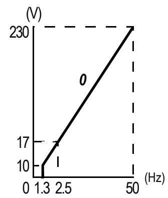
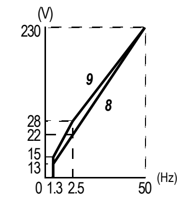
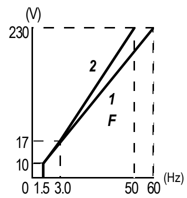
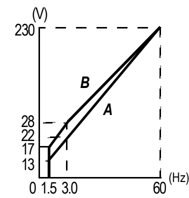
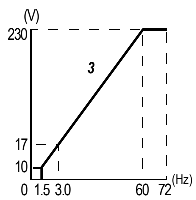
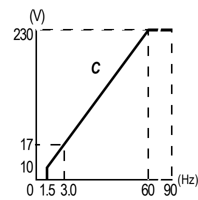
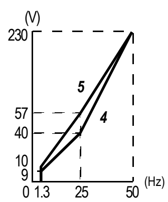
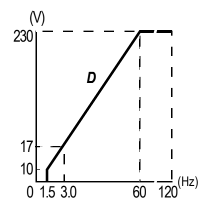
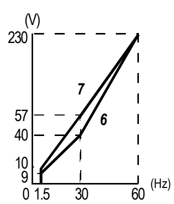
Setting	Description
0	50 Hz
1	60 Hz Saturation
2	50 Hz Saturation
3	72 Hz
4	50 Hz VT1
5	50 Hz VT2
6	60 Hz VT1
7	60 Hz VT2
8	50 Hz HST1
9	50 Hz HST2
A	60 Hz HST1
B	60 Hz HST2
C	90 Hz
D	120 Hz
E	180 Hz (invalid - OPE2 fault will occur)
F	Custom V/f (***factory default***, *with parameter values per setting 1*)
FF	Custom w/o limit

The iQpump drive operates utilizing a set V/f pattern to determine the appropriate output voltage level for each commanded speed. There are 14 different preset V/f patterns to select from with varying voltage profiles, saturation levels (frequency at which maximum voltage is reached), and maximum frequencies.

There are also settings for Custom V/f patterns that will allow the programmer to manually set (“Customize”) the V/f pattern using parameters E1-04 through E1-13.

Using parameter E1-03, the programmer can select one of the preset V/f patterns or chose between a custom V/f pattern with an upper voltage limit (E1-03 = “F: Custom V/f”) and a custom V/f pattern without a voltage limit (E1-03 = “FF: Custom w/o limit”).

Table 16   Preset V/f Patterns

	Specifications		E1-03	V/f Pattern *1		Specifications		E1-03	V/f Pattern *1
General-purpose	50 Hz		0		High Starting Torque *2	50 Hz	High Starting Torque 1	8	
							High Starting Torque 2	9	
	60 Hz Saturation		1 F			60 Hz	High Starting Torque 1	A	
	50 Hz Saturation		2				High Starting Torque 2	B	
	72 Hz		3		High Speed Operation	90 Hz		C	
Variable Torque	50 Hz	Variable Torque 1	4			120 Hz		D	
		Variable Torque 2	5						
	60 Hz	Variable Torque 1	6						
		Variable Torque 2	7						

If one of the custom V/f patterns is selected, then parameters E1-04 through E1-13 will determine the V/f pattern.

Table 18, Table 19 and Table 19 on page 55 is for 240 V class units only. For 480 V class units multiply the voltage value by 2.

Important: When a factory Initialization is performed, the setting of E1-03 is unaffected but the settings of E1-04 through E1-13 are returned to their factory default settings.

◆ E1-04 Maximum Output Frequency

Setting Range: 0.0 ~ 120.0 Hz

Factory Default: 60.0 Hz

Refer to parameter E1-04 in Appendix A for description details.

◆ E1-05 Maximum Output Voltage

Setting Ranges: 0.0 ~ 255.0 V (240 V Models)
0.0 ~ 510.0 V (480 V Models)

Factory Defaults: 240.0 V (240 V Models)
480.0 V (480 V Models)

Refer to parameter E1-05 in Appendix A for description details.

◆ E1-06 Base Frequency

Setting Range: 0.0 ~ 120.0 Hz

Factory Default: 60.0 Hz

Refer to parameter E1-06 in Appendix A for description details.

◆ E1-07 Mid Output Frequency A

Setting Range: 0.0 ~ 120.0 Hz

Factory Default: 3.0 Hz

Refer to parameter E1-07 in Appendix A for description details.

◆ E1-08 Mid Output Voltage A

Setting Ranges: 0.0 ~ 255.0 V (240 V Models)
0.0 ~ 510.0 V (480 V Models)

Factory Defaults: 17.2 V (240 V Models)
34.5 V (480 V Models)

Refer to parameter E1-08 in Appendix A for description details.

◆ E1-09 Minimum Output Frequency

Setting Range: 0.0 to 120.0 Hz

Factory Default: 1.5 Hz

Refer to parameter E1-09in Appendix A for description details.

◆ E1-10 Mid Output Voltage

Setting Ranges: 0.0 ~ 255.0 V (240 V Models)
0.0 ~ 510.0 V (480 V Models)

Factory Defaults: 10.3 V (240 V Models)
20.7 V (480 V Models)

Refer to parameter E1-10 in Appendix A for description details.

◆ E1-11 Mid Output Frequency B

Setting Range: 0.0 ~ 120.0 Hz

Factory Default: 0.0 Hz

Refer to parameter E1-11 in Appendix A for description details.

◆ E1-12 Mid Output Voltage B

Setting Ranges: 0.0 ~ 255.0 V (240 V Models)
0.0 ~ 510.0 V (480 V Models)

Factory Defaults: 0.0 V (240 V Models)
0.0 V (480 V Models)

Top set up custom V/f pattern, program the points shown in the diagram below using parameters E1-04 through E1-13. Be sure that the following condition is true:

E1-09 ≤ E1-07 ≤ E1-06 ≤ E1-11 ≤ E1-04

◆ E1-13 Base Voltage

Setting Ranges: 0.0 ~ 255.0 V (240 V Models)
0.0 ~ 510.0 V (480 V Models)

Factory Defaults: 0.0 V (240 V Models)
0.0 V (480 V Models)

To set up a custom V/f pattern, program the points shown in the diagram below using parameters E1-04 through E1-13. Be sure that the following condition is true:

E1-09 ≤ E1-07 ≤ E1-06 ≤ E1-11 ≤ E1-04

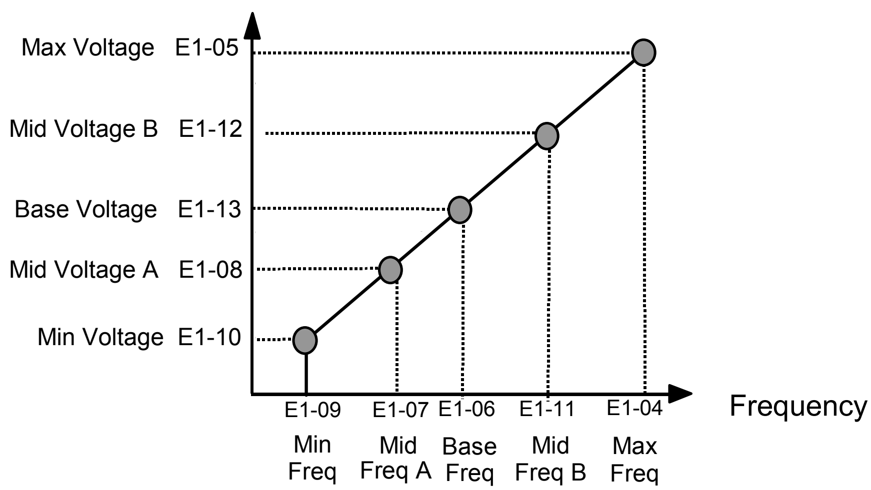


Figure 38. Custom V/f Pattern Programming Curve

Increasing the voltage in the V/f pattern increases the available motor torque. However, when setting a custom V/f pattern, increase the voltage gradually while monitoring the motor current, to prevent:

- Drive faults as a result of motor over-excitation
- Motor overheating or excessive vibration

Table 18, Table 19 and Table 19 on page 55 are for 240 V class units only. For 480 V class units, multiply the voltage values by 2.

Table 17 V/f Pattern Default Settings for Drive Capacity 0.5 ~ 2 HP for 240 V Class

Parameter No.	Name	Unit	Factory Setting														
E1-03	V/f Pattern Selection	—	0	1	2	3	4	5	6	7	8	9	A	B	C	D	F
E1-04	Max Output Frequency	Hz	50.0	60.0	60.0	72.0	50.0	50.0	60.0	60.0	50.0	50.0	60.0	60.0	90.0	120.0	60.0
E1-05	Max Output Voltage	V	240.0	240.0	240.0	240.0	240.0	240.0	240.0	240.0	240.0	240.0	240.0	240.0	240.0	240.0	240.0
E1-06	Base Frequency	Hz	50.0	60.0	50.0	60.0	50.0	50.0	60.0	60.0	50.0	50.0	60.0	60.0	60.0	60.0	60.0
E1-07	Mid Output Frequency A	V	2.5	3.0	3.0	3.0	25.0	25.0	30.0	30.0	2.5	2.5	3.0	3.0	3.0	3.0	3.0
E1-08	Mid Output Voltage A	V	17.2	17.2	17.2	17.2	40.2	57.5	40.2	57.5	21.8	27.6	21.8	27.6	17.2	17.2	17.2
E1-09	Min Output Frequency	Hz	1.3	1.5	1.5	1.5	1.3	1.3	1.5	1.5	1.3	1.3	1.5	1.5	1.5	1.5	1.5
E1-10	Mid Output Voltage	V	10.3	10.3	10.3	10.3	9.2	10.3	9.2	10.3	12.6	14.9	12.6	17.2	10.3	10.3	10.3
E1-11	Mid Output Frequency B	Hz	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E1-12	Mid Output Voltage B	V	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E1-13	Base Voltage	V	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
For 480 V class units, the value is twice that of 240 V class units.																	

Table 18 V/f Pattern Default Settings for Drive Capacity 3 ~ 40 HP for 240 V Class

Parameter No.	Name	Unit	Factory Setting														
E1-03	V/f Pattern Selection	—	0	1	2	3	4	5	6	7	8	9	A	B	C	D	F
E1-04	Max. Output Frequency	Hz	50.0	60.0	60.0	72.0	50.0	50.0	60.0	60.0	50.0	50.0	60.0	60.0	90.0	120.0	60.0
E1-05	Max. Output Voltage	V	240.0	240.0	240.0	240.0	240.0	240.0	240.0	240.0	240.0	240.0	240.0	240.0	240.0	240.0	240.0
E1-06	Base Frequency	Hz	50.0	60.0	50.0	60.0	50.0	50.0	60.0	60.0	50.0	50.0	60.0	60.0	60.0	60.0	60.0
E1-07	Mid. Output Frequency A	V	2.5	3.0	3.0	3.0	25.0	25.0	30.0	30.0	2.5	2.5	3.0	3.0	3.0	3.0	3.0
E1-08	Mid. Output Voltage A	V	16.1	16.1	16.1	16.1	40.2	57.5	40.2	57.5	20.7	26.4	20.7	26.4	16.1	16.1	16.1
E1-09	Min. Output Frequency	Hz	1.3	1.5	1.5	1.5	1.3	1.3	1.5	1.5	1.3	1.3	1.5	1.5	1.5	1.5	1.5
E1-10	Mid. Output Voltage	V	8.0	8.0	8.0	8.0	6.9	8.0	6.9	8.0	10.3	12.6	10.3	14.9	8.0	8.0	8.0
E1-11	Mid Output Frequency B	Hz	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E1-12	Mid Output Voltage B	V	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E1-13	Base Voltage	V	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
For 480 V class units, the value is twice that of 240 V class units.																	

Table 19 V/f Pattern Default Settings for Drive Capacity 50 ~ 150 HP for 240 V Class

Parameter No.	Name	Unit	Factory Setting														
E1-03	V/f Pattern Selection	–	0	1	2	3	4	5	6	7	8	9	A	B	C	D	F
E1-04	Max. Output Frequency	Hz	50.0	60.0	60.0	72.0	50.0	50.0	60.0	60.0	50.0	50.0	60.0	60.0	90.0	120.0	60.0
E1-05	Max. Output Voltage	V	240.0	240.0	240.0	240.0	240.0	240.0	240.0	240.0	240.0	240.0	240.0	240.0	240.0	240.0	240.0
E1-06	Max. Voltage Frequency	Hz	50.0	60.0	50.0	60.0	50.0	50.0	60.0	60.0	50.0	50.0	60.0	60.0	60.0	60.0	60.0
E1-07	Mid. Output Frequency A	V	2.5	3.0	3.0	3.0	25.0	25.0	30.0	30.0	2.5	2.5	3.0	3.0	3.0	3.0	3.0
E1-08	Mid. Output Voltage A	V	13.8	13.8	13.8	13.8	40.2	57.5	40.2	57.5	17.2	23.0	17.2	23.0	13.8	13.8	13.8
E1-09	Min. Output Frequency	Hz	1.3	1.5	1.5	1.5	1.3	1.3	1.5	1.5	1.3	1.3	1.5	1.5	1.5	1.5	1.5
E1-10	Mid. Output Voltage	V	6.9	6.9	6.9	6.9	5.7	6.9	5.7	6.9	8.0	10.3	8.0	12.6	6.9	6.9	6.9
E1-11	Mid Output Frequency B	Hz	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E1-12	Mid Output Voltage B	V	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E1-13	Base Voltage	V	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
For 480 V class units, the value is twice that of 240 V class units.																	

E2 Motor Setup

◆ E2-01 Motor Rated Current

Setting Range: 10% ~ 200%

Factory Default: Model Dependent

The Motor Rated Current parameter (E2-01) is necessary information for the iQpump drive motor protection function. The motor overload protection parameter L1-01 is enabled by default. In addition, motor rated current is used by the torque compensation function to insure optimum torque production. Set E2-01 to the full load amps (FLA) value stamped on the motor's nameplate. During Auto-tuning, it is required for the operator to enter the motor rated current in parameter T1-04 on the Auto-Tuning menu. If the Auto-tuning operation completes successfully, the value entered into T1-04 will be also written into E2-01.

For applications employing an iQpump drive that is oversized for the motor, E2-01 may be set as low as 10% of the iQpump drive output current rating. The AMP value in E2-01, however, must always be greater than the "No Load Current" value in parameter E2-03 or an OPE02 error will be displayed.

◆ E2-03 No Load Current

Setting Range: Model Dependent (see *Appendix B*)

Factory Default: Model Dependent

Set E2-03 to the motor no-load current at rated voltage and rated frequency. Consult the motor manufacturer for the proper value if the no load current is not stated on the motor nameplate.

◆ E2-04 Number of Motor Poles

Setting Range: 2 ~ 48 poles

Factory Default: 2 pole

This parameter sets the number of motor poles used for no-flow detection function and for the calculation of rpm-related parameters.

◆ E2-05 Motor Line-to-Line Resistance

Setting Range: 0.000 ~ 65.000 Ω

Factory Default: Model Dependent

Sets the line-to-line resistance of the motor's stator winding. Usually determined by performing Auto-tuning. If Auto-tuning cannot be completed without error, then manually set E2-05 to the value as determined by the motor manufacturer. Remember this value must be entered as line-line and not line neutral.

$$\text{E2-05} = \left(\begin{array}{c}\text{Phase-to-phase Resistance at}\\ \text{Insulation Class Temperature}\end{array}\right) \times \frac{273 + (25 + \text{insulation class temperature})/2}{273 + \text{insulation class temperature}}$$

Where: Insulation class temperature is in °C

F6 Com OPT Setup

◆ F6-01 Operation Selection After Communication Error

Setting	Description
0	Ramp to Stop
1	Coast to Stop (***factory default***)
2	Fast-Stop
3	Alarm Only

If a serial communication option board is attached to the iQpump drive at the 2CN connector, the iQpump drive will automatically monitor the card for any type of communication errors. F6-01 is applicable no matter whether a run command or speed command is coming via the option board, digital operator, or terminal input. The setting of F6-01 determines whether the communication error is seen as a fault or an alarm. If F6-01 = "3: Alarm Only," then the fault output is not energized upon a communication error. All other settings of F6-01 cause the fault output to energize. The setting of F6-01 does not apply to any of the embedded communication protocols used at the RS-485 / 422 terminals on the removable terminal board. (See parameters H5-0X.)

◆ F6-02 Option PCB External Fault Detection Selection

Setting	Description
0	Always Detected (***factory default***)
1	Detected only during operation

◆ F6-03 Option PCB External Fault Stopping Method

Setting	Description
0	Ramp to Stop
1	Coast to Stop (***factory default***)
2	Fast-Stop
3	Alarm Only

If an external fault is received from a communication option card, the settings of F6-02 and F6-03 will determine the iQpump drive operation in reaction to the fault signal. Parameter F6-02 will determine if the external fault is always recognized (F6-02 = "0: Always Detected") or only recognized when the Run command is active (F6-02 = "1: Detected only during operation").

Once the fault is recognized, parameter F6-03 will determine the operation of the drive. If parameter F6-03 is set to anything other then "3," the iQpump drive will fault and a stopping sequence is begun. If F6-03 = "3: Alarm Only," then the external fault is treated like an alarm. Operation will continue and an EF0 fault will flash on the digital operator.

◆ F6-05 Current Scaling via Communication Option PCB

Setting	Description
0	A Display (***factory default***)
1	100% / 8192 (Drive Rated Current)

A communication option card can read the drive's DPRAM to access the current monitor. The format of the current reading in the DPRAM will be determined by parameter F6-05.

F6-05 = "0: A Display" → Current is a decimal number corresponding to actual Amperes
F6-05 = "1: 100% / 8192 (Drive Rated Current)" → Current reading is a number where 8192 = 100% of the iQpump drive rated output current

H1 Digital Inputs

◆ Terminal Function Selections

Parameter No.	Parameter Name
H1-01	Terminal S3 Function Selection
H1-02	Terminal S4 Function Selection
H1-03	Terminal S5 Function Selection
H1-04	Terminal S6 Function Selection
H1-05	Terminal S7 Function Selection

Setting Range: 0 ~ 86

Factory Defaults: H1-01 = “24: External Fault”
H1-02 = “14: Fault Reset”
H1-03 = “3: Multi-Step SP1” (2-Wire)
“0: 3-Wire Control” (3-Wire)
H1-04 = “80: Hand Mode”
H1-05 = “84: Pre-charge”

The iQpump drive has five multi-function contact digital inputs. By programming parameters H1-01 through H1-06, the user can assign specific functions to each input. Below is a table with a complete list of all of the digital input functions. Following the table is a more detailed description of each of the functions.

Table 20 Digital Input Functions

Parameter setting	Function	Parameter setting	Function
0	3-Wire Control	20-2F	External Pump Fault
1	Local / Remote Selection	30	Integral Reset
2	Option / Inv Selection 1	31	Integral Hold
3	Multi-step SP1	34	PI Soft Start Cancel
4	Multi-step SP2	-	-
6	Not Used	36	Option / Inv Selection 2
7	Multi-Accel / Decel 1	60	Motor Pre-heat
8	External Baseblock N.O.	61	Speed Search 1
9	External Baseblock N.C.	62	Speed Search 2
A	Accel / Decel Ramp Hold	64	Speed Search 3
C	Terminal A2 Enable	67	Communications Test Mode
F	Terminal Not Used	68	High Slip Braking
10	MOP Increase	6A	Drive Enable
11	MOP Decrease	6B	Comm / Inv Selection
12	Not Used	6C	Com / Inv SEL 2
13	Not Used	6D	Not Used
14	Fault Reset	6E	Not Used
15	Fast Stop N.O.	70	Not Used
17	Fast Stop N.C.	80	Hand Mode
18	Timer Function	81	Disable Sleep Mode
19	PI Disable	82	Sleep Activation
1B	Program Lockout	83	Thermostat Fault
1C	Not Used	84	Disable Pre-charge
1D	Not Used	85	Low Water Level
1E	Not Used	86	Fixed Speed Auto

* Input Level Sel - H1-0x = 35, This multi-function input selection for PI Invert has been removed because it interferes with the standard iQpump operation. <0034>

Table 21 Parameters <0034>

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
H1-12	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	0.00 s	Programming
H1-13	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	0.00 s	Programming
H1-14	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	0.00 s	Programming
H1-15	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	0.00 s	Programming
H1-16	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	0.00 s	Programming

■ Function: 3-Wire Control (Setting: 0)

When one of the digital inputs is programmed for 3-Wire control, that input becomes a Forward / Reverse directional input. Whenever the input is open, the iQpump drive will be set for forward rotation of the motor shaft. If the input it closed, then the motor shaft will rotate in the reverse direction whenever a there is a Run input. The S1 and S2 digital inputs will function as a Run and Stop input respectively.

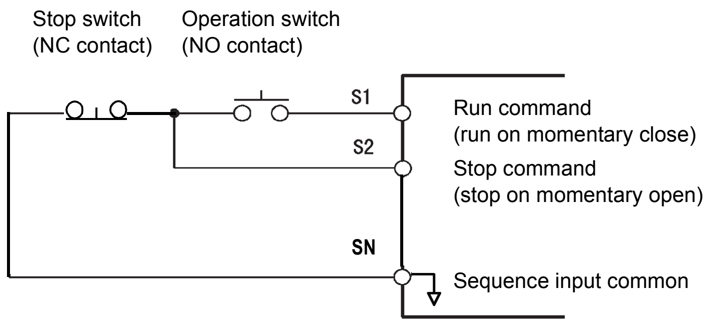


Figure 39. Terminal Configuration for 3-Wire Control

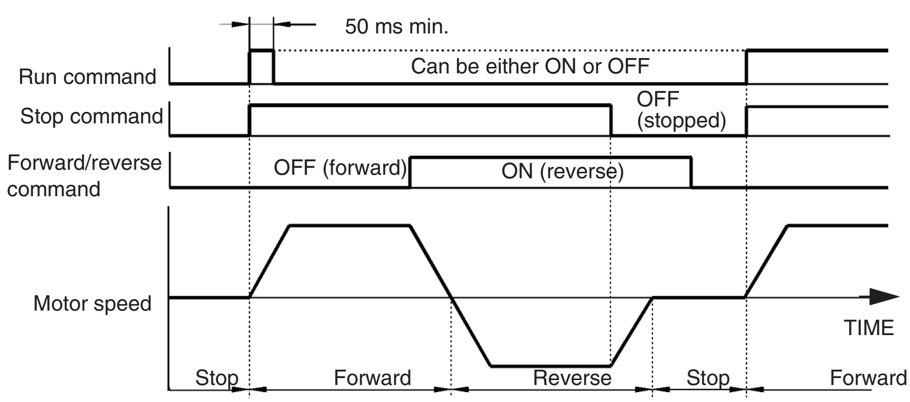


Figure 40. 3-Wire Control Timing Diagram

Important: As long as the S1(Run Command) input is applied in for at least 50 ms the Run command will latch internally in the drive.

■ Function: Local / Remote Selection (Setting: 1)

This function has been disabled. Please refer to settings “6D” and “6E”.

■ Function: Option / Inv Selection 1 (Setting: 2)

The Option / Inv Selection function allows the user to select the source for the Run and speed commands between either the drive's terminals or an optional communication card. When a digital input is programmed for the Option / Inv Selection function (H1-0x = 2) that input will function as follows:

Table 22 Digital Input Functions

Option / Inv Selection Input Status	Run and Speed Command Source
CLOSED	From the control circuit and analog input terminals
OPEN	From the Communications Option Card

To switch the command source between the option card and the terminals be sure to program the following parameters:

- Set b1-01 (Auto Setpoint Reference Selection) to 1 (Terminals).
- Set
  (Run Command Selection) to 1 (Terminals).
- Set H1-0x (Input Terminal Function Selection) to 2.

Important: Switching between the different Reference and Run sources can only be done while the iQpump drive is stopped.

■ Function: Multi-step SP1 (Setting: 3)

■ Function: Multi-step SP2 (Setting: 4)

The iQpump drive can be programmed to step through four preset setpoints and a jog reference. It is also possible to mix in the analog inputs as setpoint references that can be chosen in place of the first and second preset setpoint references. The selection of which preset setpoint will be the active setpoint is determined by the status of the digital inputs set for Multi-step SP1 (H1-0x = 3) and Multi-step SP2 (H1-0x = 4). Changing the active setpoint via the Multi-step Setpoint References can be done while the iQpump drive is running.

The following table details which reference is active based on the status of the Multi-step SP1 and Multi-step SP2 inputs:

Table 23 Digital Input Functions

Preset Reference	Terminal Programmed as Multi-step SP1	Terminal Programmed as Multi-step SP2	Details
1	OFF	OFF	Setpoint Reference 1 (d1-01) or analog input A1# (determined by b1-01)
2	ON	OFF	Setpoint Reference 2 (d1-02) or analog input A2# (determined by H3-09)
3	OFF	ON	Setpoint Reference 3 (d1-03)
4	ON	ON	Setpoint Reference 4 (d1-04)
# Shown for H3-13 = "0: Main Fref TA1"; A1 and A2 are reversed if H3-13 = "1: Main Fref TA2"			

The determination of whether the Preset Reference 1 will be the Setpoint Reference 1 (d1-01 or the analog input A1) is determined by the status of b1-01. If b1-01 = "1: Terminals," the value of the input to A1 will determine the commanded Setpoint when Preset Reference 1 is selected. If b1-01≠1, the setting of d1-01 will determine the commanded Setpoint when Preset Reference 1 is selected.

The determination of Preset Reference 2 is made much the same way as Preset Reference 1 except that the setting of parameter H3-09 decides whether the analog input A2 or d1-02 is Preset Setpoint 2. If H3-09 = "2: Aux Reference," the value of the input to A2 will determine the commanded Aux Reference when Preset Reference 2 is selected. If H3-09 = 2, the setting of d1-02 will determine the commanded setpoint when Preset Reference 2 is selected.

■ Function: Multi-Acc / Dec 1 (Setting: 7)

When a digital input configured as Multi-Acc/Dec 1 (H1-0x = 7) is OPEN the first set of acceleration / deceleration times (C1-01 and C1-02) are active.

When a digital input configured as Multi-Acc / Dec 1 (H1-0x = 7) is CLOSED the second set of acceleration / deceleration times (C1-03 and C1-04) are active.

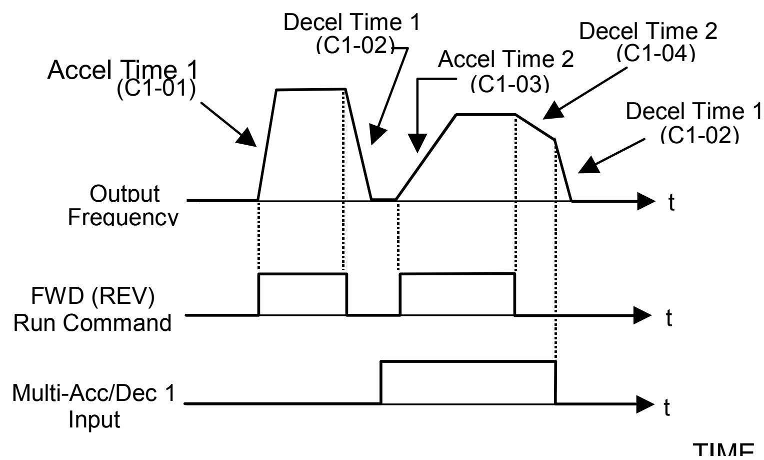


Figure 41. Multi-Accel/Decel Timing Diagram

■ Function: Ext Baseblk N.O. (Setting: 8)

■ Function: Ext Baseblk N.C. (Setting: 9)

When the iQpump drive is commanded into baseblock, gating of the output transistor stops and output voltage/frequency drops to zero (motor coasts). The iQpump drive can be forced into a baseblock state by either closing a digital input configured for Ext Baseblk N.O. (H1-0x = 8) or opening a digital input configured for Ext Baseblk N.C. (H1-0x = 9).

When the baseblock state is removed the speed search function is used to catch the coasting motor and ramp it back to the commanded speed.

The method of speed search, Current Detection or Speed Estimation, that is utilized when the baseblock input is removed depends on the setting of parameter b3-01:

If b3-01 = “0: SpdsrchF Disable” or “1: SpdsrchF Enable”; Speed Estimation is used

If b3-01 = “2: SpdsrchI Disable” or “3: SpdsrchF Enable”; Current Detection is used

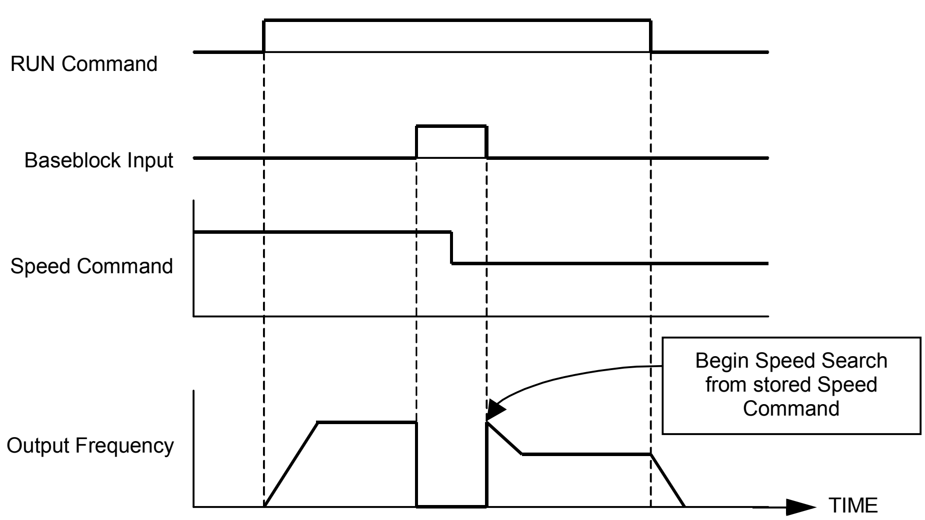


Figure 42. External Baseblock Characteristics

■ Function: Acc / Dec Ramp Hold (Setting: A)

The Acc / Dec Ramp Hold function will clamp (“hold”) the speed of the output frequency whenever a digital input that has been programmed for it (H1-0x = A) is closed. All acceleration or deceleration will stop and the iQpump drive will hold the current speed. Once the input is opened, acceleration or deceleration continues.

The Acc / Dec Ramp Hold function is affected by parameter d4-01. If d4-01 = “1: Enabled” and the Acc /Dec Ramp Hold functions are both being used, whenever the RampHold input is closed the output frequency is memorized. When interrupted power is returned and a Run command is input, the Speed Command will be the last output frequency memorized by the Acc / Dec Ramp Hold function, if the Acc / Dec Ramp Hold input is still closed.

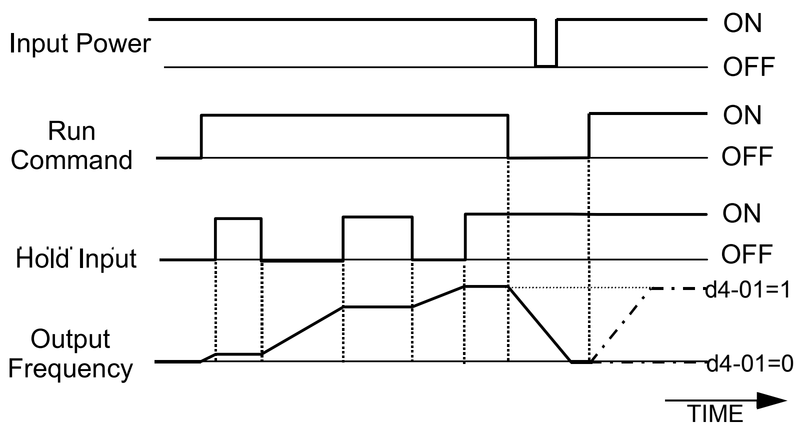


Figure 43. Accel / Dec Ramp Hold Function Timing Diagram

■ Function: Term A2 Enable (Setting: C)

Any digital input configured as Term A2 Enable (H1-0x = C) when open will cause the input to analog input A2 to be ignored.

If analog input A2 is configured as the Main Reference (H3-13 = “1: Main Fref TA1”), then the Term A2 Enable input will have no effect.

■ Function: Term Not Used (Setting: F)

Any digital input programmed as Term Not Used (H1-0x = F) will have no function assigned to it and it’s OPEN / CLOSED state will not matter to the drive’s operation.

■ Function: MOP Increase (Setting: 10)

■ Function: MOP Decrease (Setting: 11)

Using two digital inputs, the iQpump drive can operate with the same type of functionality as a motor operated potentiometer (MOP). One digital input can be programmed as an MOP Increase input (H1-0x = 10) and another digital input can be programmed as an MOP Decrease input (H1-0x = 11). This MOP functionality is also commonly referred to as Floating Point Control, Incremental Control or UP and DOWN Control since closing the MOP Increase input will cause the speed command to increase and closing the MOP Decrease input will cause the speed command to decrease.

If both the MOP Increase and the MOP Decrease are closed or open simultaneously, the speed will command will not change. The speed command will change at the active acceleration or deceleration rate.

MOP Increase cannot be programmed without also programming the MOP Decrease (or vice versa) else an OPE03 fault will occur. Setting the MOP Increase / Decrease function while the Acc / Dec RampHold function is programmed into other digital inputs will also cause an OPE03 fault.

Once the MOP function is programmed the preset speeds are disabled and the analog speed command input becomes a potential frequency reference lower limit. The lower limit of the MOP function is the greater of the analog speed command and the programmed frequency reference lower limit (d2-03). Once a Run command is issued the iQpump drive will accelerate immediately to the lower limit. The upper limit will be the Frequency Reference Upper Limit (d2-01), if used, otherwise the Maximum Frequency (E1-04).

The status of the d4-01 parameter (MOP Reference Memory) will affect the performance of the iQpump drive after power is cycled to the iQpump drive and a fresh Run command is issued. If d4-01 = “0: Disabled,” the Run command will cause the iQpump drive to ramp to the frequency reference lower limit. However, if d4-01 = “1: Enabled,” the Run command will cause the iQpump drive to ramp to the last speed commanded by the MOP function before the Run command was removed and the power cycled. Even if d4-01 = “1: Enabled,” the previous speed command can be reset to the frequency reference lower limit automatically by closing either the UP or Down input without having a Run command active.

Important: Be sure to set b1-01 = "1: Terminals," (Auto Setpoint = Terminals) if the MOP function is to be used. If b1-01 = "0: Operator," then the MOP is disabled even if it is programmed. The Jog inputs have priority over the MOP function.

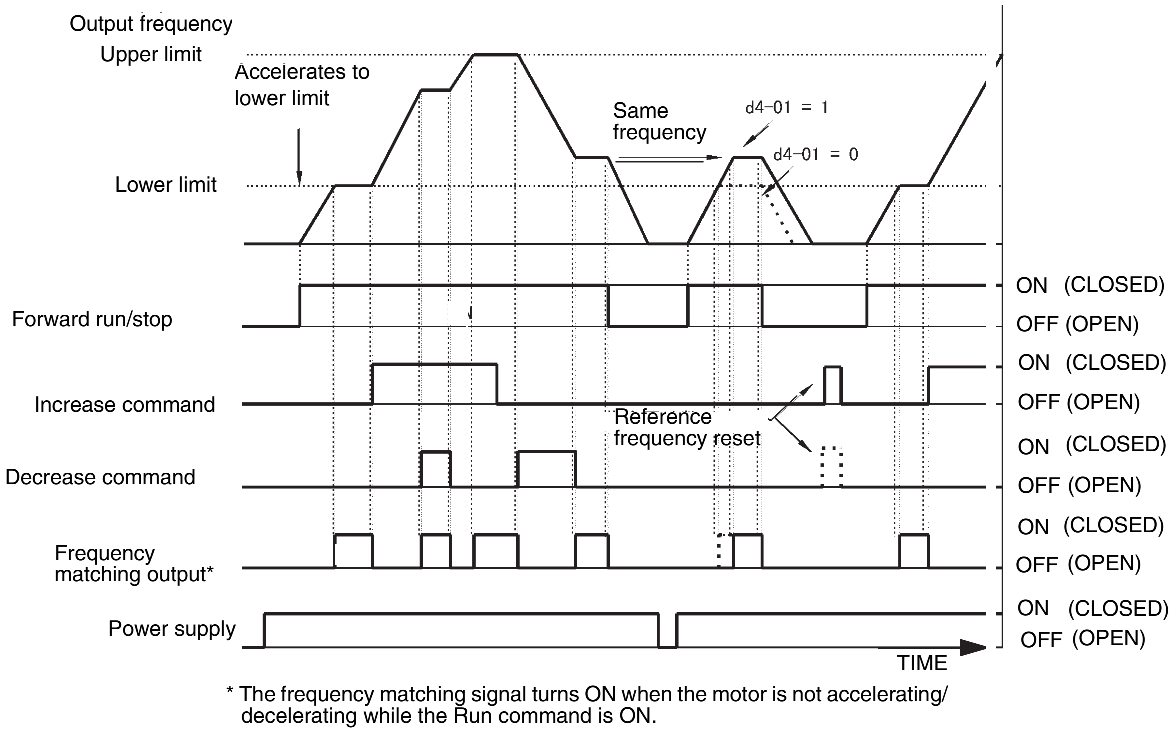


Figure 44. Floating Point Control Time Chart

■ Function: Fault Reset (Setting: 14)

Whenever the iQpump drive detects a fault condition, the fault output contact will close and the drive's output will shut OFF causing the motor to coast (specific stopping methods can be selected for some faults such as L1-04 for motor overheat). Once the Run command is removed, the fault can be reset by either the RESET key on the digital operator or by closing a digital input configured as a Fault Reset (H1-0x = 14).

■ Function: Fast Stop N.O. (Setting: 15)

■ Function: Fast Stop N.C. (Setting: 17)

The Fast Stop function operates much like an emergency stop input to the drive. While in the Run mode, if a Fast Stop is input to the iQpump drive (CLOSED for H1-0x = 15 or OPEN for H1-0x = 17), the iQpump drive will decelerate to a stop with the deceleration time determined by C1-09 (Fast Stop Time). The Run command can remain closed during the Fast Stop operation. The iQpump drive will not run, from either the terminals or the digital operator, while the Fast Stop is being input to the drive. To restart the drive, the Fast Stop input must be removed and the Run command must be cycled.

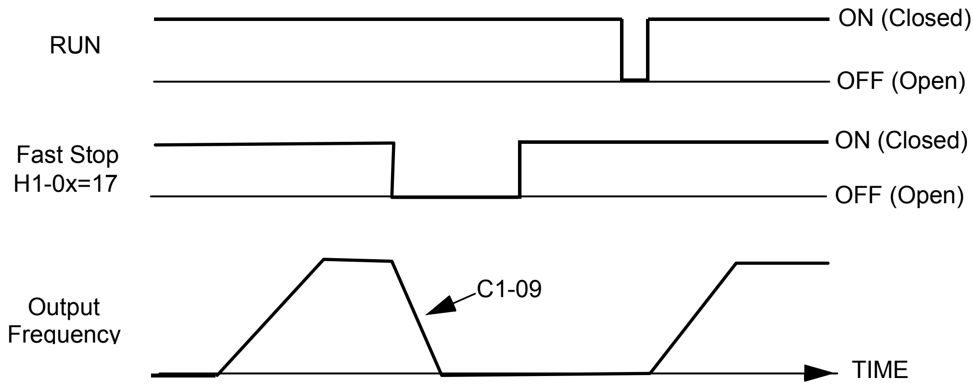


Figure 45. Fast Stop Commands Time Chart

Important: Be aware that during rapid deceleration the iQpump drive may fault on an over voltage condition. When faulted, the iQpump drive output shuts off allowing the motor to coast. The result is an uncontrolled motor state. Therefore, be sure to set an acceptable deceleration time in parameter C1-09 when using the fast stop feature.

■ Function: Timer Function (Setting: 18)

The Timer Function works independently from the drive. For Timer operation a digital input must be configured for a Timer Function start (H1-0x = 18), a digital output must be configured as a Timer Function output (H2-0x = 12), and the Timer Function ON-Delay and OFF-Delay parameters (b4-01 and b4-02, respectively) must be programmed.

Once the applicable parameter are programmed the Timer Function start digital input must be closed at least as long as the setting of b4-01 before the Timer Function output will close. The Timer Function input must be open for at least as long as the setting of b4-02 before the Timer Function output will reopen.

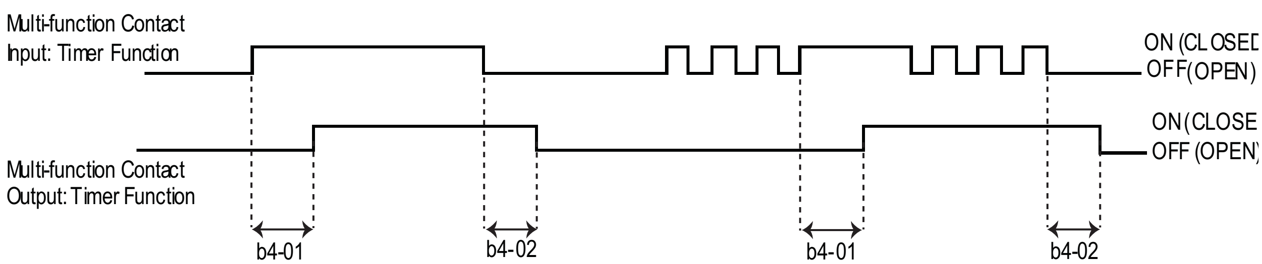


Figure 46. Timer Function Time Chart

■ Function: Program Lockout (Setting: 1B)

A Program Lockout digital input will allow changing of parameter values when it is open but prevent changing of any iQpump drive parameter value except the Speed Command when it is closed. Parameter values can be viewed even when a Program Lockout is active.

■ Function: PI Disable (Setting: 19)

When the PI Function has been enabled by b5-01 (PI Mode Selection), it can be indefinitely disabled by closing a digital input configured as a PI Disable input (H1-0x = 19). When disabled, the iQpump drive operates as a standard drive that does not have PI enabled.

■ Function: External Fault (Setting: 20 through 2F)

External Fault functionality can be programmed into the digital inputs of the drive. The External Fault inputs can be used to signal to the iQpump drive that other equipment related to the operation of the iQpump drive has experienced problems. If the External Fault is input to the iQpump drive the digital operator will display as shown in the illustration below:

The x in EFx and Sx represent the terminal number of the digital input that the fault was received on.

```
-DRIVE-              Rdy

          EFx

      Ext Fault Sx
```

To program an External Fault the value input into the H1-0x parameter will determined by:

- Contact type wired to the terminal (Normally Open or Normally Closed)
- Detection profile (Always Detected or Only Detected while Running)
- Drive operation after fault (Stopping Method or Continue Operation)

The following table shows the programming choices.

Table 24 Programming Choices

Set Value	Input Contact Type		Detection Mode		Stopping Method			
	N.O. contact	N.C. contact	Always Detected	Detected while Running	Decel to stop (major fault)	Coast to stop (major fault)	Fast stop (major fault)	Continue operation (minor fault)
20	X		X		X			
21		X	X		X			
22	X			X	X			
23		X		X	X			
24	X		X			X		
25		X	X			X		
26	X			X		X		
27		X		X		X		
28	X		X				X	
29		X	X				X	
2A	X			X			X	
2B		X		X			X	
2C	X		X					X
2D		X	X					X
2E	X			X				X
2F		X		X				X

■ Function: PI Integral Reset (Setting: 30)

By configuring one of the digital inputs as an Integral Reset Input, (H1-0x = 30), the value of the integral component of PI control can be reset to zero whenever the configured input is CLOSED. The integral component of PI control will be held at zero as long as the configured digital input is held CLOSED.

Resetting the Integral component of PI control can be useful in cases where an excessively large Integral value prevents the PI control from responding quickly to changes in the system being regulated by the iQpump drive (e.g. duct pressure, water temperature).

Function: PI Integral Hold (Setting: 31)

By configuring a digital input as an Integral Hold input (H1-0x = 31), the value of the Integral component of the PI control can be forced to clamp at the value it was at when the input is CLOSED. The Integral component of the PI control returns to accumulating error when the digital input is OPEN again.

Holding the Integral Value can be useful during periods when the error can build up naturally, such as during long accelerations. Not allowing Integral windup produces a more stable PI control.

■ Function: PI SFS Cancel (Setting: 34)

SFS means softstart, also referred to as accel / decel in this description.

By configuring a digital input as a PI SFS (softstart) Cancel input (H1-0x = 34), the operator will be able to use a contact closure to remove the acceleration and deceleration times that are applied to changes in the PI Setpoint by the b5-17 parameter. If the digital input configured as PI SFS Cancel is closed, the PI Setpoint Accel / Decel (Parameter b5-17) will be ignored. Immediate updating of any change to the setpoint will apply.

■ Function: Input Level Sel (Setting: 35)

When using the PI Function built into the drive, the chosen setpoint is compared with the measured feedback. The difference is called the Error. The proportional and integral function are applied to this error. For some applications it may be appropriate to invert the input to the PI block. This can be accomplished by setting one of the digital inputs up as an Input Level Sel (H1-0x = 35). When an Input Level Sel digital input is closed the Error will be inverted before it is passed to the PI block.

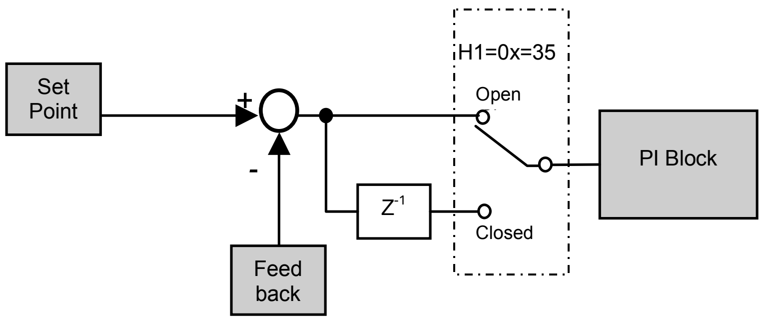


Figure 47. PI Error signal Inversion Block Diagram

■ Function: Option / Inv Sel 2 (Setting: 36)

The Option / Inv Selection function allows the user to switch the source of the Run and speed command between the drive's terminals and optional communication card. When a digital input is programmed for the Option / Inv Selection 2 function (H1-0x = 36) that input will function as follows:

Table 25 Programming Choices

Option / Inv Function Input Status	Run and Speed Command Source
CLOSED	From the Communications Option Card
OPEN	From the control circuit and analog input terminals

To switch the command source between the option card and the terminals be sure to program the following parameters:

- Set b1-01 (Frequency Reference Selection) to 1 (Terminals).
- Set b1-02 (Run Command Selection) to 1 (Terminals).
- Set H1-0x (Input Terminal Function Selection) to 36.

Important: Switching the Reference and RUN sources can only be done while the iQpump drive is stopped.

■ Function: Motor Pre-heat (Setting: 60)

In order to prevent condensation on the motor windings, a DC current can be circulated through the windings. The heat produced by the current in the windings will prevent the moisture from condensation on the wire. Motor pre-heating can only be initiated by closing a digital input programmed as a Motor Pre-heat input (H1-0x = 60). The level of the DC current used by the Motor Pre-heat function is determined by parameter b2-09.

A Run input will be given priority over a Motor Pre-heat input. When the Run command is removed, if the Motor Pre-heat input is still closed, the motor pre-heating will resume.

■ Function: Speed Search 1 (Setting: 61)

■ Function: Speed Search 2 (Setting: 62)

■ Function: Speed Search 3 (Setting: 64)

Table 26 Digital Input Functions

Setting of b3-01	Speed Search Method Used for Multi-function inputs
0	Speed Estimation
1	
2	Current Detection
3	

The Speed Search function can be turned on for all starts with parameter b3-01. If, however, it is beneficial to only use Speed Search at certain starts, a digital input can be programmed to turn on Speed Search only when it is closed.

Speed Search 1 will start searching for the rotor speed from the maximum frequency (E1-04). Speed Search 2 will begin searching for the rotor speed from the existing Speed Command. Speed Search 3 will cause the motor to baseblock when the switch is open and then perform Speed Search when it closes.

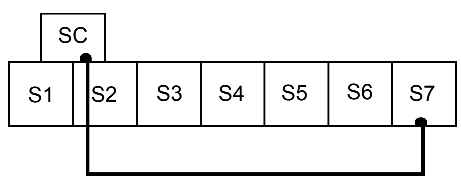
In all cases the form of Speed Search, Speed Estimation or Current Detection, is determined by the setting of b3-01. If b3-01 = "0: SpdsrchF Disable," then the Speed Estimation form of Speed Search is used. If b3-01 = "2: SpdsrchI Disable," then the Current Detection form of Speed Search is used.

■ Function: Comm Test Mode (Setting: 67)

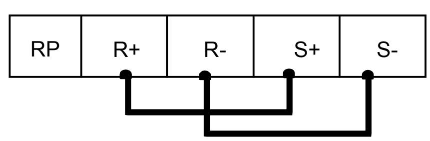
The iQpump drive has a built-in function for self-diagnosing the serial communications operation. The test involves wiring the send and receive terminals of the RS-485 / 422 port together. The iQpump drive transmits data and then confirms the communications are received normally.

In order to perform the serial communications self-diagnosis, terminal S7 must be programmed as the Comm Test Mode digital input (H1-05 = "67: Com Test Mode") and then power removed from the iQpump drive and the following steps performed:

1. Wire the S7 and SC terminals of the control circuit terminals together



2. Wire the R+ and S+ terminals of the RS-485 / 422 port together
3. Wire the R- and S- terminals of the RS-485 / 422 port together



4. Turn On the terminating resistance (Move Switch 1 of Dip Switch 1 to the ON position).

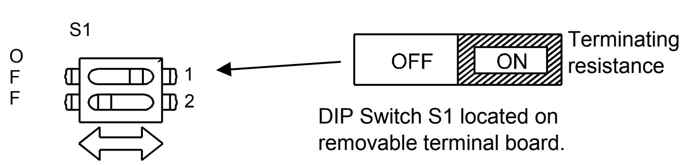


Figure 48. DIP Switch Setting for Terminating Resistor

5. Turn on power to the drive.

After step 5 above the iQpump drive will either display "Pass" if everything is okay or a CE alarm will be displayed. If the CE alarm occurs, the fault output contact will energize.

■ Function: Drive Enable (Setting: 6A)

A digital input configured as an iQpump drive Enable input (H1-0x = 6A) will prevent the iQpump drive from executing a Run command until it is closed. When the iQpump drive Enable input is open the digital operator will display:

-DRIVE-

DNE

Drive Not Enable

If a Run command is closed prior to the iQpump drive Enable input being closed the iQpump drive will not run until the Run command is cycled.

If the iQpump drive Enable input is opened while the iQpump drive is running, the iQpump drive will stop, using the method set by parameter b1-03.

■ Function: Com / Inv Sel (Setting: 6B)

■ Function: Com / Inv Sel 2 (Setting: 6C)

The Com / Inv Selection function allows the user to switch the origin of the Run and speed command between the drive's terminals and the RS-485 / 422 port (and the embedded communication protocols) on the removable terminal board. When a digital input is programmed for the Com / Inv Selection function (H1-0x = 6B) that input will function as follows:

Table 27 6B, COM / INV SEL

Option / Inv Function Input Status	Run and Speed Command Source
OPEN	From the control circuit and analog input terminals (follows b1-01)
CLOSED	From Serial Comm port (R+, R-, S+, and S-) (embedded protocols)

To switch the command source between the serial communication port and the control circuit terminals be sure to program the following parameters:

- Set b1-01 (Auto Setpoint Reference Selection) to 1 (Terminals).
- Set b1-02 (Run Command Selection) to 1 (Terminals).
- Set H1-0x (Input Terminal Function Selection) to 6B or 6C.

The Com / Inv Sel 2 function will operate the same way except the logic is reversed. When a digital input is programmed for the Com / Inv Selection function (H1-0x = 6C) that input will function as follows:

Table 28 6C, COM / INV SEL 2

Option / Inv Function Input Status	Run and Speed Command Source
OPEN	From Serial Comm port (R+, R-, S+, and S-) (embedded protocols)
CLOSED	From the control circuit and analog input terminals (follows b1-01)

Important: Switching the Reference and Run sources can only be done while the iQpump drive is stopped.

■ Function: Low City Press (Setting: 73) <0034>

Indicates pressure status on the inlet to the pump. Function logic depends on parameter P4-21 (Low City Pressure Input Select).

■ Function: Reset Accum (Setting: 75) <0034>

Closed: Volume accumulated will be reset to zero (and held at zero if digital input remains closed).

■ Function: High Water Level (Setting: 76) <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

Function: Hand Mode (Setting: 80)

A digital input can be configured to operate the drive in the hand mode from an external contact as a Hand Mode command (H1-0x = 80).

In conjunction with the digital input programmed to hand mode, the run command source has to be programmed to 1 (b1-02 = 1: Terminals).

The multi-function digital input terminal S6 is programmed for Hand Mode as a factory default (H1-04 = 80).

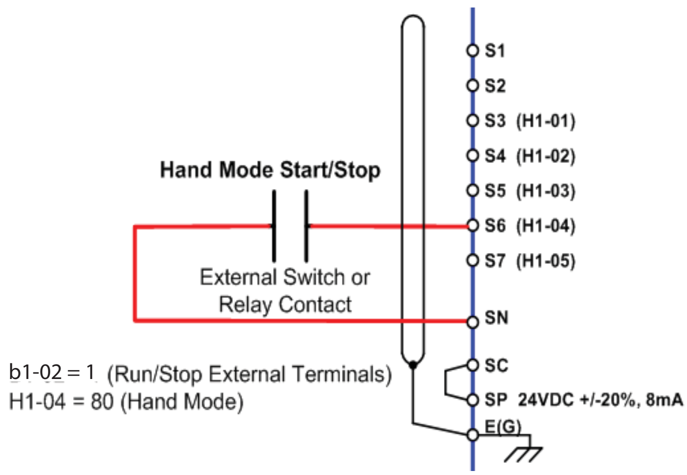


Figure 49. Connection Diagram for External Hand Mode Contact (b1-02 = 1)

■ Function: Disable Sleep Mode (Setting: 81)

A digital input can be configured to enable or disable the Sleep Mode (H1-0x = 81). The Sleep Mode is only active when the drive is in the Auto Mode. A contact closure into the multi-function digital input will disable the Sleep Mode. Also, the Feedback Drop Detection and Over Cycle Protection will also be disabled. When the digital input is open, the Sleep Mode, Feedback Drop Detection and Over Cycle Protection will be enabled.

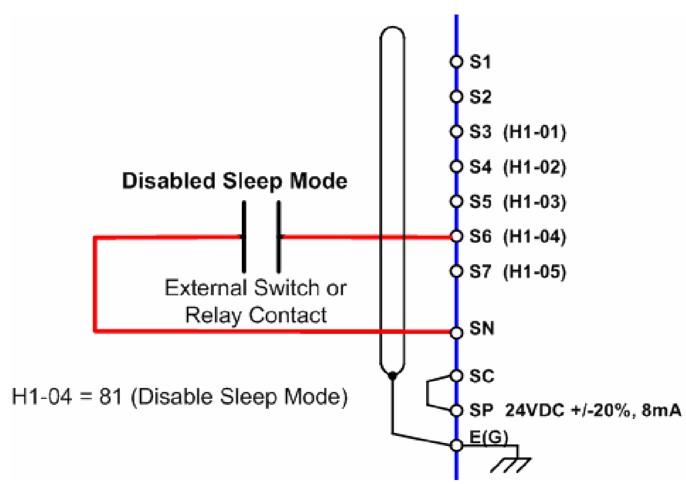


Figure 50. Wiring Diagram

■ Function: Activate Sleep (Setting: 82)

A digital input can be configured to activate the Sleep Mode (H1-0x = 82) when the drive is operating in the Auto Mode. A contact closure into the multi-function digital input will cause the drive to go to sleep for the time specified by the Sleep Delay Time (P2-03). When the digital input is open, the drive will return to normal operation. Refer to the P2 group for further description of the Sleep function.

Note: Oscillation can occur if Sleep is activated by using the digital input and Sleep Feedback Drop Detection is enabled and detected. It is recommended to disable Sleep Feedback Drop Level (P2-04) or program a long Sleep Delay Time (P2-03) and a large Delta Sleep Feedback Drop Level (P2-04).

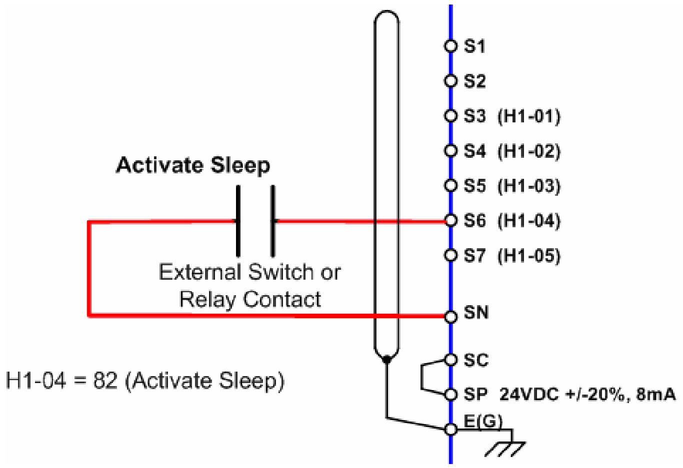


Figure 51. Wiring Diagram

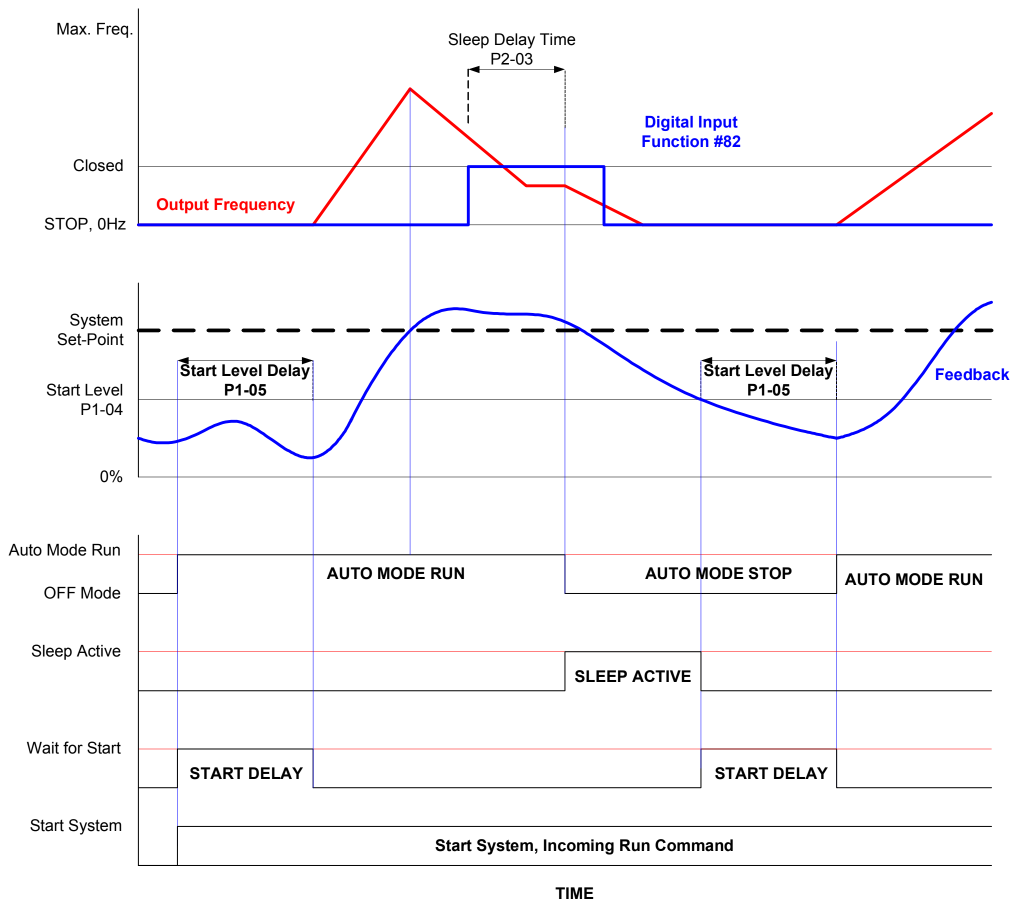


Figure 52. Timing Chart

■ Function: Thermostat Fault (Setting: 83)

A digital input can be configured to indicate a Thermostat Fault from an external contact (H1-0x = 83). A contact closure into the multi-function input will enable the Thermostat Fault. After an initiation of a Thermostat Fault, to disable the Thermostat Fault requires a open digital input contact, the drive run command to be open and reset the Thermostat Fault via the drive's reset button or fault reset input.

Note: An OPE12 fault will occur if H1-xx = 83 and 87. H1-xx cannot be programmed to “83” and “87” at the same time.

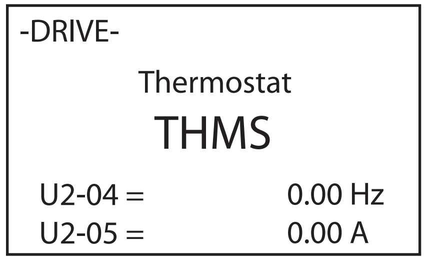


Figure 53. Thermostat Fault on Operator

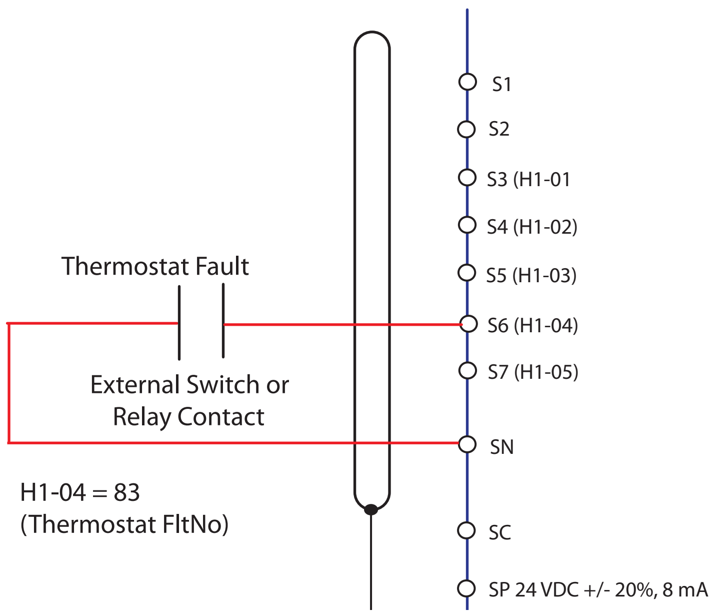


Figure 54. Wiring Diagram

■ Function: Disable Pre-charge (Setting: 84)

A digital input can be configured to enable or disable the Pre-charge function (H1-0x = 84). A contact closure into the multi-function digital input will disable the Pre-charge function independent of the value programmed into the Pre-charge Time (P4-03). When the digital input is open, the Pre-charge function is enabled.

■ Function: Low Water Level (Setting: 85)

A digital input can be configured to indicate a Low Water Level Fault (H1-0x = 85). The Low Water Level input can be configured as a normally open or normally closed contact by programming the Water DI Config (P1-15). When P1-15 = 0 or 2, a Low Water Level Fault will occur when the contact is closed (normally open). An open contact will indicate the drive is operating under normal operating conditions.

When P1-15 = 1 or 3, a Low Water Level Fault will occur when the contact is open (normally closed). A closed contact will indicate the drive is operating under normal operating conditions.

If the Pre-charge function is activated, the Low Water Level will not cause a Low Water Level Fault. The Low Water Level will only indicate that the Pre-charge function has been completed.

If the drive is operating under normal operating condition and a Low Water Level occurs, the drive will indicate a Low Water Level Fault (LFB / LW) on the digital operator.

To reset the Low Water Level Fault would require the removal of the run command, initiate a fault reset, and restart the drive using the Pre-charge function.

IMPORTANT: **<0034>**
Program P1-15 to 0 or 2 when the “Low Water” function is not used.

Note: Low Water Level Fault is only active in the Auto Mode and inactive during the Pre-charge function.

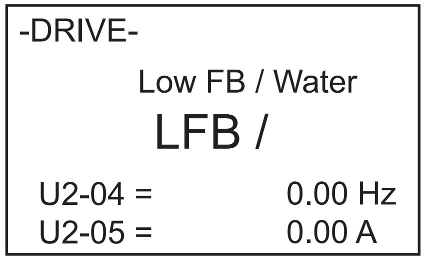


Figure 55. Lower Water Fault on Operator

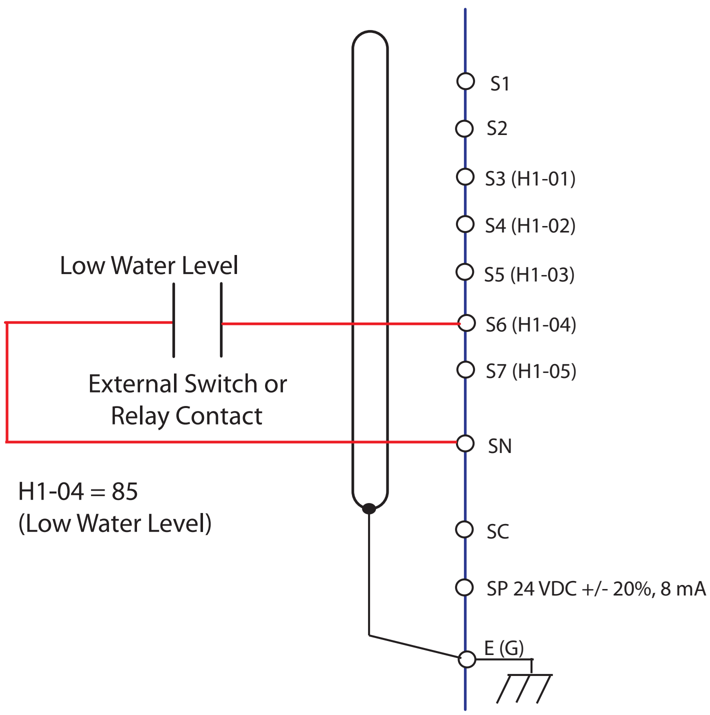


Figure 56. Wiring Diagram

■ Function: Fixed Speed Auto (Setting: 86)

A digital input can be configured to enable the Fixed Speed Auto (H1-0x = 86) when operating in the Auto Mode. A contact closure into the multi-function input will enable the Fixed Speed Auto function.

The Fixed Speed Auto will cause the drive to run at the iQpump drive Multi / Maximum Level (P3-02) and disable the PI Control, Sleep Mode and Lead / Lag operation.

When the digital input is open, the Fixed Speed Auto is disabled.

Note: Pre-charge and Thrust Bearing functions have a higher priority than Fixed Speed Auto.

■ Function: Thermostat Fault (Setting:87) <0032>

A digital input can be configured to indicate a Thermostat Fault from an external contact (H1-0x = 87). An open contact into the multi-function input will enable the Thermostat Fault. After an initiation of a Thermostat Fault to disable the Thermostat Fault requires a closed digital input contact, the drive run command to be open and reset the Thermostat Fault via the drive's reset button or fault reset input.

Note: An OPE12 fault will occur if H1-xx = 83 and 87. H1-xx cannot be programmed to "83" and "87" at the same time.

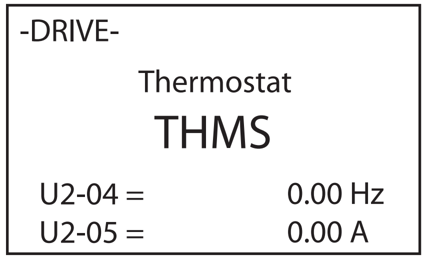


Figure 57. Thermostat Fault on Operator

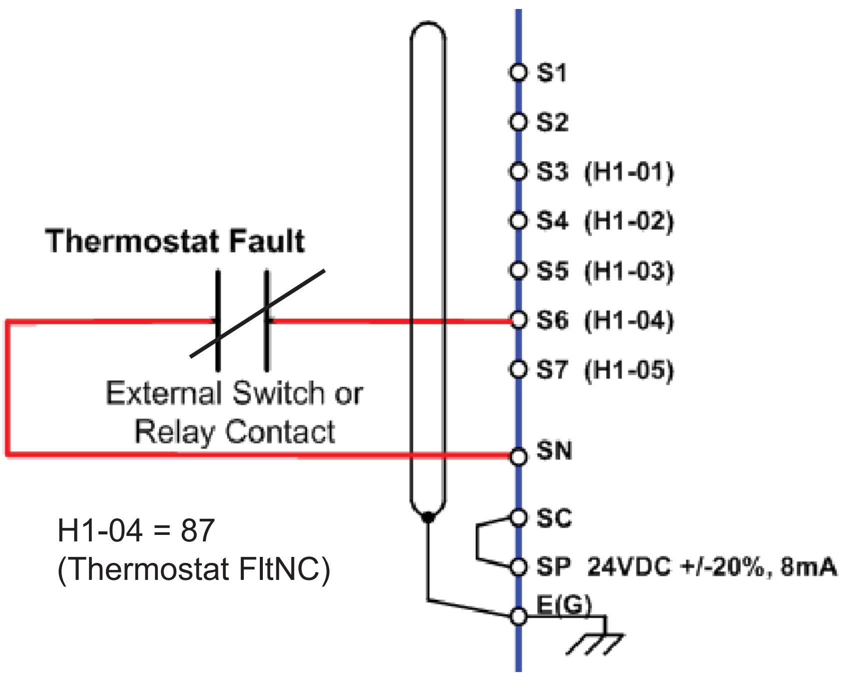


Figure 58. Wiring Diagram

◆ Time Delayed External Fault(s)

Allow all external faults to have a settable time delay.

- An "On-Delay" timer will be applied to the external fault if it is "Normally Open".
- An "Off-Delay" timer will be applied to the external fault if it is "Normally Closed".
- If the external fault is set to "During Run", the time delay will start after a run command is received.

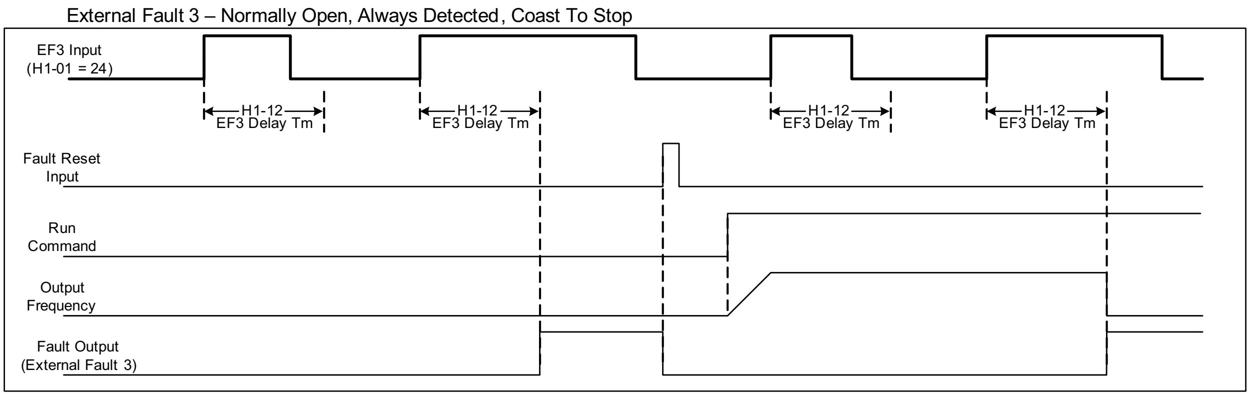


Figure 59. External Fault 3 - Normally Open, Always Detected, Coast To Stop

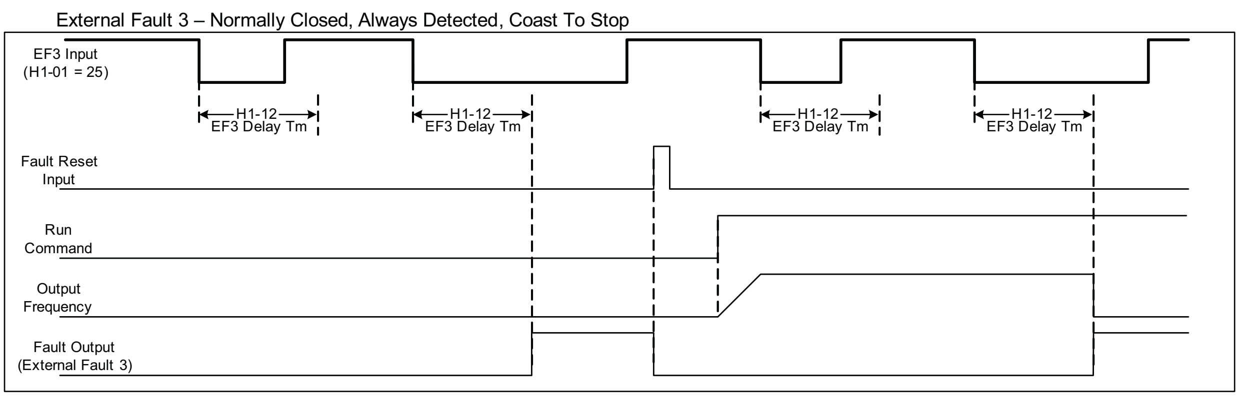


Figure 60. External Fault 3 - Normally Closed, Always Detected, Coast To Stop

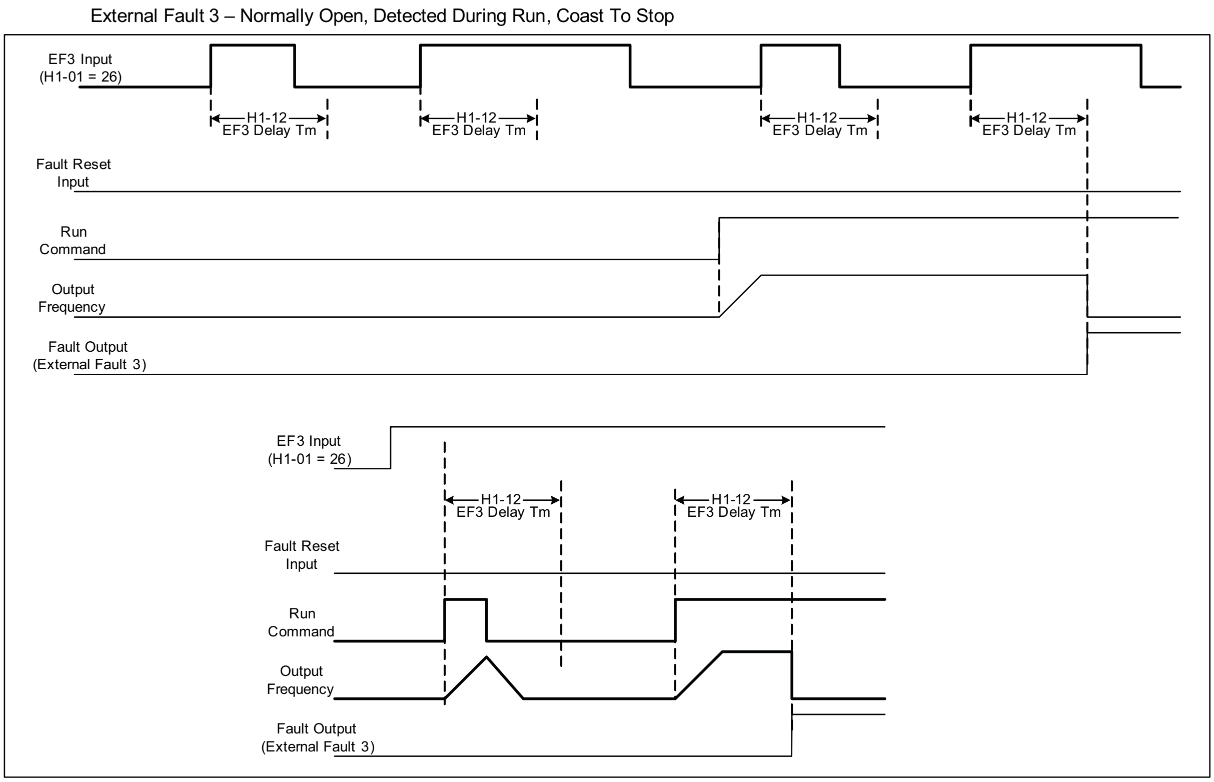


Figure 61. External Fault 3 - Normally Open, Detected During Run, Coast To Stop

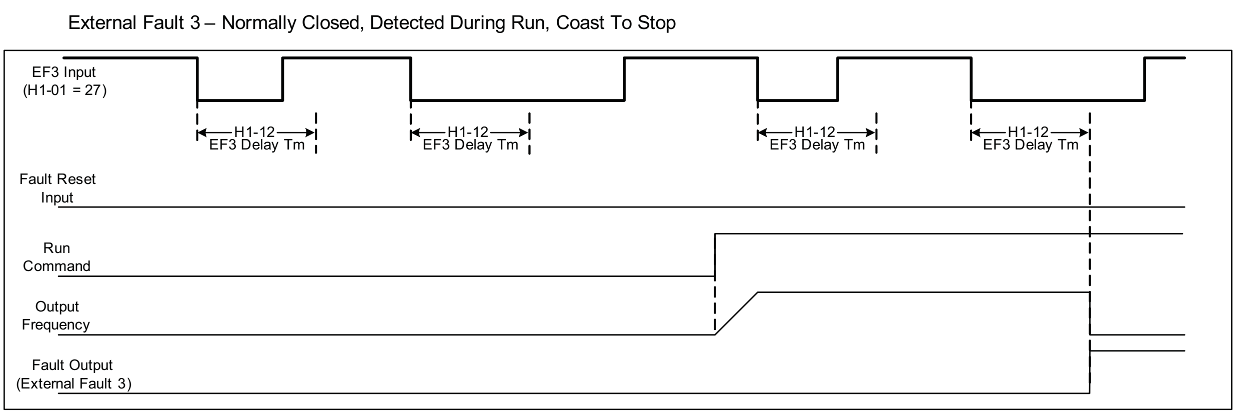


Figure 62. Normally Closed, Detected During Run, Coast To Stop

H2 Digital Outputs

◆ Terminal Function Selections

Parameter No.	Parameter Name
H2-01	Terminal M1-M2 Function Selection
H2-02	Terminal M3-M4 Function Selection

Setting Range: 0 ~ 57

Factory Defaults: H2-01 = "40: Pump 2 Control"
H2-02 = "41: Pump 3 Control"

The iQpump drive has two multi-function outputs. By programming parameters H2-01 and H2-02, the user can assign specific functions to each output. Below is a table with a complete list of all of the digital output functions. Because the iQpump drive is a dedicated pump controller, the digital outputs described in this section only relate to the pump specific functions. Following the table is a more detailed description of each of the pump related functions.

Table 29 Digital Output Functions

Parameter setting	Function	Parameter setting	Function
0	During Run1	3B	Run from Serial Com
1	Zero Speed	3D	Cooling Fan Err
2	FREF / FOUT Agree 1	40	Pump 2 Control
3	FREF / Set Agree 1	41	Pump 3 Control
4	Frequency Detect 1	42	Pump Fault
5	Frequency Detect 2	43	Mot 2 Alternate
6	Drive Ready	44	Sleep Active
7	DC Bus Undervoltage	45	Start Lvl Delay
8	Baseblock 1	46	Thrust Bearing
9	Option Reference	47	Pre-charge
A	Remote Operation	48	High Feedback
B	Torque Detect 1 N.O.	49	Low Feedback
C	Loss of Reference	4A	Transducer Loss
E	Fault	4B	Setpoint Not Met
F	Terminal Not Used	4C	Loss of Prime
10	Minor Fault	4D	Thermostat Fault
11	Reset Cmd Active	4E	Low Flow
12	Timer Output	4F	Accum Level
17	Torque Detect 1 N.C.	50	Utility Delay
1A	Reverse Direction	51	Run / Stop-Stop
1E	Restart Enabled	52	Run / Stop-Finish
1F	Overload (OL1)	53	Anti-Jam / De-Scale
20	OH Pre-alarm	54	During Run 2
38	Drive Enable	55	Lube Pump
39	Drive Waiting	56	High Flow
3A	Frequency Reduced, OH	57	Low Water Level

Table 30 Parameters <0034>

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
H2-01	40B	Terminal M1-M2 Function Selection **Terminal M1-M2 Sel**	Selects the functionality of the M1-M2 digital output contacts.	0 ~ 57	40	Programming
H2-02	40C	Terminal M3-M4 Function Selection **Terminal M3-M4 Sel**	Selects the functionality of the M3-M4 digital output contacts.	0 ~ 57	40	Programming

Table 31 Multi-Function Output Setting <0034>

Setting	Description
44	**Sleep Active** Closed: Drive is in the sleep mode.
45	**Start Lvl Delay** 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** Closed: The Thrust Bearing feature is active (output frequency is between zero and P4-05).
47	**Pre-charge** 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** Closed: During a "High FB / Water: Fault OR Closed: During a "High Feedback" Alarm.
49	**Low Feedback** Closed: During a Low FB / Water Fault OR Closed: During a "Low Feedback" Alarm
4B	**Setpoint Not Met** Closed: During an "NMS - Setpoint Not Met" Fault
4C	**Loss of Prime** Closed: During an "LOP - Loss Of Prime" Fault
4D	**Thermostat Fault** Closed: Thermostat Fault is present
54	**During Run 2** Closed: Whenever the drive is outputting voltage to the motor (not base-blocked).

■ Function: During Run 1 (Setting: 0)

A "During Run 1"output will close whenever the Run command is provided and the iQpump drive is outputting voltage. This will include deceleration and DC Injection.

■ Function: Zero Speed (Setting: 1)

The "Zero Speed" output will close whenever the output frequency falls below the Minimum Frequency (E1-09).

■ Function: Fref / Fout Agree 1 (Setting: 2)

The "Fref / Fout Agree 1" output will close whenever the actual output frequency is within the Speed Agree Width (L4-02) of the current Speed Command regardless of the direction.

■ Function: Fref / Set Agree 1 (Setting: 3)

The "Fref / Set Agree 1" output will close whenever the actual output frequency and the Speed Command are within the Speed Agree Width (L4-02) of the programmed Speed Agree Level (L4-01).

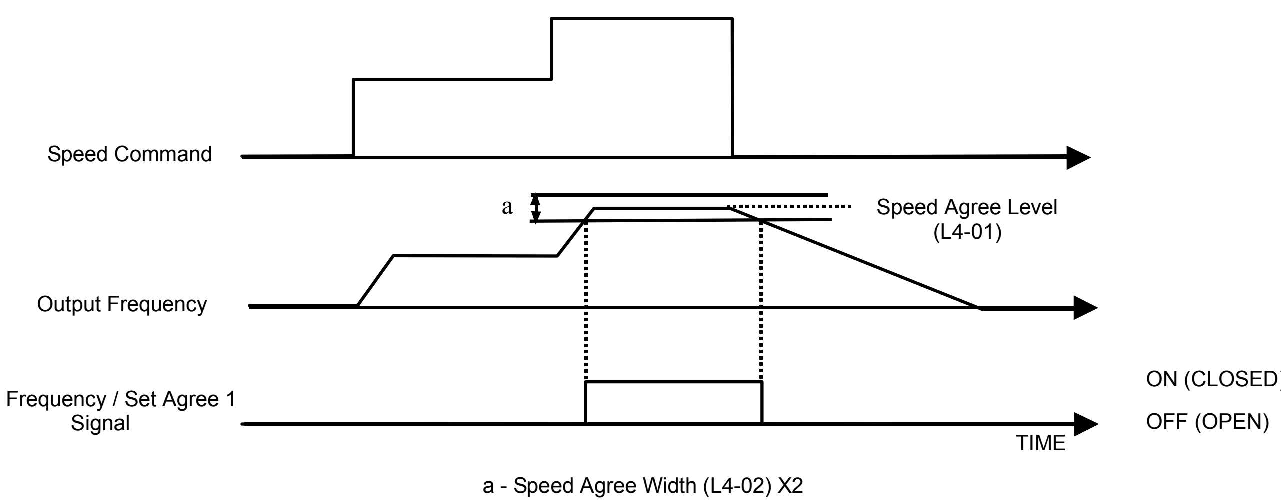


Figure 63. Fref / Set Agree 1 Timing Diagram

■ Function: Freq Detect 1 (Setting: 4)

A “Freq Detect 1” output will be closed whenever the output frequency is equal to or below the value of the programmed Speed Agree Level (L4-01). The Speed Agree Width (L4-02) is the hysteresis to the Freq Detect 1 function. Whenever the output frequency approaches the Speed Agree Level while accelerating it will need to be equal to or exceed the Speed Agree Level (L4-01) plus the Speed Agree Width (L4-02) before the Freq Detect 1 output will energize.

As the output frequency approaches the Speed Agree Level while decelerating, the Freq Detect 1 output will de-energize exactly at the Speed Agree Level.

The Freq Detect 1 function is effective during both forward and reverse operation.

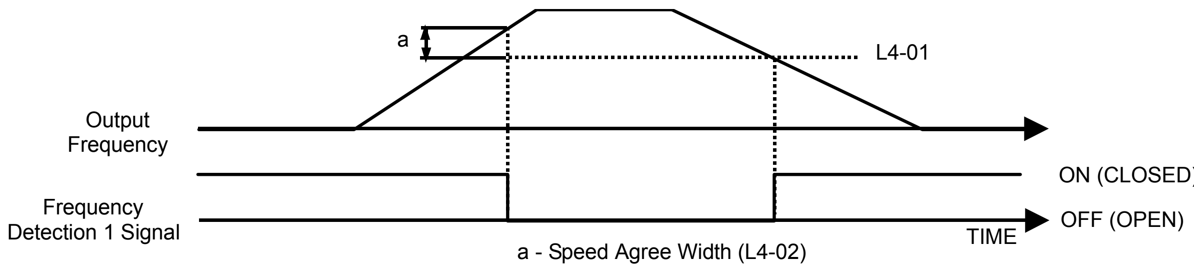


Figure 64. Freq Detect 1 Timing Diagram

■ Function: Freq Detect 2 (Setting: 5)

A Freq Detect 2 output will be closed whenever the output frequency is equal to or above the value of the programmed Speed Agree Level (L4-01). The Speed Agree Width (L4-02) is the hysteresis to the Freq Detect 2 function. Whenever the output frequency approaches the Speed Agree Level (L4-01) while accelerating it will de-energize exactly at the Speed Agree Level.

As the output frequency approaches the Speed Agree Level while decelerating, the Freq Detect 2 output will de-energize when the output frequency is equal to or below the Speed Agree Level (L4-01) minus the Speed Agree Width (L4-02).

The Freq Detect 2 function is effective during both forward and reverse operation.

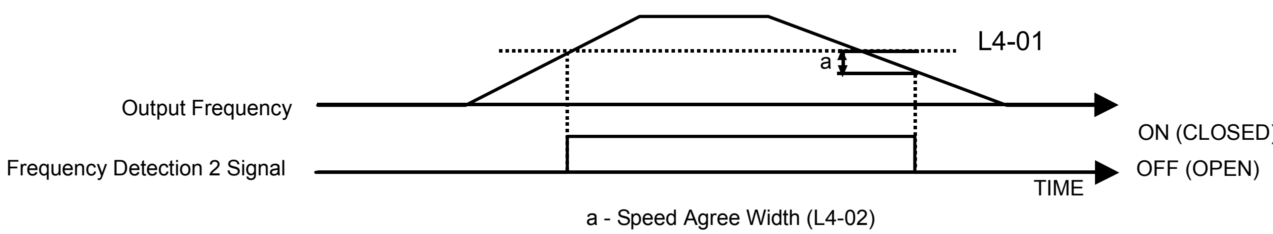


Figure 65. Freq Detect 2 Timing Diagram

■ Function: Inverter Ready (Setting: 6)

The Inverter Ready output will be closed whenever the iQpump drive is not in a fault state and not being programmed. If b1-08 = “1: Enabled,” an iQpump drive that is in an active Run state that is also being programmed will have the Inverter Ready output closed.

■ Function: DC Bus Undervolt (Setting: 7)

The DC Bus Undervolt output will close whenever the main circuit DC Bus voltage or control circuit power supply drop below their respective trip level. The undervoltage trip level is determined by parameter L2-05. An open soft charge contactor answer back signal will also cause the DC Bus Undervolt output to close.

■ Function: BaseBlk 1 (Setting: 8)

A BaseBlk 1 programmed output will close to indicate that the iQpump drive is in baseblocked state. While in a baseblock state the drive’s output transistors are prevented from firing. A BaseBlk 1 output contact can also serve as notice that the iQpump drive has a charged DC Bus, no fault and can start at any time.

■ Function: Option Reference (Setting: 9)

When an output is configured as an Option Reference output, the output will close to show that the speed command is being sourced from the digital operator. If the Option Reference output is open, it indicates the speed command is coming from the control circuit terminals or an optional communications card.

■ Function: Remote / Auto Operation (Setting: A)

When an output is configured as a Remote Operation output, the output will close to show that the Run command is being sourced from the digital operator. If the Remote Operation output is open, it indicates the Run command is coming from the control circuit terminals or an optional communications card.

■ Function: Trq Det 1 N.O. (Setting: B)

The Trq Det 1 function ties a digital output to the overtorque / undertorque sensing capabilities of the drive. If a digital output is configured as Trq Det 1 N.O., whenever the output current differs from the level of L6-02 for at least the length of time set in L6-03, the digital output will close.

The torque detection function has a built-in hysteresis of 10% of the iQpump drive rated output current.

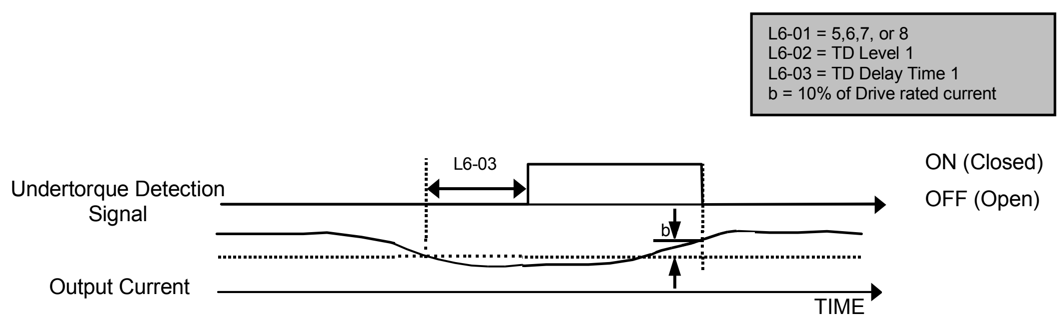


Figure 66. Trq Det 1 N.O. Timing Diagram

■ Function: Loss of Reference (Setting: C)

The Loss of Reference configured digital output will close when the iQpump drive has detected a loss of the analog speed command. The speed command is considered lost when the voltage level drops 90% in 0.4 seconds. Parameter L4-05 determines the drive's reaction to a loss of reference state in addition to turning on the Loss of Reference digital output.

The Loss of Reference digital output will only initiate if the iQpump drive is configured for the speed command to be via one of the analog inputs (A1 or A2).

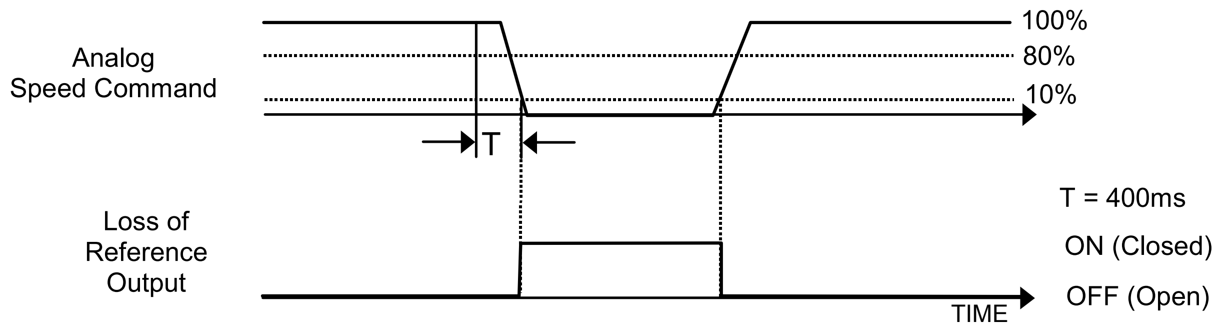


Figure 67. Loss of Reference Function Characteristics

■ Function: Fault (Setting: E)

The Fault configured digital output will close whenever the iQpump drive experiences a major fault with the exception of the CPF00 and CPF01 (Digital Operator Communications Faults).

■ Function: Not Used (Setting: F)

The Not Used setting can be used to disable the digital output.

■ Function: Minor Fault (Setting: 10)

A Minor Fault, also referred to as an alarm, indicates that a condition exists that may be critical to the iQpump drive or application but does not require the iQpump drive to stop. A minor fault will be flashed on the digital operator but neither the Fault output (MA-MB) nor any digital output configured as a Fault output (H2-0x = E) will close. Any digital output configured as Minor Fault will close whenever a minor fault of alarm condition exists.

■ Function: Reset Cmd Active (Setting: 11)

A Reset Cmd Active digital output will close to signal that a Fault reset is being attempted from terminals or Serial Com.

■ Function: Timer Output (Setting: 12)

This Timer function, that is built into the drive, is independent of the rest of the iQpump drive operation, i.e. there is no requirement for a Run command for the timer to operate. A Timer digital output will close b4-01 seconds after a digital input configured as Timer Input (H1-0x = 18) closes and remains closed. The Timer digital output will remain closed for b4-02 seconds after the Timer digital input opens and remains open.

Refer to the descriptions of parameters b4-01 and b4-02 for a timing chart of the Timer function.

Function: Trq Det 1 N.C. (Setting: 17)

The Trq Det 1 function ties a digital output to the overtorque / undertorque sensing capabilities of the drive. If a digital output is configured as Trq Det 1 N.C., whenever the output current exceeds the level of L6-02 for at least the length of time set in L6-03, the digital output will open.

The torque detection function has a built-in hysteresis of 10% of the iQpump drive rated output current.

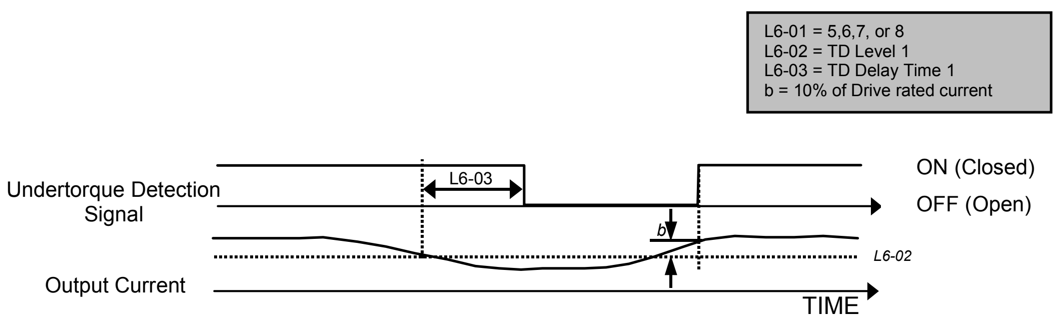


Figure 68. Trq Det 1 N.C. Timing Diagram

■ Function: Reverse Dir (Setting: 1A)

The Reverse Dir digital output will close whenever the iQpump drive is turning the motor in the direction that corresponds to the reverse direction (CW or CCW). The Reverse Dir digital output will remain closed during deceleration when the rotation is in the reverse direction.

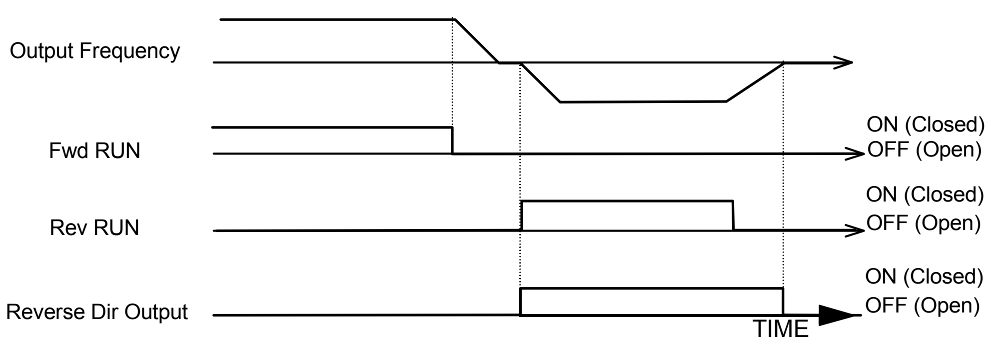


Figure 69. Reverse Direction Timing Diagram

■ Function: Restart Enabled (Setting: 1E)

Depending on the setting of parameter L5-01, the iQpump drive may be configured to automatically attempt to restart itself after certain faults. The Restart Enabled output will be closed once the restarts begin and will remain closed until a successful restart is accomplished or the number of Auto Restart attempts as specified by L5-01 is reached.

A timing diagram for the Auto Restart function is contained in the parameter L5-01 description.

■ Function: Overload (OL1) Alarm (Setting: 1F)

The OL1 fault function is designed to protect the motor. It estimates the motor’s winding temperature based on the output current, output frequency, and time. The OL1 time is determined by the setting of parameters E2-01, L1-01, and L1-02. An Overload digital output will close whenever 90% of the programmed OL1 time is exceeded.

■ Function: OH Prealarm (Setting: 20)

The Overheat fault function (OH) is designed to protect the iQpump drive from excessive temperature damage. Thermistors attached to the heatsink of the iQpump drive monitor the temperature near the devices attached to the heatsink (e.g. input diode modules, output transistor modules) and will fault the drive if the temperature reaches 105oC.

An OH Prealarm digital output will close whenever the heatsink temperature reaches the level specified by parameter L8-02. Parameter L8-03 will determine the drive’s response to reaching the OH Prealarm level, in addition to closing the configured digital output.

■ Function: Drive Enabled (Setting: 38)

A iQpump drive Enable digital output will reflect the status of a digital input configured as an iQpump drive Enable input (H1-0x = 6A). If the iQpump drive Enable digital input is closed then the iQpump drive Enabled digital output will also close.

■ Function: Drive Waiting (Setting: 39)

A iQpump drive Waiting digital output will close during the time-out period between the input of a Run command and the expiration of the delay time specified by b1-11.

■ Function: Frequency Reduced, OH (Setting: 3A)

A Frequency Reduced, OH digital output will close when L8-03 = “4:OH Alarm and Reduce” and an overheat pre-alarm is detected.

■ Function: Run from Serial Com (Setting: 3B)

A Run from Serial Com digital output will close when the drive run command is from embedded serial com or the com option card.

■ Function: Pump 2 Control (Setting: 40)

The multi-function digital output is configured to enable a second lag pump based on the normal operating conditions of the iQpump, which determines when the second lag pump should be activated or deactivated. The operation of the digital output is determined by the programming of the Pump Mode selection (P1-01).

If P1-01 = 0, the iQpump is programmed for drive only; therefore, the Pump 2 Control output will be deactivated.

If P1-01 = 1 or 2, the iQpump will activate the Pump 2 Control output based on normal operating conditions.

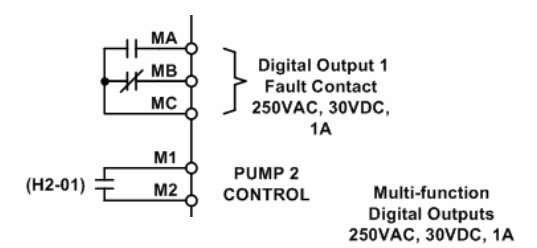


Figure 70.

■ Function: Pump 3 Control (Setting: 41)

The multi-function digital output is configured to enable a third lag pump based on the normal operating conditions of the iQpump, which determines when the third lag pump should be activated or deactivated. The operation of the digital output is determined by the programming of the Pump Mode selection (P1-01).

If P1-01 = 1 or 2, the iQpump is programmed for drive only or drive + 1 pump; therefore, the Pump 3 Control output will be deactivated.

If P1-01 = 2, the iQpump will activate the Pump 3 Control output based on normal operating conditions.

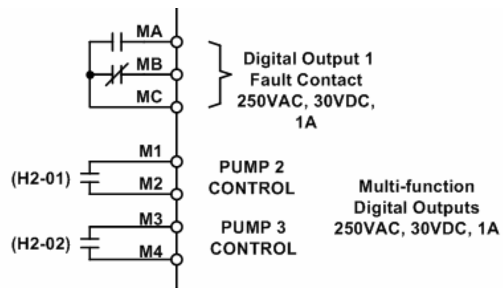


Figure 71.

■ Function: Pump Fault (Setting: 42)

The multi-function digital output can be configured to indicate a Pump Fault (H2-0x = 42). An open contact or output will indicate a normal condition and that no Pump Fault has occurred.

A closed contact or output will indicate a Pump Fault has occurred. The following is a list of dedicated Pump Faults: Low Feedback Fault, High Feedback Fault, Over Cycling Fault, Pump Protection Fault, Thermostat Fault, Low Water Fault, External Pump Fault.

Note: The Pump Fault function is active in Hand, Auto, Pre-charge and Thrust Bearing Modes. If the Pump Fault function is used, one or both of the Pump Controls (Pump 2, pump 3) will not be available.

■ Function: Mot 2 Alternate (Setting: 43) <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.

■ Function: Sleep Active (Setting: 44) <0034>

Closed: Drive is in the sleep mode.

■ Function: Start Lvl Delay (Setting: 45) <0034>

Closed: During the Start Level Delay Time (P1-05). Feedback has dropped below the P1-04 level and the drive is delaying running.

■ Function: Thrust Bearing (Setting: 46) <0034>

Closed: The Thrust Bearing feature is active (output frequency is between zero and P4-05).

■ Function: Pre-charge (Setting: 47) <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 or P4-13).

■ Function: High Feedback (Setting: 48) <0034>

Closed: During a “High FB / Water” Fault - OR -

Closed: During a High Feedback” Alarm.

■ Function: Low Feedback (Setting: 49) <0034>

Closed: During a Low FB / Water” Fault - OR -

Closed: During a “Low Feedback” Alarm.

■ Function: Transducer Loss (Setting: 4A) <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) - OR -

Closed: During a “FBL - Feedback Loss Fault”.

■ Function: Setpoint Not Met (Setting: 4B) <0034>

Closed: During an “NMS - Setpoint Not Met” Fault - OR -

Closed: Feedback level is outside of the P1-11 window. (P1-12 delay is not applied.)

Note: If P1-11 is set to zero, this digital output will always be open.

■ Function: Loss of Prime (Setting: 4C) <0034>

Closed: During an “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.

■ Function: Thermostat Fault (Setting: 4D) <0034>

Closed: Thermostat Fault is present.

■ Function: Low Flow (Setting: 4E) <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”).

■ Function: Accum Level (Setting: 4F) <0034>

Closed: Accumulated level has exceeded the P6-098 and P6-10 setting. - OR -

Closed: During the “Accum Level” Fault.

■ Function: Utility Delay (Setting:50) <0034>

Closed: Drive is stopped and is waiting for the utility delay timer to expire. (Configured by P4-11.)

■ Function: Run / Stop - Stop (Setting: 51) <0034>

Closed: Drive is stopped due to the Run / Stop control (and P4-19). - OR -

Closed: Drive is stopped because the number of Run / Stop cycles has completed. (P4-20)

■ Function: Run / Stop Finish (Setting: 52) <0034>

Closed: Drive is stopped because the number of Run / Stop cycles has completed. (P4-20)

■ Function: Anti-Jam / De-Scale (Setting: 53) <0034>

Closed: When the Anti-Jam or the De-Scale features are active. (Configured by P7-xx)

■ Function: During Run 2 (Setting: 54) <0034>

Closed: Whenever the drive is outputting voltage to the motor (not base-blocked).

■ Function: Lube Pump (Setting: 55) <0034>

Closed: When the Lube Pump Feature is active.

■ Function: High Flow (Setting: 56) <0034>

CLosed: During the “High Flow Fault” condition - OR -

Closed: During a high flow condition as set by P6-12 ~ P6-14 (includes “High Flow Alarm”).

■ Function: Low Water Level (Setting: 57) <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”.

Refer to iQpump MEMOBUS / Modbus Status Registers (#728).

H3 Analog Inputs

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

◆ H3-02 Terminal A1 Gain Setting

Setting Range: 0.0 ~ 1000.0%

Factory Default: 100.0%

Refer to parameter H3-02 in Appendix A for description details.

◆ H3-03 Terminal A1 Bias Setting

Setting Range: -100.0% ~ +100.0%

Factory Default: 0.0%

In order to have the iQpump drive properly interpret an analog input, it may be necessary to apply a gain and / or a bias to the signal. The analog inputs have a resolution of 10 bits (1024 steps). Using the factory default settings for the analog input's gain and bias, the 0-10 Vdc or 4-20 mA signal at the analog input will yield a 0-100% speed command span.

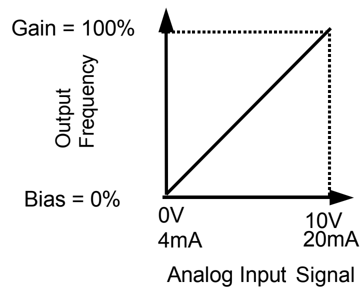


Figure 72. Output Frequency as Commanded Via Analog Input

If a different span of analog input signal is desirable, it will be necessary to adjust the gain, the bias, or both to allow the analog input level to generate the desired frequency command. Adjustment of the gain setting will change the speed command that is equivalent to the maximum analog input (10 Vdc or 20 mA). If, for instance, the gain is increased to 200%, then 10 Vdc or 20 mA will be equivalent to a 200% speed command and 5 Vac or 12 mA will be equivalent to a 100% Speed Command. Since the iQpump drive output is limited by the maximum frequency parameter (E1-04), 0-5 Vdc or 4-12 mA will now be equivalent to 0-100% speed command span.

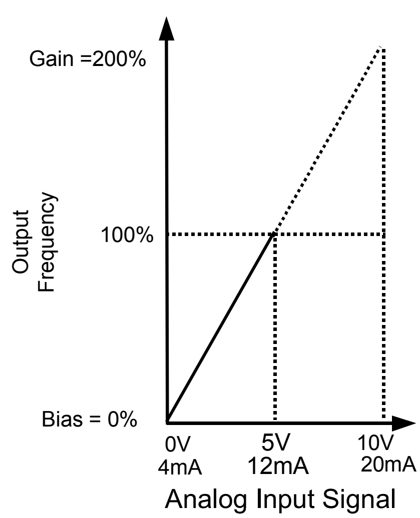


Figure 73. Output Frequency as Commanded via Analog Input with Increased Gain Setting

Adjustment of the bias setting will likewise adjust the speed command that is equivalent to the minimum analog input level (0 Vdc or 4 mA). If, for instance, the bias is set to –25%, then 0 Vdc or 4 mA will be equivalent to a –25% speed command. Since the minimum speed command is 0% an analog input of 2 to 10 Vdc or 7.2 to 20 mA will now be equivalent to 0-100% speed command span.

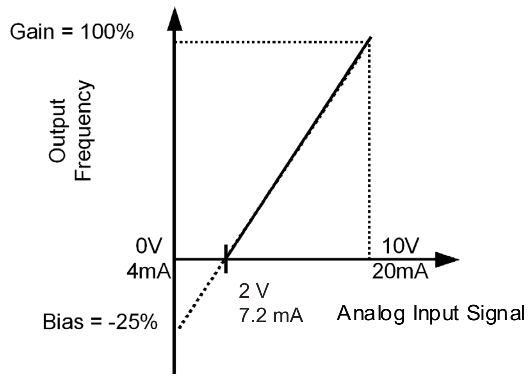


Figure 74. Output Frequency with Reduced Bias Setting

As a further example, for an inverse-acting speed command, set the bias = 100% and the gain = 0%. The minimum analog input level (0 Vdc or 4 mA) will produce a 100% speed command and the maximum analog input level (10 Vdc or 20 mA) will produce a 0% speed command.

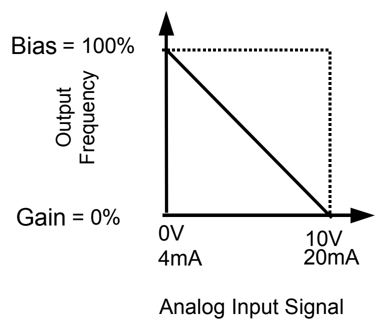
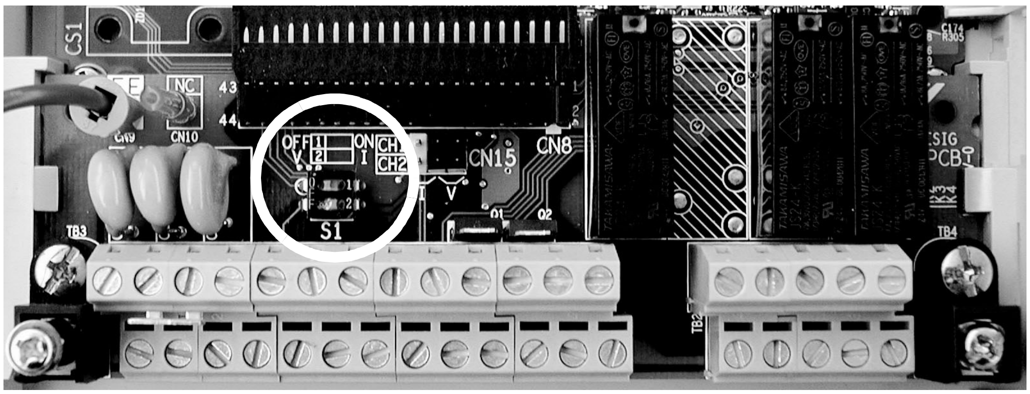


Figure 75. Output Frequency with Inverted Gain and Bias Settings

◆ H3-08 Terminal A2 Signal Level

Setting	Description
0	0 - 10 Vdc
2	4 - 20 mA (***factory default***)
3	0 - 20 mA

The H3-08 parameter (Terminal A2 Signal Level) allows the programmer to specify the signal that will be applied to the A2 analog input. The A2 analog input can accept either a 0–10 Vdc or 4-20 mA signal as a reference. The iQpump drive also has a DIP switch (S1) on the removable terminal board that must be set for the proper reference signal into the A2 analog input. The S1-2 dipswitch setting determines the internal resistance of the A2 input while parameter H3-08 determines how the iQpump drive interprets the measured signal.



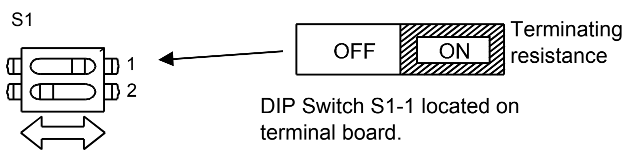


Figure 76. DIP Switch S1

Table 32 DIP Switch S1

Name	Function	Setting
S1-1	RS-485 and RS-422 terminating resistance	OFF: No terminating resistance ON: Terminating resistance of 110 Ω
S1-2	Input method for analog input A2	OFF: 0 to 10 V (internal resistance: 20 kΩ) ON: 4 ~ 20 mA (internal resistance: 250 Ω) (Default)

◆ H3-09 Terminal A2 Function Selection

Setting	Description
0	Frequency Bias
2	Aux Reference
B	PI Feedback (***factory default***)
D	Frequency Bias 2
E	Motor Temperature
16	PI Differential
1F	Not Used

The A2 analog input can be programmed to perform many different functions. The setting of parameter H3-09 determines which of the following functions the A2 analog input will perform.

■ Function: Frequency Bias (Setting: 0)

By setting H3-09 = "0: Frequency Bias," the A2 analog input will serve as a bias signal to the A1 Speed Command. The effect of using A2 for a frequency bias is that the level of the A2 analog input will be summed with the level of the Speed Command analog input (A1). For example, if H3-02 = 100%, H3-03 = 0%, and the A2 analog input level is 1 Vdc, the Speed Command profile will look like *Figure 77.* below. If A1 = 0 Vdc the Speed Command would be 10% of the programmed maximum frequency because A1 (0 Vdc) + A2 (1 Vdc) = 1 Vdc.

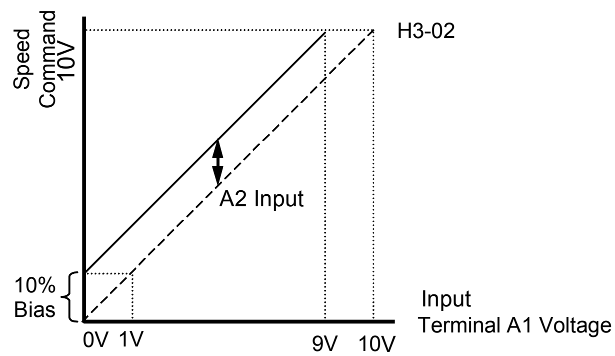


Figure 77. Effect of Frequency Bias Function on Speed Command

It should be noted that the bias applied by the A2 analog input functions differently than the level set by the H3-03. If both biases are used simultaneously they will sum together.

The level of the A1 analog input, as a percentage of the maximum input (either 10 Vdc or 20 mA), can be viewed by the U1-15 monitor. The level of the A2 analog input, as a percentage of the maximum input, can be viewed by the U1-16 monitor.

The bias applied by setting H3-09 = "0: Frequency Bias," can be used in conjunction with the parameter bias H3-03. In that case the H3-03 bias is applied first which changes the slope of the Speed Command vs. Terminal A1 Voltage graph. Then the level of the A2 analog input is summed with the A1 analog input level, which in effect shifts the Speed Command vs. Terminal A1 Voltage graph upwards or downwards but does not change the slope of the line.

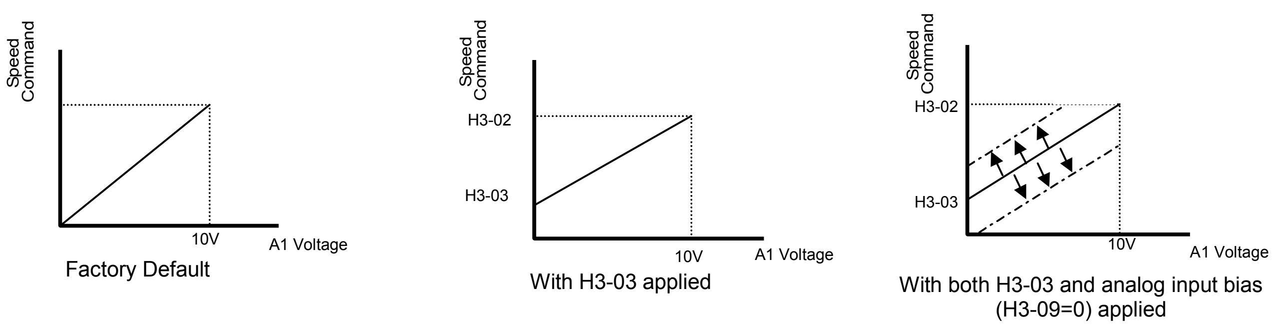


Figure 78. Frequency Bias Applied to Analog Speed Command

Function: Aux Reference (Setting: 2)

In order for the A2 analog input to be used as the master Speed Command, parameter H3-09 must be set for Aux Reference (H3-09 = "2: Aux Reference"). Once A2 is configured as an auxiliary reference, it can be selected as the master Speed Command by setting H3-13 = "1: Main Fref TA2". If H3-09 = 2, terminal A2 analog input will become the speed command when a digital input programmed for Multi-Step Ref 1 (H1-0x = 3) is selected by a contact closure.

Function: PI Feedback (Setting: B)

Configuring the A2 analog input as PI Feedback (H3-09 = "B: PI Feedback") is a requirement of setting the iQpump drive up for PI operation. The A2 analog input is the only source for feedback for PI operation though the setpoint can come from a number of different sources (refer to the section covering the PI parameters for more information regarding specifying the setpoint source. PI parameters are listed in "b5 PI Function" on page 32).

Parameters H3-10 (Terminal A2 Gain) and H3-11 (Terminal A2 Bias) can be used to configure the A2 analog input to match the signal from the Feedback Transmitter.

The U1-24 monitor (PI Feedback) can be used to check the PI Feedback level with the digital operator.

Function: Frequency Bias 2 (Setting: D)

By setting H3-09 = "D: Frequency Bias 2," the A2 analog input will serve as a bias signal to the A1 Speed Command. This setting functions the same as a setting of H3-09 = 0: Frequency Bias.

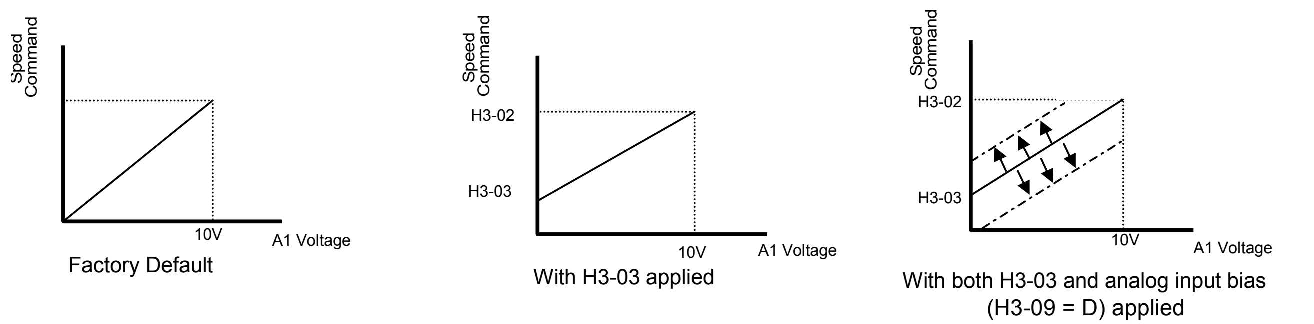


Figure 79. Frequency Bias 2 Applied to Analog Speed Command

Function: Motor Temperature (Setting: E)

In addition to or in place of the OL1 (Motor Overload) fault of the drive, it is possible to use a PTC (Positive Temperature Coefficient) thermistor for motor insulation protection. The PTC thermistors are built into the windings of some motors and will vary their resistance based on temperature. An example PTC characteristic is show below.

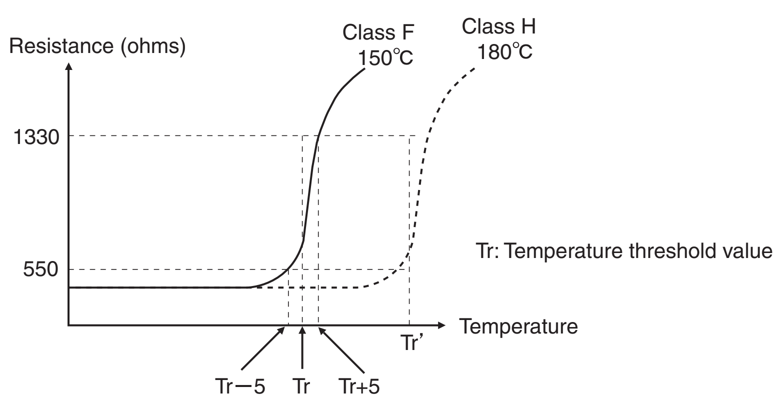


Figure 80. PTC Thermistor Temperature-Resistance Value Characteristics

Connection of the thermistor to the iQpump drive is shown below, in addition make sure Dip Switch S1-2 is in the OFF position, see *Figure 81*.

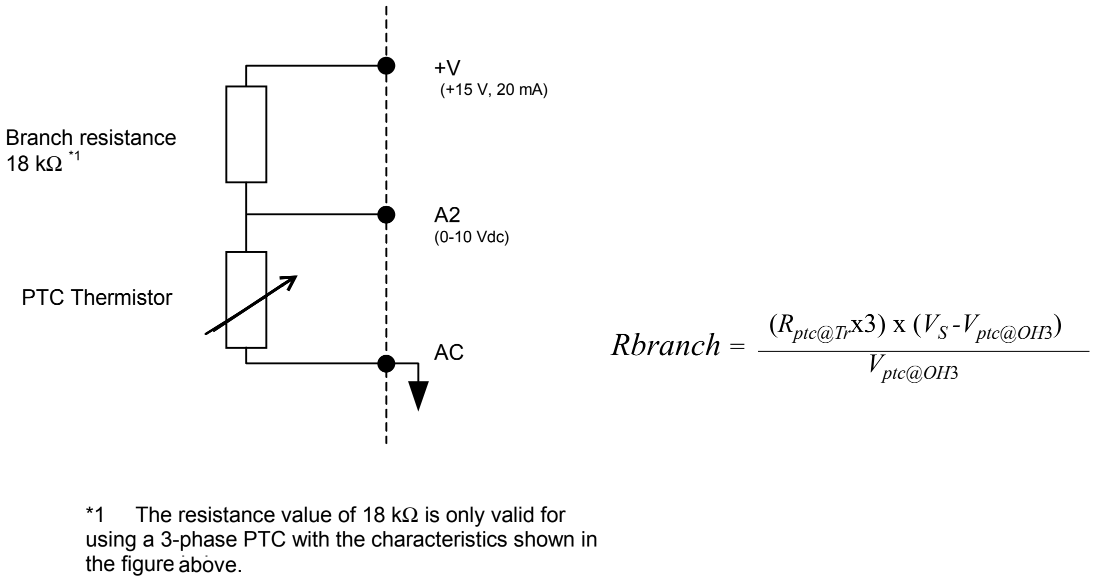


Figure 81. Thermistor to Drive Connection Diagram

After the connections are made, configure the A2 analog input for motor temperature protection by setting H3-09 = “E: Motor Temperature”. Parameters L1-03, L1-04, and L1-05 set the response to the alarm level being exceeded, response to the fault level being exceeded, and temperature sensing delay time, respectively.

The proper value of the branch resistance is approximated by the formula:

$$Rbranch = \frac{(R_{ptc@Tr} x3) \text{ x } (V_S - V_{ptc@OH3})}{V_{ptc@OH3}}$$

Where: ($R_{ptc@Tr}$ x 3) = The resistance value of the thermistor at either the alarm or fault level adjusted for three phase (three thermistors in series, refer to typical PTC thermistor characteristic in *Figure 81.*).

V_S = The supply voltage (+15 Vdc)

$V_{ptc@OH3}$ = The rated voltage for the over-temperature alarm or fault

■ Function: PI Differential (Setting: 16)

Normal PI operation will adjust the iQpump drive output in order to match the measured feedback value to a desired setpoint. When PI is operated in the differential mode, however, the iQpump drive output is adjusted in order to maintain a desired differential between two feedback signals. Air handling unit return fan speed control in a “volume snatching” strategy for building pressure control is an example.

When the A2 analog input is configured as a PI Differential (H3-09 = “16: PI Differential”), the A1 analog input becomes the other PI Differential input. The desired differential is set by parameter b5-07 (PI Differential Setpoint) and can be set so that A2 is held less than A1 (b5-07 <0) or A2 is held greater than A1 (b5-07>0).

When PI Differential operation is chosen, the A1 feedback level can be monitored by U1-24 (PI Feedback) and the A2 feedback level can be monitored by U1-53 (PI Feedback2).

■ Function: Not Used (Setting: 1F)

When H3-09 = “1F: Not Used,” any signal applied to the A2 analog input will be ignored by the drive.

◆ H3-10 Terminal A2 Gain Setting

Setting Range: 0.0 ~ 1000.0%

Factory Default: 100.0%

Refer to parameter H3-10 in Appendix A for description details.

◆ H3-11 Terminal A2 Bias Setting

Setting Range: -100.0% ~ +100.0%

Factory Default: 0.0%

Parameters H3-10 and H3-11 perform the same function for the A2 analog input that parameters H3-02 and H3-03 perform for the A1 analog input. Please refer to the parameter description for H3-02 and H3-03 for information about H3-10 and H3-11.

These parameters could be used for final calibration of a factory or field installed pressure to electric transducer input connected to terminal A2 and AC. This field calibration may be needed if there is a job site variation from the typical 3 to 15 psi g pneumatic signal input range.

◆ H3-12 Analog Input Filter Time Constant

Setting Range: 0.00 ~ 2.00 s

Factory Default: 0.30 s

An analog input filter can be used to prevent erratic iQpump drive control when a "noisy" analog reference is used. Parameter H3-12 sets the time constant for a first order filter that will be applied to both the A1 and A2 analog inputs. The iQpump drive operation becomes more stable the longer the time programmed, but it becomes less responsive to rapidly changing analog signals.

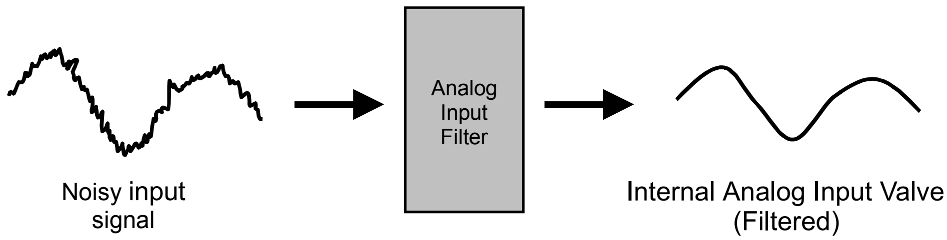


Figure 82. Analog Input Filter Time Constant Effect on "Noisy" Signal

◆ H3-13 Master Frequency Reference Terminal Selection

Setting	Description
0	Main Fref = A1 (***factory default***)
1	Main Fref = A2

Parameter H3-13 allows the programmer to select which analog input will serve as the Speed Command input when "Terminals" are selected as the Auto Mode Speed source (b1-01 = "1: Terminals"), or Terminal is selected as the reference source for the Hand mode (b1-12 = "1: Terminals"). For the A2 analog input to be an effective selection for the H3-13 parameter, parameter H3-09 must be configured as Aux Reference (H3-09 = "2: Aux Reference").

If H3-09≠2, then the A1 analog input will be used regardless of the setting of parameter b1-12.

H4 Analog Outputs

◆ H4-01 Terminal FM Monitor Selection

Setting Range: 1 ~ 53

Factory Default: 2: Output Freq

The FM and AM analog output terminals can be programmed to output a 0-10 Vdc signal proportional to any one of functions detailed in *Table 33 on page 93*.

Table 33

Setting	Description	Setting	Description
1	Frequency Ref	20	SFS Output*
2	Output Freq	24	PI Feedback
3	Output Current	31	Not Used
6	Output Voltage	36	PI Input
7	DC Bus Voltage	37	PI Output
8	Output kWatts	38	PI Setpoint
15	Term A1 Level	51	Auto Mode Fref
16	Term A2 Level	52	Hand Mode Fref
18	Mot SEC Current	53	PI Feedback 2
* SFS is the internal soft starter signal. This signal is generated from the reference and often it passes through the accel / decel functions.			

When the H4-01 or H4-04 are configured the iQpump drive will output 10 Vdc to represent 100% of the function programmed into them.

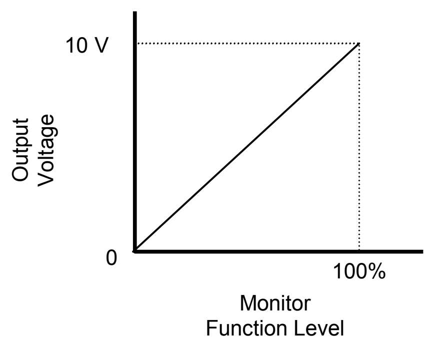


Figure 83. Analog Output Signal Level as a Function of the Monitor Value

■ Function: Frequency Ref (Setting: 1)

The analog output level will correspond to the chosen Speed Command input whether it is input via the digital operator, analog input, or serial communication. 100% will be equivalent to the maximum output frequency of the iQpump drive (E1-04).

■ Function: Output Freq (Setting: 2)

The analog output level will correspond to the actual Speed being output by the iQpump drive and will include the acceleration and deceleration ramps. 100% will be equivalent to the maximum output frequency of the iQpump drive (E1-04).

■ Function: Output Current (Setting: 3)

The analog output level will correspond to the output current level of the drive. 100% will be equivalent to the drives rated output current which is based on the kVA Rating of the iQpump drive (o2-04).

■ Function: Output Voltage (Setting: 6)

The analog output level will correspond to the output voltage level of the drive. 100% will be equivalent to either 200 Vac or 400 Vac depending on the input voltage rating of the drive.

■ Function: DC Bus Voltage (Setting: 7)

The analog output level will correspond to the voltage level of the drive's DC bus. 100% will correspond to 400 Vdc for the 240 Vac input iQpump drive and 800 Vdc for the 480 Vac input drive.

■ Function: Output kWatts (Setting: 8)

The analog output level will correspond to an internally calculated output power level based on the measured output current and output voltage. 100% will correspond to the kilowatt rating of the iQpump drive as determined by o2-04.

■ Function: Term A1 Level (Setting: 15)

The analog output level will correspond to the analog input to the drive's A1 terminal. 100% will be equivalent to 10 Vdc.

■ Function: Term A2 Level (Setting: 16)

The analog output level will correspond to the analog input to the drive's A2 terminal. 100% will be equivalent to 10 Vdc.

■ Function: Mot SEC Current (Setting: 18)

The analog output level will correspond to the calculated secondary (torque producing) current. 100% will be equivalent to motor's full load secondary current as calculated by:

$$I\,s = \sqrt{I_{\text{Nameplate}}^{\,2} - I_{\text{no load}}^{\,2}}$$

$$= \sqrt{(E2\text{-}01)^2 - (E2\text{-}03)^2}$$

■ Function: SFS (Softstart) Output (Setting: 20)

The analog output level will correspond to the Speed Command after the applicable acceleration and deceleration rates are applied. The SFS (Softstart) Output monitor will not include variations to the Speed Command other than the acceleration and deceleration ramps. 100% will be equivalent to the maximum output frequency of the iQpump drive (E1-04).

■ Function: PI Feedback (Setting: 24)

The analog output level will correspond to the analog input to the drive's A2 terminal during normal PI operation but will correspond to the A1 analog input when the A2 analog input is configured as a PI Differential input (H3-09 = "16: PI Differential"). The output will function even if PI operation is not selected (b5-01 = "0: Disabled"). Parameter b5-20 will apply a gain to the measured analog output voltage before the monitor is displayed.
(i.e. with b5-20 = 5 the 2 Vdc feedback signal will generate 10 Vdc on the analog output).

■ Function: Not Used (Setting: 31)

When H4-01 = "31: Not Used" no voltage is output by the analog output.

■ Function: PI Input (Setting: 36)

The analog output will correspond to the measured error of the PI function. The measured error of normal PI operation is the setpoint minus the feedback. The measured error of the differential PI is the difference between the A1 and A2 analog inputs summed with the PI differential setpoint). The output will not function unless PI operation is selected (b5-01≠0).

■ Function: PI Output (Setting: 37)

The analog output will correspond to the output of the PI function. The PI output will be measured after any gains, offsets, or limits are applied to the output of the Proportional and Integral factors. The output will not function unless PI operation is selected (b5-01≠0) and there is an active Run command. 100% will be equivalent to maximum frequency (E1-04).

■ Function: PI Setpoint (Setting: 38)

The analog output will correspond to the level of the chosen setpoint of the PI function. Please refer to table on page ***32*** included in the section PI Control (b5 parameters) for more information about selecting the PI Setpoint source. The output will not function unless PI operation is selected (b5-01≠0).

◆ H4-02 Terminal FM Gain Setting

Setting Range: 0.0 ~ 1000.0%

Factory Default: 100.0%

Refer to parameter H4-03 section for description details.

◆ H4-03 Terminal FM Bias Setting

Setting Range: -110.0% ~ +110.0%

Factory Default: 0.0%

The gain and bias parameters for the analog outputs of the iQpump drive allow the programmer to customize the output signal for the equipment connected to the output. The analog outputs are adjustable over a range of 0-10 Vdc. The gain settings for the analog outputs determine the output voltage level that will be equivalent to 100% of the Monitor Function Level. A gain setting greater than 100% will produce 10 Vdc on the analog output when the monitor function is less than 100%.

For example, if H4-02 = 150%, then the FM analog output will produce 6.7 Vdc when the assigned output function initially reached the 100% level.

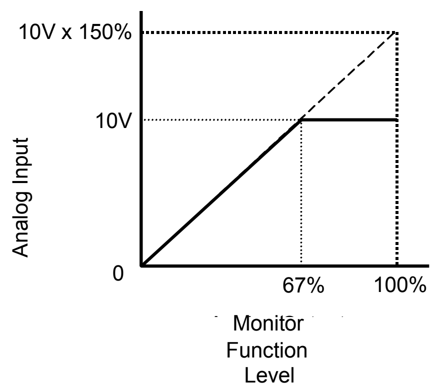


Figure 84. Analog Output gain Setting Adjustment

Like the bias settings for the analog inputs (H3-03 and H3-11), the bias settings for the analog outputs determine the output function level that will be equivalent to 0 Vdc (or 4 mA if the optional terminal board is used).

For example, if H4-03 = -25%, then when the output function level is at 0% the FM analog output will output 2 Vdc.

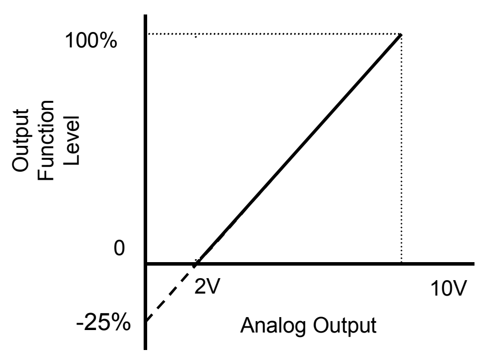


Figure 85.

◆ H4-04 Terminal AM Monitor Selection

Setting Range: 1 ~ 53 <0032>

Factory Default: 8: Output kWatts

Refer to parameter H4-01 section for description details.

◆ H4-05 Terminal AM Gain Setting

Setting Range: 0.0 ~ 1000.0%

Factory Default: 50.0%

Refer to parameter H5-05 in Appendix A for description details.

◆ H4-06 Terminal AM Bias Setting

Setting Range: -110.0% ~ +110.0%

Factory Default: 0.0%

Refer to parameters H4-02 and H4-03 sections for description details.

◆ H4-07 and H4-08 Terminal Signal Level Selections

Parameter No.	Setting	Description
H4-07	0	Terminal FM Signal Level Selection, 0 - 10 Vdc (***factory default***)
H4-08	1	Terminal AM Signal Level Selection, 4 - 20 mA

When the iQpump drive is equipped with the optional, removable terminal board with 4-20 mA outputs (p/n ETC618120), parameters H4-07 and H4-08 determine whether analog outputs are configured as 0-10 Vdc or 4-20 mA. Refer to the documentation for the optional terminal board as the proper jumper settings are required in addition to programming H4-07 and H4-08.

If the standard removable terminal board is being used, the settings of H4-07 and H4-08 have no effect.

H5 Serial Communications Setup

This section explains the individual functions used in special applications involving MEMOBUS / Modbus Communications.

◆ Communication Specifications

The MEMOBUS / Modbus communication specifications are shown below:

Table 34 MEMOBUS / Modbus Communication Specifications

Item	Specifications	
Interface	RS-422, RS-485	
Communications Cycle	Asynchronous (Start-stop synchronization)	
Communications Parameters	Baud rate:	Select from 1200, 2400, 4800, 9600, and 19200 bps.
	Data length:	8 bits fixed
	Parity:	Select from even, odd, or none.
	Stop bits:	1 bit selected
Communications Protocol	MEMOBUS / Modbus	
Number of Connectable Units	31 units max.	

◆ MEMOBUS / Modbus Communication Configuration

MEMOBUS / Modbus communication is configured using 1 master (PLC) and a maximum of 31 slaves. Serial communication between master and slave is normally initiated by the master and responded to by the slaves.

The master performs serial communication with one slave at a time. Consequently, the slave address of each slave must be individually set, so that the master can perform serial communication using that address. Slaves receiving commands from the master perform the specified functions, and send a response back to the master.

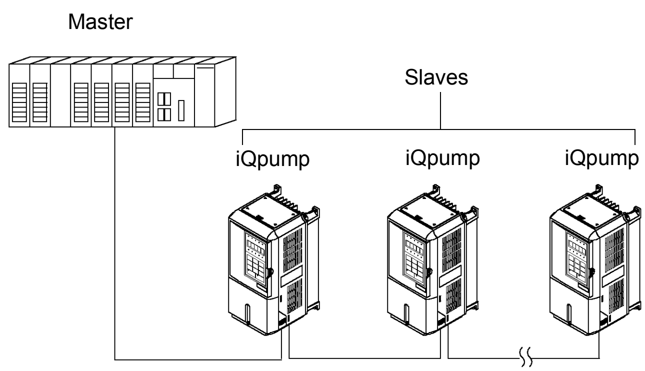


Figure 86. Example of Connections between Master and Drive

◆ Communication Connection Terminal

MEMOBUS / Modbus communication uses the following terminals: S+, S-, R+, and R-. The terminating resistance must be turned ON only if the iQpump drive is at the very end of the Serial Communication chain. Set the terminating resistance by turning ON pin 1 of switch S1 On the drives terminal board. Switch S1 is located directly above the left most relay module.

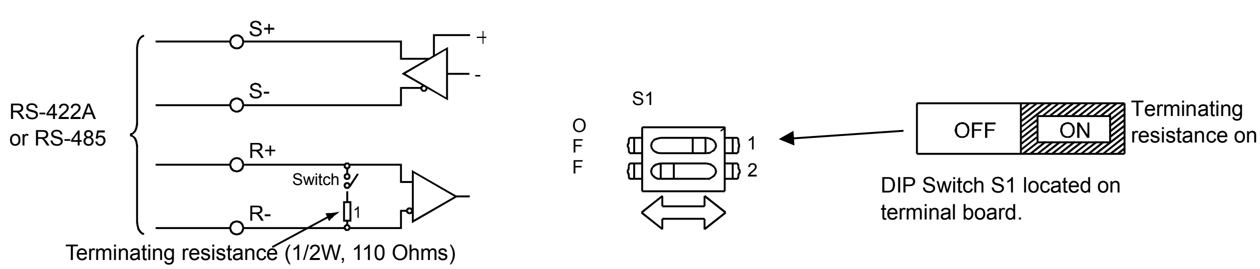


Figure 87. Communication Connection Terminals and Terminating Resistance

Important:

- Separate the communication cables from the main circuit cables and control circuit wiring.
- Use shielded cables for the communication cable, and use proper shield clamps.
- When using RS-485 2 Wire communication, connect S+ to R+, and S- to R-, on the control circuit terminal board. See *Figure 88.*.
- Terminate shield at one end only.

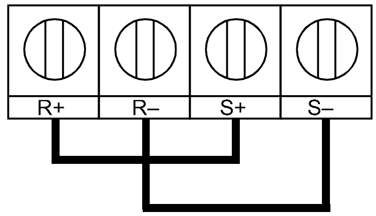


Figure 88.

◆ Procedure for Setting Up Communication

Use the following procedure to perform communication with the PLC.

1. Turn OFF the input power to the iQpump drive and connect the communication cable between the PLC and the drive.
2. Turn ON the input power to the drive.
3. Set the required communication parameters (H5-01 ~ H5-09) using the Digital Operator.
4. Turn OFF the input power to the drive, and check that the Digital Operator display has completely faded.
5. Turn ON the input power to the iQpump drive once again.
6. Perform communication with the PLC.

■ Related Parameters

The following parameters need to be set correctly to insure proper operation of the iQpump drive when using MEMOBUS / Modbus communication.

Table 35 Serial Communication Related Parameters

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location	Page Number
b1-01	0108	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	0 ~ 3	0	Pump Quick Setup	*260*
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	0 ~ 3	1	Pump Quick Setup	*260*
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. <0034> *Range is dependent on P9-25, if P1-01 = 3. <0034>	0 ~ 20*	1F	Programming	*272*
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	*272*
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	*272*

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location	Page Number
H5-04	0428	Stopping Method after Communication Error **Serial Fault 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	*272*
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	*272*
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	5 ms	Programming	*273*
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	*273*
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 ~ 10.0	2.0 s	Programming	*273*

*Set H5-01 to 0 to disable drive responses to MEMOBUS / Modbus communications.

MEMOBUS / Modbus communication can perform the following operations regardless of the settings in b1-01 and b1-02:

1. Monitoring operation status of the drive
2. Setting and reading iQpump drive parameters
3. Resetting faults
4. Input multi-function commands

Important:
An OR operation is performed between the multi-function command input from the PLC and the command input from multi-function digital input terminals S3 to S7.

■ Message Format

In MEMOBUS / Modbus communication, the master sends commands to the slave, and the slave responds. The message format is configured for both sending and receiving as shown below. The length of the data packets is changed by the command (function) contents.

Slave address
Function code
Data
Error check

Figure 89. Message Format

The space between messages must support the following:

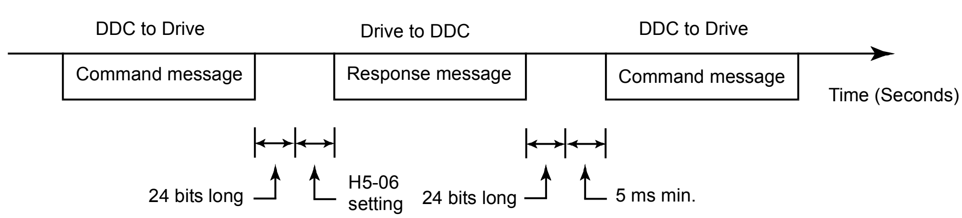


Figure 90. Message Spacing

Slave Address

Set the iQpump drive address from 0 to 32. If 0 is selected, commands from the master will be broadcast (i.e., the iQpump drive will not return responses).

Function Code

The function code specifies commands. There are four function codes supported by the drive, as shown below.

Table 36 MEMOBUS / Modbus Function Codes

Function Code (Hexadecimal)	Function	Command Message		Response Message	
		Min. (Bytes)	Max. (Bytes)	Min.* (Bytes)	Max. (Bytes)
03H	Reading / Holding Register Contents	8	8	7	37
06H	Write In Single Holding Register	8	8	8	8
08H	Loopback Test	8	8	8	8
10H	Write In Several Holding Registers	11	41	8	8
* Minimum bytes for a normal Response Message (error response message is always 5 bytes).					

Data

Configure consecutive data by combining the storage register address (test code for a loopback address) and the data the register contains. The data length changes depending on the command details.

Error Check

Errors are detected during communication using CRC-16. Perform calculations using the following method:

1. The factory setting for CRC-16 communication is typically zero, but when using the MEMOBUS / Modbus system, set the factory setting to one (e.g., set all 16 bits to 1).
2. Calculate CRC-16 using MSB as slave address LSB, and LSB as the MSB of the final data.
3. Calculate CRC-16 for response messages from the slaves and compare them to the CRC-16 in the response messages.

MEMOBUS / Modbus Function Code Details

■ Reading / Holding Register Contents (03H)

Read the contents of the storage registers only for the specified number of registers. The addresses must be consecutive, starting from a specified start register. The data content of the storage register are separated into high bytes and low bytes.

The following tables show message examples when reading status signals, error details, data link status, and frequency references from the slave 2 drive.

Command Message		
Slave Address		02H
Function Code		03H
Start Register	High Byte	00H
	Low Byte	20H
No. of Registers	High Byte	00H
	Low Byte	04H
CRC-16	High Byte	45H
	Low Byte	F0H

Response Message (During Normal Operation)		
Slave Address		02H
Function Code		03H
Data quantity		08H
First Storage Register	High Byte	00H
	Low Byte	65H
Second Storage Register	High Byte	00H
	Low Byte	00H
Third Storage Register	High Byte	00H
	Low Byte	00H
Fourth Storage Register	High Byte	01H
	Low Byte	F4H
CRC-16	High Byte	AFH
	Low Byte	82H

Response Message (During Error)		
Slave Address		02H
Function Code		83H
Error code		03H
CRC-16	High Byte	F1H
	Low Byte	31H

Figure 91. Function Code 03H Message Example

■ Write In Single Holding Register (06H)

Command Message		
Slave Address		01H
Function Code		06H
Register Address	Upper	00H
	Lower	01H
Setting Data	Upper	00H
	Lower	01H
CRC-16	Upper	98H
	Lower	0BH

Response Message (During Normal Operation)		
Slave Address		01H
Function Code		06H
Register Address	Upper	00H
	Lower	01H
Setting Data	Upper	00H
	Lower	01H
CRC-16	Upper	98H
	Lower	0BH

Response Message (During Error)		
Slave Address		01H
Function Code		86H
Error code		21H
CRC-16	Upper	82H
	Lower	78H

Figure 92. Function Code 06H Message Example

■ Loopback Test (08H)

The loopback test returns the command message directly as the response message without changing the contents to check the communications between the master and slave. Set user-defined test code and data values.

The following tables show a message example when performing a loopback test with the slave 1 drive.

Command Message		
Slave address		01H
Function code		08H
Test Code	High Byte	00H
	Low Byte	00H
Data	High Byte	A5H
	Low Byte	37H
CRC-16	High Byte	DAH
	Low Byte	8DH

Response Message (During Normal Operation)		
Slave address		01H
Function code		08H
Test Code	High Byte	00H
	Low Byte	00H
Data	High Byte	A5H
	Low Byte	37H
CRC-16	High Byte	DAH
	Low Byte	8DH

Response Message (During Error)		
Slave address		01H
Function code		88H
Error Code		01H
CRC-16	High Byte	86H
	Low Byte	50H

Figure 93. Function Code 08H Message Example

■ Write In Several Holding Registers (10H)

Write the specified data to the desired slave indicating the desired starting register. The written data must be consecutive, starting from the specified address in the command message: High Byte (8 bits), then Low Byte 8 bits, in sequential storage register order.

The following tables show an example of a message when a forward Run command has been set at a speed command of 60.0 Hz in the slave 1 iQpump drive by the PLC.

Command Message		
Slave Address		01H
Function Code		10H
Start Register	High Byte	00H
	Low Byte	01H
No. of Registers	High Byte	00H
	Low Byte	02H
No. of Bytes*		04H
First 2 Bytes of data	High Byte	00H
	Low Byte	01H
Second 2 Bytes of data	High Byte	02H
	Low Byte	58H
CRC-16	High Byte	63H
	Low Byte	39H

Response Message (During Normal Operation)		
Slave Address		01H
Function Code		10H
Start Register	High Byte	00H
	Low Byte	01H
No. of Registers	High Byte	00H
	Low Byte	02H
CRC-16	High Byte	10H
	Low Byte	08H

Response Message (During Error)		
Slave Address		01H
Function Code		90H
Error code		02H
CRC-16	High Byte	CDH
	Low Byte	C1H

* No. of bytes = 2 x (# of Registers)

Figure 94. Function Code 08H Message Example

Important: Set the number of bytes as quantity of specified registers x 2. Handle response messages in the same way.

MEMOBUS / Modbus Data Tables

The data tables are shown below. The types of data are as follows: Reference data, monitor data and broadcast data.

■ Reference Data

The reference data table is shown below. Reference data can be read and written to.

Table 37 Reference Data

Register Hex	Contents	
0000	Reserved	
0001	Sequence Control	
	Bit 0	Run Forward 1: Run 0: Stop
	Bit 1	Run Reverse 1: Run 0: Stop
	Bit 2	External fault1: Fault (EFO)
	Bit 3	Fault reset1: Reset command
	Bit 4	ComNet
	Bit 5	ComCtrl
	Bit 6	Multi-function digital input command 3
	Bit 7	Multi-function digital input command 4
	Bit 8	Multi-function digital input command 5
	Bit 9	Multi-function digital input command 6
	Bit A	Multi-function digital input command 7
	Bits B ~ F	Not used
0002	Frequency reference (Set units using parameter o1-03)	
0003 ~ 0005	Not used	
0006	PI Setpoint	
0007	Analog output 1 setting (-11 V = 726 ~ 11 V = 726) → 10 V = 660	
0008	Analog output 2 setting (-11 V = 726 ~ 11 V = 726) → 10 V = 660	
0009	Multi-function contact output setting	
	Bit 0	Digital output 1 (Terminal M1-M2) 1: ON 0: OFF
	Bit 1	Digital output 2 (Terminal M3-M4) 1: ON 0: OFF
	Bit 2	Not Used
	Bits 3 ~ 5	Not used
	Bit 6	Set fault contact (terminal MA-MC) output using bit 7. 1: ON 0: OFF
	Bit 7	Fault contact (terminal MA-MC) 1: ON 0: OFF
	Bits 8 ~ F	Not used
000A ~ 000E	Not used	
000F	Reference selection settings	
	Bit 0	Not used
	Bit 1	Input PI Setpoint 1: Enabled 0: Disabled
	Bits 3 ~ B	Not used
	C	Broadcast data terminal S5 input 1: Enabled 0: Disabled
	D	Broadcast data terminal S6 input 1: Enabled 0: Disabled
	E	Broadcast data terminal S7 input 1: Enabled 0: Disabled
	F	Not used
Note: Write 0 to all unused bits. Also, do not write data to reserved registers.		

■ Monitor Data

The following table shows the monitor data. Monitor data can only be read.

Table 38 Monitor Data

Register Hex	Contents	
0020	Drive status	
	Bit 0	Running 1: Running 0: Stopped
	Bit 1	Reverse operation 1: Reverse operation 0: Forward operation
	Bit 2	Drive startup complete 1: Completed 0: Not completed
	Bit 3	Fault1: Fault
	Bit 4	Data setting error1: Error
	Bit 5	Multi-function digital output 1 (terminal M1 - M2) 1: ON 0: OFF
	Bit 6	Multi-function digital output 2 (terminal M3 - M4) 1: ON 0: OFF
	Bit 7	Not used
	Bits 8 ~ F	Not used
0021	Fault details	
	Bit 0	Overcurrent (OC) Ground fault (GF)
	Bit 1	Main circuit overvoltage (OV)
	Bit 2	Drive overload (OL2)
	Bit 3	Drive overheat (OH1, OH2)
	Bit 4	Not used
	Bit 5	Fuse blown (PUF)
	Bit 6	PI feedback reference lost (FbL)
	Bit 7	External error (EF, EFO)
	Bit 8	Hardware error (CPF)
	Bit 9	Motor overload (OL1) or overtorque 1 (OL3) detected
	Bit A	PG broken wire detected (PGO), Overspeed (OS), Speed deviation (DEV)
	Bit B	Main circuit undervoltage (UV) detected
	Bit C	Main circuit undervoltage (UV1), control power supply error (UV2), inrush prevention circuit error (UV3), power loss
	Bit D	Missing output phase (LF)
	Bit E	MEMOBUS / Modbus communications error (CE)
	Bit F	Operator disconnected (OPR)
0022	Data link status	
	Bit 0	Writing data
	Bit 1	Not used
	Bit 2	Not used
	Bit 3	Upper and lower limit errors
	Bit 4	Data integrity error
	Bits 5 ~ F	Not used
0023	Frequency reference	U1-01
0024	Output frequency	U1-02
0025	Output voltage reference	U1-06
0026	Output current	U1-03
0027	Output power	U1-08
0028	Torque reference	U1-09
0029	Not used	
002A	Not used	

Register Hex	Contents	
002B	Sequence input status	
	Bit 0	Input terminal S1 1: ON 0: OFF
	Bit 1	Input terminal S2 1: ON 0: OFF
	Bit 2	Multi-function digital input terminal S3 1: ON 0: OFF
	Bit 3	Multi-function digital input terminal S4 1: ON 0: OFF
	Bit 4	Multi-function digital input terminal S5 1: ON 0: OFF
	Bit 5	Multi-function digital input terminal S6 1: ON 0: OFF
	Bit 6	Multi-function digital input terminal S7 1: ON 0: OFF
	Bits 7 ~ F	Not used
002C	Drive status	
	Bit 0	Operation1: Operating
	Bit 1	Zero speed1: Zero speed
	Bit 2	Frequency agree1: Matched
	Bit 3	Desired frequency agree1: Matched
	Bit 4	Frequency detection 11: Output frequency £ L4-01
	Bit 5	Frequency detection 21: Output frequency Š L4-01
	Bit 6	Drive startup completed1: Startup completed
	Bit 7	Low voltage detection 1: Detected
	Bit 8	Baseblock1: Drive output baseblock
	Bit 9	Frequency reference mode1: Not communication 0: Communication
	Bit A	Run command mode1: Not communication 0: Communication
	Bit B	Overtorque detection1: Detected
	Bit C	Frequency reference lost1: Lost
	Bit D	Retrying error1: Retrying
	Bit E	Error (including MEMOBUS / Modbus communications time-out) 1:Error occurred
	Bit F	MEMOBUS / Modbus communications time-out 1: Timed out
002D	Multi-function digital output status	
	Bit 0	Multi-function digital output 1 (terminal M1-M2) 1: ON 0: OFF
	Bit 1	Multi-function digital output 2 (terminal M3-M4): 1: ON 0: OFF
	Bit 2	Not used
	Bits 3 ~ F	Not used
002E - 0030	Not used	
0031	Main circuit DC voltage	
0032 - 0037	Not used	
0038	PI feedback level (Input equivalent to 100% / Max. output frequency; 10 / 1%; without sign)	
0039	PI input level (±100% / ±Max. output frequency; 10 / 1%; with sign)	
003A	PI output level (±100% / ±Max. output frequency; 10 / 1%; with sign)	
003B	CPU software number	
003C	Flash software number	
003D	Communication error details	
	Bit 0	CRC error
	Bit 1	Invalid data length
	Bit 2	Not used
	Bit 3	Parity error
	Bit 4	Overrun error
	Bit 5	Framing error
	Bit 6	Time-out
	Bits 7 ~ F	Not used
003E	kVA setting	
003F	Control method	

Note: Communication error details are stored until an error reset is input (errors can be reset while the drive is operating).

■ Broadcast Data

The following table shows the broadcast data. Broadcast Data Can Be Written (function Code 06 / 10) only.

Table 39 Broadcast Data

Register Hex	Contents	
0001	Operation signal	
	Bit 0	Run forward 1: Run 0: Stop
	Bit 1	Reverse operation command 1: Run 0: Stop
	Bits 2 and 3	Not used
	Bit 4	External error (1: Fault set using H1-01)
	Bit 5	Error (Fault 1: Reset commandset using H1-02)
	Bits 6 ~ B	Not used
	Bit C	Multi-function digital input terminal S5 input
	Bit D	Multi-function digital input terminal S6 input
	Bit E	Multi-function digital input terminal S7 input
	Bit F	Not used.
0002	Frequency reference	30000 / 100%
Note: Bit signals not defined in the broadcast operation signals use local node data signals continuously.		

■ Enter Command

When writing parameters to the iQpump drive from the PLC using MEMOBUS / Modbus communication, the parameters are temporarily stored in the constant data area in the drive. To enable these parameters in the parameter data area, use the Enter command.

There are two types of Enter commands:

1. Enter commands that enable parameter data in RAM
2. Enter commands that write data to EEPROM (non-volatile memory) in the iQpump drive at the same time as enabling data in RAM.

The following table shows the Enter command data. Enter command data can only be written.

The Enter command is enabled by writing 0 to register number 0900 or 0901.

Table 40 Enter Command

Register Hex	Contents
0900	Write parameter data to EEPROM
0910	Parameter data is not written to EEPROM, but refreshed in RAM only.

Important: The maximum number of times the EEPROM can be written using the iQpump drive is 100,000. Do not frequently execute Enter commands (0900) written to EEPROM.
The Enter command registers are write-only. Consequently, if reading these registers, the register address will become invalid (Error code: 02).

■ Error Codes

The following table shows MEMOBUS / Modbus communication error codes.

Table 41 Error Codes

Error Code (Hex)	Contents
01	Function code error A function code other than 03, 08, or 10 has been set by the PLC.
02	Invalid register number error • The attempt to access the register address is not recorded. • With broadcast sending, a start address other than 0000, 0001, or 0002 has been set.
03	Invalid quantity error • The number of data packets being read or written is outside the range of 1 to 16. • In write mode, the number of data packets in the message is not No. of packets x 2.
21	Data setting error • Upper limit or lower limit error has occurred in the control data or when writing parameters. • When writing parameters, the parameter setting is invalid.
22	Write mode error • Attempting to write parameters to the drive during run. • Attempting to write via Enter commands during run. • Attempting to write parameters other than A1-00 to A1-05, E1-03, or 02-04 when a CPF03 (defective EEPROM) fault has occurred. • Attempting to write read-only data.
23	Writing during main circuit undervoltage (UV) fault • Writing parameters to the drive during UV (main circuit undervoltage) alarm. • Writing via Enter commands during UV (main circuit undervoltage) alarm.
24	Writing error during parameters processing Attempting to write parameters while processing parameters in the drive.

■ Slave Not Responding

In the following cases, the slave will ignore the write function.

- When a communication error (overrun, framing, parity, or CRC-16) is detected in the command message.
- When the slave address in the command message and the slave address in the iQpump drive do not agree.
- When the data that configures the message and the data time length exceed 24 bits.
- When the command message data length is invalid.

Important: If the slave address specified in the command message is 0, all slaves execute the write function, but do not return response messages to the master.

■ MEMOBUS / Modbus Self-Diagnosis

The iQpump drive has a built-in function for self-diagnosing the operations of serial communication interface circuits. The self-diagnosis function connects the communication parts of the send and receive terminals, receives the data sent by the drive, and checks if communication is being performed normally.

Perform the self-diagnosis function using the following procedure.

1. Turn ON the power supply to the drive, and set parameter H1-05 (Terminal S7 Function Selection) to 67 (Comm Test Mode).
2. Turn OFF the power supply to the drive.
3. Perform wiring according to the following diagram while the power supply is turned OFF.
4. Turn ON the terminating resistance. (Turn ON pin 1 on DIP switch 1.)
5. Turn ON the power supply to the iQpump drive again.

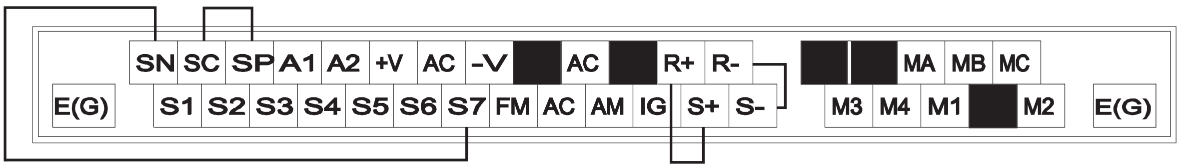


Figure 95. Communication Terminal Connection for Self -Diagnosis Function

6. During normal self-diagnostic operation, the Digital Operator displays the frequency reference value. If an error occurs, a CE (MEMOBUS / Modbus communication error) alarm will be displayed on the Digital Operator, the fault contact output will be turned ON, and the iQpump drive operation ready signal will be turned OFF.

■ H5-01 Drive Node Address

Setting Range:	0 ~ 20 (Hex)	} MODBUS	0 ~ FF	} N2	0 ~ 63	} P1
Factory Default:	1F		1F		1F	

In order for a master to be able to communicate with the iQpump drive using serial communications, the iQpump drive must have a unique node address. The iQpump drive is given a node address if H5-01≠ 0. The node addresses do not have to be assigned in sequential order but they must be unique, i.e. no two drives on the same serial network can be assigned the same address. After setting the iQpump drive address with the H5-01 parameter, the power to the iQpump drive must be cycled for the addressing to take effect.

Leaving H5-01 = 0 will disable responses to MEMOBUS / Modbus communications.

■ H5-02 Communications Speed Selection

Setting	Description
0	1200 Baud
1	2400 Baud
2	4800 Baud (Standard for APOGEE)
3	9600 Baud (***factory default***) (Standard for Metasys)
4	19200 Baud

■ H5-03 Communications Parity Selection

Setting	Description
0	No Parity (***factory default***)
1	Even Parity
2	Odd Parity

Parameters H5-02 and H5-03 configure the drives MEMOBUS / Modbus communications via the RS-485 / 422 terminals on the removable terminal block. Configure H5-02 and H5-03 to match the settings of the master controller of the serial network. After changing the H5-02 or H5-03 parameter, the power to the iQpump drive must be cycled for the change to take effect.

If either the speed or parity value is changed via the serial communications, the serial communications will cease to operate until the iQpump drive power is cycled.

It may be necessary to avoid the 19.2 K baud setting if frequent serial communications errors occur at that baud rate.

■ H5-04 Stopping Method after Communication Error

Setting	Description
0	Ramp to Stop
1	Coast to Stop
2	Fast-Stop
3	Alarm Only (***factory default***)

The setting of parameter H5-04 will determine the drive's reaction to a serial communications fault such as the CE fault. The iQpump drive can be programmed to either ramp to a stop in the time specified by C1-02 (H5-04 = "0: Ramp to stop"), coast to a stop (H5-04 = 1), ramp to a stop at the special fast stopping time specified by C1-09 (H5-04 = "2: Fast-Stop"), or continue operating using the commands received before the serial communication fault and flashing an alarm on the digital operator (H5-04 = "3: Alarm Only").

■ H5-05 Communications Error Detection Selection

Setting	Description
0	Disabled
1	Enabled (***factory default***)

The iQpump drive can be configured by parameter H5-05 to recognize a CE fault whenever serial communications time-out. If H5-05 = "1: Enabled," the iQpump drive will fault if serial communication responses are not received within a set period of time determined by parameter H5-09. iQpump drive power should be cycled after a change is made to this parameter.

■ H5-06 Drive Transit Wait Time

Setting Range: 5 ~ 65 ms

Factory Default: 5 ms

Parameter H5-06 will set the delay time between the receiving of a message from the master and the sending of a response from the iQpump drive back to the master. The iQpump drive power should be cycled after a change is made to this parameter.

■ H5-07 RTS Control Selection

Setting	Description
0	Disabled (RTS is always on)
1	Enabled (RTS turns on only when sending) (***factory default***)

RTS or Request To Send control is a method of flow control applied to messaging in serial communications. Parameter H5-07 configures whether the iQpump drive will implement RTS messaging all the time (H5-07 = "0: Disabled") or only when sending (H5-07 = "1: Enabled"). It is recommended to set H5-07 = "0: Disabled," when using RS-485 and set H5-07 = "1: Enabled," when using RS-422. The iQpump drive power should be cycled after a change is made to this parameter.

■ H5-08 Communication Protocol Selection

Setting	Description
0	MEMOBUS / Modbus (***factory default***)
1	N2 (Metasys)
2	FLN (APOGEE)

Since the iQpump drive is capable of using MEMOBUS / Modbus, Metasys N2, or Apogee FLN communications via the RS-485 / 422 terminals, parameter H5-08 must be programmed to specify to the iQpump drive which format is being used. iQpump drive power should be cycled after a change is made to this parameter.

■ H5-09 Communication Error Detection Time

Setting Range: 0.0 ~ 10.0 s

Factory Default: 2.0 s

The setting of parameter H5-09 determines the length of time that serial communications must be lost before a CE fault occurs. Setting H5-09 = 0 will configure the iQpump drive for the quickest CE fault detection but may cause nuisance faults. The iQpump drive power should be cycled after a change is made to this parameter.

iQpump MEMOBUS / Modbus Status Registers

The data in these registers is not synchronized to any other MEMOBUS / Modbus register, even if read from within the same "read multiple" MEMOBUS / Modbus Read Command. This data from various iQpump features is copied and scaled for inclusion in the following register.

■ MEMOBUS / Modbus Registers

Table 42   MEMOBUS / Modbus Registers

Register Hex	Description	
728	**Extended Pump Status Word**	
	Bit	Description
	0	Sleep Active
	1	Start Level Delay
	2	Thrust Bearing Active
	3	Pre-charge Active
	4	High Feedback Detected
	5	Low Feedback Detected
	6	Transducer Loss
	7	Setpoint Not Met
	8	Loss of Prime
	9	Thermostat Fault
	A	Low Flow Detected
	B	Utility Delay Active
	C	Run / Stop Stopped Condition
	D	Run / Stop Finished (cycles complete)
	E	Anti-Jam / De-Scale Active
	F	Reserved
729	**Extended Pump Status Word 1**	
	Bit	Description
	0	Sleep Active
	1	Start Level Delay
	2	Thrust Bearing Active
	3	Pre-charge Active
	4	High Feedback Detected
	5	Low Feedback Detected
	6	Transducer Loss
	7	Setpoint Not Met
	8	Loss of Prime
	9	Thermostat Fault
	A	Low Flow Detected
	B	Utility Delay Active
	C	Run / Stop Stopped Condition
	D	Run / Stop Finished (Cycles complete)
	E	Anti-Jam Active
	F	De-Scale Active

Register Hex	Description
72E	**Extended Pump Status Word 1** Bit Description 0 Sleep Active 1 Accum. Level Maximum Reached 2 During Run 2 3 Lube Pump Active 4 High Flow Active 5 Low Water Level Active (Digital Input) 6 High Water Level Active (Digital Input) 7 Sleep Boost Active 8 Thrust Bearing Decel Active 9 Thrust Bearing Accel Active 10 Motor 2 Alternate Enabled (P4-14 > 0 and P1-01 = 0) 11 Alternate Motor 2 Selected 12 Alternate Motor Change Pending 13 Dual Zone PI Control Enabled 14 Dual Zone: Zone 1 Active (both Zone 1 and Zone 2 for Zone 3) 15 Dual Zone: Zone 2 Active (both Zone 1 and Zone 2 for Zone 3)
72F	**Extended Pump Status Word 1** Bit Description 0 Timer Run Active (On / Off Control) 1 Low City Pressure Input Active (after time delay) 2 Water Level Control Active 3 Low Water Level Detected (Water Level Control Mode, Auto-Mode Run Only 4 Pre-charge Freq. 1 Active 5 Pre-charge Freq. 2 Active 6 ~ 15 -- NOT USED--
730	Anti-Jam / De-Scale: Cycle Count
731	Utility Delay Timer (1 = 0.1 min)
732	Fault Restart Timer (1 = 0.1 s)
733	Active Alternate Timer (Two Motor Alternation Function) (1 = 0.1 hr)
734	Active On Timer (Run / Stop Mode) (1 = 0.1 min)
735	Active Off Timer (Run / Stop Mode) (1 = 0.1 min)
736	Control Cycles (Run / Stop Mode)
737	De-Scale Run Timer (1 = 0.1 hr)
750	Pump System Array Index (for Writing) (master only)
751	Pump System Array Index (for Reading / Verification) (master only)
752	Pump System Array drive_status (master only)
753	Pump System Array pump_status (master only)
754	Pump System Array pump_runtime (master only)
755	Pump System Array pump _feedback_o (master only)
756	Pump System Array pump_control (master only)
757	Pump System Array pump_control2 (master only)
758	Pump System Array pump_feedback_x (master only)
759	Pump System Array pump_running (master only)
75A	Pump System Array pump_available (master only)
75B	Pump System Array Index (for Writing) (master only)
75C	Pump System Array Index (for Reading) (master only)
75D	Pump System Array address (master only)
75E	Pump Queue Array p_stats (master only)
75F	Pump Queue Array queue_no (master only)
760	Network Status Flags net_status (master only)
761	Network Status Flags net_status2 (master only)
762	Communication Register i_drive_status
763	Communication Register i_pump_status
764	Communication Register i_pump_runtime

Register Hex	Description
765	Communication Register i_pump_feedback_o
766	Communication Register i_pump_control
767	Communication Register i_pump_control2
768	Communication Register i_pump_feedback_x
769	Communication Register i_pump_running
76A	Communication Register i_pump_available
76B	Local Node Status Flags node_flags

L1 Motor Overload

◆ L1-01 Motor Overload Protection Selection

Setting	Description
0	Disabled
1	Std Fan Cooled (Enabled) (***factory default***)

The iQpump drive has an I^2t electronic overload protection function, the OL1 fault, for protecting the motor from overheating. The iQpump drive bases the protection on time, output current, and output frequency. The electronic thermal overload function is UL-recognized so an external thermal overload relay is not required.

If the iQpump drive is connected to a single motor, the motor overload protection should be enabled (L1-01 = "1: Std Fan Cooled") unless another means of preventing motor thermal overload is provided.

The time before the OL1 fault will occur changes as the output frequency is reduced. The maximum output current level at which there is no time limit for operation (the OL Start Point) is different depending on the output frequency. For instance, if the iQpump drive is being operated at 60 Hz and the output current level is below 106% of the motor's rated current (E2-01), the iQpump drive will run without an OL1 fault indefinitely. Once the 106% output current level is exceeded, de-rating of the OL1 time starts.

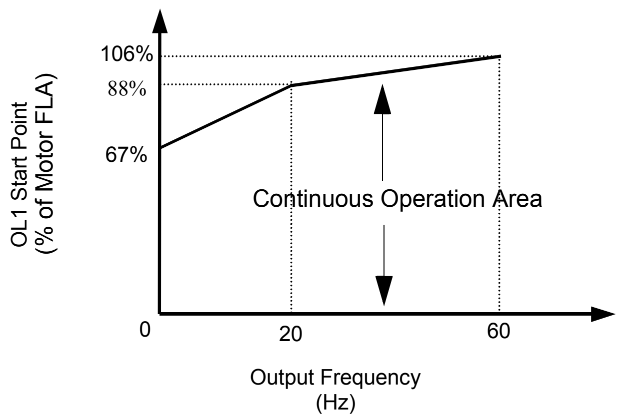


Figure 96. Motor Overload Protection Curve

Important: If the iQpump drive is connected to more than one motor for simultaneous operation, the electronic overload protection should be disabled (L1-01 = "0: Disabled") and each motor should be wired with its own motor thermal overload.

◆ L1-02 Motor Overload Protection Time

Setting Range: 0.1 ~ 20.0 min

Factory Default: 8.0 min

The L1-02 parameter will set the allowed operation time before the OL1 fault will occur when the iQpump drive is running at 60 Hz and 133% of the motor's full load amp rating (E2-01). Adjusting the value of L1-02 can shift the set of OL1 curves up the Y-axis of the diagram below but will not change the shape of the curves.

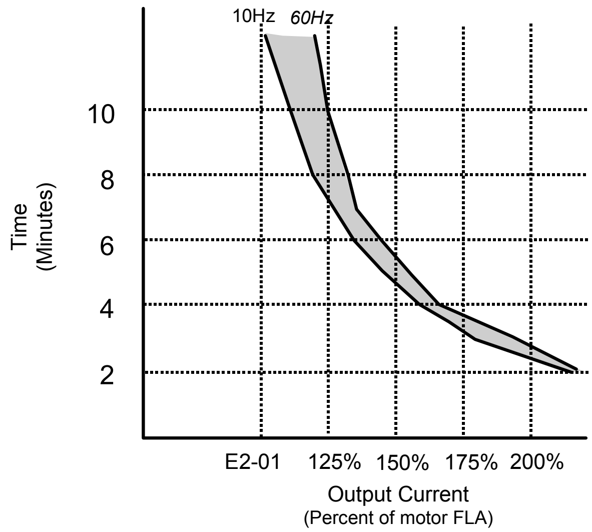


Figure 97. Motor Overload Protection Time based on Output frequency and Load

◆ L1-03 Motor Overheat Alarm Operation Selection

Setting	Description
0	Ramp to Stop
1	Coast to Stop
2	Fast-Stop
3	Alarm Only (***factory default***)

◆ L1-04 Motor Overheat Fault Operation Selection

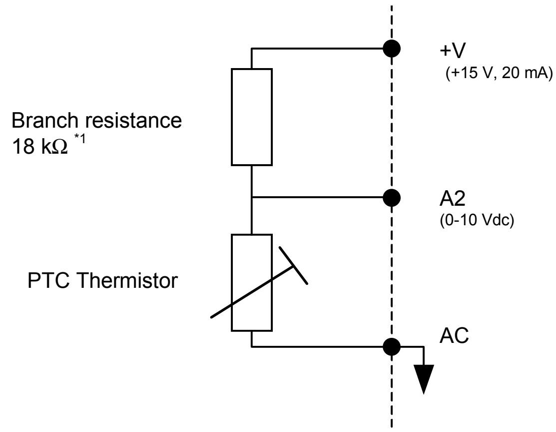
Setting	Description
0	Ramp to Stop
1	Coast to Stop (***factory default***)
2	Fast-Stop

◆ L1-05 Motor Temperature Input Filter Time

Setting Range: 0.00 ~ 10.00 s

Factory Default: 0.20 s

The iQpump drive can be programmed to accept a PTC (Positive Temperature Coefficient) Thermistor input for monitoring motor temperature. By setting parameter H3-09 = "E: Motor Temperature," and attaching the PTC thermistor per the *Figure 98.* below, the iQpump drive can react to the increasing motor winding temperature with both an alarm (L1-03) and a fault (L1-04).



*1 The resistance value of 18 kΩ is only valid for using a 3-phase PTC with the characteristics shown in the figure on following page.

Figure 98.

A typical PTC Thermistor characteristic shown on the following page.

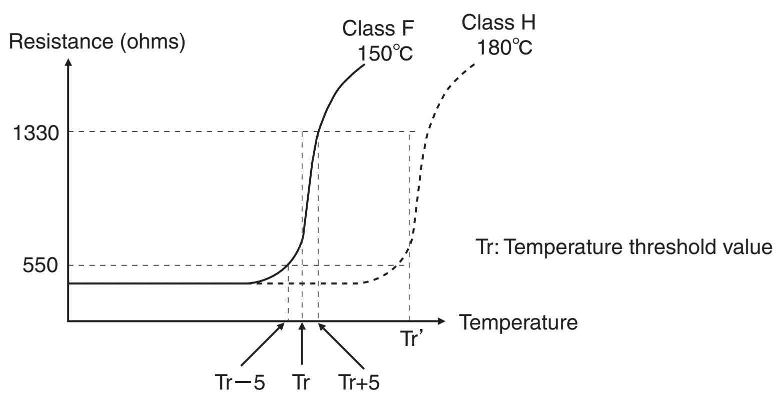


Figure 99. PTC Thermistor Temperature-Resistance Value Characteristics

Using the changing voltage drop across the thermistor the voltage into the A2 analog input will vary according to the motor's winding temperature. If the measured voltage into A2 exceeds 1.17 Vdc the iQpump drive will flash an OH3 alarm on the digital operator and will either ramp to a stop in the time specified by C1-02 (L1-03 = "0: Ramp to Stop"), coast to a stop (L1-03 = "1: Coast to Stop"), ramp to a stop at the special fast stopping time specified by C1-09 (L1-03 = "2: Fast-Stop"), or continue operating using the commands received before the OH3 alarm (L1-03 = "3: Alarm Only"). The drive's fault contact, MA-MB, will not close.

If the measured voltage into the A2 analog input exceeds 2.34 Vdc the iQpump drive will fault (OH4) and either ramp to a stop in the time specified by C1-02 (L1-04 = "0: Ramp to Stop"), coast to a stop (L1-04 = "1: Coast to Stop"), ramp to a stop at the special fast stopping time specified by C1-09 (L1-04 = "2: Fast-Stop"). The drive's fault contact, MA-MB, will close.

Parameter L1-05 will apply a time delay filter to the A2 analog input when it is configured as the thermistor input. The greater the time programmed into L1-05 the less responsive the iQpump drive will be to quick changes to the input voltage but the more stable the input will be. A noisy input will benefit from a greater L1-05 time.

L2 Momentary Power Loss Ride-thru Function

When momentary power loss recovery is enabled (L2-01≠0), a speed search is executed to catch the potentially spinning motor shaft. This speed search will occur regardless of the setting of b3-01 "Speed Search Selection".

◆ L2-01 Momentary Power Loss Detection Selection

Setting	Description
0	Disabled
1	PwrL Ride Thru t
2	CPU Power Active (***factory default***)

◆ L2-02 Momentary Power Loss Ride-Thru Time

Setting Range: 0.0 ~ 25.5 s

Factory Default: Model Dependent

The iQpump drive allows different responses to momentary power losses. The setting of L2-01 determines whether the iQpump drive attempts to restart after a short loss of incoming AC power and for what length of time this capability remains active.

If L2-01 = "0: Disabled," the iQpump drive detects a UV1 fault 15 ms after power loss and automatic restarting is disabled. The iQpump drive cannot restart until the external run command is removed and the UV1 fault is reset.

If L2-01 = "1: PwrL Ride Thru t," the iQpump drive restarts without the UV1 fault if power is returned within the time specified in L2-02, the Momentary Power Loss Ride-thru Time. During the power loss but before the fault trip, the digital operator will display a UV alarm. If L2-02 is set for a time longer than the control power supply can be sustained, a UV1 fault will not occur and the iQpump drive restarts upon the return of AC power. The time that the control power supply can be maintained varies with iQpump drive size. The larger the drive, the greater the potential ride-thru time.

If L2-01 = "2: CPU Power Active," the iQpump drive ignores L2-02 and attempts a restart as long as the control power supply is still able to maintain a minimal voltage level. In effect, setting L2-01 = "2: CPU Power Active" (factory default) is programming the iQpump drive for maximum Power Loss Ride-thru. An equivalent setting is L2-01 = "1: PwrL Ride Thru t," with L2-02 set to a time longer than the control power supply can be maintained after power is lost.

Note: The run command must be held during power loss for any power loss ride-thru capability to be possible. It is for this reason that 3-wire control is not recommended for use with the Momentary Power Loss function.

◆ L2-03 Momentary Power Loss Minimum Baseblock Time

Setting Range: 0.1 ~ 5.0 s

Factory Default: Model Dependent

When momentary power loss recovery is enabled (L2-01≠ 0) the iQpump drive will baseblock for a period of time specified by the L2-03 parameter. The baseblock time will be executed just prior to the speed search function in order to allow any residual magnetic fields in the motor windings to decay before any new voltage is applied to the motor.

If the motor's secondary circuit time constant is known, set L2-03 = 0.7x (value of time constant). If an OC or OV fault occurs during momentary power loss recovery, increase the setting of L2-03.

The L2-03 parameter also sets the baseblock time for the DC Injection Braking function (b1-03 = "2: DC Injection to Stop"). If an OC or OV fault occurs during DC Injection Braking to Stop, increase the setting of L2-03.

◆ L2-04 Momentary Power Loss Voltage Recovery Ramp Time

Setting Range: 0.0 ~ 5.0 s

Factory Default: Model Dependent

When momentary power loss recovery is enabled (L2-01≠0), a speed search is executed to catch the potentially spinning motor shaft. As part of the speed search function full voltage is not immediately applied to the motor but is ramped up. The setting of parameter L2-04 determines the ramp time for increasing the output voltage from zero to maximum voltage (E1-05).

If a UV1 fault occurs during the current detection speed search function, increase the setting of L2-04.

◆ L2-05 Undervoltage Detection Level

Setting Range: 150 ~ 210 Vdc

Factory Default: 190 Vdc

The L2-05 parameter sets the DC Bus undervoltage level. The setting of L2-05 affects the voltage at which a UV alarm or a UV1 fault will occur. If the setting of L2-05 is lowered below the factory default level (190 Vdc for a 240 Vac drive and 380 Vdc for a 480 Vac drive), then an AC Input Reactor must be installed on the input AC line to prevent inrush current from damaging the drive's input diodes. An AC Line dip and fast voltage recovery can potentially cause a large inrush current.

L3 Stall Prevention

◆ L3-01 Stall Prevention Selection During Accel

Setting	Description
0	Disabled
1	General Purpose (***factory default***)
2	Intelligent

◆ L3-02 Stall Prevention Level During Accel

Setting Range: 0 ~ 200% of the iQpump drive rated output current

Factory Default: 120% of the iQpump drive rated output current

The stall prevention during acceleration function adjusts the acceleration time in order to prevent OC fault trips during acceleration. If L3-01 = "0: Disabled," stall prevention is disabled. If the load is large enough and the acceleration time short enough the iQpump drive may fault and stop.

If L3-01 = "1: General Purpose," then the standard stall prevention function is enabled. When the output current exceeds the level set by the L3-02 parameter, the iQpump drive will discontinue accelerating and maintain speed. If, during acceleration, the output current comes within 15% of the level set by parameter L3-02, the acceleration time is lengthened. Once the output current level has dropped below the L3-02 level, acceleration will begin again with the acceleration rate reaching the programmed rate once again 15% below the L3-02 level.

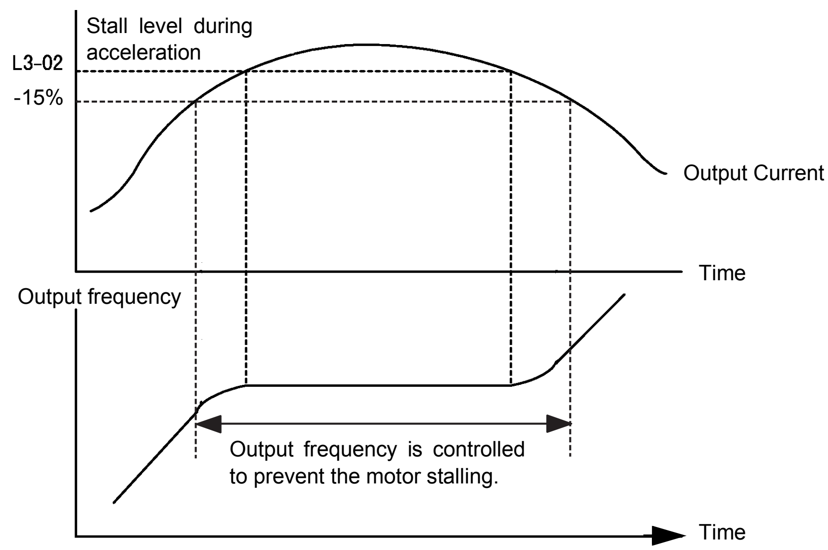


Figure 100. Detailed Time Chart for Stall Prevention During Acceleration

If L3-01 = "2: Intelligent," the intelligent stall prevention is enabled. The active acceleration time is ignored and the iQpump drive will attempt to accelerate as quickly as possible without exceeding the L3-02 output current level.

Important: Stall Prevention during Acceleration is not effective when the output frequency is less than 6 Hz.

The following *Figure 101.* demonstrates acceleration when L3-01 = "1: General Purpose".

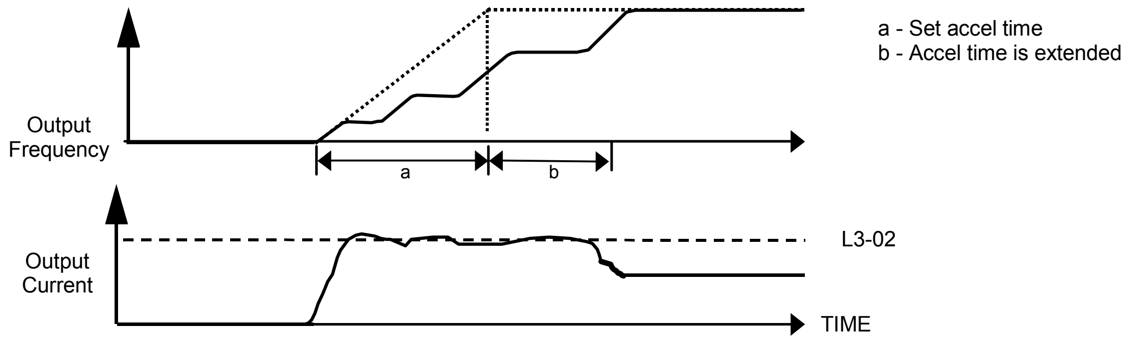


Figure 101. Time Chart for Stall Prevention During Acceleration

The L3-02 parameter is set as a percentage of the iQpump drive rated output current. If the motor capacity is small compared to the drive's capacity, or if the motor stalls during acceleration, lower the set value of L3-02.

◆ L3-04 Stall Prevention Selection During Decel

Setting	Description
0	Disabled
1	General Purpose (***factory default***)
2	Intelligent

The stall prevention during deceleration function adjusts the deceleration time in order to prevent OV fault trips during deceleration. If L3-04 = "0: Disabled," stall prevention is disabled and if the load is large and the deceleration time short enough the iQpump drive may fault and stop.

If L3-04 = "1: General Purpose," then the standard stall prevention function is enabled. If, during deceleration, the DC Bus voltage exceeds the stall prevention level (see *Table 43 on page 120*), the iQpump drive will discontinue decelerating and maintain speed. Once the DC Bus voltage has dropped below the stall prevention level, the deceleration will continue down to the Speed Command level. See *Figure 102.*.

Table 43 Stall Prevention During Decel

Drive Voltage		Stall Prevention Level during Deceleration (V)
240 Vac		380
480 Vac	E1-01 ≥ 400 Vac	760
	E1-01 < 400 Vac	660

If L3-01 = "2: Intelligent," the intelligent stall prevention is enabled. The active deceleration time is ignored and the iQpump drive will attempt to decelerate as quickly as possible without causing the DC Bus voltage to exceed the stall prevention level.

The following *Figure 102.* demonstrates acceleration when L3-04 = "1 General Purpose".

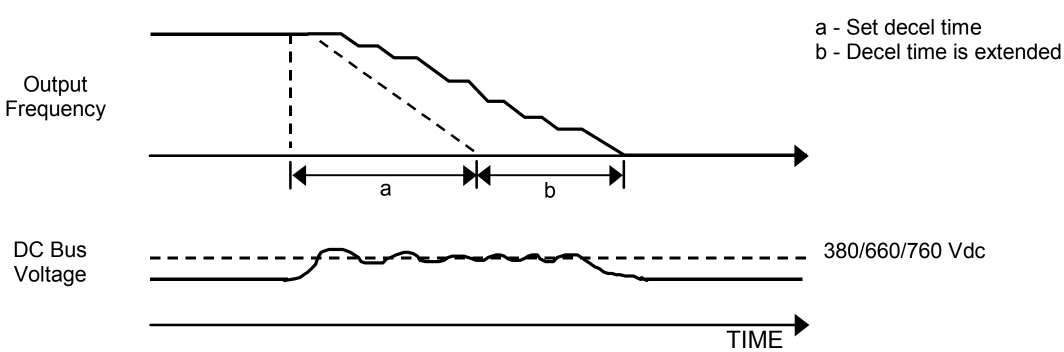


Figure 102. Time Chart for Stall Prevention During Deceleration

◆ L3-05 Stall Prevention Selection During Running

Setting	Description
0	Disabled
1	Decel Time 1 (***factory default***)
2	Decel Time 2

◆ L3-06 Stall Prevention Level During Running

Setting Range: 30 ~ 200% of the iQpump drive rated output current

Factory Default: 120% of the iQpump drive rated output current

The Stall Prevention During Running function will attempt to avoid an iQpump drive OC fault occurrence while the iQpump drive is operating at a constant speed. If L3-05 = "0: Disabled," the iQpump drive may fault if the load increases sufficiently to cause the output current to reach the OC fault level (180% of the iQpump drive rated output current).

If L3-05 = "1: General Purpose," the iQpump drive is outputting a constant speed, and the drive's output current level exceeds the level set by parameter L3-06 for more than 100 ms the iQpump drive will begin to decelerate at the rate specified by parameter C1-02. The iQpump drive will continue to decelerate until the output current level drops below the L3-06 level (less a 2% hysteresis). Once the output current drops below the L3-06 – 2% level the iQpump drive will begin to accelerate at the currently active acceleration rate (either C1-01 or C1-03).

If L3-05 = "2: Decel Time 2," the iQpump drive will function as described above except C1-04 will be used instead of C1-02 as the deceleration rate used when the output current exceeds L3-06 for more than 100 ms.

The following *Figure 103.* demonstrates acceleration when L3-05≠0.

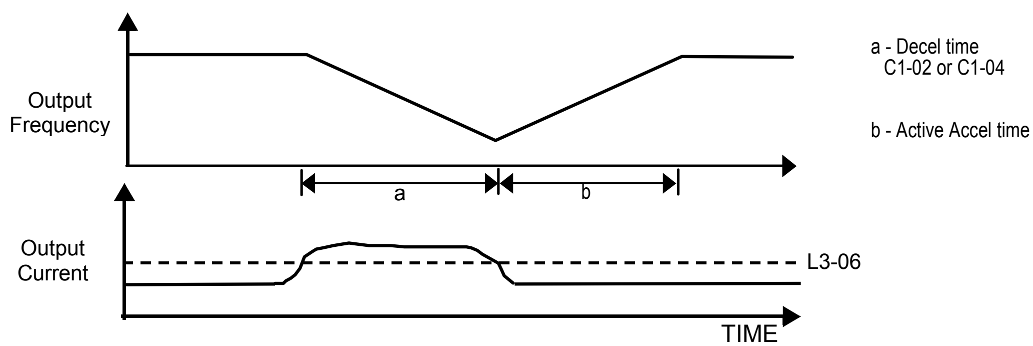


Figure 103. Time Chart for Stall Prevention Level During Running

The L3-06 parameter is set as a percentage of the iQpump drive rated output current. If the iQpump drive still faults when L3-05≠0, then either lower the L3-06 or adjust the C1-02 or C1-04 settings for a quicker deceleration.

L4 Speed Command Loss Detection

◆ L4-01 Speed Agreement Detection Level

Setting Range: 0.0 ~ 200.0 Hz

Factory Default: 0.0 Hz

Refer to parameter L4-01 in Appendix A for description details.

◆ L4-02 Speed Agreement Detection Width

Setting Range: 0.0 ~ 20.0 Hz

Factory Default: 2.0 Hz

Parameters L4-01 and L4-02 are user specified levels for use with the Fref / Fout Agree 1, Fref / Set Agree 1, and Freq Detect 1 and 2 digital output functions. Please refer to the H2 Digital Output Parameters for more information.

◆ L4-05 Frequency Reference Loss Detection Selection

Setting	Description
0	Disabled
1	Enabled @ % of PrevRef (***factory default***)

Note: Only available in Hand Mode (P5-01 = 0).

◆ L4-06 Frequency Reference at Loss of Frequency Reference

Setting Range: 0.0 ~ 100% of previous speed command

Factory Default: 80% of previous speed command

The drive can be configured to compensate for the loss of its external speed command. An external speed command is considered lost if it drops 90% of its value in 400 mS or less.

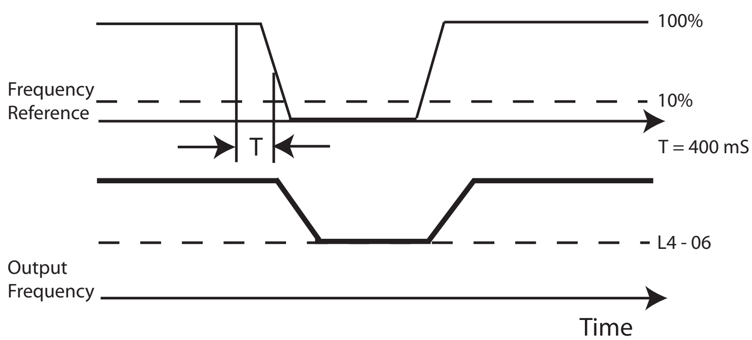


Figure 104. Loss of Frequency Reference Timing Diagram

To enable Frequency loss detection, set L4-05 = “1: Enabled @% of PrevRef”. If Frequency Reference Loss Detection is enabled and the reference is lost, the drive continues to operate at the speed commanded by parameter L4-06. When the speed command returns, the drive again follows the speed command.

Setting H2-01 / H2-02 = “C: Loss of Ref”, configures a digital output as a Frequency Reference Loss indication only when L4-05 = “1” Enabled @ % of PrevRef”.

Note: Only available in Hand Mode (P5-01 = 0).

L5 Fault Restart

◆ L5-01 Number of Auto Restart Attempts

Setting Range: 0 ~ 10

Factory Default: 5

Refer to parameter L5-01 in Appendix A for description details.

◆ L5-02 Auto Restart Operation Selection

Setting	Description
0	No Flt Relay (***factory default***)
1	Flt Relay Active

◆ L5-03 Maximum Restart Time After Fault

Setting Range: 10.0 ~ 3600.0 s <0032>

Factory Default: 20.0 s

All major faults will cause the iQpump drive to stop. For some faults it is possible to configure the iQpump drive to attempt a restart automatically. After the fault occurs, the iQpump drive baseblocks for the Maximum Restart Time After Fault programmed in L5-03. After the baseblock is removed the iQpump drive checks if a fault condition still exists. If no fault condition exists the iQpump drive will attempt to restart the motor. If the restart is successful, the iQpump drive performs a Speed Search (Regardless of the status of b3-01 “Speed Search Selection”) from the set speed command and the Auto Restart Attempts count is increased by one. Even if the restart fails the restart count is increased by one as long as the iQpump drive attempted to rotate the motor. The restart count will not be incremented if the restart is not attempted due to a continuing fault condition, (i.e. an OV fault). The iQpump drive waits the Maximum Restart Time After Fault (L5-03) before attempting another restart. This parameter is not applicable to Loss of Prime Fault.

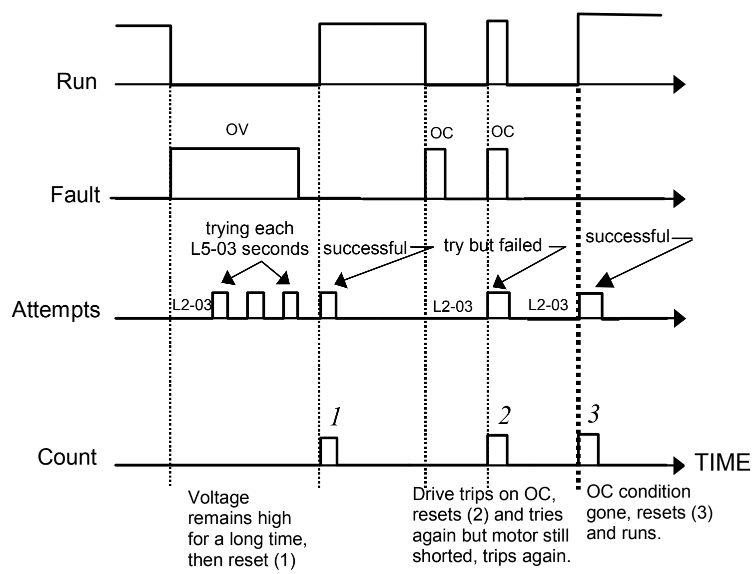


Figure 105. Automatic Restart Timing Diagram

The auto restart count is reset back to 0 if any of the following occur:

- No further faults for ten minutes after the last retry.
- The drives power is turned off (the iQpump drive must be without power long enough to let control power dissipate).
- The SHIFT / RESET key is pushed after the last reset attempt.

The setting of parameter L5-02 determines whether the fault output (MA-MB) will be closed during an auto restart attempt. The setting of L5-02 can be important when interfacing the iQpump drive with other equipment.

The following faults will allow the Auto Restart function to initiate:

- OC (Overcurrent)
- LF (Output Open Phase)
- PF (Input Phase Loss)
- PUF (DC Bus Fuse)
- OL1 (Motor Overload)
- OL3 (Overtorque)
- OL2 (Drive Overload)
- OV (DC Bus Overvoltage)
- GF (Ground Fault)
- UV1 (DC Bus Undervoltage)
- OH1 (Overheat)

In order for auto restart after a UV1 fault, Momentary Power Loss Ride-thru must be enabled (L2-01 = “1: PwrL Ride Thru t,” or “2: CPU Power Active”). Setting H2-01 or H2-02 equal to “1E” configures a digital output as “Restart Enabled” to signal if an impending auto restart is possible.

L6 Torque Detection

◆ L6-01 Torque Detection Selection 1

Setting	Description
0	Disabled (***factory default***)
1	OL@SpdAgree - Alm
2	OL At Run -Alm
3	OL@SpdAgree - Flt
4	OL At Run - Flt
5	UL@SpdAgree - Alm
6	UL at Run - Alm
7	UL@SpdAgree - Flt
8	UL At Run - Flt

◆ L6-02 Torque Detection Level 1

Setting Range: 0 ~ 300% of the iQpump drive rated output current

Factory Default: 15% of the iQpump drive rated output current

Refer to parameter L6-02 in Appendix A for description details.

◆ L6-03 Torque Detection Time 1

Setting Range: 0.0 ~ 10.0 s

Factory Default: 10.0 s

The iQpump drive can be programmed to indicate when either an overtorque or an undertorque conditions exist. A digital output must be programmed for “Torque Detection,” (H2-01 / H2-02 = “B: Trq Det 1 N.O.” or “17: Trq Det 1 N.C.). A warning of an overtorque condition can indicate a jam and an undertorque condition can indicate a broken belt, no water in a pump, or other loss of load.

To configure Torque Detection requires the following decisions:

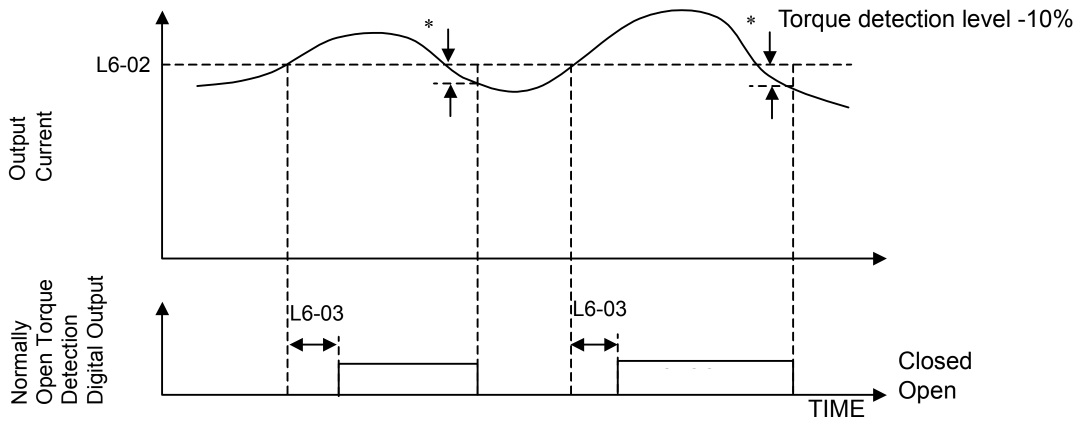
1. Is an overtorque condition or an undertorque condition being checked?
2. Is the torque condition present when the drive is running or only at speed agree? Nuisance detection during acceleration, when variable torques are normally required, can be avoided.
3. Is the drive to fault if the torque condition is detected or only alarm and continue operation?

The following table can help choose the proper setting for Torque Detection Selection 1 to get the wanted results.

Table 44 L6-01 Setting Choices

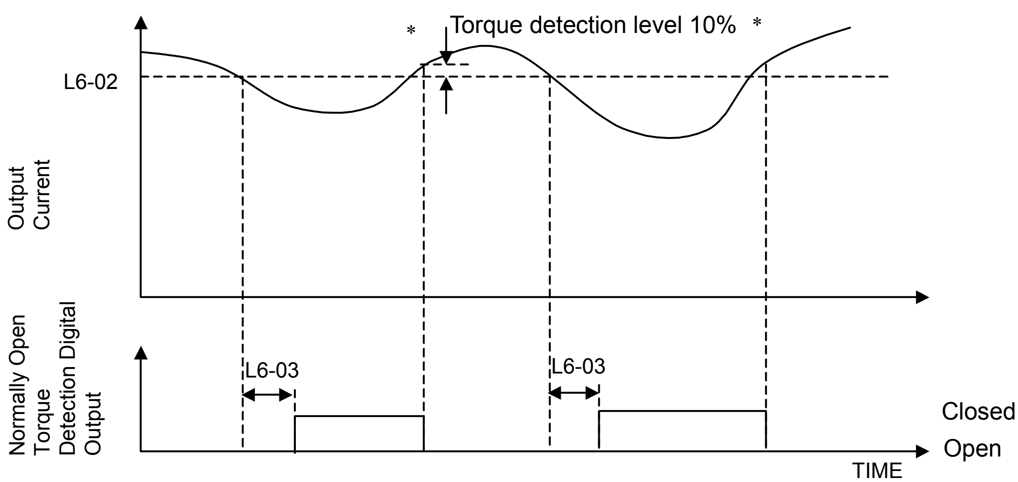
L6-01 Setting	Overtorque	Undertorque	Fault	Alarm	Always Detected	Only Detected @ Spd Agree
0	Torque Detection Disabled					
1	X			X		X
2	X			X	X	
3	X		X			X
4	X		X		X	
5*		X		X		X
6		X		X	X	
7		X				X
8		X			X	
*Suggested settings for Loss of Load indication						

After selecting the proper detection scheme the Torque Detection Level (L6-02) must be specified. If the current level read by the output current transformers rises above (overtorque) or drops below (undertorque) this level, and remains there for at least the Torque Detection Time (L6-03), then the Torque Detection Function will change the state of any digital output configured for Torque Detection (H2-01 / H2-02 = “B: Trq Det 1 N.O.,” or “17: Trq Det 1 N.C.”).



* When the output current drops below the Torque Detection Level by approximately 10% of the Drive's rated output current the digital output is reset.

Figure 106. Overtorque Detection



* When the output current rises above the Torque Detection Level by approximately 10% of the Drive's rated output current the digital output is reset.

Figure 107. Undertorque Detection

L8 Hardware Protection

◆ L8-01 Internal Dynamic Braking Resistor Protection Selection

Setting	Description
0	Not Provided (***factory default***)
1	Provided

This parameter is not applicable for iQpump drive operation.

◆ L8-02 Overheat Pre-Alarm Level

Setting Range: 50 ~ 130 °C

Factory Default: 95 °C

Refer to parameter L8-02 in Appendix A for description details.

◆ L8-03 Overheat Pre-Alarm Operation Selection

Setting	Description
0	Ramp to Stop (Decel Time C1-02)
1	Coast to Stop
2	Fast-Stop (Decel Time C1-09)
3	Alarm Only
4	OH Alarm and Reduce (***factory default***)

The iQpump drive is capable of warning the operator of an impending heatsink over-temperature fault via an oH pre-alarm. The level at which the pre-alarm will activate is determined by the setting of parameter L8-02. Measurement of the heatsink temperature is done with several strategically mounted thermistors. If any of the heatsink thermistors measure a temperature in excess of the setting of L8-02, the iQpump drive will fault (oH2) and either: ramp to stop using the C1-02 deceleration rate (L8-03 = “0: Ramp to Stop”), coast to stop (L8-03 = “1: Coast to Stop”), ramp to stop using the C1-09 fast stop deceleration rate (L8-03 = “2: Fast-Stop”), alarm (oH) and continue running (L8-03 = “3: Alarm Only”), alarm (oH) and continue running but at a reduced speed (L8-03 = “4: Alarm and Reduce”). If L8-03 = 4: Alarm and Reduce, the iQpump drive will continue to run but will reduce the speed to the level determined by parameter L8-19. Refer to the description for parameter L8-19.

If a digital output is configured for OH Prealarm (H2-01 = “20: oH PreAlarm”), it will close whenever the heatsink temperature is greater than the L8-02 level no matter what the setting is of L8-03.

◆ L8-05 Input Phase Loss Protection <0033>

Setting	Description
0	Disabled
1	Enabled (***factory default***)

The input phase loss detection circuit monitors the DC bus current ripple and activates when one of the input phases is lost. The detection circuit calculates the maximum and minimum values of the DC bus voltage in one second intervals, and compares the difference (DV) between these values with an internal detection level. If DV reaches or exceeds the detection level, after 0.5 second, the input phase loss is detected; a PF fault occurs and the motor coasts to a stop.

Input phase loss detection is disabled in the following cases:

- A Stop command is input
- Magnetic Contactor (MC) shuts OFF
- CPU A/D converter fault (CPF5)
- During deceleration
- Output current < 30% of Inverter rated current

◆ L8-06 Input Phase Loss Detection Level

Setting Range: 0.0 ~ 25.0% of Drive O V Trip point

Factory Default: kVA Dependent

The iQpump drive checks for a lost input phase by monitoring the DC Bus voltage ripple. After an initial delay of approximately 12 seconds, the iQpump drive will sample the DC BUS voltage every 1.28 seconds to determine the minimum and maximum voltage readings. The difference between the minimum and maximum voltage is averaged over ten consecutive scans. If this “averaged” value is greater than the trip level as determined by L8-06 (L8-06 x 400 for 200 V class drives; L8-06 x 800 for 400 V class drives) the iQpump drive shuts down and displays “PF,” an input phase loss fault.

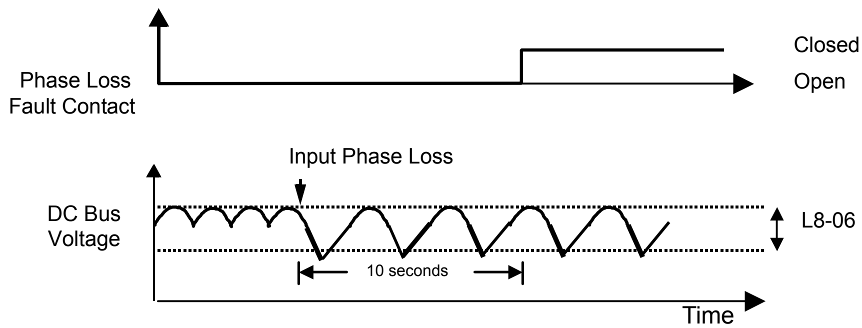


Figure 108. Input Phase Loss Detection Diagram

◆ L8-07 Output Phase Loss Protection <0033>

Setting	Description
0	Disabled
1	Enabled (***factory default***)

The output phase loss detection circuit monitors the DCCT and activates when one or more of the output phases are lost. The detection circuit calculates the RMS current value (IRMS) for each of the phases and compares it with an internal output detection level. If IRMS decreases to or below the detection level for 10 seconds, an output phase loss (LF) fault occurs and the motor coasts to a stop.

◆ L8-09 Output Ground Fault Detection Selection

Setting	Description
0	Disabled
1	Enabled (***factory default***)

The iQpump drive has a ground fault detection circuit that activates when the current to ground exceeds 50% of the drive’s rated output current. The current to ground is determined by comparing the measured current on each of the output phases. If the current to ground is determined to be above 50% of the drive’s rated output current the digital operator will display a GF and the iQpump drive will coast to stop.

◆ L8-10 Heatsink Cooling Fan Operation Selection

Setting	Description
0	Fan On-Run Mode (***factory default***)
1	Fan Always On

Refer to L8-11 description.

◆ L8-11 Heatsink Cooling Fan Operation Delay Time <0033>

Setting Range: 0 ~ 300 s

Factory Default: 300 s

Parameters L8-10 and L8-11 allow the iQpump drive programmer to customize the heatsink cooling fan operation. Parameter L8-10 determines whether the cooling fans are always ON whenever the iQpump drive is powered (L8-10 = “1: Fan Always On”) or if the cooling fans are only ON when the iQpump drive is in a Run condition (L8-10 = “0: Fan On-Run Mode”).

Parameter L8-11 is a delayed OFF for the cooling fan if L8-10 = “0: Fan On-Run Mode”. When the cooling fans are set to turn OFF is when either the Run command is removed or the drive is in baseblock. The iQpump parameter L8-11 will cause the fans to continue cooling the iQpump drive for the amount of time programmed into L8-11 after the Run command is actually removed or baseblocked enabled. The iQpump drive can be programmed to allow the cooling fan to run for up to 5 minutes (factory default) after the run command is removed or baseblock enabled.

Both parameters are intended to extend fan life while still providing sufficient cooling for proper iQpump drive operation.

Figure 109. Heatsink Cooling Fan Operation Timing Diagram

◆ L8-12 Ambient Temperature Setting

Setting Range: 113 ~ 140 °F (45 ~ 60 °C)

Factory Default: 113 °F (45 °C)

Set parameter L8-12 to the temperature °F (°C) of the area in which the iQpump drive is mounted. If L8-12 exceeds the actual rated ambient temperature of the iQpump drive 113 °F (45 °C), the OL2 fault level will be de-rated as shown in *Figure 110.* below. This will allow the user to trade-off lighter drive loading for operation in a higher ambient temperature.

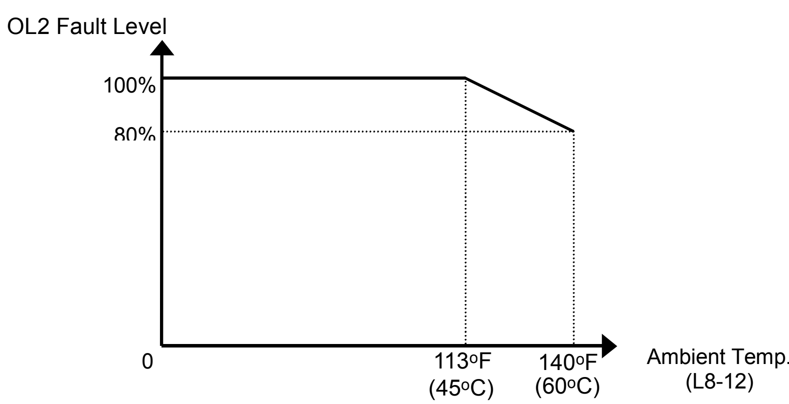


Figure 110. Ambient Temperature Derating Curve

◆ L8-15 OL2 Characteristic Selection at Low Speeds

Setting	Description
0	Disabled
1	Enabled (L8-18 is active) (***factory default***)

At very low speeds (6 Hz and below) and very high current levels it can be possible to damage output transistors. Therefore the factory default setting of L8-15 is to shorten the time before an OL2 fault will occur during low speed / high load situations (L8-15 = “1: Enabled”).

◆ L8-18 Soft CLA Selection

Setting	Description
0	Disabled
1	Enabled (***factory default***)

The Soft CLA (software current limit level) is an iQpump drive protection function that will limit the drive's output current. The iQpump drive limits the output current by reducing the output frequency whenever the current exceeds 110% of the inverter rated current If the current level drops below the Soft CLA level, then normal operation will continue.

If the software current limit is disabled (L8-18 = "0: Disabled"), the iQpump drive may trip on an OC fault if the load is prohibitively large or the acceleration is too short. For proper iQpump drive protection and operation leave the Soft CLA function enabled.

◆ L8-19 Overheat Frequency Reference Reduction Level

Setting Range: 0.0 ~ 100.0% of maximum frequency

Factory Default: 20.0% of maximum frequency

When the heatsink temperature reaches the OH Pre-alarm level (L8-02) and the Overheat Pre-Alarm Operation Selection parameter is set for Alarm and Reduce (L8-03 = "4: OH Alarm and Reduce"), the L8-19 parameter sets the amount of speed decrease that will be applied to the Speed Command in order to lower the heatsink temperature. The decrease in speed will lower the current being switched and conducted by the heat producing output transistors of the drive.

Parameter L8-19 is set in percentage of maximum frequency (E1-04).

n1 Hunting Prevention

◆ n1-01 Hunting Prevention Selection

Setting	Description
0	Disabled
1	Enabled (***factory default***)

◆ n1-02 Hunting Prevention Gain Setting

Setting Range: 0.00 ~ 2.50

Factory Default: 1.00

Sometimes when the iQpump drive is lightly loaded and the carrier frequency is high, the drive's output current may vary, or hunt. This varying current can cause the motor to vibrate. The drive's Hunting Prevention function can stabilize the motor's magnetizing current by adjusting the output voltage (n1-01 = "1: Enabled"). The Hunting Prevention function can eliminate the vibration but at the cost of the iQpump drive response.

Parameter n1-02 can adjust the gain of the Hunting Prevention function if it is enabled by n1-01. Normally there is no need to adjust n1-02 from the factory default setting. Make adjustments in the following cases:

- If vibration occurs with a light load, increase the setting of n1-02.
- If the motor stalls, reduce the setting of n1-02.

An overly large Hunting Prevention Gain (n1-02) may cause the motor to stall.

n3 High-Slip Braking

◆ n3-01 High-Slip Braking Deceleration Frequency

Setting Range: 1.0 ~ 20.0%

Factory Defaults: 5%

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

◆ n3-02 High-Slip Braking Current Limit

Setting Range: 100.0 ~ 200.0%

Factory Defaults: 150%

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

◆ n3-03 High-Slip Braking Dwell Time at Stop

Setting Range: 0.00 ~ 10.00 s

Factory Defaults: 1.0 s

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

◆ n3-04 High-Slip Braking Overload Time

Setting Range: 30.0 ~ 1200.0 s

Factory Defaults: 40 s

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

o1 Monitor Configuration

◆ o1-01 User Monitor Selection

Setting Range: 6 ~ 94

Factory Default: 6

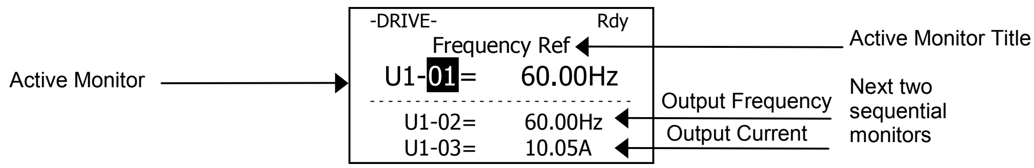
Setting	Description
6	Output Voltage (***factory default***)
7	DC Bus Voltage
8	Output Power
10	Input Terminal Status
11	Output Terminal Status
12	Drive Operation Status
13	Cumulative Operation Time
14	Software Number
15	Terminal A1 Input Voltage
16	Terminal A2 Input Voltage
18	Motor Secondary Current (Iq)
20	Output Frequency After Soft Start
24	PI Feedback Value
28	CPU Number
34	First Parameter Causing an OPE
36	PI Input
37	PI Output
38	PI Setpoint
39	MEMOBUS / Modbus Communication Error Code
40	Heatsink Cooling Fan Operation Time
51	Auto Mode Frequency Reference Value
52	Hand Mode Frequency Reference Value
53	PI Feedback 2 Value
90	Pump Setpoint
91	Pump Feedback
92	Pump Status
93	Total Setpoint Compensation
94	Motor Speed <0032>

◆ o1-02 Power-On Monitor

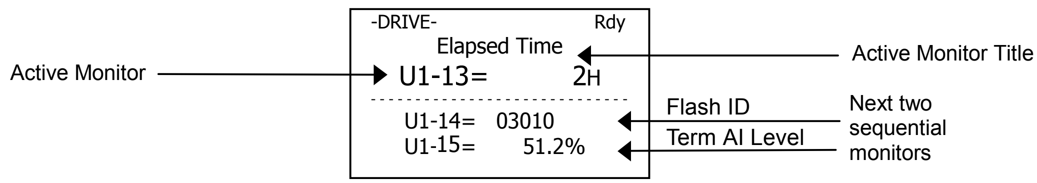
Setting	Description
1	Auto: Setpoint Reference (***factory default***)
2	Output Frequency
3	Output Current
4	User Monitor (set by o1-01)

When the iQpump drive is powered up, three monitors are displayed on the digital operator. The first and largest monitor is the "Power-On" monitor. The factory default "Power-On monitor" is Speed Command (U1-01). Below the Speed Command monitor are the next two sequential monitors, Output Frequency (U1-02) and Output Current (U1-03). Pressing the INCREASE key once scrolls the monitors to show the User Monitor as selected by o1-01. The factory default for o1-01 is the Output Voltage monitor (U1-06).

The active monitor displayed when the iQpump drive is powered on can be changed to either be U1-01 (Speed Command), U1-02 (Output Frequency), U1-03 (Output Current), or the User Monitor. Whichever monitor is selected as the Power-On top monitor, the two monitors displayed below it are the next two sequential monitors. See example below.



For example, if the iQpump drive needs to display the Elapsed Timer as the Power-On monitor, then o1-01 must be set to “13” and o1-02 must be set to “4”. The next time iQpump drive power is cycled, the digital operator displays U1-13 (Elapsed Time), U1-14 (Flash ID), and U1-15 (Term AI Level).



◆ o1-05 LCD Contrast Adjustment

Setting Range: 1, 3 or 5

Factory Default: 3

The contrast setting of the LCD display of the digital operator can be adjusted by the setting of parameter o1-05. The higher the number programmed into o1-05, the darker the background will become. Set o1-05 to the value that makes the LCD the easiest to view at the normal viewing distance and angle.

◆ o1-06 User Monitor Selection Mode

Setting	Description
0	3 Mon Sequential
1	3 Mon Selectable (***factory default***)

◆ o1-07 Second Line User Monitor

Setting Range: 1 ~ 94

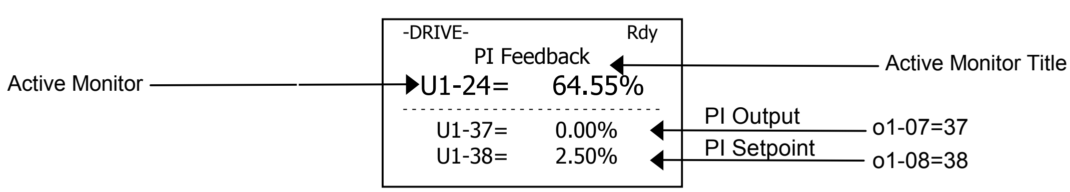
Factory Default: 2

◆ o1-08 Third Line User Monitor

Setting Range: 1 ~ 94

Factory Default: 91

Normally the monitors shown directly below the active monitor are the next two sequential monitors. If o1-06 (User Monitor Selection Mode) is set to “1: 3 Mon Selectable,” those two monitors are locked as specified by parameters o1-07 and o1-08 and will not change as the top parameter is scrolled with the INCREASE and DECREASE keys.



o2 Key Selections

◆ o2-01 Local / Remote Key Selections

Setting	Description
0	Disabled
1	Enabled (*factory default*)

The o2-01 parameter will have no effect on the operation of the iQpump drive when the HOA (Hand / Off / Auto) keypad is used. If an optional non-HOA keypad is used with the drive, parameter o2-01 determines whether the Local / Remote switch on the digital operator will be enabled and will switch between keypad operation and the sources specified by the b1-01 and b1-02 parameters when the iQpump drive is stopped.

◆ o2-02 OFF Key Function During Auto Run

Setting	Description
0	Disabled
1	Enabled (*factory default*)

The factory default setting of the OFF Key Function During Auto Run parameter (o2-02 = "1: Enabled") enables the OFF key on the digital operator even if b1-02 specifies the Run command source for the Auto mode as not coming from the digital operator. In effect the OFF key becomes an alternative Stop input. Once the iQpump drive has been stopped by the OFF key it can be restarted either by cycling the external Run command or pressing the Auto key. If o2-02 = "0: Disabled," pressing the OFF key while in the Auto mode will have no effect.

◆ o2-03 User Parameter Default Value

Setting	Description
0	No Change (*factory default*)
1	Set Defaults
2	Clear All

The iQpump drive gives the option of configuring any and all of the programming parameters and then saving the parameters as "User Initialization Values". After configuring the drive, set parameter o2-03 = "1: Set Defaults," to save the parameters to a User Initialization memory location. Once this has been done, the "Initialize Parameters" parameter (A1-03) will offer the choice of "1110:User Initialize". Choosing A1-03 = "1110: User Initialized," will reset all modified parameters back to what they were the last time they were saved using o2-03.

The choice of setting A1-03 = "1110: User Initialized," is unavailable until first setting the User Initialization parameters using o2-03. Once a User Initialization is set (saved), it can be cleared by setting o2-03 = "2: Clear All". After clearing the User Initialization parameters, the choice of "1110: User Initialize" is no longer a available in A1-03.

◆ o2-04 Drive / kVA Selection

Setting Range: 0 ~ FF

Factory Default: Model Dependent

Parameter o2-04 matches the control board to the iQpump drive hardware. Proper setting of o2-04 is important so that the control board can provide proper protection for the iQpump drive hardware. This parameter is configured at the factory and does not normally require adjustment in the field. It is available primarily to accommodate control board replacement in the event of damage.

Table 45 kVA Settings by iQpump Drive Model Number

208-230 / 240 Vac		480 Vac	
Model Number	Proper o2-04 Setting	Model Number	Proper o2-04 Setting
20P4	0	40P4	20
20P7	1	40P7	21
21P5	2	41P5	22

208-230 / 240 Vac		480 Vac	
Model Number	Proper o2-04 Setting	Model Number	Proper o2-04 Setting
22P2	3	42P2	23
23P7	4	43P7	24
27P5	6	45P5	26
2011	7	47P5	27
2015	8	49P0	3C
2018	9	4011	28
2022	A	4015	29
2030	B	4018	2A
2037	C	4022	2B
2045	D	4024	3D
2055	E	4030	2C
2075	F	4037	2D
2090	10	4045	2E
2110	11	4055	2F
		4075	30
		4090	31
		4110	32
		4160	34
		4185	35
		4220	36
		4300	37

The factory defaults of the following parameters may be changed when the setting of o2-04 is changed:

- b8-04 (Energy Saving Coefficient Value)
- C6-02 (Carrier Frequency Selection)
- E2-01 (Motor Rated Current)
- E2-03 (Motor No-Load Current)
- E2-05 (Motor Line-to-Line Resistance)
- L2-02 (MPL Ride-Thru Time)
- L2-03 (MPL Minimum Base Block Time)
- L2-04 (MPL Voltage Recovery Ramp Time)
- L8-02 (Overheat Pre-Alarm Level)
- L8-06 (Input Phase Loss Detection Level)

◆ o2-05 Frequency Reference Setting Method Selection

Setting	Description
0	Disabled (***factory default***)
1	Enabled

The factory default setting of the Frequency Reference Setting Method parameter (o2-05 = “1: Enabled”) dictates that when setting a Speed Command via the digital operator (“Hand” mode), it is not necessary to press the DATA / ENTER key before the iQpump drive will begin to accelerate or decelerate to the new set speed. This is referred to as MOP (Motor Operated Potentiometer) type functionality. When o2-05 = “1: Enabled,” the speed command is stored to memory 5 seconds after the INCREASE or DECREASE keys are released.

When o2-05 = “0: Disabled,” the digital operator INCREASE and DECREASE keys will change the speed command but the iQpump drive will not accelerate or decelerate to the new speed command until the DATA / ENTER key is pressed. In order to change the Speed Command in the HAND mode, U1-01 must be the top monitor and then the ENTER key must be pressed in order to access the Speed Command function. This in not to be confused with pressing the ENTER key in order to achieve a change in speed using the INCREASE and DECREASE keys, which is the subject of parameter o2-05.

◆ o2-06 Operation Selection when Digital Operator is Disconnected

Setting	Description
0	Disabled
1	Enabled (***factory default***)

Leaving o2-06 enabled will cause the iQpump drive to fault, when the digital operator is removed, even if it's not outputting to the motor. The reset key on the digital operator will need to be pressed after reconnecting the digital operator to reset the fault and continue normal operation.

If o2-06 = "0: Disabled" then the iQpump drive will not fault if the digital operator is disconnected, but the iQpump drive will discontinue motor operation. If full iQpump drive operation is required while the digital operator is removed set o2-06 = "0: Disabled" and o2-15 = "0: Disabled" (Hand Key Function). If both o2-06 and o2-15 are disabled then the digital operator can be disconnected without disturbing iQpump drive operation.

◆ o2-07 Cumulative Operating Time Setting

Setting Range: 0 ~ 65535 Hours

Factory Default: 0 Hours

Refer to parameter o2-07 in Appendix A for description details.

◆ o2-08 Cumulative Operation Time Selection

Setting	Description
0	Power-On Time
1	Running Time (***factory default***)

The iQpump drive features an Elapsed Timer monitor that records in units of hours. The Elapsed Timer monitor is U1-13. Parameter o2-08 programs this function to either accumulate elapsed hours based on time the iQpump drive is powered (o2-08 = "0: Power-On Time") or time the iQpump drive is running (o2-08 = "1: Running Time"). The iQpump drive is considered "running" anytime there is an active run command or when the iQpump drive is outputting voltage (i.e. including during deceleration).

```
-DRIVE-
        Elapsed Time
      U1-13 = 0H
  U1-14 =          03010
  U1-15 =          34.1%
```

Parameter o2-07 allows manual adjustment of the Elapsed Timer, primarily to accommodate maintenance or control board replacement in the event of damage. To reset the Elapsed Timer back to zero, set o2-07 = 0.

◆ o2-10 Cumulative Cooling Fan Operation Time Setting

Setting Range: 0 ~ 65535 hr

Factory Default: 0 hr

The elapsed time of heatsink cooling fan operation is tracked by the U1-40 monitor. Much like the o2-07 parameter can be used to adjust or reset the iQpump drive operation elapsed timer, parameter o2-10 can be used to adjust the time displayed by the U1-40 monitor in the event of fan replacement.

```
-DRIVE-                  Rdy
      FAN Elapsed Time
    U1-40 = 152H
  U1-51 =          52.33%
  U1-52 =          57.60%
```

◆ o2-12 Fault Trace / Fault History Clear Function

Setting	Description
0	Disabled (No Effect) (***factory default***)
1	Enabled

The operator can clear the Fault Trace (U2) and Fault History logs by setting o2-12 = “1: Enabled”. Clearing the Fault Trace and Fault History logs erases all the information.

◆ o2-14 kWh User Monitor Initialization

Setting	Description
0	Disabled (No Change) (***factory default***)
1	Clear All

The kWh monitors (U1-29 and U1-30) track the power usage of the iQpump drive and are not reset by powering down the drive. To reset the monitors back to zero, set o2-14 = “1: Clear all”.

o3 Digital Operator Copy Function

◆ o3-01 Copy Function Selection

Setting	Description
0	COPY SELECT (*factory default*)
1	INV → OP READ
2	OP → INV WRITE
3	OP ↔ INV VERIFY

Note: The copy function is disabled when serial communication is active.

◆ o3-02 Read Allowed Selection

Setting	Description
0	Disabled (*factory default*)
1	Enabled

The digital operator has parameter COPY capabilities via built in non-volatile memory. The digital operator can READ all of the parameters in the iQpump drive and store them for later WRITE back to the iQpump drive or into an iQpump drive with the same product code and software number. In order to read the parameter values and store them in the digital operator, select o3-02 = “1: Enabled”. If an attempt is made to READ the data, which overwrites previously stored data, without first setting o3-02 = “1: Enabled,” the following error will occur:

-ADV-

PRE

READ IMPOSSIBLE

After setting o3-02 = “1: Enabled,” it is possible to store parameter values in the digital operator by setting o3-01 = 1 (INV→ OP READ).

A successful READ of the parameter values will display:

-ADV-

READ

READ COMPLETE

An error may occur while saving the parameter values to the digital operator’s memory. If an error is displayed, press any key to cancel the error display and return to parameter o3-01. Error displays and their meanings are covered in Chapter 6: Diagnostics and Troubleshooting of the iQpump User Manual (TM.iQp.06). To COPY parameter values into a drive, set o3-01 = “2: OP→ INV WRITE”. During the writing of the parameter values into the iQpump drive the digital operator will display:

-ADV-

COPY

OP → INV COPYING

A successful COPY of the parameter values will display:

```
-ADV-
COPY
COPY COMPLETE
```

An error may occur while writing the parameter values to the drive. If an error is displayed, press any key to cancel the error display and return to parameter o3-01. Error displays and their meanings are covered in Chapter 6: Diagnostics and Troubleshooting of the iQpump User Manual (TM.iQp.06).

It is possible to compare the parameter values stored in the digital operator with the parameter values currently in the iQpump drive by using the VERIFY function. This VERIFY function should not be confused with the "-VERIFY-" that is displayed on the digital operator when viewing the "Modified Constants" menu. To VERIFY the parameter values in the iQpump drive as compared with those stored in the digital operator, set o3-01 = "3: OP↔INV VERIFY". During the comparing of the parameter values into the iQpump drive the digital operator will display:

```
-ADV-
VERIFY
DATA VERIFYING
```

A successful VERIFY of the parameter values will display:

```
-ADV-
VERIFY
VERIFY COMPLETE
```

If all the parameter values stored in the digital operator do not match those programmed in the drive, the digital operator displays the following:

```
-ADV-
VYE
VERIFY ERROR
```

The digital operator will not display which parameters did not match, only that the verification found discrepancies in some parameter values.

Note: In order to properly use the COPY or VERIFY functions, the following iQpump drive specifications must be identical between the iQpump drive that the parameters were read from and the iQpump drive that the parameters are to be written to:

- Model Number (e.g. CIMR-P7U2015-107)
- Software Number (e.g. 30030 also known as FLASH ID)

Yaskawa offers DriveWizard™ software that can also READ, COPY, and VERIFY iQpump drive parameter values. DriveWizard™ lists all discrepancies between the iQpump drive and a pre-saved parameter file when verifying is performed.

To use DriveWizard first select o2-15 = "0: Disabled" and select o2-06 = "0: Disabled" then remove the digital operator / keypad and attach the DriveWizard cable in its place.

P1 Pump Basic

◆ P1-01 Pump Mode

Setting	Description
0	Drive only (Simplex) (***factory default***)
1	Drive + 1 Pump (Duplex)
2	Drive + 2 Pumps (Triplex)
3	MEMOBUS / Modbus Network <0034>

Lead-Lag Operation P1-01 Setting 1 & 2

The iQpump drive can be configured to specify the number of pumps to be controlled by programming the Pump Mode (P1-01). The maximum number of pumps that can be controlled is 3 pumps (1 lead and 2 lag). The iQpump can be configured for lead-lag operation where 1 pump is controlled by the iQpump drive's output (lead) and the other two pumps controlled by the drive's digital outputs (M1-M2, M3-M4) or lag operation.

To control the two lag pumps requires the multi-function digital outputs (H2-0x) to be programmed for Pump 2 Control (H2-01 = 40) and Pump 3 Control (H2-01 = 41).

Note: The factory defaults for the digital outputs (H2-0x) are programmed for Pump 2 and Pump 3 Control.

Auxiliary Pump Control P1-01 Setting 1 & 2

The iQpump drive can be configured to control multiple pumps with multiple iQpump drives by programming the Pump Mode (P1-01). The maximum number of pumps that can be independently controlled is 3 pumps.

To configure an Auxiliary Pump Control system requires the first drive to be programmed for drive + 1 (P1-01 = 1) and the second drive (last) for drive only (P1-01 = 0). The multi-function digital output (M1-M2) needs to be programmed for Pump 2 Control (H2-01 = 40).

The first drive starts to run and brings the second drive online based on the pump system demand. The moment the second drive starts running, the multi-function digital output (M1-M2) closes.

The multi-function digital output provides an input command (Terminal S7 and SN) to the first iQpump drive and initiates a Fixed Speed Auto function on the first drive (H1-05 = 86).

When the Fixed Speed Auto input is closed, the first drive will run at a fixed speed without PID control. When the second drive goes to sleep, the Fixed Speed Auto input opens and the first drive starts operating under normal pump control.

When using the iQpump drive to control 3 pumps, all of the drives need to be daisy chained in a similar configuration. The last drive always has to be programmed for drive only (P1-01 = 0) and the other drives for duplex mode (P1-01 = 1).

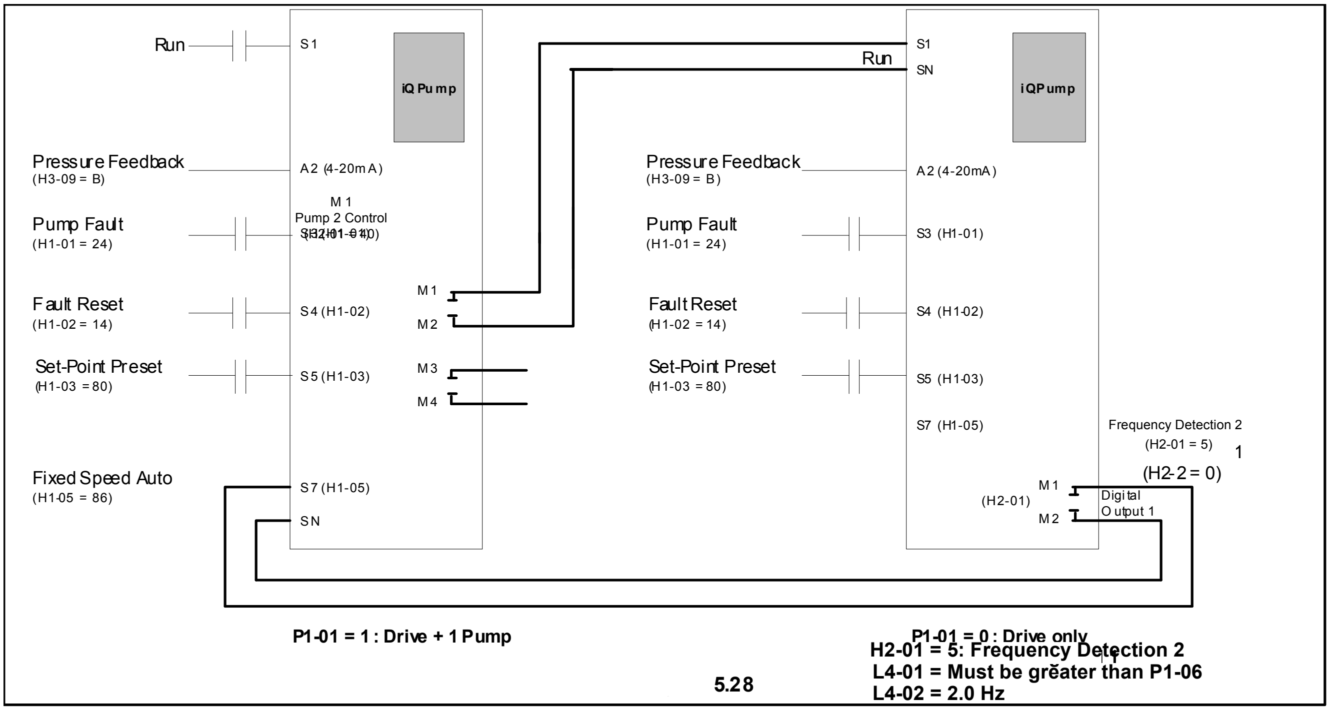


Figure 111.

Note: When the Fixed Speed Auto is activated, the sleep and lead-lag functions are disabled. This configuration is only active in Auto Mode.

The L4-01 parameter of the last drive controls the previous drive and activates the Auto Mode (when the frequency level drops below L4-01).

◆ MEMOBUS / Modbus Communication <0034>

The current iQpump software only allows the drive to be a slave on a MEMOBUS / Modbus Network which means that an external device such as a computer or PLC needs to be connected to the network and issue commands to the drives. Having a drive act as a MEMOBUS / Modbus Master eliminates the need for an external master and introduces better drive control since it can be configured for either a general or specific application feature.

◆ MEMOBUS / Modbus Communication Configuration P1-01=3 <0034>

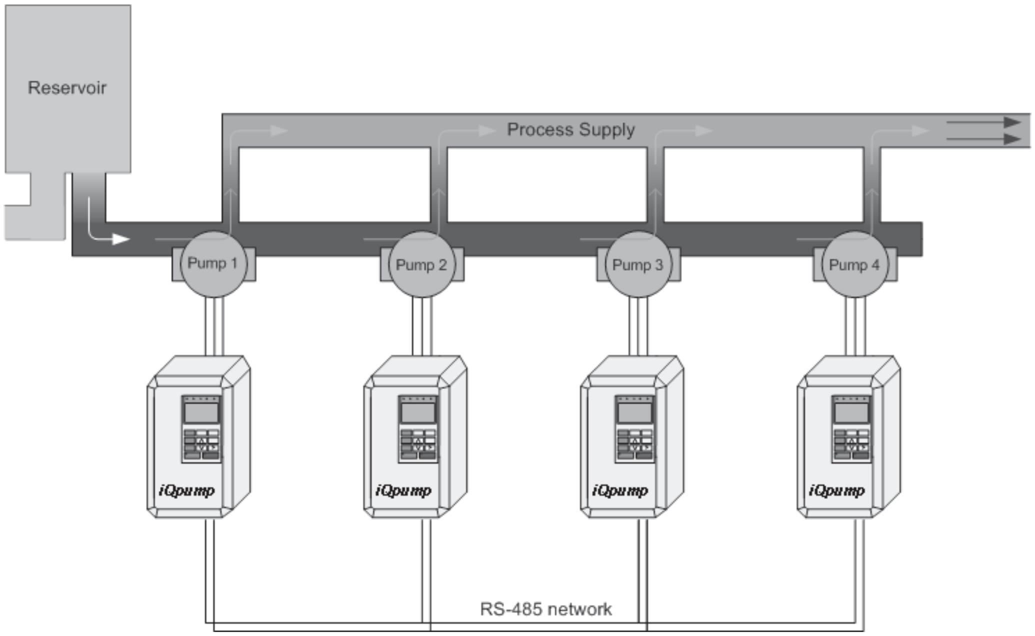


Figure 112. Example of Connections between Master and Drive <0034>

This change will allow the drive to function as a MEMOBUS / Modbus Master on the RS-485 interface and issue commands to the MEMOBUS / Modbus slaves based on their current status. A new mode, MEMOBUS / Modbus Network, will be added to P1-01. When the drives are running in this mode, as long as at least one of the drives is set to Automatic Network Recovery (P9-27 = 0), a MEMOBUS / Modbus Master will be active. The MEMOBUS / Modbus Master will read from and write to a predefined set of addresses for proper operation of the iQpump system. A maximum of 16 iQpump drives (with node addresses 1 to 16) can be operated in this manner. To maximize network performance, a new parameter Highest Node Address (P9-25) can be programmed to be the node address limit. Drives with node address beyond this parameter will be ignored.

Network recovery in the event that the master is lost, is also possible when Automatic Network Recovery is used.

■ System Faults with P1-01=3 <0034>

When P1-01 = 3 (MEMOBUS / Modbus Network), the following faults are considered system faults and work as described below:

Low Feedback / Low Water: Active on any drive in the network. When a drive incurs the LFB/LW fault, it will stop all other drives on the network, and prevent them from running until the fault is cleared. The system message “Net Pump Err” is displayed on all other network drives.

High Feedback / High Water: Active on the lead drive in the network. When the lead incurs the HFB / HW fault, it will stop all other drives on the network, and prevent them from running until the fault is cleared. The system message “Net Pump Err” is displayed on all other network drives.

Flow Meter: Low Flow, High Flow and Accumulated Level: Active on any drive in the network that has an Auto Run command. When the drive incurs the fault (LOWFL, HIFLO, ACCUM), the network will stop all other drives and prevent them from running until the fault is cleared. The system message “Net Pump Err” is displayed on all other network drives.

Setting System Fault Restart P9-22 to zero disables restarting of any system fault regardless of L5-01, Feedback Fault Restart P4-07, and Protection Fault Restart P4-08 parameter settings. However, if P9-22 > 0, but L5-01 = 0 or P4-07 / P4-08 is set to disable the fault restart, then if that drive gets a system fault, the system will not be able to restart.

Whenever a drive with a system fault auto-restarts the network System Fault Restart counter gets incremented and the L5-01 fault restart counter does not get increased. If the system fault restart counter becomes equal to P9-22, the iQpump MEMOBUS / Modbus Network will disable automatic fault restart. Manually resetting the fault will clear the system fault restart counter. If the iQpump MEMOBUS / Modbus Network does not experience a system fault for 10 minutes, it will clear the system restart fault counter.

◆ Function Description: MEMOBUS / Modbus Communication

When P1-01 = 3 (Pump Mode = MEMOBUS / Modbus Network), the drive will either become a Master or Slave, depending on P9-27 (Network Recovery). In addition, H5-01 (Serial Comm Address) is range limited by P9-25 (Highest Node Address). Setting P9-27 to anything other than 0 (Automatic) will force that drive to never become a Master Network controller. When P9-27 = 0, the drive will attempt to become a Master whenever P9-26 (Master Time-out) expires. A fixed amount of time (node address H5-01 x 0.25 s) is always added to P9-26 to minimize network collision resulting from multiple drives attempting to become a master at the same time.

If P9-27 = 0 at start-up, the drive uses a different Master Time-out which is based on the node address:
Initial Master Time-Out (in seconds) = 1.5 + (node address H5-01 x 0.25)

If P9-27 ≠ 0, then P9-26 is used as the Master Time-Out at start-up.

So, if P9-27 = 0 for all the networked drives, logically when power is restored to the drives at the same time the drive with the lowest node address will always become the Master drive initially (see *Figure 112.*). Once a drive either becomes a master or receives data from it, the start-up process is concluded and the drives use P9-26 plus a fixed number (node address H5-01 x 0.25 s) as the Master Time-out.

The drive that becomes a master during the start-up process will attempt to query the drives starting from address 1 up to P9-25 (Highest Node Adr). If it gets a good response from the query, the drive gets added to the Network Active Pumps list. Drives in the Network Active Pumps list are given network commands and refreshed regularly through the MEMOBUS / Modbus Sequencer.

Node addresses that are not part of the Network Active Pumps list, but are within the P9-25 range are queried regularly and added if they become online. Nodes that are part of the Active list, but do not reply to the network commands are removed from the list.

In the event that the master goes down, another drive (P9-27 = 0) can assume master functionality after the Master Time-out expires. The new master will use data from Pumps Available list to rebuild the network data. If the data suggests that there is an available drive on the network, then the new master will not do a complete scan. It will also skip writing commands to the active drives until it performs a read on the current Pump Status, which is then used to recreate the previous command given to that drive. However if the data suggests that there no available drive, then it will do complete scan of all the valid node addresses.

A new master will perform Network Restore, which attempts to run the drives as they were before the old master went down by using the drive's current status. Additionally, if Network Restore encounters ambiguity, such as multiple lead drives running at the same time, it will attempt to resolve the conflict following normal operation flow.

Setting P9-27 = 1 (Slave / Resume) prevents the drive from becoming a network master and at the same time will not cause a MSL fault if the master does go down. It will continue running using the last command received.

Note: The drive will keep running in its current operation state which could cause an undesirable condition.

Setting P9-27 = 2 (Slave / Resume) prevents the drive from becoming a network master and at the same time will not cause a MSL fault if the master does go down. It will continue running when the master is lost.

Setting P9-27 = 3 (Fault MSL) will fault the drive after P9-26 expires.

Parameter P9-28 (NETSCAN Alarm Time) can be varied to control the amount of time before a NETSCAN alarm is displayed after the last time a message from the master has been received. High network latency or having a lot of offline drives will require a higher setting. An offline drive is defined as a pump with node address within 1 to P9-25 that does not have power, has connection issues, or is disconnected physically form the network.

More detailed information regarding functionality can be found in VSP130034-DD.

Table 46 Parameters <0034>

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
H5-01	425	Drive Node Address **Serial Comm Adr**	Selects drive station node number (address O for terminals R+, R-, S+, and S- (drive power must be cycled before the changes will take effect). *Range is dependent on P9-25 if P1-01 = 3.	0 ~ 20*	1F	Programming
P1-01	600	Pump Mode **Pump Mode**	Select type of control operation. 0 = Drive Only (Simplex) 1 = Drive + 1 Pump 2 = Drive + 2 Pumps 3 = MEMOBUS / Modbus Network	0 ~ 3	0	Programming

Table 47 Parameters <0034>

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
P9-25	0898	Highest Node Address **Highest Node Address**	Defines the highest possible node address in the MEMOBUS / Modbus 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.	02 h ~ 10 h	08 h	Programming
P9-26	0899	Master Time-out **Master Time-out**	Sets the minimum amount of time that he slave drives will wait for a message from the master before performing the action set in P9-27.	3.0 ~ 10.0 s	4.0 s	Programming
P9-27	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). Note: The drive will keep running in its current operation state which could cause an undesirable condition.	0 ~ 3	0	Programming
P9-28	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 s	2.0 s	Programming

Table 48 Function Text

Function Number	Function Name Digital Operator Display
P9	Network Options **Network Options**

Table 49 Faults <0034>

Fault Display	Description	Cause	Countermeasures
MSL Net Master Lost	MEMOBUS / Modbus Master has been lost.	No message received form the master within the time specified in P9-26 when Network Recovery is set to Fault MSL (P9-27 = 3).	Increase P9-26 to account for network latency.
			Verify that there is a drive on the network with parameters set as P1-01 = 3 and P9-27 = 0.
			Check network connections and verify H5-01 and P9-25 for all drives on the network.

Table 50 Message <0034>

Message Display	Description	Cause	Countermeasures
NETSCAN Waiting for Master	Waiting for a message from the master	No message received form the master within the time specified in P9-28.	Increase P9-28 to account for network latency.
			Verify that there is a drive on the network with parameters set as P1-01 = 3 and P9-27 = 0.
			Check network connections and verify H5-01 and P9-25 for all drives on the network.

Table 51 Monitors <0034>

Monitor No.	Addr. Hex	Monitor Name Digital Operator Display	Description
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

(*n1) Displayed units are determined by parameter P6-02.

◆ P1-02 System Units

Setting	Description
0	WC: Inch of Water
1	psi: 1b / Sqr Inch (***factory default***)
2	GPM: Gallons / min

Setting	Description
3	F: Degrees Fahrenheit
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: Degrees Celsius
11	ft: Feet <0032>
12	%: Percent
13	rpm: Revs / min (*su1) <0034>
14	Hz: Hertz (*su1) <0034>

The iQpump drive can be configured to program the drive using units or scaling that are appropriate for the pumping system by programming the System Units (P1-02). The System Units will affect setpoint references, feedback scaling, pump levels, and display monitors. The following is a list of parameters that are affected by the programming of the System Units (P1-02).

- d1 Group: d1-01 through d1-04.
- o1 Group: o1-07, o1-08.
- P1 Group: P1-03, P1-04, P1-07, P1-09, P1-11, P1-13.
- P2 Group: P2-02, P2-04, P2-09, P2-10, P2-15, P2-16.
- P3 Group: P3-03, P3-05, P3-07, P3-08, P3-12, P3-14.
- P4 Group: P4-01
- U1 Monitor: U1-91

For further description of each parameter, please refer to the appropriate section or Appendix A.

(*su1) When P1-02 = 13, parameter P1-03 will have to be set to (120 x E1-04 / E2 / 04) for proper display. When P1-02 = 14, parameter P1-03 will have to be set to the same value as E1-04 for proper display. <0034>

Table 52 Related Parameters <0034>

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Range	Default	Menu Location
P1-02	601	System Units **System Unit**	0: WC: Inch of Water 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: Deg Celsius 11: Mtr: Meters 12:%: Percent 13: rpm: Revs / min (*su 1) 14: Hz: Hertz(*su 1)	0 ~ 14	1	Programming
(*su1) When P1-02 = 13, parameter P1-03 will have to be set to (120 * E1-04 / E2-04) for proper display. When P1-02 = 14, parameter P1-03 will have to be set to the same value as E1-04 for proper display.						

◆ P1-03 Feedback Device Scaling

Setting Range: 1 ~ 36000 [based on System Units (P1-02)

Factory Default: 00145 psi

The iQpump drive can be configured to scale the feedback signal using the Feedback Device Scaling Parameter (P1-03). The programmed value in P1-03 represents the maximum level when a feedback reference is provided to the drive. An example: If a 4-20 mA signal is provided and P1-03 is set to 145 psi, then 20 mA would represent the maximum psi readout level of 145 psi. This parameter works in conjunction with the System Units (P1-02).

X	X	X	X	X
Digit 5	Digit 4	Digit 3	Digit 2	Digit 1

Digits 1 through 4 set the desired number to be displayed at maximum feedback level. Digit 5 determines the number of decimal places in the displayed number.

If Digit 5 = 0 number format is XXXX
If Digit 5 = 1 number format is XXX.X
If Digit 5 = 2 number format is XX.XX
If Digit 5 = 3 number format is X.XXX

Example 1: 00145 (factory default)
P1-02 = 1 (factory default)
P1-03 = 145 psi (No decimal point)

Example 2: 11000 (one decimal point)
P1-02 = 1
P1-03 = 100.0 psi (one decimal point)

◆ Feedback Device

The iQpump Controller requires a feedback device (e.g. Pressure transducer, flow meter, etc.) to perform automatic system regulation. Any analog 0~10 V or 4-20 mA feedback device can be used in combination with the iQpump controller.

■ Connecting a Feedback Device to the iQpump Controller

Note: The factory default setting for the iQpump controller is 4~20 mA feedback device connected to analog input A2.

Figure 113. Wire Control

◆ P1-04 Start Level

Setting Range: - 999.0 ~ 999.9 <0034>

Factory Default: 0.0

The iQpump drive can be configured to program the starting pressure for the system by programming the Start Level (P1-04). The units for this parameter are determined by the System Units (P1-02).

If set to a negative value, the feedback level must drop by this amount below the setpoint.<0034>

If P1-01 = 3, the function will stop all drives running on the network when the system fault occurs.<0034>

Function Description <0034>

Normal PI Control (b5-09 = 0).

When parameter P1-04 is set to a positive value, the feedback must drop below that value before the drive will wake up. When parameter P1-04 is set to a negative value, the feedback must drop the P1-04 amount below the setpoint.

Inverse PI Control(b5-09 = 1).

When parameter P1-04 is set to a positive value, the feedback must drop above that value before the drive will wake up. When parameter P1-04 is set to a negative value, the feedback must increase to the P1-04 amount plus the setpoint.

Table 53 Related Parameters <0034>

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Range	Default	Menu Location
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 Start Level Delay Time

Setting Range: 0 ~ 3600 s

Factory Default: 1 s

The iQpump drive can be configured to prevent the pump from starting for a set period of time by programming the Start Level Delay Time (P1-05) after an Auto Mode run has been initiated.

If this parameter is set to a non-zero value and a run command is present within 1 second of power being applied to the drive, the start of the drive will be delayed. Presumably, multiple drives fed off of the same utility feed would have their timers set to different times.

Note: The Start Delay Time will function only after a stop command due to the no-flow detection or sleep detection functions. Removing the enable signal does not activate the Start Delay.

Important: Please refer to the Pump Protection (P2 Group on page *155*) and Pump Multiplex section (P3 Group on page *172*) for further details and timing diagrams.

Table 54 Related Parameters <0034>

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Range	Default	Menu Location
P1-05 ♦	604	Start Level Delay Time **S-Lev Delay Time**	System starts when feedback level drops below start level for a time specified in P1-05.	0 ~ 3600 s	1 s	Programming
P4-10	11E	Auto Mode Operator Run Power Down Storage **AMO PwDn-Storage**	Stores the run status in Auto Mode when operating from operator (b1-02 = 0). 0: Disabled 1: Enabled **Warning:** When drive is powered down while running then upon power-up it will automatically initiate an internal run command	0 ~ 1	0	Programming
♦ Denotes that parameter can be changed when the drive is running.						

◆ P1-06 Minimum Pump Frequency

Setting Range: 0 ~ 120 Hz

Factory Default: 40 Hz

The iQpump drive can be configured to operate the pump at a minimum output frequency by programming the Minimum Pump Frequency (P1-06). The minimum value has to be programmed to a value smaller than Pump 2 Frequency Shutdown Level (P3-09) and Pump 3 Frequency Shutdown Level (P3-10), when the drive is operating in the Multiplex Mode (P1-01). The programmed value in P1-06 will also limit the minimum PID output. If the Thrust Bearing Frequency (P4-05) is programmed for a value greater than 0, then the minimum frequency is determined by the Thrust Bearing Frequency (P4-05).

Important: Please refer to the Pump Protection (P2 Group on page *155*) and Pump Multiplex section (P3 Group on page *172*) for further details and timing diagrams.

◆ P1-07 Low Feedback Level

Setting Range: 0.0 ~ 6000.0

Factory Default: 0.0

The iQpump drive can be configured to display a Low Feedback (LFB) alarm when the feedback level falls below the programmed Low Feedback Level (LFB). The “LFB” alarm will turn off when the feedback level rises above P1-07 plus the Hysteresis Level (P1-13). Setting P1-07 to a value of 0 will disable this function. This function is only active during operation in the Auto Mode.

The Low Feedback Level (P1-07) works in conjunction with Low Level Fault Time (P1-08). The units for this parameter are determined by the System Units (P1-02).

◆ P1-08 Low Level Fault Delay Time

Setting Range: 0 ~ 3600 s

Factory Default: 5 s

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Range	Default	Menu Location
P1-08 ♦	607	Low Feedback Level Fault Delay Time **Low Lvl FLT Time**	System will fault LFB/LW “Low Feedback / Water” fault when feedback level falls below the programmed level for a time specified in P1-08. On fault the drive will coast to a stop. A value of 0 disables this function. This function is only active during running while operating in auto mode. If P1-01 = 3, function will stop all drives running on the network when the fault occurs (system fault).	0 ~ 3600 s	5 s	Programming

The iQpump drive can be configured to display a Low Feedback (LFB) alarm when the feedback level falls below the programmed Low Feedback Level (P1-07) for the time programmed in the Low Level Fault Delay Time (P1-08).

Setting P1-08 to a value of 0 will disable this function. This function is only active during operation in the Auto Mode.

The Low Level Fault Delay Time (P1-08) works in conjunction with Low Feedback Level (P1-07).

If P1-01 = 3, the function will stop all drives running on the network when the system fault occurs. <0034>

◆ P1-09 High Feedback Level

Setting Range: 0.0 ~ 6000.0

Factory Default: 155.0 (system units P1-02)

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Range	Default	Menu Location
P1-09 ♦	608	High Feedback Level **High FB Level**	System will show alarm (HFB) when 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 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.	0 ~ 6000.0 (system units P1-02)	155.0 (system units P1-02)	Programming
♦ Denotes that parameter can be changed when the drive is running.						

◆ P1-10 High Level Fault Delay Time

Setting Range: 0 ~ 3600 s

Factory Default: 2 s

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Range	Default	Menu Location
P1-10 ♦	609	High Feedback Level Fault Delay Time **Hgh Lvl FLT Time**	System will fault HFB / HW “High Feedback / Water Fault” when feedback level rises above the programmed level for a time specified in P1-10. On fault the drive will coast to a stop. This function is active during running in all operation modes. If P1-01 = 3, function will stop all drives running on the network when the fault occurs (system fault).	0 ~ 3600 s	2 s	Programming
♦ Denotes that parameter can be changed when the drive is running.						

The iQpump drive can be configured to display a High Feedback (HFB) alarm when the feedback level rises above the programmed High Feedback Level (P1-09) for the time programmed in the High Level Fault Delay Time (P1-10).

Setting P1-10 to a value of 0 will disable this function.

The High Level Fault Delay Time (P1-10) works in conjunction with High Feedback Level (P1-09).

If P1-01 = 3, the function will stop all drives running on the network when the system fault occurs. <0034>

This function is active during operation in the Hand Mode, Auto Mode, Pre-charge, and Thrust-Bearing Mode.

◆ P1-11 Maximum Setpoint Difference <0032>

Setting Range: 0.0 ~ 6000.0

Factory Default: 0.0 (system units P1-02)

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Range	Default	Menu Location
P1-11 ♦	106	Maximum Setpoint Difference **Max Set-Pnt Diff**	When system is running and the difference between setpoint and feedback exceeds level in P1-11 for the time specified in P1-12 the drive will trip on a NMS “Not Maintaining Setpoint” fault. On fault the drive will coast to a stop. A value of 0 disables this function. This function is only active during running while operating in auto mode. If P1-01 = 3, function is active on the lead drive but will stop all drives running on the network when the fault occurs (system fault).	0.0 ~ 6000.0	0.0 (system units P1-02)	Programming
♦ Denotes that parameter can be changed when the drive is running.						

The iQpump drive can be configured to display a Not Maintaining Setpoint (NMS) fault when the difference between the setpoint and the feedback exceeds the Maximum Setpoint Difference (P1-11). When the Maximum Setpoint Difference has been exceeded, the drive will trip on NMS fault and will coast to a stop when the fault occurs.

The faults Not Maintaining Setpoint (NMS), Loss of Prime (LOP), High Feedback / High Water (HFB / HW), Low Feedback / Low Water (LFB / LW), Low Flow (LOWFL), High Flow (HIFLO), and Accumulated Level (ACCUM) are considered System Faults. When these faults occur, all the drives in the network need to be stopped and prevented from running until the fault is cleared or auto-restarted.<0034>

When a system fault is detected on a drive, the iQpump MEMOBUS / Modbus Network sends out a system message to all other drives informing them of the fault, stopping any drives that are running, and preventing any drives from running until the fault is no longer present. Resetting the fault on the drive will clear the message.<0034>

When Fault Restarts are enabled (L5-01 > 0, P4-07 and P4-08 set appropriately), system faults do not consume L5-01 attempts, but instead uses a new parameter P9-22 System Fault Retry. The system fault retry attempts apply to all the drives on the network and gets incremented when a drive with a system fault auto-restarts. For proper operation, P9-22 should be set the same for all drives on the iQpump MEMOBUS / Modbus Network (P1-01 = 3).

Setting P1-11 to a value of 0 will disable this function. This function is only active during operation in the Auto Mode.

The Maximum Setpoint Difference (P1-11) works in conjunction with the Not Maintaining Setpoint (P1-12). The units for this parameter are determined by the System Units (P1-02).

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. Refer to *Figure 114.* <0034>

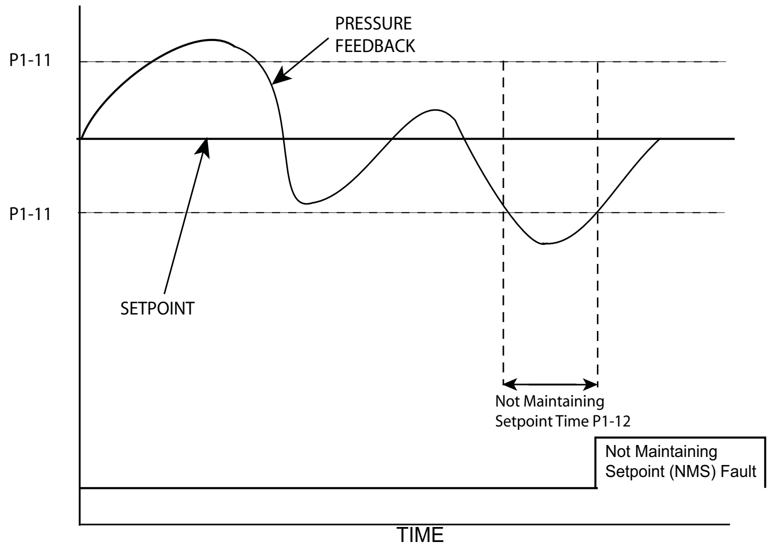


Figure 114. Not Maintaining Setpoint (NMS) Fault

Table 55 Messages <0034>

Message Display	Description	Cause	Countermeasures
Net Pump Err Chk Faulted Pump	Drive has been stopped because another drive in the network has a system fault (LOP, NMS, HFB / HW, LFB / LW, LOWFL, HIFLO, or ACCUM) or has the Low City Pressure alarm.	Another drive in the network has a system fault (LOP, NMS, HFB / HW, LFB / LW, LOWFL, HIFLO, or ACCUM).	Check the drive that has the actual system fault and either let the System Fault Retry function clear the fault, or manually reset the faulted drive.
		Another drive in the network has a Low City Pressure alarm.	Check the drive that has the Low City Pressure alarm and either reset the Low City Pressure digital input (H1-0x = 73) or resolve the pressure situation.

◆ P1-12 Not Maintaining Setpoint Time <0034>

Setting Range: 0 ~ 3600 s

Factory Default: 60 s

The iQpump drive can be configured to display a Not Maintaining Setpoint (P1-12) fault when the difference between the setpoint and the feedback levels are exceeded for the time programmed in the Not Maintaining Setpoint (P1-12). The drive will coast to a stop after the level has been exceeded for the specified time programmed in P1-12.

This function is only active during operation in the Auto Mode.

The Not Maintaining Setpoint Time (P1-12) is also used for the Prime Loss Level (P1-14) function. Refer to Prime Loss Level (P1-14) for more details.

The Not Maintaining Setpoint Time (P1-12) works in conjunction with Maximum Setpoint Difference (P1-11) and Prime Loss Level (P1-14).

Note: The time value programmed into P1-12 is shared by Maximum Setpoint Difference (P1-11) and Prime Loss Level (P1-14) functions. However, independent times are maintained. If one function time; such as P1-11, has elapsed, the other functions time (P1-14) is still maintained until this time has elapsed.

Not Maintaining Setpoint: The “Not Maintaining Setpoint” detection is now the only thing that parameter P1-12 controls. Also, the “Not Maintaining Setpoint” timer is held reset during the pre-charge function to prevent erroneous operation.

- P1-12 is only effective for the “Setpoint Not Met” fault.
- “Setpoint Not Met” is disabled during pre-charge.

Table 56 Parameters

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Range	Default	Menu Location
P1-12	107	Not Maintaining Setpoint Time **Not Maint SP Tm**	Delay time before a Not Maintaining Setpoint fault occurs. Pump protection criteria specified in P1-11 must be met for the drive to fault. On fault the drive will coast to a stop. Setting P1-12 = 0 disables the Not Maintaining Setpoint fault	0 ~ 3600 s	60 s	Programming

Table 57 Fault <0034>

Fault Display	Description	Cause	Countermeasures
NMS Setpoint Not Met	Not Maintaining Setpoint Setpoint cannot be maintained.	When the setpoint can not be maintained for a time specified in P1-12. Function is disabled when the drive is not running and PID is not active. **Possible causes:** Blocked Impeller, Over-Cycling, Broken Pipe	Difference between setpoint and feedback is smaller than P1-11 Maximum Setpoint Difference.

◆ P1-13 Hysteresis Level

Setting Range: 0.0 ~ 100.0

Factory Default: 0.0

The iQpump drive can be configured to detect Low Feedback Level (P1-07) and High Feedback Level (P1-09) alarms. The Hysteresis Level (P1-13) is used to provide a bandwidth before the drive returns to normal operation. The Hysteresis Level is used to prevent rapid cycling between alarm and normal operations.

The Hysteresis Level (P1-13) works in conjunction with the Low Feedback Level (P1-07) and High Feedback Level (P1-09) functions. The units for this parameter are determined by the System Units (P1-02).

◆ P1-14 Prime Loss Level

Table 58 Parameters

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Range	Default	Menu Location
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	0.0 A	Programming

◆ P1-15 Low / Hi Water Digital Input Congifuration / Water DI Config <0034>

Setting	Description
0	Low N.O. - Hi N.O. (Low Water Normally Open / High Water Normally Open)
1	Low N.C. - Hi N.O. (Low Water Normally Closed / High Normally Open)
2	Low N.O. - Hi N.C. (Low Water Normally Open / High Water Normally Closed)
3	Low N.C. - Hi N.C. (Low Water Normally Closed / High Normally Closed)

The iQpump drive can be configured to detect a low water level condition. To activate the low water level detection requires one of the multi-function digital inputs to be programmed for low water level (H1-xx = 85). The multi-function digital input can be configured to accept a normally closed or normally open contact by programming the Low Water Input (P1-15).

This function is only active during operation in the Auto Mode.

A digital input and fault may be added for “High Water Level” switch. A digital input was created to connect a float or pressure switch to indicate if the level in the reservoir is too high. This fault will be detected whenever the drive is

Important: Refer to H1-xx = 85 on page *186* for further description of the low water level function.

■ Function Description: <0034>

- The “High Feedback / High Water” will activate based on the PI feedback. However, this fault will also activate based on an digital input (H1-0x = 88).
- The parameter that configures the Normally Open / Normally Closed operation of the Low Water switch has settings which will configure the added High Water switch.
- The High Water condition will be detected anytime the drive is running.
- The High Water fault is NOT be auto-restartable.

Table 59 Parameters

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Range	Default	Menu Location
P1-15	10A	Low / Hi Water Digital Input Configuration **Water DI Config**	0 = Low N.O.-Hi N.O. (Low Water Normally Open High Water Normally Open) 1 = Low N.C.-Hi N.O. (Low Water Normally Closed High Water Normally Open) 2 = Low N.O.-Hi N.C. (Low Water Normally Open High Water Normally Closed)3 3 = Low N.C.-Hi N.C. (Low Water Normally Closed High Water Normally Closed)	0 ~ 3	0	Programming

Table 60 Modified Multi-Function Input Setting

Setting	Description
85	**Low Water Level** 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 Open: Low Water Level Fault 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.

Table 61 Multi-Function Input Setting

Setting	Description
76	**High Water Level** 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

Table 62 Faults

Fault Display	Description	Cause	Countermeasures
High FB / High Water **HFB / HW**  	High Feedback Fault - Feedback signal is too high. OR The “High Water Level” digital input is active (H1-0x = 88).	The feedback level has risen above P1-09 level for the time specified in P1-10. High feedback fault is active in Hand Mode, Auto Mode, Pre-charge and Thrust Mode when the drive is running. OR High Water Level Switch is activated / defective or P1-15 is programmed incorrectly.	Feedback level lower than P1-09 High Feedback Level. OR Lower the water level / adjust the High Water Level switch.

◆ P1-16 Loss of Prime Time <0034>

Setting Range: 1 - 600 s

Factory Default: 20 s

Prime Loss Time: The “Prime Loss” detection is no longer controlled by parameter P1-12. Instead it is controlled by a new parameter, P1-16. Also, the “Prime Loss” detection is enabled during the pre-charge function, but only when not ramping (output frequency = pre-charge frequency).

- Parameter P1-16 is used as the “Loss of Prime” fault timer.
- Parameter P1-16 should be enabled when in pre-charge, but only when the output frequency is within 1 Hz of the pre-charge frequency.
- Loss of Prime Detection is allowed when output frequency is within 1 Hz of d2-01 value instead of the fmax value.
- Loss of Prime Detection is allowed regardless of how many pumps are staged (contactor multiplex operation).
- Loss of Prime is enabled during Timed Run and Run / Stop Control.

Table 63 Parameters

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Range	Default	Menu Location
P1-16	87F	Loss of Prime Time **Prime Time Loss**	Delay time before a Loss of Prime fault occurs. Pump protection criteria specified in P1-14 must be met for the drive to fault. On fault the drive will coast to a stop.	0 ~ 600 s	20 s	Programming

Table 64 Fault <0034>

Fault Display	Description	Cause	Countermeasures
LOP Loss of Prime	Loss of Prime Fault- Pump has lost its prime.	If the output current drops below the P1-14 Prime Loss Level for the time specified in P1-16 and the output frequency is at a high enough level, a “Loss of Prime” fault occurs **Possible causes:** Dry Well, Air in System, No Water	Allow the system to pump water again (must have resistance in pump).

P2 Pump Protection

◆ P2-01 Sleep Level Type

Setting	Description
0	Output Frequency (***factory default***)
1	Output Current
2	Feedback
3	Output Speed (rpm) <0034>
4	Low Flow (Terminal A1 - Flow meter required) <0034>

■ If P2-01 = “0: Output Frequency”

The iQpump drive can be configured to enter a “sleep” condition based on output frequency. The drive will enter the sleep mode when the output frequency falls below the programmed Sleep Level (P2-02) for a time specified by the Sleep Delay Time (P2-03).

This function is only active during operation in the Auto Mode. The display will indicate “Sleep” alarm when active.

The Sleep Level Type works in conjunction with the Sleep Level (P2-02), Sleep Delay Time (P2-03), and Alternative Sleep Activate Level (P2-20). A multi-function digital output can be programmed to enable sleep (H1-xx = 82).

The sleep boost feature will only operate in simplex mode (P1-01 = 0) or in multiplex mode (P1-01 > 0) with just one drive running.

Note: If the value programmed into Alternative Sleep Activate Level (P2-20) is greater than 0.0 Hz, the sleep function will become active when the output frequency rises above the programmed Sleep Level (P2-02) and above the programmed Alternative Sleep Activate Level (P2-20). It is recommended that P2-20 be programmed 1 or 2 Hz above the P1-06 value. The sleep level using P2-20 enables the sleep mode; however, the drive still enters sleep based on P2-20. With the normal default sleep level programmed in P2-02, the sleep cycle will not activate until the output frequency is above P2-02.

■ Function Description: <0034>

Sleep Level Type = Motor Speed (rpm): When parameter P2-01 = 3, the drive will respond exactly the same as if P2-01 = 0 (Output Frequency), except the sleep level parameter will now display units of “rpm” instead of “Hz”.

Sleep Level Type = Low Flow: When parameter P2-01 = 4, the drive will go to sleep based on the flow meter input. See the portion of the specification that describes the flow meter for details.

Sleep Boost: The Sleep Boost function is intended to be used with a pump / pressure-tank system. In order for the sleep boost function to activate, the following conditions need to be met:

- PI control must be active (b5-01 > 0)

- PI control must NOT be inverted (b5-09 ≠ 1)

- Sleep must be enabled (P2-02 > 0.0)

- Drive must be running in “AUTO MODE” (not Hand or Local control)

- Sleep Boost function must be enabled (P2-21 > 0.0)

- Must be in simplex mode (P1-01 = 0) or must have just one drive running in multiplex mode (P1-01 > 0)

When the sleep boost function is enabled and the conditions are met for the drive to go into sleep, the P2-03 timer will then complete. At that time, the setpoint will be increased by the amount entered into parameter P2-21. In order for the drive to go into sleep, the system must reach the boosted setpoint for at least 0.5 seconds, or the time set into parameter P2-22 must expire.

Note: The Sleep Boost Timer will NOT start timing until after the P2-03 sleep delay timer has expired.

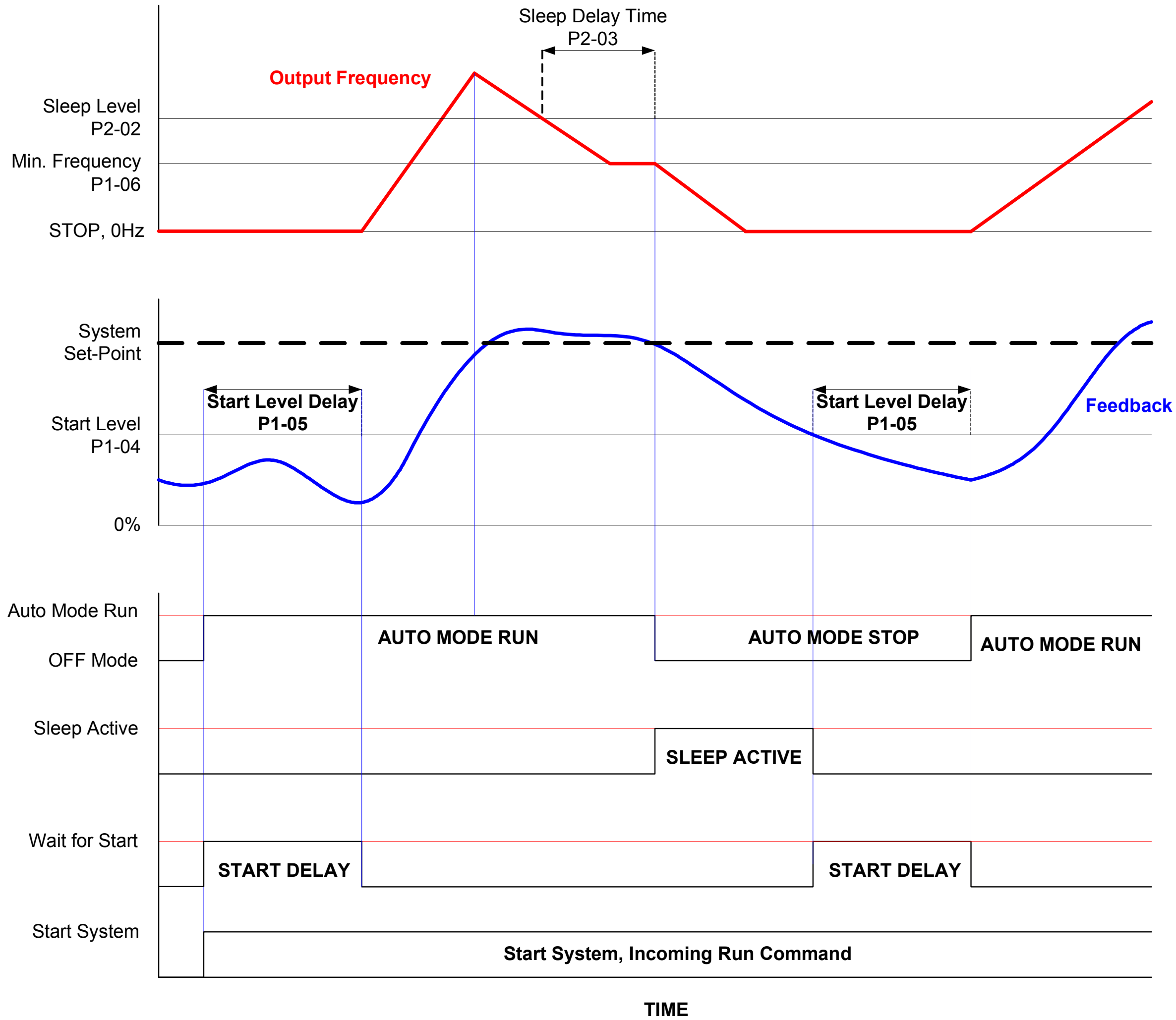


Figure 115. Sleep Function Based on Output Frequency

■ If P2-01 = "1: Output Current"

The iQpump drive can be configured to enter a "sleep" condition based on output current. The drive will enter the sleep mode when the output current falls below the programmed Sleep Level (P2-02) for a time specified by the Sleep Delay Time (P2-03).

This function is only active during operation in the Auto Mode. The display will indicate "Sleep" alarm when active.

The Sleep Level Type works in conjunction with the Sleep Level (P2-02), Sleep Delay Time (P2-03), and Alternative Sleep Activate Level (P2-20). A multi-function digital output can be programmed to enable sleep (H1-xx = 82).

Timing Chart: Start Level Operation

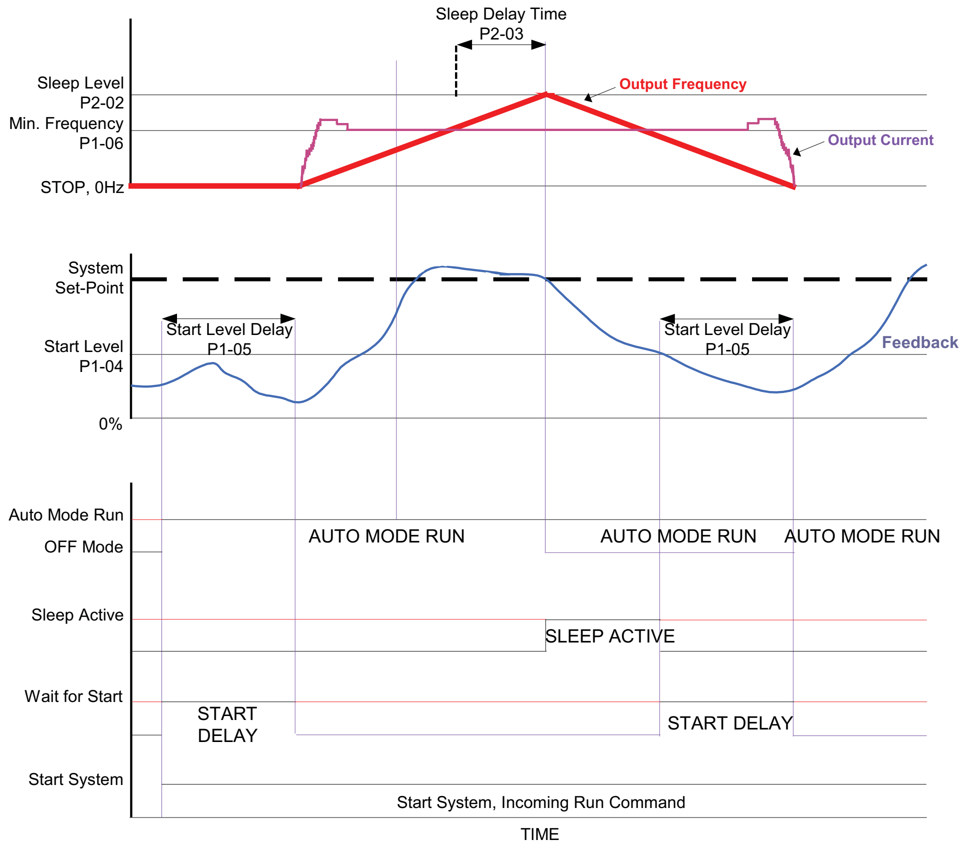


Figure 116. Sleep Function Based on Output Current

■ If P2-01 = "2: Feedback"

The iQpump drive can be configured to enter a "sleep" condition based on the feedback signal. The drive will enter the sleep mode when the feedback signal rises above the programmed Sleep Level (P2-02) for a time specified by the Sleep Delay Time (P2-03).

This function is only active during operation in the Auto Mode.

The Sleep Level Type works in conjunction with the Sleep Level (P2-02), Sleep Delay Time (P2-03), and Alternative Sleep Activate Level (P2-20).

Note: The feedback signal depends on the PID direction (b5-09). If the PID operation is programmed Reverse Output direction, the sleep mode will activate when the feedback signal falls below the programmed Sleep Level (P2-02). The PID will automatically be reset while sleep mode is active.

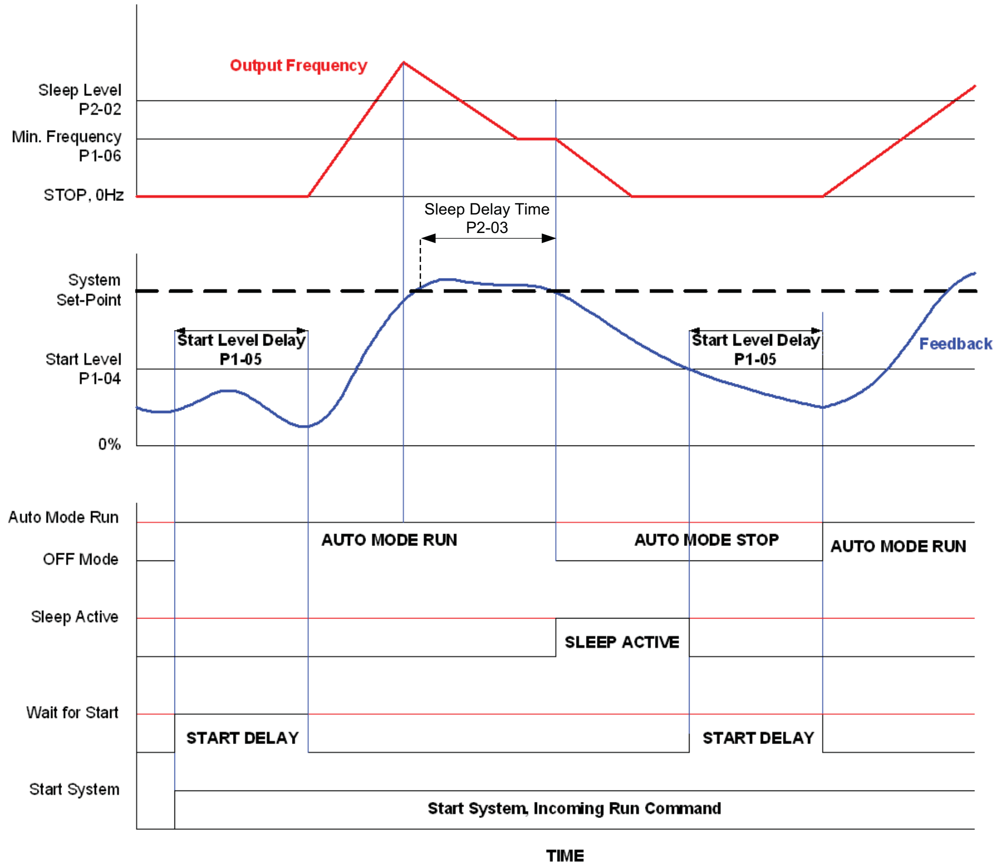


Figure 117. Sleep Function Based on Feedback Level

■ If P2-01 = "3: Output Speed (rpm)" <0034>

The iQpump drive can be configured to enter a "sleep" condition based on the feedback signal. The drive will enter the sleep mode when the feedback signal rises above the programmed Sleep Level (P2-02) for a time specified by the Sleep Delay Time (P2-03).

■ If P2-01 = "4: Low Flow (Terminal A1 - Flow meter required)" <0034>

The iQpump drive can be configured to enter a "sleep" condition based on the feedback signal. The drive will enter the sleep mode when the feedback signal rises above the programmed Sleep Level (P2-02) for a time specified by the Sleep Delay Time (P2-03).

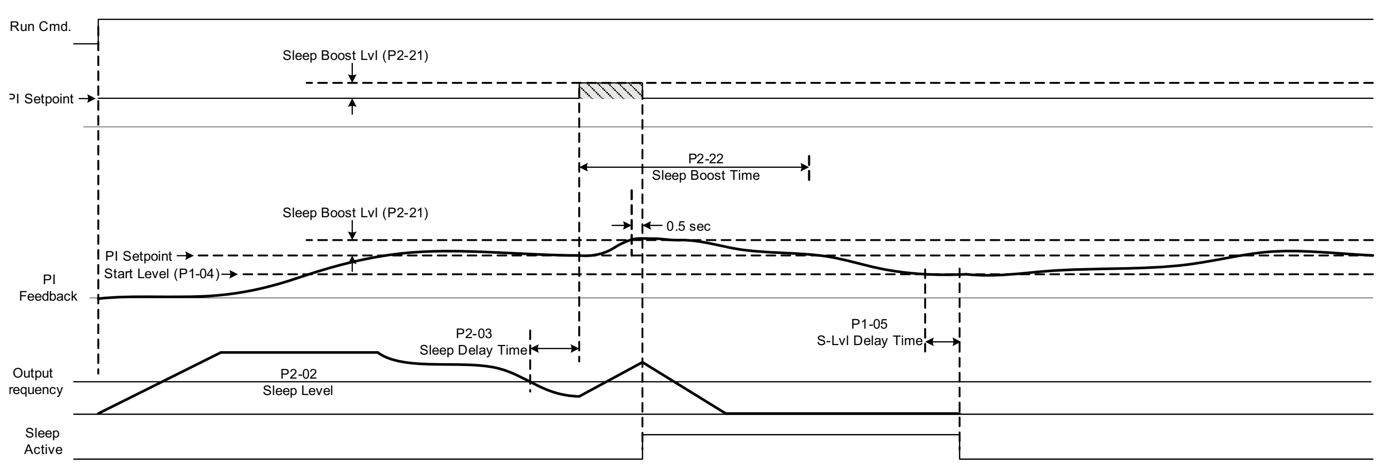


Figure 118. Sleep Boost: Feedback reaches boosted setpoint

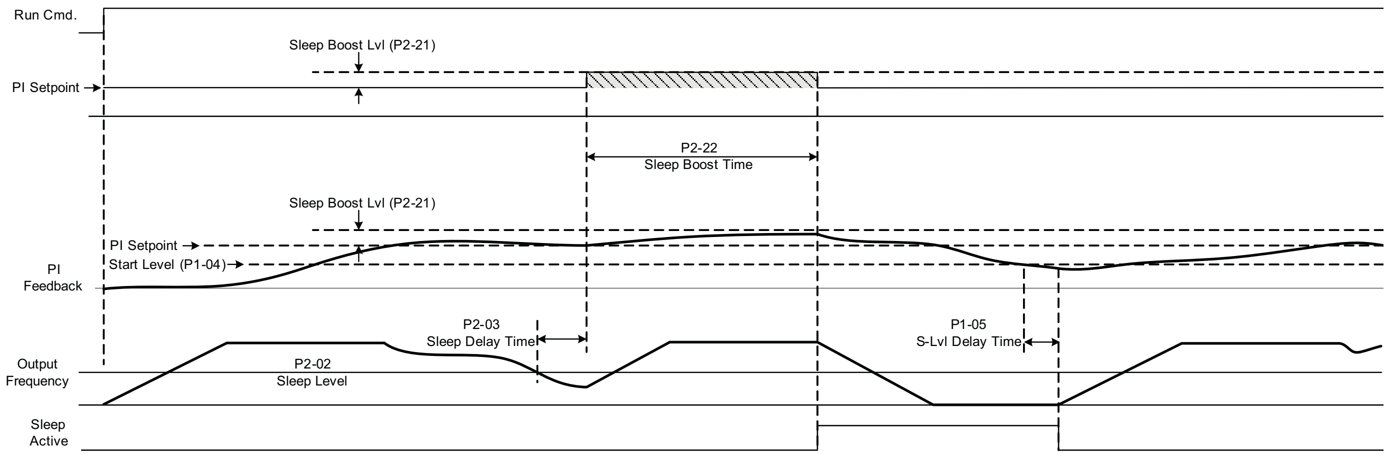


Figure 119. Sleep Boost: Feedback does not reach boosted setpoint

Table 65 Related Parameters <0034>

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Range	Default	Menu Location
P1-04 ♦	603	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. **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.	- 999.9 ~ 999.9 (system units P1-02)	0.0 (system units P1-02)	Pump Quick Setup
P1-12 ♦	107	Not Maintaining Set Point Time **Not Maint SP Tm**	Delay time before a Not Maintaining Setpoint fault occurs. Pump protection criteria specified in P1-11 must be met for the drive to fault. On fault the drive will coast to a stop. Setting P1-12 = 0 disables the Not Maintaining Setpoint fault.	0 ~ 3600 s	60 s	Programming
P2-01	60A	Sleep Level Type **Sleep Lvl Type**	Select sleep type: 0 = Output Frequency 1 = Output Current 2 = Feedback 3 = Output Speed (rpm) 4 = Low Flow (Term A1 - Flow Meter Required) **Note:** Feedback depends on PID direction operation. Display “Sleep” Alarm when active.	0 ~ 4	0	Programming
P2-02 ♦		Sleep Level **Sleep Level**	Sleep activates when selected level (P2-01) reaches programmed sleep level for time specified in P2-03. 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. **Display Units for Sleep Level P2-02:** P2-01 = 0, => “Hz” P2-01 = 1, => “A” P2-01 = 2, => P1-02 Selection P2-01 = 3, => “rpm” P2-01 = 4, => P6-02 Selection **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 ~ 6000.0	0.0	Programming
P2-03 ♦		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 s	5 s	Programming

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Range	Default	Menu Location
P2-20 ♦		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 output frequency is greater or equal to the level P2-20. When programmed to 0, sleep function will become active in above P2-02 Sleep Level. **Display Units for Sleep Level P2-20:** P2-01 = 0, => “Hz” P2-01 = 1, => “Hz” P2-01 = 2, => “Hz” P2-01 = 3, => “rpm” P2-01 = 4, => “Hz” A value of 0 disables this function.	0.0 ~ 6000.0	0.0	Programming
P4-04		Thrust Bearing Acceleration Time **Thrust Acc Time**	When enabled (P4-05>0) the drive output frequency will ramp up to the specified reference frequency in P4-05 in the time specified in P4-04. <1> PI mode is automatically disabled.	0 ~ 600.0 s	1.0 s	Programming
P4-06		Thrust Bearing Deceleration Time **Thrust Dec Time**	This is the amount of time that it will take 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 Thrust Mode above the Thrust Frequency, this deceleration time will be used once the frequency reference is at or below the Thrust Frequency.	0 ~ 600.0 s	1.0 s	Programming
♦ Denotes that parameter can be changed when the drive is running.						

Table 66 Parameters <0034>

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Range	Default	Menu Location
P1-16 ♦	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 s	20 s	Programming
P2-21	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	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 s	5.0	Programming
♦ Denotes that parameter can be changed when the drive is running.						

Table 67 Messages <0034>

Message Display	Description
Sleep Boost Active	The drive is entering the sleep mode and the pressure setpoint is being boosted. During this time, the U1-01 monitor will be updated with the boosted setpoint.

Table 68 Alarms <0034>

Alarm Display	Description	Countermeasures
Freq. Ref < Pump Min P1-06	The drive's frequency reference is set less than the Minimum Pump Frequency P1-06. The frequency reference will be lower-limited to P1-06 during this time. This will only be active when: -Drive is NOT in PI mode -Drive is running -Minimum Pump Frequency is enabled (P1-06 > 0.00)	Increase the frequency reference to a value greater than P1-06.
Freq. Ref < Thrust P4-05	The drive's frequency reference is set less than the Thrust Bearing Frequency P4-05. The frequency reference will be lower-limited to P4-05 during this time. This will only be active when: -Drive is NOT in PI mode -Drive is running -Thrust Bearing is enabled (P4-05 > 0.00)	Increase the frequency reference to a value greater than P4-05.

◆ P2-02 Sleep Level

Setting Range: 0.0 ~ 6000.0

Factory Default: 0.0

The iQpump drive can be configured to enter a "sleep" condition based on the programmed Sleep Level Type (P2-01). The drive will enter the sleep mode when the output frequency or current falls below the programmed Sleep Level (P2-02). When the Sleep Level Type (P2-01) is set to Feedback (P2-01 = 2), the drive will enter the sleep mode when the feedback signal rises above the programmed Sleep Level (P2-02).

The display units for the Sleep Level (P2-02) are determined by the setting of P1-02.

Setting	Display Units
0	Hz (Hertz)
1	A (Amps)
2	Determined by System Units P1-02
3	rpm <0034>
4	Determined by P6-02 selection <0034>

A value of 0 programmed into the Sleep Level (P2-02) disables the sleep function. This function is only active during operation in the Auto Mode.

If P1-01 = 3, the function is active when there is only one drive running on the network.

Note: The Sleep Level (P2-02) has to be programmed above the Minimum Pump Frequency (P1-06) for the sleep function to operate. If P2-02 = 0, pump will sleep at minimum speed.

◆ P2-03 Sleep Delay Time

Setting Range: 0 ~ 3600 s

Factory Default: 5 s

The iQ Pump drive can be configured to enter a "sleep" condition based on the programmed Sleep Level (P2-02) and Sleep Level Type (P2-01). The drive can be programmed to provide a delay time before the drive enters the sleep mode by programming the Sleep Delay Time (P2-03).

The Sleep Delay Time (P2-03) works in conjunction with the Sleep Level (P2-02).

◆ P2-04 Delta Sleep Feedback Drop Level

Setting Range: 0.0 ~ 6000.0

Factory Default: 0.0

The iQpump drive can be configured to detect a no-flow condition when the drive enters the sleep mode. The drive will monitor the incoming feedback signal. If the difference between the system setpoint and the feedback exceeds the Delta Sleep Feedback Drop Level (P2-04) within the programmed Feedback Detection Drop Time (P2-05) and the output frequency is greater than the Minimum Pump Frequency (P1-06), the drive will stop decelerating (sleep deactivate) and return to normal operation (flow detected).

The drive will enter the sleep mode when the difference between the system setpoint and the feedback are smaller than the Delta Sleep Feedback Drop Level (P2-04). This function is only active during operation in the Auto Mode. A value of 0 programmed into Delta Sleep Feedback Drop Level (P2-04) will disable this function.

The Delta Sleep Feedback Drop Level (P2-04) works in conjunction with the Feedback Detection Drop Time (P2-05).

Note: A no-flow detection during deceleration is only active when the output frequency is greater than the Thrust Bearing Frequency (P4-05).

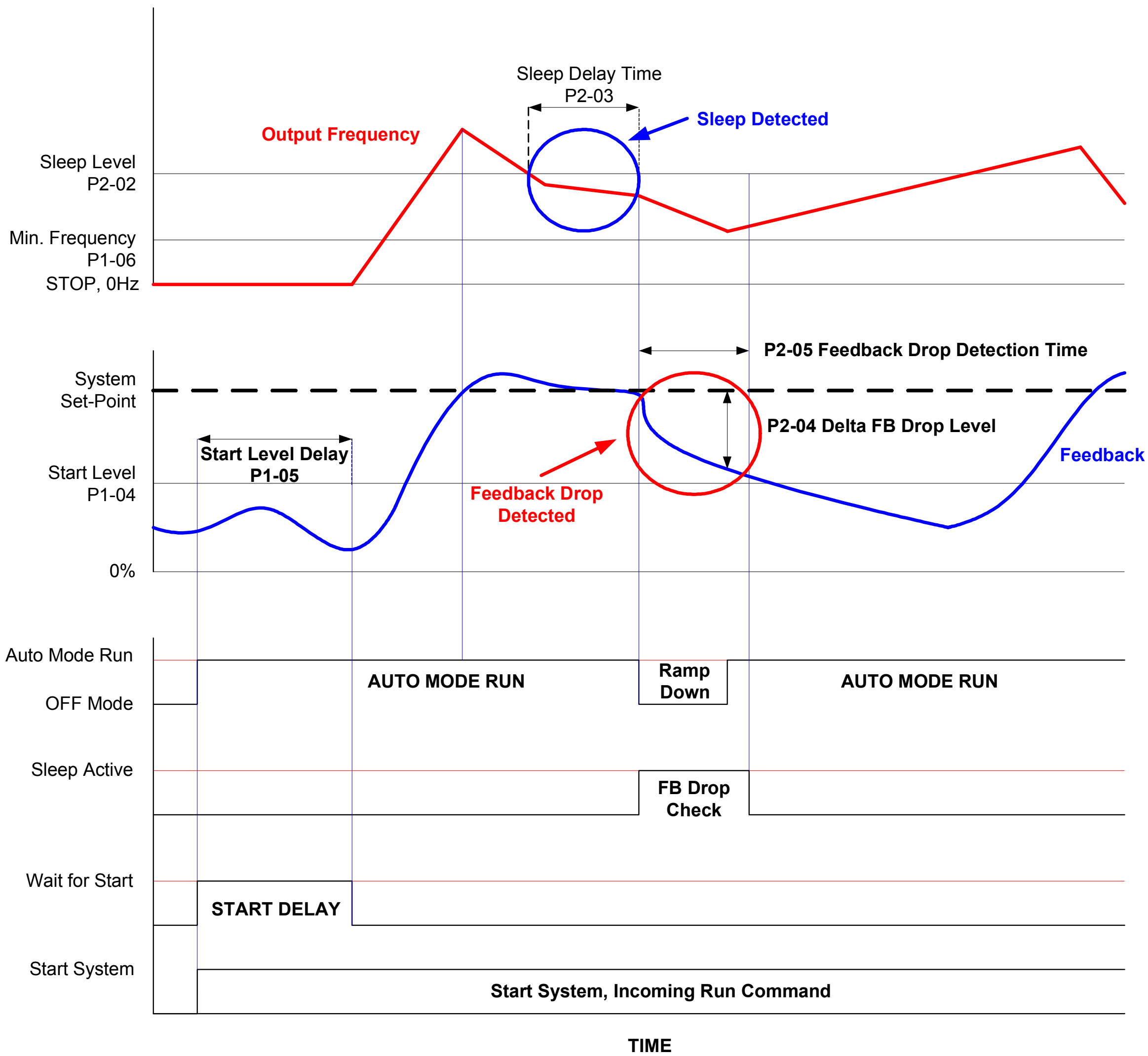


Figure 120. No-Flow Detection During Deceleration

◆ P2-05 Feedback Detection Drop Time

Setting Range: 0 ~ 3600 s

Factory Default: 10 s

The iQpump drive can be configured to detect a no-flow condition. The drive can be programmed to monitor the feedback signal during a flow, no-flow condition for a programmed Feedback Detection Drop Time (P2-05).

The Feedback Detection Drop Time (P2-05) works in conjunction with the Delta Sleep Feedback Drop Level (P2-04).

◆ P2-06 Sleep Mode: Cycling Protection

Setting Range: 0 ~ 10

Factory Default: 0

The iQpump drive can be configured to allow a maximum number of cycles before initiating a “Pump Over Cycle Fault (POC).” The drive will determine the maximum number of cycles based on the programmed number in the Sleep Mode: Cycling Protection (P2-06). One cycle is defined by the drive transferring from normal operation to sleep mode when operating in the Auto Mode. A value of 0 programmed into the Sleep Mode: Cycling Protection (P2-06) will disable this function.

The maximum time allowed between cycles can be programmed in the Sleep Mode: Maximum Cycling Protection Time (P2-07).

The Sleep Mode: Cycling Protection (P2-06) works in conjunction with the Sleep Mode: Maximum Cycling Protection Time (P2-07).

If P1-01 = 3, the function is active when there is only one drive running on the network. <0034>

◆ P2-07 Sleep Mode: Maximum Cycling Protection Time

Setting Range: 0 ~ 3600 s

Factory Default: 300 s

The iQpump drive can be configured to allow a maximum number of cycles before initiating a “Pump Over Cycle Fault (POC).” The number of cycles allowed is determined by programming the Sleep Mode: Cycling Protection (P2-06). The maximum time allowed between cycles can be programmed in the Sleep Mode: Maximum Cycling Protection Time (P2-07). If no cycling occurs within the programmed time, the drive will reset the internal cycle register.

The Sleep Mode: Maximum Cycling Protection Time (P2-07) works in conjunction with the Sleep Mode: Cycling Protection (P2-06).

◆ P2-08 Over-Cycling Mode

Setting	Description
0	Disabled (***factory default***)
1	Alarm
2	Pump Over Cycle Fault (POC)
3	Auto Compensation

If P2-08 = “0: Disabled,” the over-cycling mode is disabled.

If P2-08 = “1: Alarm,” then a “Pump Cycling” alarm will occur to indicate a pump over-cycle condition when the maximum number of cycles has been reached as defined by the Sleep Mode: Cycling Protection (P2-06).

If P2-08 = “2: Pump Over Cycle Fault (POC),” then a “Pump Over Cycle (POC)” fault will occur to indicate a pump over-cycle fault condition, when the maximum number of cycles has been reached, as defined by the Sleep Mode: Cycling Protection (P2-06).

If P2-08 = “3: Auto Compensation,” then the drive will automatically increase (compensate) the system setpoint by the value programmed in the setpoint Compensation (P2-09) parameter.

The compensation will increase each time the maximum number of cycles is reached as defined by the Sleep Mode: Cycling Protection (P2-06) function. When the setpoint is increased (incremented), the internal over-cycle counter will be reset.

The original setpoint will be restored (decreased) in steps defined by Setpoint Compensation (P2-09) when the pump system has been operating without cycling for the time programmed in the Maximum Cycle Protection Time (P2-07) parameter.

Over-cycle protection is only active during operation in the Auto Mode and in combination with no-flow sleep functions P2-05 and P2-07.

Note: Maximum setpoint compensation can be programmed in Maximum Setpoint Compensation (P2-10).

Manually starting and stopping the drive will reset the internal over-cycle counter. Transitioning from Hand to Auto Mode will also reset the internal over-cycle counter.

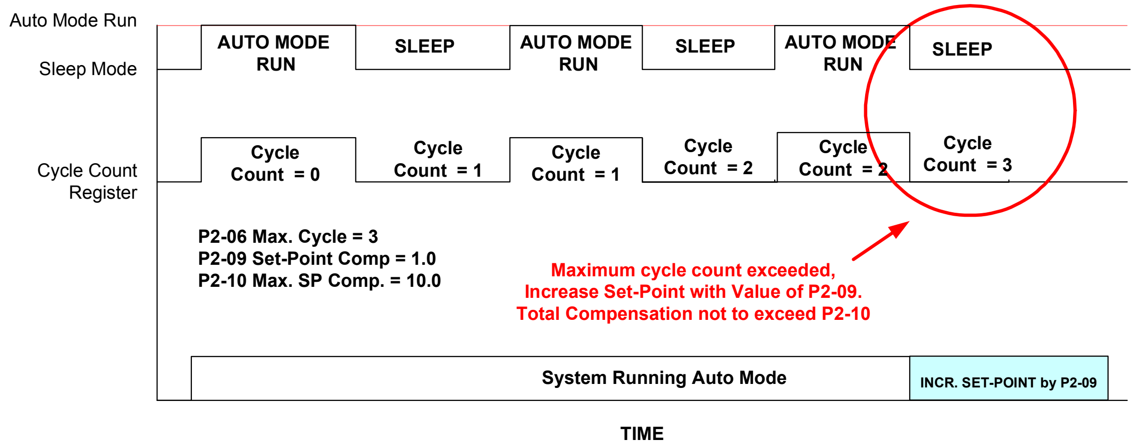


Figure 121.

Total setpoint compensation can be monitored with Total Setpoint Compensation (U1-93).

◆ P2-09 Setpoint Compensation

Setting Range: 0.0 ~ 6000.0

Factory Default: 0.0

The iQpump drive can automatically increase the setpoint each time the maximum number of cycles programmed in Sleep Mode: Cycling Protection (P2-06). The units for this parameter are determined by the System Units (P1-02).

Refer to Over-Cycling Mode: (P2-08 = 3: Auto Compensation) for more details.

◆ P2-10 Maximum Setpoint Compensation

Setting Range: 0.0 ~ 6000.0

Factory Default: 0.0

The iQpump drive can set the maximum allowable setpoint compensation during an over-cycling condition by the value programmed in Maximum Setpoint Compensation (P2-10). The units for this parameter are determined by the System Units (P1-02).

Refer to Over-Cycling Mode: (P2-08 = 3: Auto Compensation) for more details.

◆ P2-11 No-Flow Activation Level

Setting Range: 0 ~ 24000 rpm

Factory Default: 0 rpm

The iQpump drive can be configured to activate a no-flow detection by programming the No-Flow Activation Level (P2-11). The no-flow detection is active when the motor is operating below this No-Flow Activation Level (P2-11) and below the No-Flow Detection Bandwidth (P2-12).

Setting P2-11 to a value of 0 will disable this function. This function is only active during operation in the Auto Mode and when the drive is operating above the Minimum Pump Frequency (P1-06) and below the level programmed in P2-11.

Note: Program Start Level (P1-04) to a value greater than 0.

The No-Flow Activation Level (P2-11) works in conjunction with the No-Flow Detection Bandwidth (P2-12).

If P1-01 = 3, the function is active on the lead drive. <0034>

■ No-Flow Detection Basic Operation

The iQpump drive can be configured for a no-flow detection condition. The no-flow detection function of the iQpump drive is an advanced feature for all pumping applications. The typical applications for this function are submersible and booster station pumps.

The programming of the No-Flow Activation Level (P2-11) will activate the no-flow detection function. The drive will monitor the motor rpm and if the motor rpm falls below the No-Flow Activation Level (P2-11) and the No-Flow Detection Bandwidth (P2-12), the no-flow process is activated.

The drive will check for system response by monitoring the motor rpm for a time specified by the No-Flow Detection Time (P2-13). If the motor rpm is within the bandwidth programmed in P2-12 after the time specified by P2-13, the setpoint will be lower by the value programmed in the No-Flow Setpoint Compensation (P2-16). The drive will wait for the system to stabilize for the time programmed in the No-Flow Stabilization Time (P2-14).

After the time programmed in P2-14 has elapsed, the setpoint is returned to the original value. The drive will again wait for the system to stabilize for the time programmed in P2-13. If the time programmed in P2-13 has elapsed, the drive will continue to monitor the feedback level. If the feedback level falls within the No-Flow Delta Feedback Level (P2-15) for a time programmed in No-Flow Feedback Delay Time (P2-17), the drive will enter a "sleep" mode after the P2-13 time elapses.

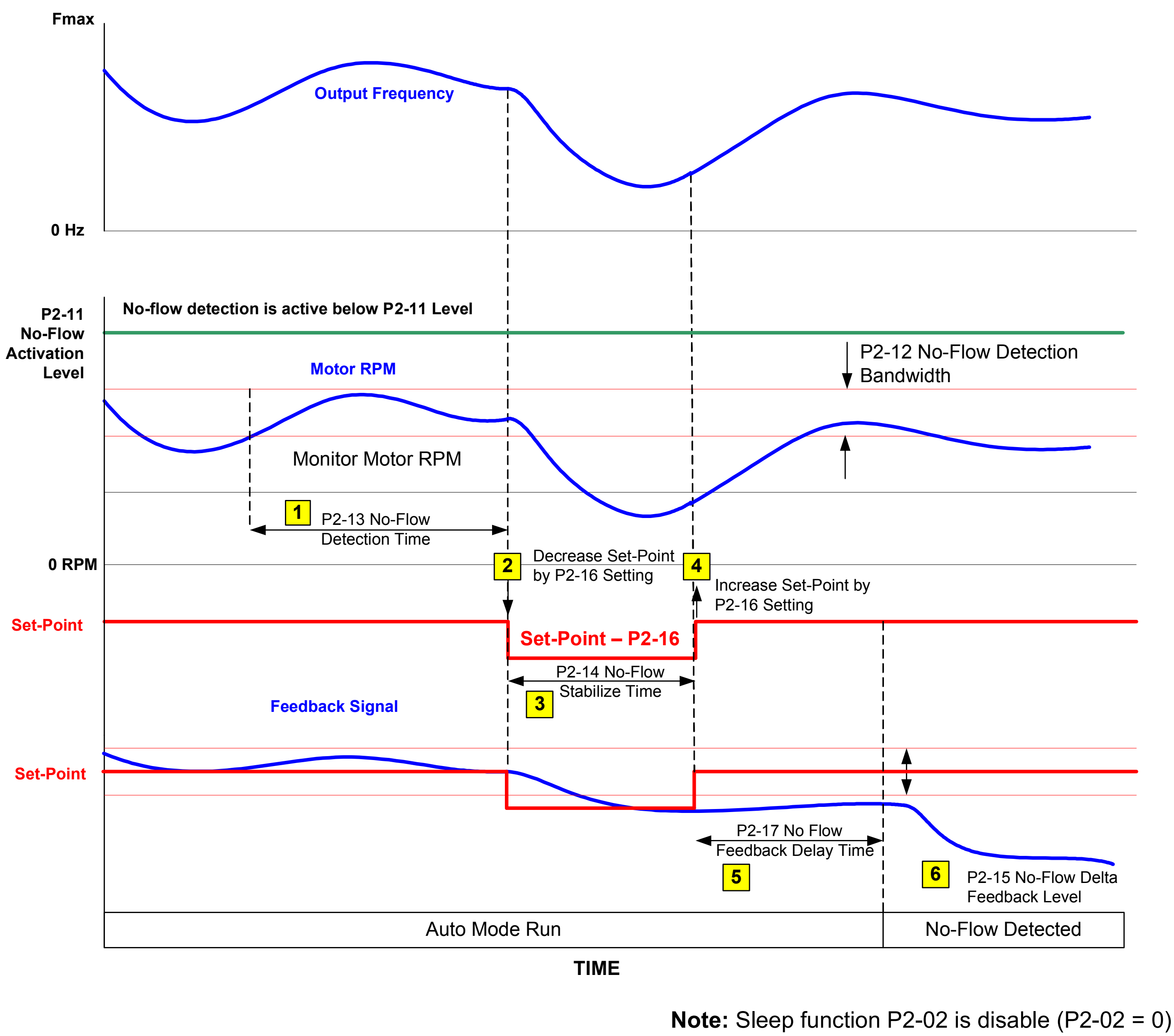


Figure 122.

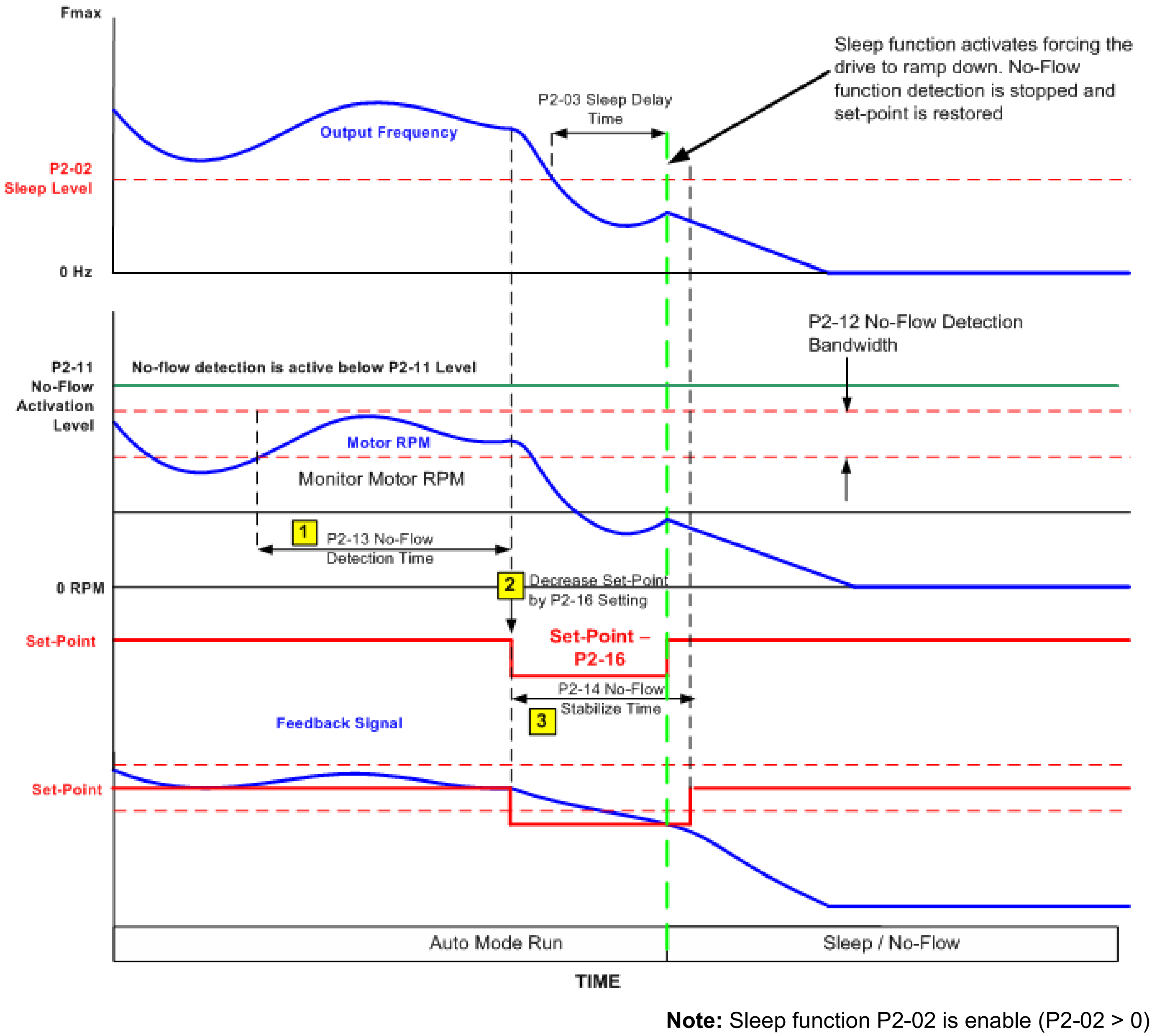


Figure 123.

◆ P2-12 No-Flow Detection Bandwidth

Setting Range: 0 ~ 1000 rpm

Factory Default: 15 rpm

The iQpump drive can be configured to activate a no-flow detection by programming the No-Flow Activation Level (P2-11). The no-flow activation can have a programmed bandwidth before the no-flow condition is activated by programming the No-Flow Detection Bandwidth (P2-12).

The No-Flow Detection Bandwidth (P2-12) sets the motor rpm fluctuation bandwidth. The no-flow detection activates when the motor rpm is below the No-Flow Activation Level (P2-11) and remains within the programmed No-Flow Detection Bandwidth (P2-12) for a time specified by the No-Flow Detection Time (P2-13).

The No-Flow Detection Bandwidth (P2-12) works in conjunction with the No-Flow Activation Level (P2-11).

Refer to the No-Flow Activation Level (P2-11) for more details.

◆ P2-13 No-Flow Detection Time

Setting Range: 0.0 ~ 1000.0 s

Factory Default: 5.0 s

The iQpump drive can be configured to activate a no-flow condition by programming the No-Flow Activation Level (P2-11) and No-Flow Detection Bandwidth (P2-12). The no-flow detection activates when the motor rpm remains within the programmed bandwidth (P2-12) for a time programmed in the No-Flow Detection Time (P2-13).

The No-Flow Detection Time (P2-13) works in conjunction with the No-Flow Detection Bandwidth (P2-12) and the No-Flow Feedback Level (P2-15).

Refer to the No-Flow Activation Level (P2-11) for more details.

◆ P2-14 No-Flow Stabilization Time

Setting Range: 0.0 ~ 1000.0 s

Factory Default: 5.0 s

The iQpump drive can be configured to activate a no-flow detection by programming the No-Flow Activation Level (P2-11). When the no-flow detection is activated, the system setpoint will be lowered by the value programmed in the No-Flow Setpoint Compensation (P2-16) for a specific time as programmed by the No-Flow Stabilization Time (P2-14). After the time programmed in P2-14 has elapsed, the system setpoint will return to the original setting.

The No-Flow Stabilization Time (P2-14) works in conjunction with the No-Flow Setpoint Compensation (P2-16).

Refer to the No-Flow Activation Level (P2-11) for more details.

◆ P2-15 No-Flow Delta Feedback Level

Setting Range: 0.0 ~ 6000.0

Factory Default: 1.0

The iQpump drive can be configured to activate a no-flow detection by programming the No-Flow Activation Level (P2-11). When the no-flow detection is activated, the feedback level is monitored and compared to the system setpoint. If the difference between the system setpoint and the feedback level exceeds the No-Flow Delta Feedback Level (P2-15) for a time specified by the No-Flow Feedback Delay Time (P2-17), the drive will enter a “sleep” mode.

The No-Flow Delta Feedback Level (P2-15) works in conjunction with the No-Flow Feedback Delay Time (P2-17). The units for this parameter are determined by the System Units (P1-02).

Refer to the No-Flow Activation Level (P2-11) for more details.

Note: The feedback detection direction can be selected by programming No-Flow Feedback Detection Direction (P2-19).

◆ P2-16 No-Flow Setpoint Compensation

Setting Range: 0.0 ~ 6000.0

Factory Default: 1.5

The iQpump drive can be configured to activate a no-flow detection by programming the No-Flow Activation Level (P2-11). When the no-flow detection is activated and the No-Flow Detection Time (P2-13) has elapsed, the system setpoint will be lowered by the value programmed in the No-Flow Setpoint Compensation (P2-16) for the time programmed in No-Flow Stabilization Time (P2-14).

The No-Flow Setpoint Compensation (P2-16) works in conjunction with the No-Flow Stabilization Time (P2-14). The units for this parameter are determined by the System Units (P1-02).

Refer to the No-Flow Activation Level (P2-11) for more details.

◆ P2-17 No-Flow Feedback Delay Time

Setting Range: 0.0 ~ 1000.0 s

Factory Default: 2.0 s

The iQpump drive can be configured to activate a no-flow detection by programming the No-Flow Activation Level (P2-11). When the no-flow detection process is activated, and the system setpoint has returned to the original value, the feedback will be monitored. If the feedback level is within the No-Flow Delta Feedback Level (P2-15), a specific delay time can be programmed in the No-Flow Feedback Delay Time (P2-17) before the drive enters a “sleep” mode.

The No-Flow Feedback Delay Time (P2-17) works in conjunction with the No-Flow Delta Feedback Level (P2-15).

Refer to the No-Flow Activation Level (P2-11) for more details.

◆ P2-18 No-Flow Motor RPM Sample Time

Setting Range: 0.0 ~ 1000.0 s

Factory Default: 2.0 s

The iQpump drive can be configured to activate a no-flow detection by programming the No-Flow Activation Level (P2-11). The no-flow detection function monitors the motor rpm. The motor rpm monitor sample rate can be programmed in the No-Flow Motor RPM Sample Time (P2-18).

Refer to the No-Flow Activation Level (P2-11) for more details.

◆ P2-19 No-Flow Feedback Detection Direction

Setting	Description
0	Outside Bandwidth (P2-15) (***factory default***)
1	Inside Bandwidth (P2-15)

The iQpump drive can be configured to activate a no-flow detection by programming the No-Flow Activation Level (P2-11). When the no-flow detection process is activated, and the system setpoint has returned to the original value, the feedback will be monitored. The direction of the feedback upon return of the no-flow detection can be selected by programming the No-Flow Feedback Detection Direction (P2-19).

The No-Flow Feedback Detection Direction (P2-19) works in conjunction with the No-Flow Delta Feedback Level (P2-15).

Refer to the No-Flow Activation Level (P2-11) for more details.

◆ P2-20 Alternative Sleep Activation Level

Setting Range: 0.0 ~ 6000.0 <0034>

Factory Default: 0.0

The iQpump drive can be configured to activate a “sleep” mode. In addition, the iQpump drive can be configured to activate an alternative “sleep” mode. When the Sleep Level Type (P2-01) is set for a value of 0 (P2-01 = 0: Output Frequency), the alternative sleep activation level is set when a value greater than 0 is programmed in the Alternative Sleep Activation Level (P2-20).

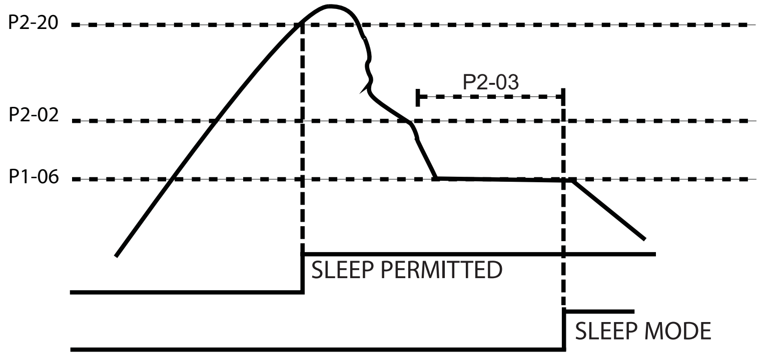


Figure 124.

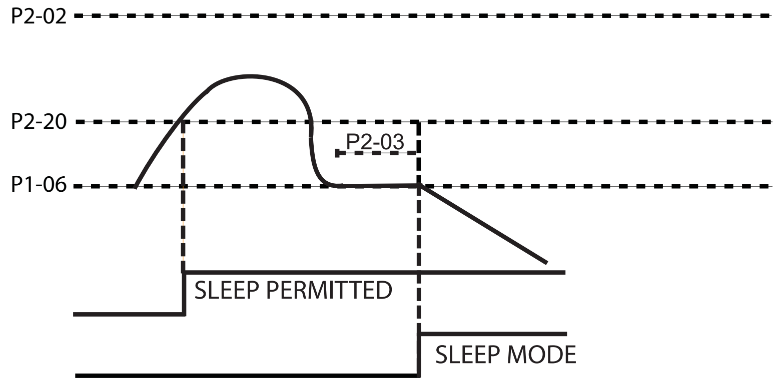


Figure 125.

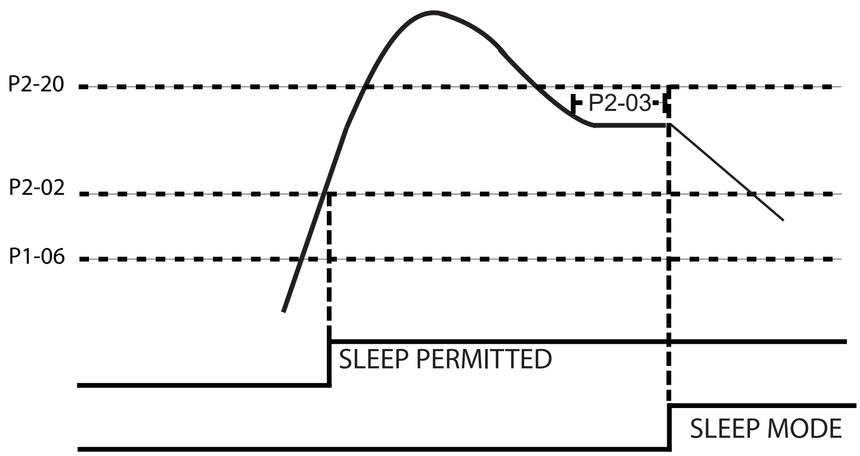


Figure 126.

The sleep function can be active during the following conditions:

- When P2-20 is set to 0 or 3 <0034> (disabled), the output frequency must be greater than the Sleep Level (P2-02).
- When P2-20 is greater than P2-02, the output frequency must be greater than Alternative Sleep Activation Level (P2-20). See *Figure 124.*.
- When P2-20 is greater than 0 and less than P2-02, the output frequency must be greater than Alternative Sleep Activation Level (P2-20). See *Figure 125.*.
- When P2-20 is greater than 0 and less than P2-02, the output frequency must be greater than Alternative Sleep Activation Level (P2-20) and Sleep Level (P2-02). See *Figure 126.*

A value of 0 programmed in P2-20 will disable this function.

- P2-01 = 0: Display based on “Hz” <0034>

• P2-01 = 1: Display based on “Hz” <0034>
• P2-01 = 2: Display based on “Hz” <0034>
• P2-01 = 3: Display based on “rpm” <0034>
• P2-01 = 4: Display based on “Hz” <0034>

The Alternative Sleep Activation Level (P2-20) works in conjunction with the Start Level (P1-04) and the Sleep Level Type (P2-01).

It is recommended that P2-20 be programmed 1 or 2 Hz above the P1-06 value. The sleep level using P2-20 enables the sleep mode; however, the drive still enters sleep based on P2-20. With the normal default sleep level programmed in P2-02, the sleep cycle will not activate until the output frequency is above P2-02.

◆ P2-21 Sleep Boost Level <0034>

Setting Range: 0.0 ~ 6000.0

Factory Default: 0.0

Refer to parameter P2-21 in Appendix A for description details.

◆ P2-22 Sleep Boost Maximum Time <0034>

Setting Range: 1.0 ~ 160.0 s

Factory Default: 5.0 s

Refer to parameter P2-22 in Appendix A for description details.

◆ P2-23 Anti-No Flow Bandwidth <0034>

Setting Range: 0.00 ~ 2.00%

Factory Default: 0.40%

The iQpump P2-23 parameter is to provide a simple and reliable method of detecting and reacting to the “No-Flow” condition. When the drive detects that the pump is no longer contributing to the overall pressure in the system due to a “No-Flow” condition, an increased rate of deceleration will occur. The normal sleep function will then take over. This function will only operate when the Sleep Level Type is frequency or speed (P2-01 = 3).

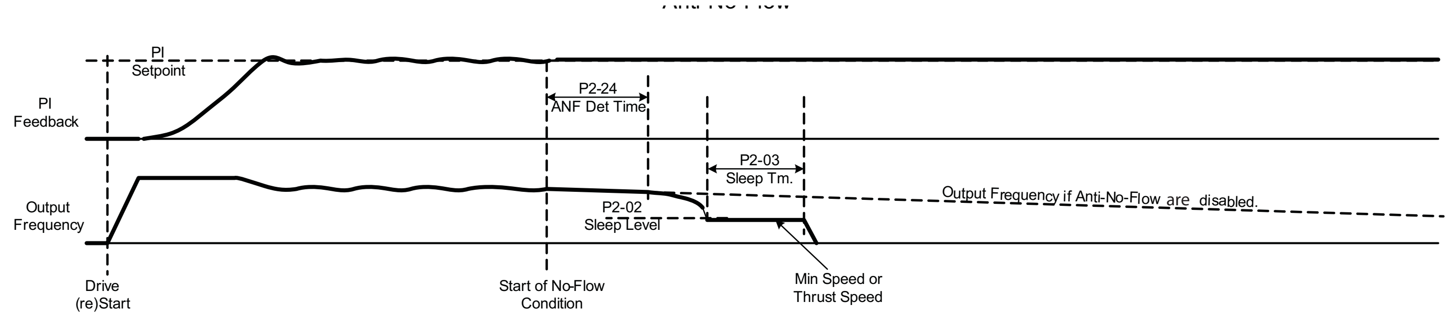


Figure 127. Anti-No-Flow

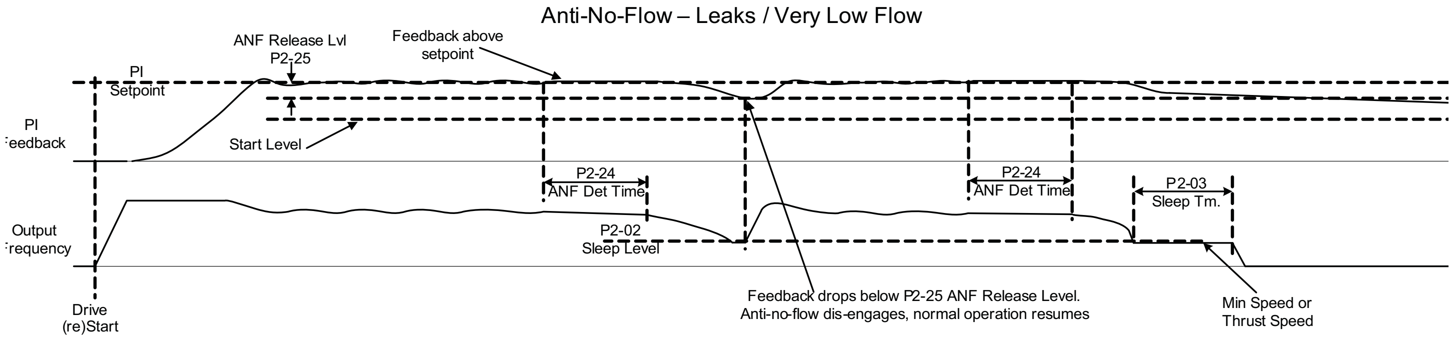


Figure 128. Anti-No-Flow - Leaks / Very Low Flow

Table 69 Parameters

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Range	Default	Menu Location
P2-23 ♦	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 0.000% disables this feature.	0.00 ~ 2.00%	0.40%	Programming
P2-24 ♦	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 s	10.0 s	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.						

Table 70 Monitors <0034>

Monitor No.	Addr. Hex	Monitor Name Digital Operator Display	Description
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.

◆ P2-24 Anti-No Flow Detection Time <0034>

Setting Range: 1.0 ~ 60.0 s

Factory Default: 10.0 s

Refer to parameter P2-24 in Appendix A for description details.

◆ P2-25 Anti-No Flow Release Level <0034>

Setting Range: 1.0 ~ 100.0 psi

Factory Default: 3.0 psi

Refer to parameter P2-25 in Appendix A for description details.

P3 Pump Multiplex

◆ P3-01 Lead-Lag Control

Setting	Description	Parameters Used
0	Output Frequency (***factory default***)	P3-02, P3-04, P3-09, P3-10
1	Feedback Level	P3-03, P3-04, P3-05, P3-06
2	Output Frequency + Feedback Level	P3-02, P3-03, P3-05, P3-06, P3-07, P3-08, P3-10

The iQpump drive can be configured for lead-lag control. The lead-lag control refers to the drive (lead) controlling a pump and turning on auxiliary pumps (lag) by the drive's output contacts. The controlling of the auxiliary pumps is referred to staging and de-staging. Up to three (3) total pumps can be operated, one lead (drive control) and two auxiliary pumps. The pump control staging and de-staging can be controlled by three (3) different lead-lag control methods.

0: Output Frequency

1: Feedback Level

2: Output Frequency + Feedback Level

■ P3-01 = 0: Output Frequency

The "output frequency" control method monitors the drive's output frequency and determines if the auxiliary pumps need to be staged (turned ON) to maintain the programmed system's setpoint. The output frequency also determines when the auxiliary pumps are to be de-staged (turned OFF). Refer to *Figure 129.* and *Figure 130.* for the staging and de-staging of the auxiliary pumps using the "output frequency" control method.

Auxiliary Pump Staging (ON)

The staging of auxiliary pump 2 occurs when the output frequency remains above the iQpump drive Multi / Maximum Level (P3-02) for the time programmed in Add Pump Delay Time (P3-04).

The staging of auxiliary pump 3 occurs when the auxiliary pump 2 is staged and the output frequency remains above the iQpump drive Multi / Maximum Level (P3-02) for the time programmed in Add Pump Delay Time (P3-04). Refer to *Figure 129.* for the staging of the auxiliary pump 2 and 3 using the "output frequency" control method.

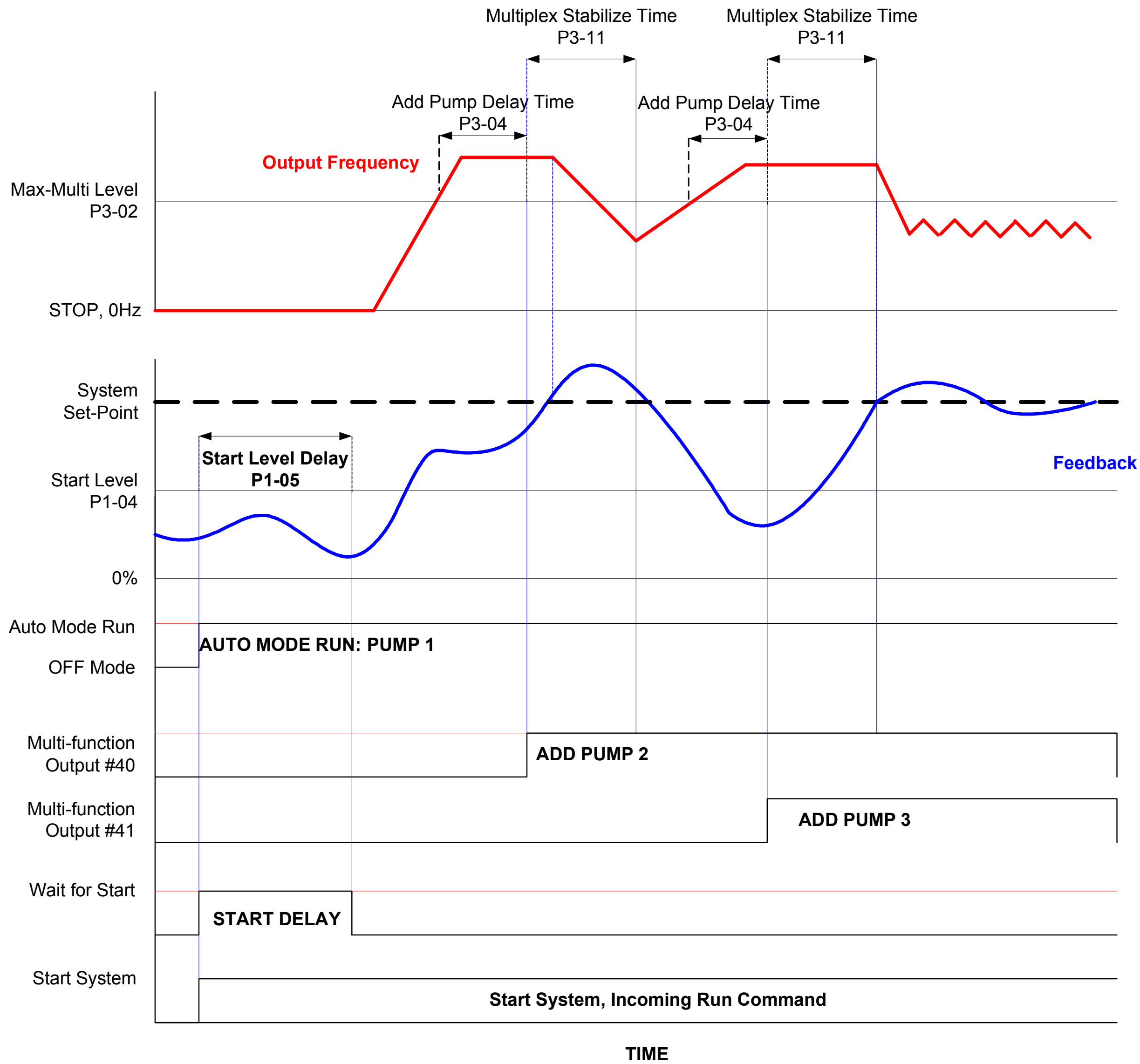


Figure 129.

Auxiliary Pump De-Staging (OFF)

The de-staging of the auxiliary pumps 2 and 3 will occur in the reverse order of the staging process described previously.

The de-staging of auxiliary pump 3 occurs when the output frequency falls below the Pump 3 Frequency Shutdown Level (P3-10) for the time programmed in the Shutdown Pump Delay Time (P3-06).

The de-staging of pump 2 occurs when the auxiliary pump 3 is de-staged and the output frequency falls below the Pump 2 Frequency Shutdown Level (P3-09) for the time programmed in the Shutdown Pump Delay Time (P3-06). Refer to *Figure 130.* for the de-staging of the auxiliary pumps 2 and 3 using the “output frequency” control method.

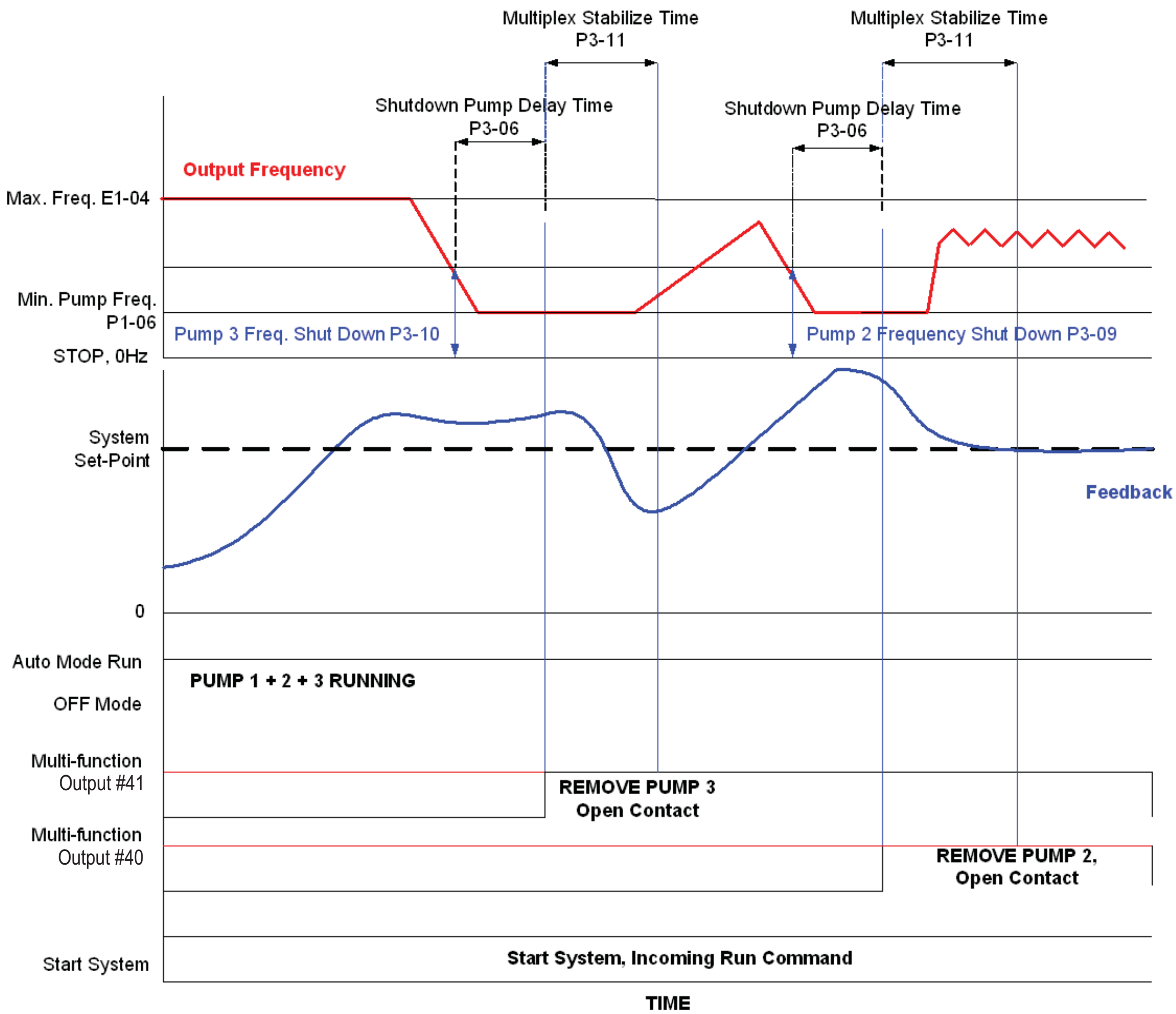


Figure 130.

The pump system can be allowed to stabilize by programming a time into the Multiplex Stabilization Time (P3-11). The Multiplex Stabilization Time (P3-11) becomes active after an auxiliary pump is staged or de-staged.

Note: The pump protection function is disabled during auxiliary pump staging and de-staging.

The No-Flow and Sleep functions are only active when the lead pump controlled by the drive is the only pump operating the pump system.

■ P3-01 = 1: Feedback Level

The “feedback level” control method monitors the drive’s output frequency and the system’s feedback level to determine if the auxiliary pumps need to be staged (turned ON) to maintain the programmed system’s setpoint. The output frequency and the system’s feedback also determine when the auxiliary pumps are to be de-staged (turned OFF). Refer to *Figure 131.* and *Figure 132.* for the staging and de-staging of the auxiliary pumps using the “feedback level” control method.

Auxiliary Pump Staging (ON)

The staging of auxiliary pump 2 occurs when the difference between the system setpoint minus the feedback level exceeds the value programmed in the Add Pump Delta Level (P3-03) for the time programmed in Add Pump Delay Time (P3-04).

The staging of auxiliary pump 3 occurs when the auxiliary pump 2 is staged and when the difference between the system setpoint minus the feedback level exceeds the value programmed in the Add Pump Delta Level (P3-03) for the time programmed in Add Pump Delay Time (P3-04). Refer to *Figure 131.* for the staging of the auxiliary pumps using the “feedback level” control method.

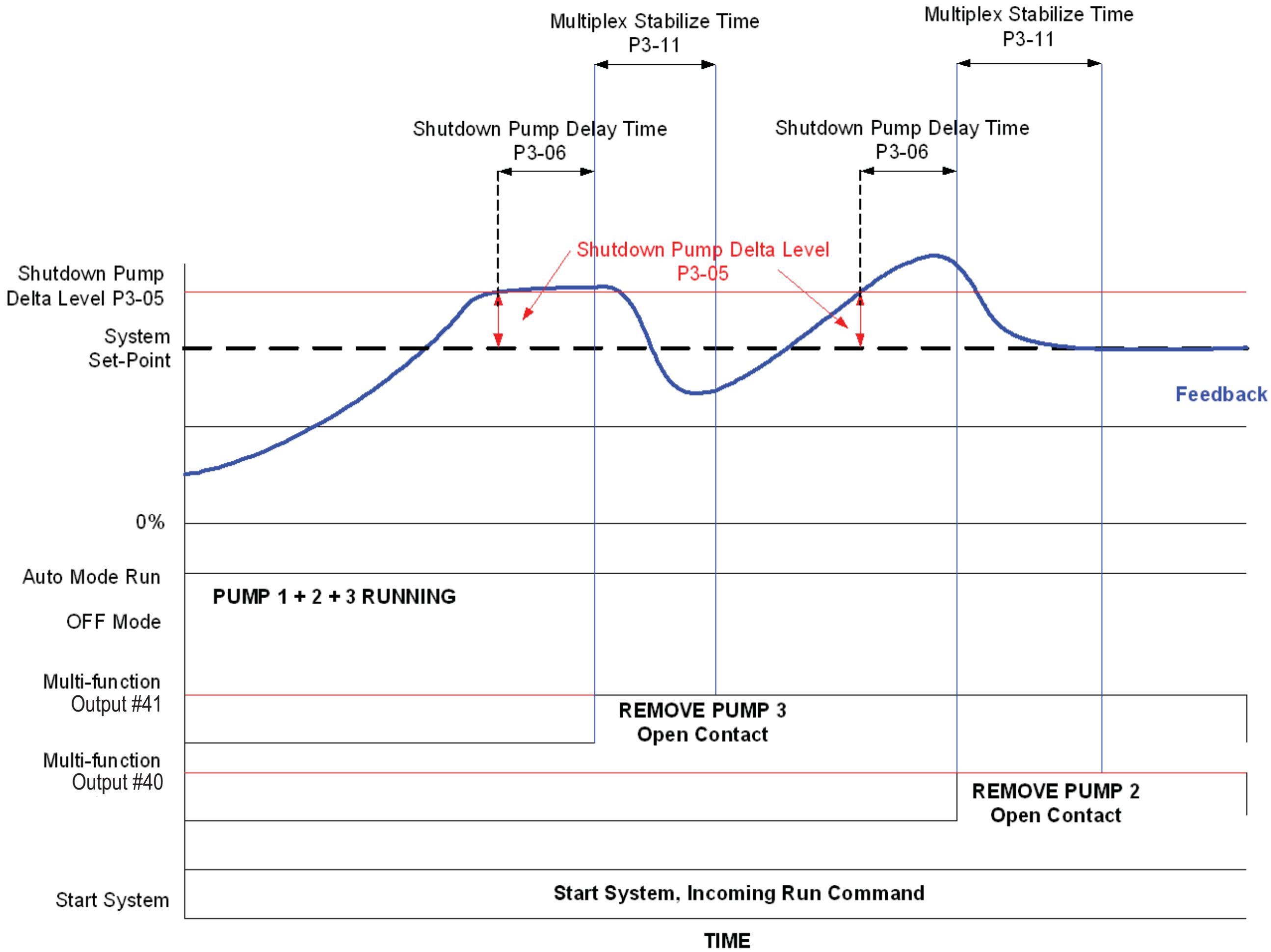


Figure 131.

Auxiliary Pump De-Staging (OFF)

The de-staging of the auxiliary pumps 2 and 3 will occur in the reverse order of the staging process described previously.

The de-staging of auxiliary pump 3 occurs when the difference between the system's feedback level minus the setpoint exceeds the value programmed in the Shutdown Pump Delta Level (P3-05) for the time programmed in the Add Pump Delay Time (P3-04).

The de-staging of auxiliary pump 2 occurs when the auxiliary pump 3 is de-staged and the difference between the system's feedback level and setpoint exceeds the value programmed in the Shutdown Pump Delta Level (P3-05) for the time programmed in Add Pump Delay Time (P3-04). Refer to *Figure 132.* for the de-staging of the auxiliary pumps 2 and 3 using the "feedback level" control method.

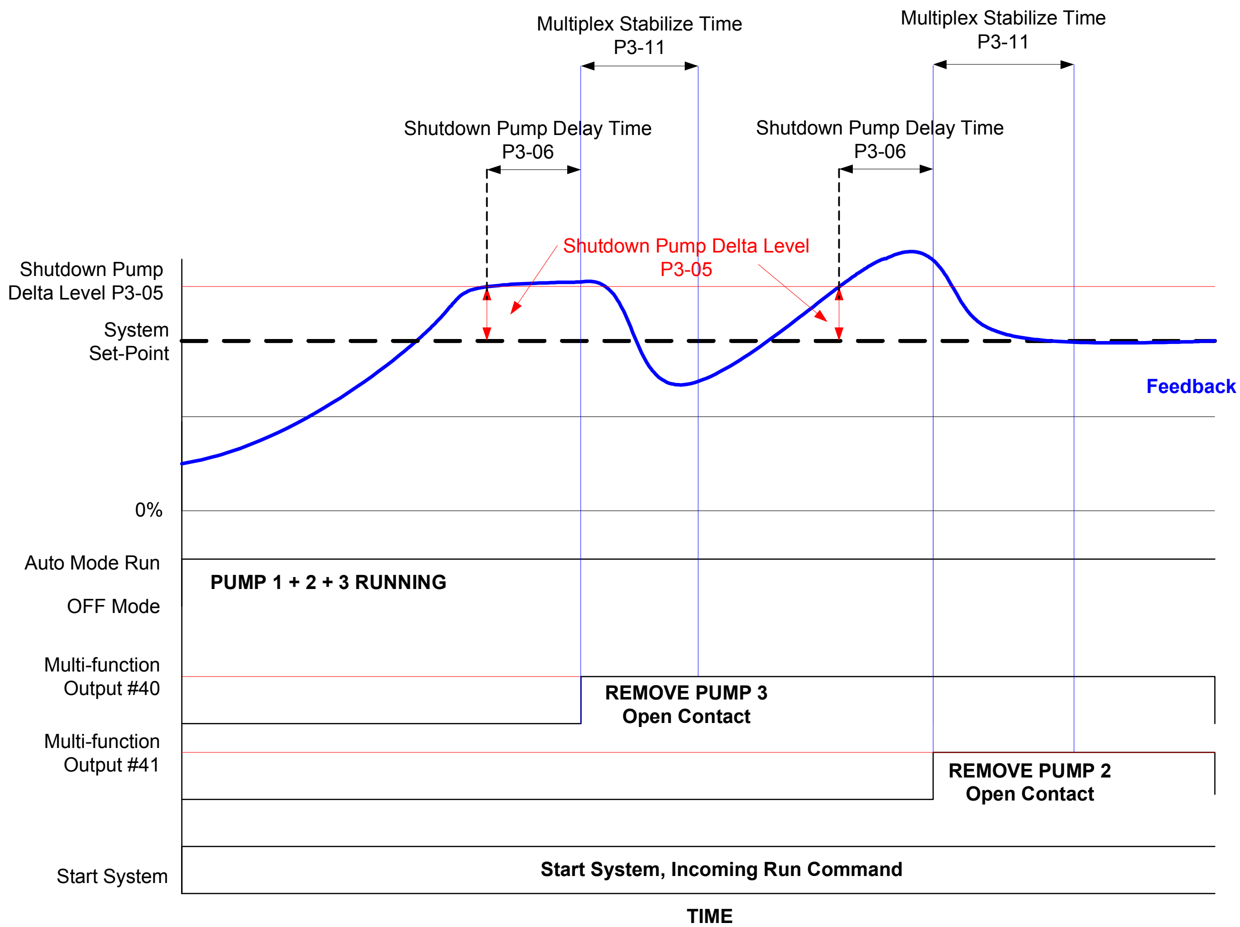


Figure 132.

The pump system can be allowed to stabilize by programming a time into the Multiplex Stabilization Time (P3-11). The Multiplex Stabilization Time (P3-11) becomes active after an auxiliary pump is staged or de-staged.

Note: The pump protection function is disabled during auxiliary pump staging and de-staging.

The No-Flow and Sleep functions are only active when the lead pump controlled by the drive is the only pump operating the pump system.

■ P3-01 = 2: Output Frequency + Feedback Level

The "output frequency + feedback level" control method monitors the drive's output frequency and the difference between the system's setpoint and feedback level to determine if the auxiliary pumps need to be staged (turned ON) to maintain the programmed system's setpoint. The output frequency and the difference between the system's setpoint and feedback level also determine when the auxiliary pumps are to be de-staged (turned OFF). Refer to *Figure 133.* and *Figure 134.* for the staging and de-staging of the auxiliary pumps using the "output frequency + feedback level" control method.

Auxiliary Pump Staging (ON)

The staging of auxiliary pump 2 occurs when the output frequency remains above the iQpump drive Multi / Maximum Level (P3-02) and the difference between the system's setpoint and the feedback level exceeds the value programmed in the Add Pump Delta Level (P3-03) for the time programmed in Add Pump Delay Time (P3-04).

The staging of auxiliary pump 3 occurs when the auxiliary pump 2 is staged and when the output frequency remains above the iQpump drive Multi / Maximum Level (P3-02) and the difference between the system's setpoint and feedback level exceeds the value programmed in the Add Pump Delta Level (P3-03) for the time programmed in Add Pump Delay Time (P3-04). Refer to *Figure 133.* for the staging of the auxiliary pumps using the "output frequency + feedback level" control method.

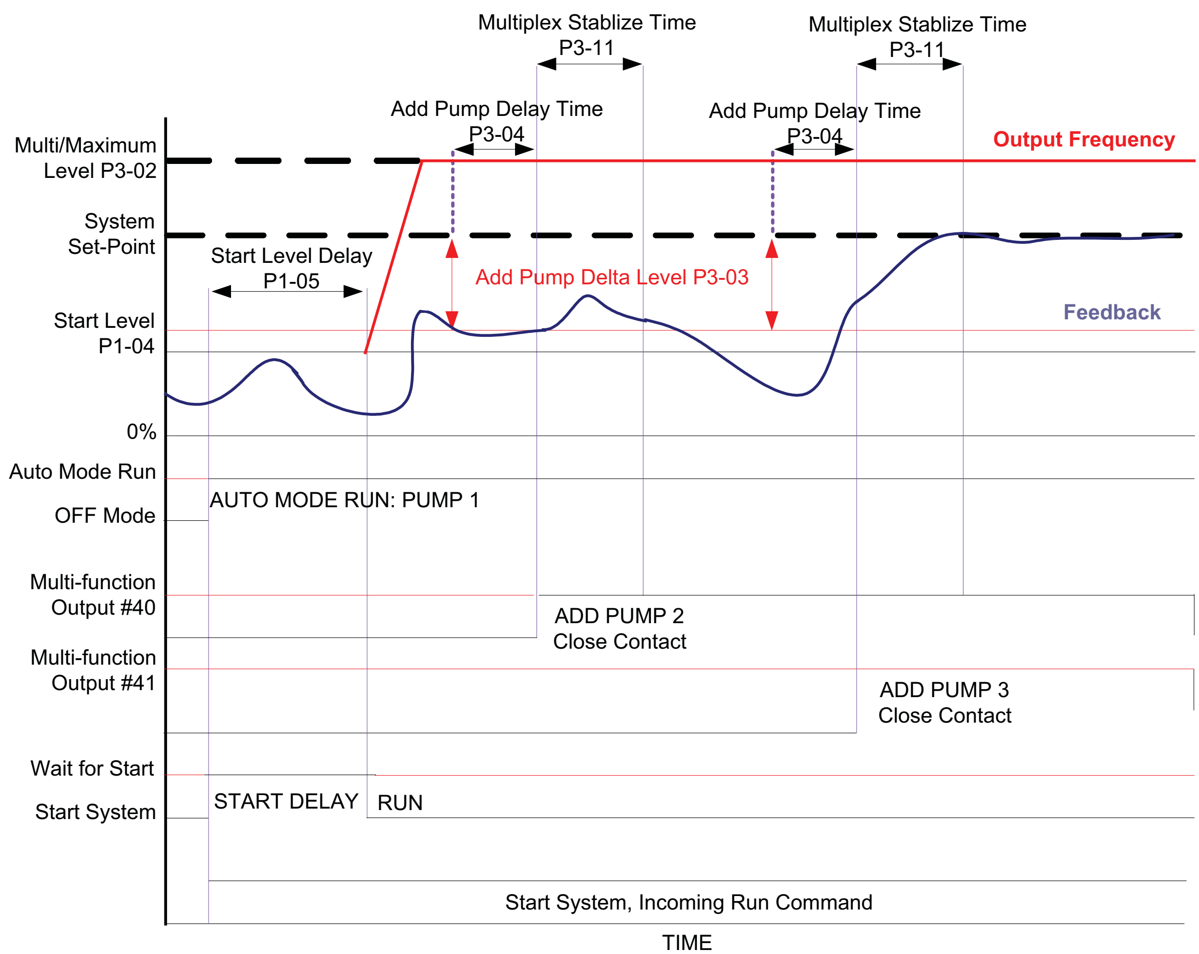


Figure 133.

Auxiliary Pump De-Staging (OFF)

The de-staging of the auxiliary pumps 2 and 3 will occur in the reverse order of the staging process described previously.

The de-staging of auxiliary pump 3 occurs when the output frequency falls below the Pump 3 Frequency Shutdown Level (P3-10) and the difference between the system's feedback minus the setpoint exceeds the value programmed in the Shutdown Pump Delta Level (P3-05) for the time programmed in the Add Pump Delay Time (P3-04).

The de-staging of auxiliary pump 2 occurs when the auxiliary pump 3 is de-staged and the output frequency falls below the Pump 2 Frequency Shutdown Level (P3-09) and the difference between the system's feedback level minus the setpoint exceeds the value programmed in the Shutdown Pump Delta Level (P3-05) for the time programmed in Shutdown Pump Delay Time (P3-06). Refer to *Figure 134.* for the de-staging of the auxiliary pumps using the "output frequency + feedback level" control method.

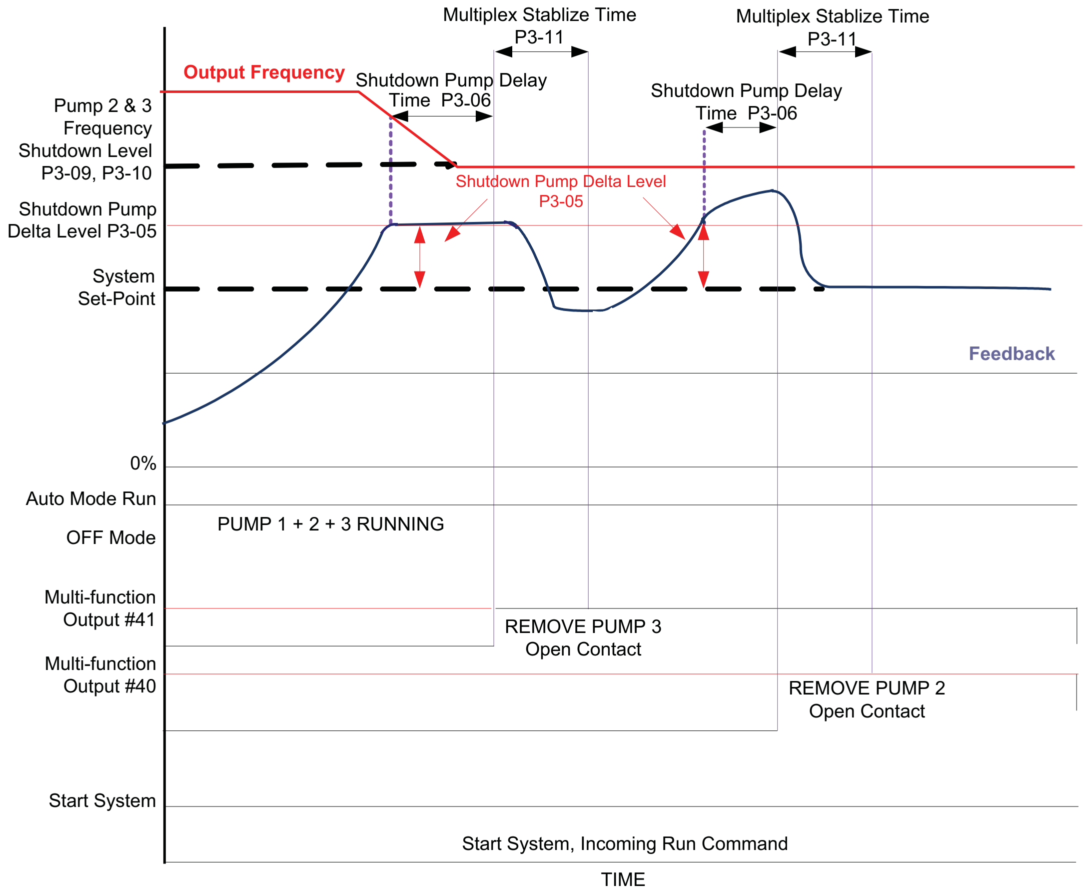


Figure 134.

◆ P3-02 Drive Multi / Maximum Level

Setting Range: 0.0 ~ 120.0 Hz

Factory Default: 59.0 Hz

The maximum frequency level used for the multiplex pumping operation (staging) is programmed in the iQpump drive Multi / Maximum Level (P3-02) is active when the Lead-Lag Control (P3-01) is set to 0 or 2. The multiplex pumping operation (staging) is determined by the programmed setting of P3-01 as described below.

■ If P3-01 = 0: Output Frequency

The staging (turning ON) of the auxiliary pump occurs when the output frequency rises above the iQpump drive Multi / Maximum Level (P3-02) for the time programmed in the Add Pump Delay Time (P3-04). The auxiliary pumps will be added by the control of the multi-function digital output contact closure (H2-xx = 40 and 41).

■ If P3-01 = 1: Feedback Level (P3-02: Not Used)

The iQpump drive Multi / Maximum Level (P3-02) is not used when Lead-Lag Control (P3-01) is set to 1.

■ If P3-01 = 2: Output Frequency + Feedback Level

The staging (turning ON) of the auxiliary pump occurs when the output frequency rises above the iQpump drive Multi / Maximum Level (P3-02) and the difference between the system's setpoint minus the feedback level has exceeded the Add Pump Delta Level (P3-03) for the time programmed in the Add Pump Delay Time (P3-04).

The auxiliary pumps will be added by the control of the multi-function digital output contact closure (H2-xx = 40 and 41).

Refer to Lead-Lag Control (P3-01) for further description of the staging of the pump system.

◆ P3-03 Add Pump Delta Level

Setting Range: 0.0 ~ 6000.0

Factory Default: 0.0

The delta level used for the staging of the multiplex pumping operation is programmed in the Add Pump Delta Level (P3-03). The staging of the multiplex pumping operation is determined by the programmed setting of P3-01 as described below.

■ If P3-01 = 0: Output Frequency (P3-03: Not used)

The Add Pump Delta Level (P3-03) is not used when Lead-Lag Control (P3-01) is set to 0.

■ If P3-01 = 1: Feedback Level

The staging (turning ON) of the auxiliary pump occurs when the difference (delta) between the system's setpoint minus the feedback level has exceeded the Add Pump Delta Level (P3-03) for the time programmed in the Add Pump Delay Time (P3-04).

The auxiliary pumps will be added by the control of the multi-function digital output contact closure (H2-xx = 40 and 41).

■ If P3-01 = 2: Output Frequency + Feedback Level

The staging (turning ON) of the auxiliary pump occurs when the output frequency rises above the level programmed in the iQpump drive Multi / Maximum Level (P3-02) and the difference (delta) between the system's setpoint minus the feedback level has exceeded the Add Pump Delta Level (P3-03) for the time programmed in the Add Pump Delay Time (P3-04).

The auxiliary pumps will be added by the control of the multi-function digital output contact closure (H2-xx = 40 and 41).

The units for this parameter are based on P1-02. Refer to Lead-Lag Control (P3-01) for further description of the staging of the pump system.

⚠ CAUTION
Do not program this level too close to the system's setpoint.
If the level is too close to the setpoint, excessive cycling of the pump system may occur.

◆ P3-04 Add Pump Delay Time

Setting Range: 0 ~ 3600 s

Factory Default: 2 s

The staging (turning ON) of the auxiliary pumps will occur after the time delay programmed in the Add Pump Delay Time (P3-04) has elapsed. The time delay will occur prior to the staging of the auxiliary pumps.

The Add Pump Delay Time (P3-04) works in conjunction with iQpump drive Multi / Maximum Level (P3-02), Add Pump Delta Level (P3-03), No-Flow Activation Level (P2-11) and No-Flow Feedback Detection Direction (P2-19).

Refer to Lead-Lag Control (P3-01) for further description of the staging of the pump system.

◆ P3-05 Shutdown Pump Delta Level

Setting Range: 0.0 ~ 6000.0

Factory Default: 0.0

The delta level used for the de-staging of the multiplex pumping operation is programmed in the Shutdown Pump Delta Level (P3-05). The de-staging of the multiplex pumping operation is determined by the programmed setting of P3-01 as described below.

■ If P3-01 = 0: Output Frequency (P3-05: Not used)

The Shutdown Pump Delta Level (P3-05) is not used when Lead-Lag Control (P3-01) is set to 0.

■ If P3-01 = 1: Feedback Level

The de-staging (turning OFF) of the auxiliary pump occurs when the difference (delta) between the system's feedback level minus the setpoint has exceeded the Shutdown Pump Delta Level (P3-05) for the time programmed in the Shutdown Pump Delay Time (P3-06).

The auxiliary pumps will be added by the control of the multi-function digital output contact closure (H2-xx = 40 and 41).

■ If P3-01 = 2: Output Frequency + Feedback Level

The de-staging (turning OFF) of the auxiliary pump occurs when the output frequency drops below the level programmed in the Pump 3 Frequency Shutdown Level (P3-10) or Pump 2 Frequency Shutdown Level (P3-09) and the difference (delta) between the system's feedback level minus setpoint has exceeded the level programmed in the Shutdown Pump Delta Level (P3-05) for the time programmed in the Shutdown Pump Delay Time (P3-06).

The auxiliary pumps will be added by the control of the multi-function digital output contact closure (H2-xx = 40 and 41).

⚠ CAUTION
Do not program this level too close to the system's setpoint. If the level is too close to the setpoint, excessive cycling of the pump system may occur.

◆ P3-06 Shutdown Pump Delay Time

Setting Range: 0 ~ 3600 s

Factory Default: 5 s

The de-staging (turning OFF) of the auxiliary pumps will occur after the time delay programmed in the Shutdown Pump Delay Time (P3-06) has elapsed. The time delay will occur prior to de-staging of the auxiliary pumps.

The Shutdown Pump Delay Time (P3-06) works in conjunction with iQpump drive Multi / Maximum Level (P3-02) and Add Pump Delta Level (P3-03).

Refer to Lead-Lag Control (P3-01) for further description of de-staging of the pump system.

◆ P3-07 Multi Pump Setpoint Increase

Setting Range: 0.0 ~ 6000.0

Factory Default: 0.0

The iQpump drive can be configured for multiplex pumping operation. The multiplex pumping operation can have the system setpoint increased each time a pump is staged (turned ON) by programming the amount to be increased into the Multi Pump Setpoint Increase (P3-07). The system's setpoint will be lowered by this amount when each pump is de-staged (turned OFF). Refer to *Figure 135.* below.

The units for this parameter are determined by the System Units (P1-02).

Example: Constant Pressure System

System Setpoint: 80 psi

Pressure Transducer: 150 psi

Multi Pump Setpoint Increase: 4 psi

Pump 1 (Running) Setpoint = 80 psi

Pump 1 + Pump 2 (Running) Setpoint = 84 psi (80 psi + 4 psi)

Pump 1 + Pump 2 + Pump 3 (Running) Setpoint = 88 psi (80 psi + 4 psi + 4 psi)

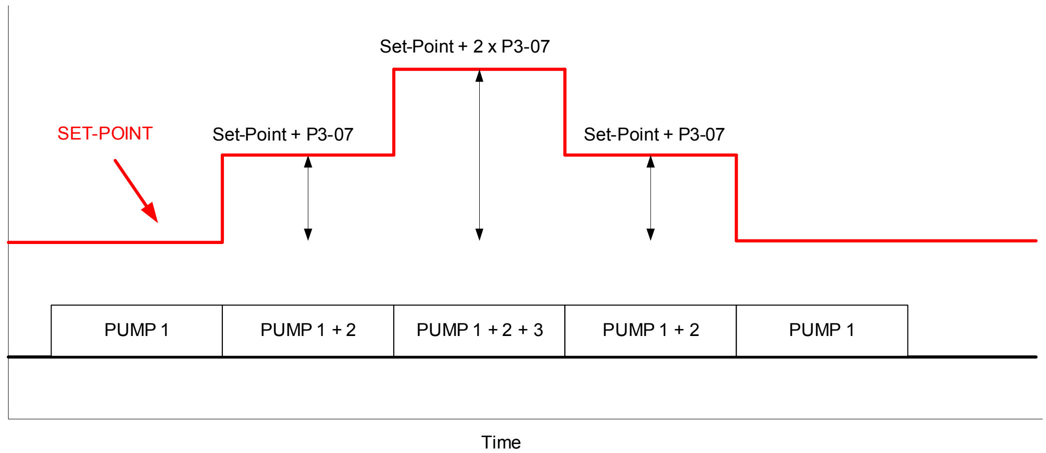


Figure 135.

◆ P3-08 Multi Pump Setpoint Decrease

Setting Range: 0.0 ~ 6000.0

Factory Default: 0.0

The iQpump drive can be configured for multiplex pumping operation. The multiplex pumping operation can have the system setpoint decreased each time a pump is staged (turned ON) by programming the amount to be decreased into the Multi Pump Setpoint Decrease (P3-08). The system's setpoint will be raised by this amount when each pump is de-staged (turned OFF). Refer to *Figure 136.* below.

The units for this parameter are determined by the System Units (P1-02).

Example: Constant Pressure System

System Setpoint: 80 psi

Pressure Transducer: 150 psi

Multi Pump Setpoint Increase: 4 psi

Pump 1 (Running) Setpoint = 80 psi

Pump 1 + Pump 2 (Running) Setpoint = 76 psi (80 psi - 4 psi)

Pump 1 + Pump 2 + Pump 3 (Running) Setpoint = 72 psi (80 psi - 4 psi - 4 psi)

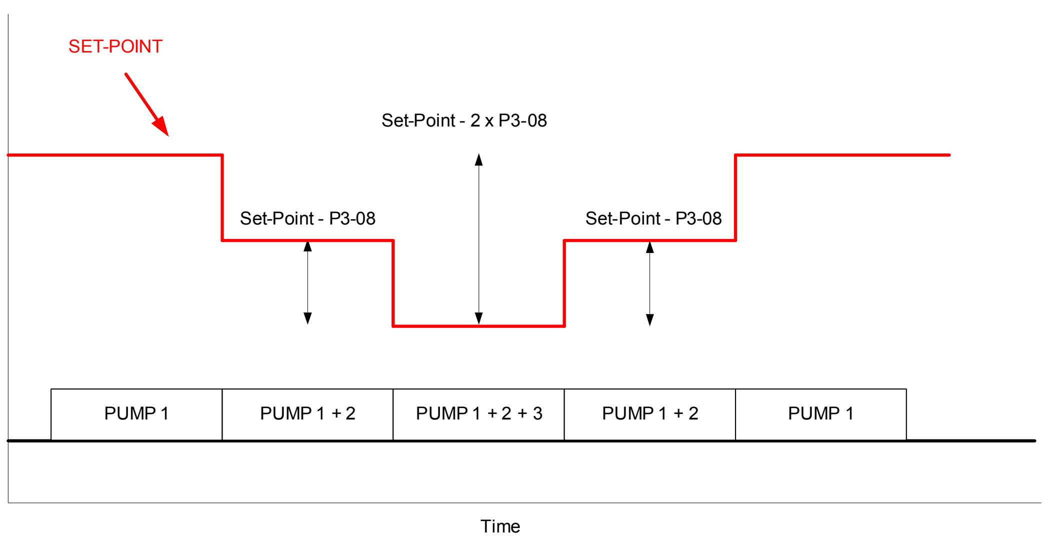


Figure 136.

◆ P3-09 Pump 2 Frequency Shutdown Level

Setting Range: 0.0 ~ 120.0 Hz

Factory Default: 40.0 Hz

The Pump 2 shutdown frequency level used for the multiplex pumping operation (de-staging) is programmed in the Pump 2 Frequency Shutdown Level (P3-09). The Pump 2 Frequency Shutdown Level (P3-09) is active when the Lead-Lag Control (P3-01) is set to 0 or 2. The multiplex pumping operation (de-staging) is determined by the programmed setting of P3-01 as described below.

■ If P3-01 = 0: Output Frequency

The de-staging (turning OFF) of the auxiliary pump occurs when the output frequency falls below the Pump 2 Frequency Shutdown Level (P3-09) for the time programmed in the Shutdown Pump Delay Time (P3-06).

The auxiliary pumps will be removed by the control of the multi-function digital output contact opening (H2-xx = 40 and 41).

■ If P3-01 = 1: Feedback Level (P3-02: Not Used)

The Pump 2 Frequency Shutdown Level (P3-09) is not used when Lead-Lag Control (P3-01) is set to 1.

■ If P3-01 = 2: Output Frequency + Feedback Level

The de-staging (turning OFF) of the auxiliary pump occurs when the output frequency falls below the Pump 2 Frequency Shutdown Level (P3-09) and the difference between the feedback minus the system's setpoint has exceeded the Shutdown Pump Delta Level (P3-05) for the time programmed in the Shutdown Pump Delay Time (P3-06).

The auxiliary pumps will be removed by the control of the multi-function digital output contact opening (H2-xx = 40 and 41).

Refer to Lead-Lag Control (P3-01) for further description of the de-staging of the pump system.

◆ P3-10 Pump 3 Frequency Shutdown Level

Setting Range: 0.0 ~ 120.0 Hz

Factory Default: 40.0 Hz

The Pump 3 shutdown frequency level used for the multiplex pumping operation (de-staging) is programmed in the Pump 3 Frequency Shutdown Level (P3-10). The Pump 3 Frequency Shutdown Level (P3-10) is active when the Lead-Lag Control (P3-01) is set to 0 or 2. The multiplex pumping operation (de-staging) is determined by the programmed setting of P3-01 as described below.

■ If P3-01 = 0: Output Frequency

The de-staging (turning OFF) of the auxiliary pump occurs when the output frequency falls below the Pump 3 Frequency Shutdown Level (P3-10) for the time programmed in the Shutdown Pump Delay Time (P3-06).

The auxiliary pumps will be removed by the control of the multi-function digital output contact opening (H2-xx = 40 and 41).

■ If P3-01 = 1: Feedback Level (P3-02: Not Used)

The Pump 3 Frequency Shutdown Level (P3-10) is not used when Lead-Lag Control (P3-01) is set to 1.

■ If P3-01 = 2: Output Frequency + Feedback Level

The de-staging (turning OFF) of the auxiliary pump occurs when the output frequency falls below the Pump 3 Frequency Shutdown Level (P3-10) and the difference between the feedback minus the system's setpoint has exceeded the Shutdown Pump Delta Level (P3-05) for the time programmed in the Shutdown Pump Delay Time (P3-06).

The auxiliary pumps will be removed by the control of the multi-function digital output contact opening (H2-xx = 40 and 41).

Refer to Lead-Lag Control (P3-01) for further description of the de-staging of the pump system.

◆ P3-11 Multiplex Stabilization Time

Setting Range: 0 ~ 3600 s

Factory Default: 2 s

The iQpump drive can be configured for multiplex pumping operation. A time delay can be programmed to allow the system to stabilize when a pump is staged (turned ON) or de-staged (turned OFF). The time used for system stabilization is programmed into the Multiplex Stabilization Time (P3-11). When a pump is staged (turned ON), the stabilization time (P3-11) temporarily disables the lead / lag functionality during this time period to prevent pump cycling.

This function is only active when the Pump Mode (P1-01 > 0) is greater than 0.

Refer to Lead-Lag Control (P3-01) for more details.

Note: The pump protection and lead-lag control are suspended during this time period.

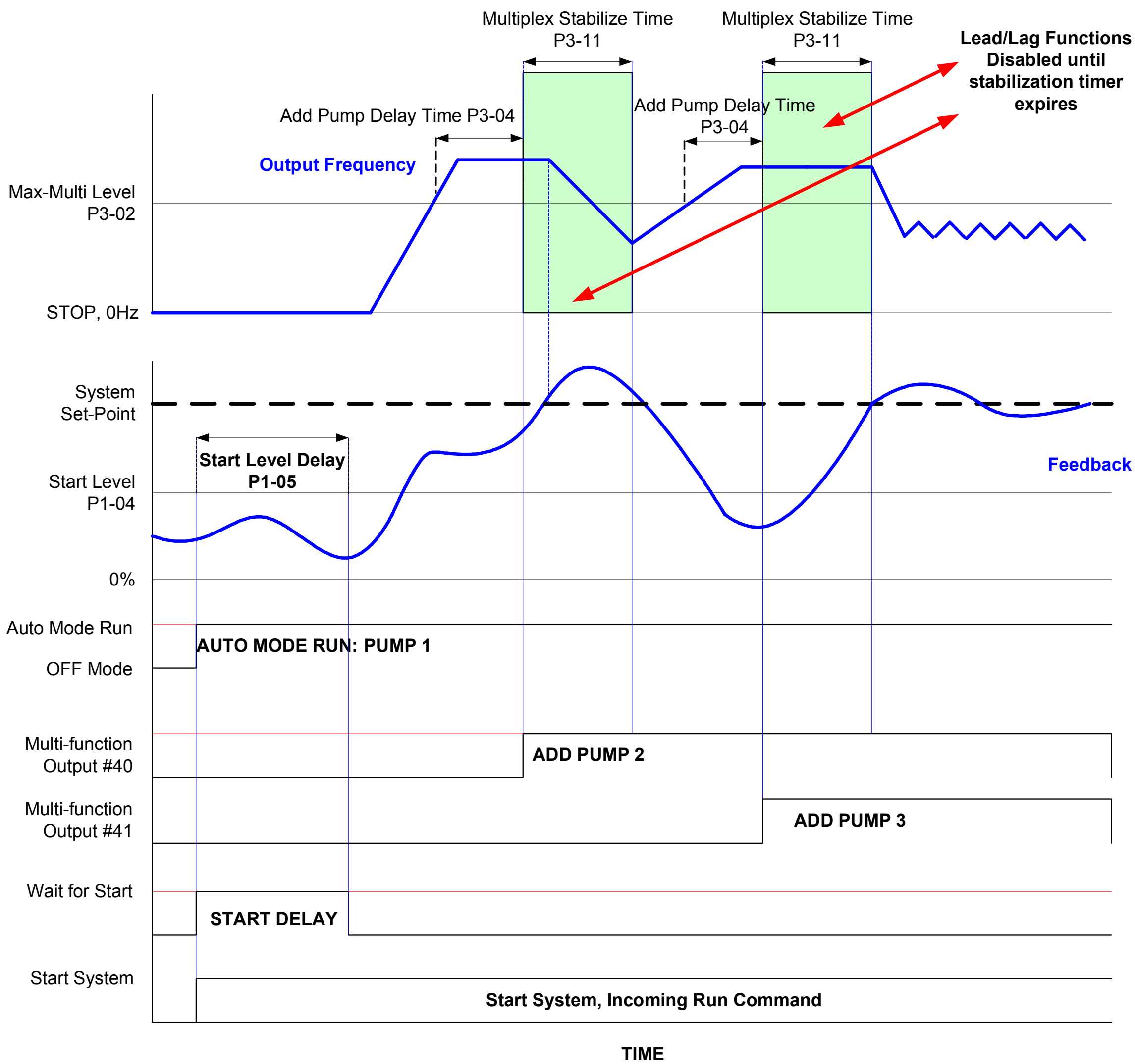


Figure 137.

◆ P3-12 Delta Setpoint Feedback Acc / Dec Changeover

Setting Range: 0.0 ~ 6000.0

Factory Default: 0.0

The iQpump drive can be configured for multiplex pumping operation. The acceleration (Acc) and deceleration (Dec) times can be changed when the difference between the delta setpoint and feedback are within the programmed level in the Delta Setpoint Feedback Acc / Dec Changeover (P3-12).

The acceleration and deceleration times during this changeover are programmed into C1-05 and C1-06, respectively.

This function is used to improve the pump regulation.

Setting P2-12 to a value of 0 will disable this function.

■ System Response During Normal Automatic Operation (P3-12)

Acceleration and Deceleration times can automatically be adjusted during Automatic Setpoint regulation to improve system stability.

◆ P3-13 Friction Compensation Start Frequency

Setting Range: 0.0 ~ 120.0 Hz

Factory Default: 0.0 Hz

The iQpump drive can be configured for multiplex pumping operation. The pump system may experience an increase of friction when additional pumps are staged (turned ON). The level when the additional compensation for friction losses can be programmed into the Friction Compensation Start Frequency (P3-13). This function will activate when the output frequency rises above the Friction Compensation Start Frequency (P3-13). The maximum compensation at Maximum Output Frequency (E1-04) is specified by the Maximum Friction Increase at Maximum Frequency (P3-14).

The Friction Compensation Start Frequency (P3-13) works in conjunction with the Maximum Friction Increase at Maximum Frequency (P3-14).

Note: This function is only active when the Pump Mode (P1-01) is set to 0.

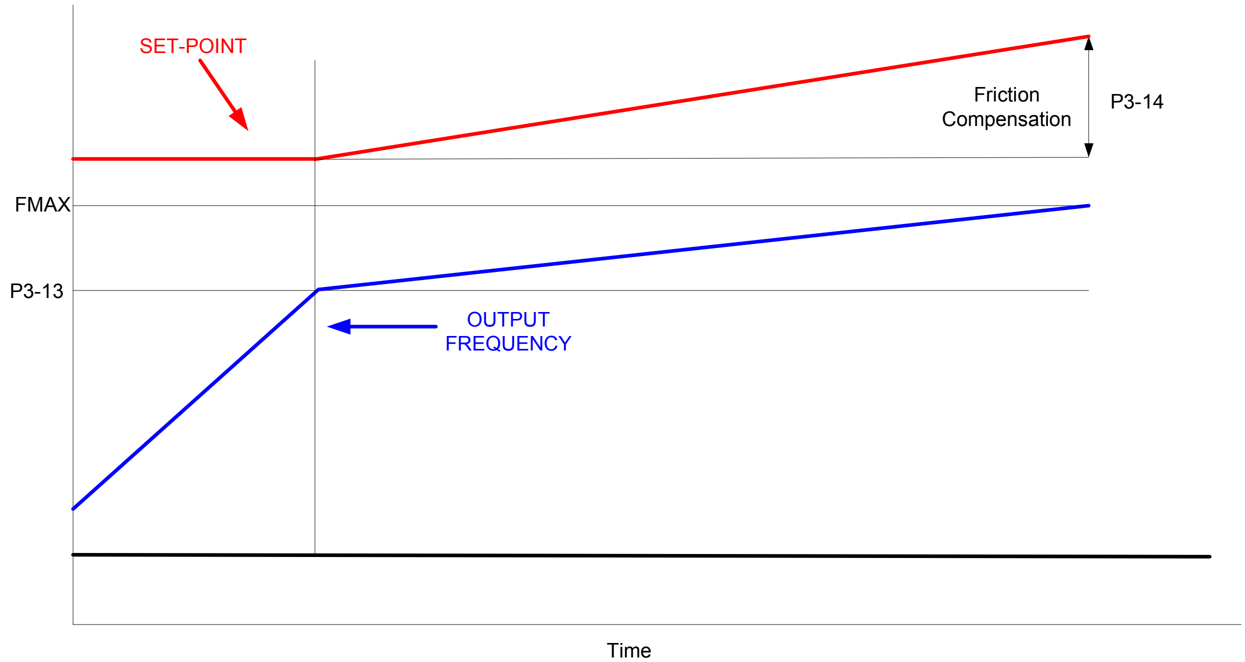


Figure 138.

◆ P3-14 Maximum Friction Increase at Maximum Frequency

Setting Range: 0.0 ~ 6000.0

Factory Default: 0.0

The iQpump drive can be configured for multiplex pumping operation. The pump system may experience an increase of friction when additional pumps are staged (turned ON). The level when the additional compensation for friction losses can be programmed into the Maximum Friction Increase at Maximum Frequency (P3-14). This function will activate when the output frequency rises above the Friction Compensation Start Frequency (P3-13). The maximum compensation at Maximum Output Frequency (E1-04) is specified by the Maximum Friction Increase at Maximum Frequency (P3-14).

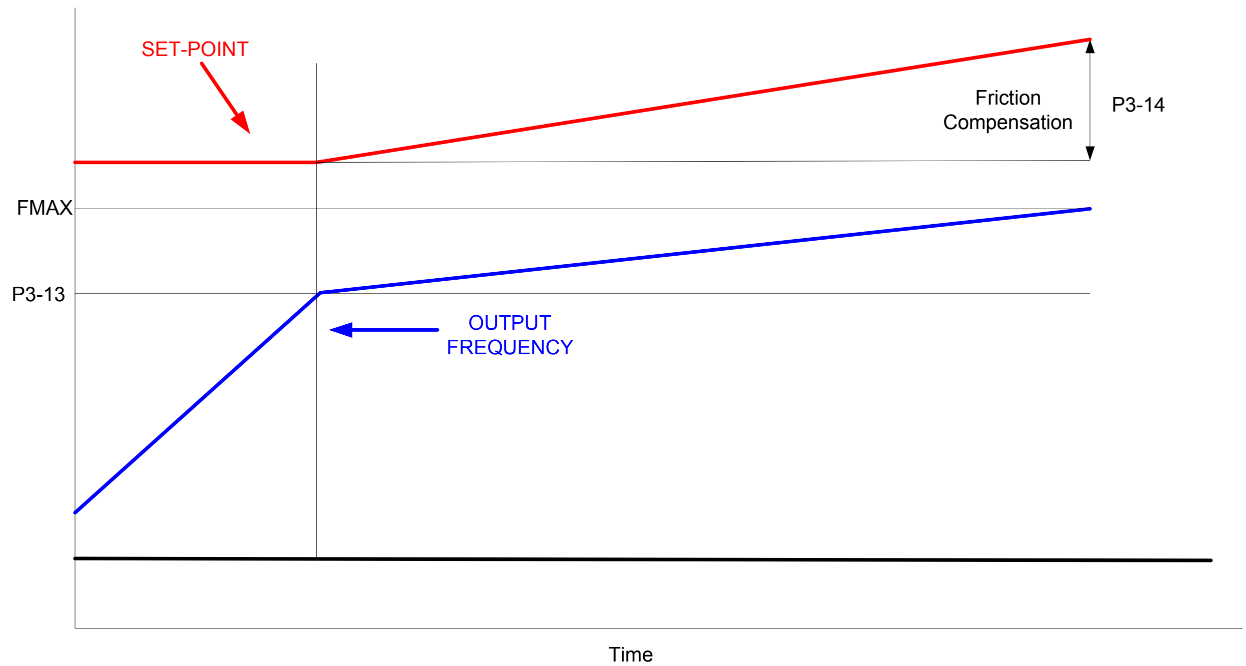


Figure 139.

The maximum compensation at Maximum Output Frequency (E1-04) is specified by programming the Maximum Friction Increase at Maximum Frequency (P3-14).

The Maximum Friction Increase at Maximum Frequency (P3-14) works in conjunction with the Friction Compensation Start Frequency (P3-13). The units for this parameter are determined by the System Units (P1-02).

Note: This function is only active when the Pump Mode (P1-01) is set to 0.

Example:

If P3-13 = 30.0 Hz, P3-14 = 10.0 psi, Output Frequency = 45.0 Hz, and Maximum Frequency = 60 Hz, then:

Setpoint Increase = 5.0 psi

(45.0 - 30.0 Hz) x (10 psi / (60.0-30.0 Hz)) = 5.0 psi

P4 Pump Advanced

◆ P4-01 Pre-charge Level

Setting Range: 0.0 ~ 6000.0

Factory Default: 0.0

The iQpump drive can be configured for special functions for dedicated pumping applications. These functions are: Pre-charge Level (P4-01) and Thrust Bearing Frequency (P4-05). Refer to the Thrust Bearing Frequency (P4-05) for further description about the thrust bearing function. There are two pre-charge operation methods: (1) Pre-charge with Thrust Bearing function disabled. (2) Precharge and Thrust Bearing functions both enabled.

Some pump systems require the system to be “pre-charged” before normal operation can occur. The built-in pre-charge function allows the pump system to run at a fixed motor speed for a programmed time. This function also operates in conjunction with a programmable feedback level and/or an external contact to indicate that the desired level has been reached.

Pre-charge with Thrust Bearing Function Disabled.

The pre-charge level that the iQpump drive will operate at is determined by programming the Pre-charge Level (P4-01). The drive will monitor the Feedback Level (U1-91) and compare the feedback level with the level programmed in the Pre-charge Level (P4-01). When the feedback level reaches the Pre-charge Level (P4-01), the drive will disable the pre-charge mode and switch to Auto Mode or automatic regulation.

The frequency reference used during the pre-charge mode is determined by programming Pre-charge Frequency (P4-02) for a maximum allowable time set in the Pre-charge Time (P4-03).

A multi-function digital input can be programmed to indicate the pre-charge has been completed, “Low Water Level” (H1-xx = 85), with Low Water Input (P1-15) determining if the low water detection is a normally-open or normally-closed contact.

The pre-charge can also be disabled by programming the multi-function digital input for Pre-charge Disabled (H1-xx = 84).

The pre-charge is only active in Auto Mode. The Pre-charge Level (P4-01) works in conjunction with the Pre-charge Frequency (P4-02) and the Pre-charge Time (P4-03). The units for this parameter are determined by the System Units (P1-02).

Note: The drive will stop when one of the following conditions occur:

- The feedback level rises above the Pre-charge Level (P4-01)
- The Pre-charge Time (P4-03) elapses, or
- The Low Water Level input (H1-xx = 85) is deactivated

If P1-01 = 3, the function is active when there is only one drive running on the network. <0034>

The acceleration time used during pre-charge mode is determined by Acceleration Time 1 (C1-01).

If the Pre-charge Frequency (P4-02) is less than the Minimum Pump Frequency (P1-06), the drive will internally use a Pre-charge Frequency equal to the Minimum Pump Frequency (P1-06) value.

The pre-charge function can only be activated while the drive is in “stop” condition. To enable the pre-charge function requires the Pre-charge Time (P4-03) to be set to a value greater than 0. When the pre-charge function is activated, a “Pre-charge” alarm will be displayed on the digital operator.

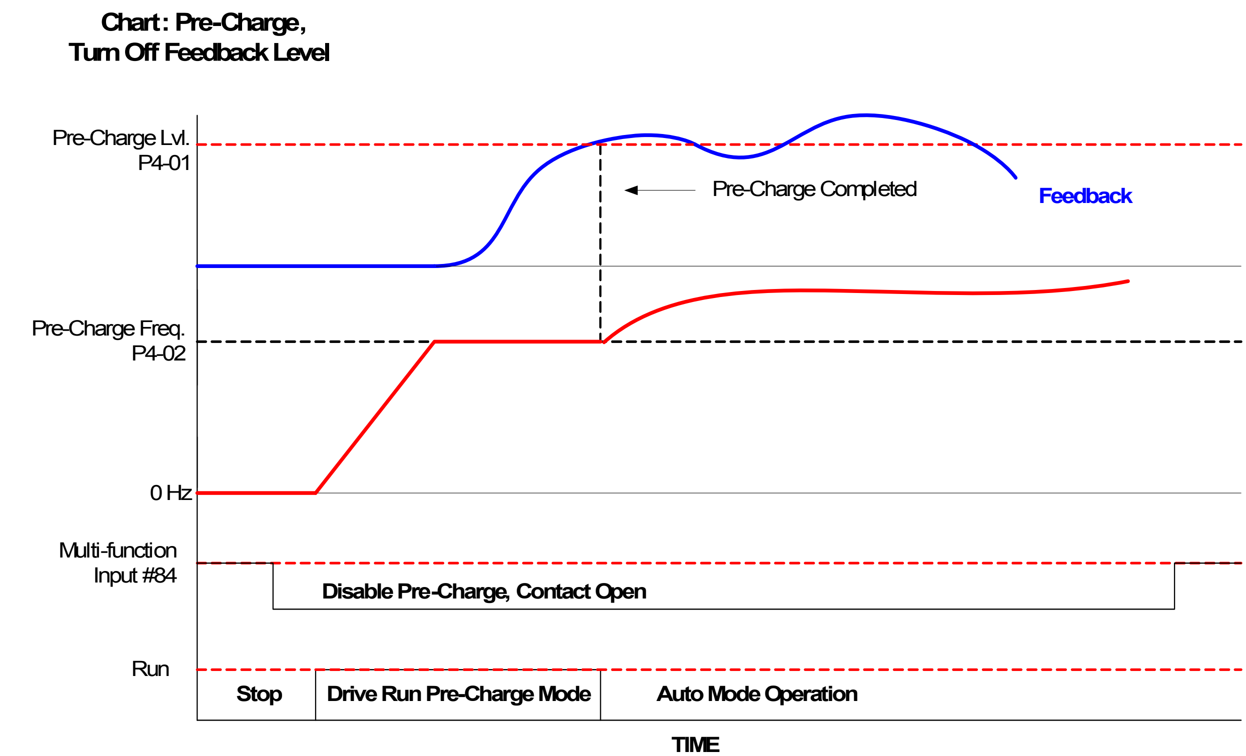


Figure 140.

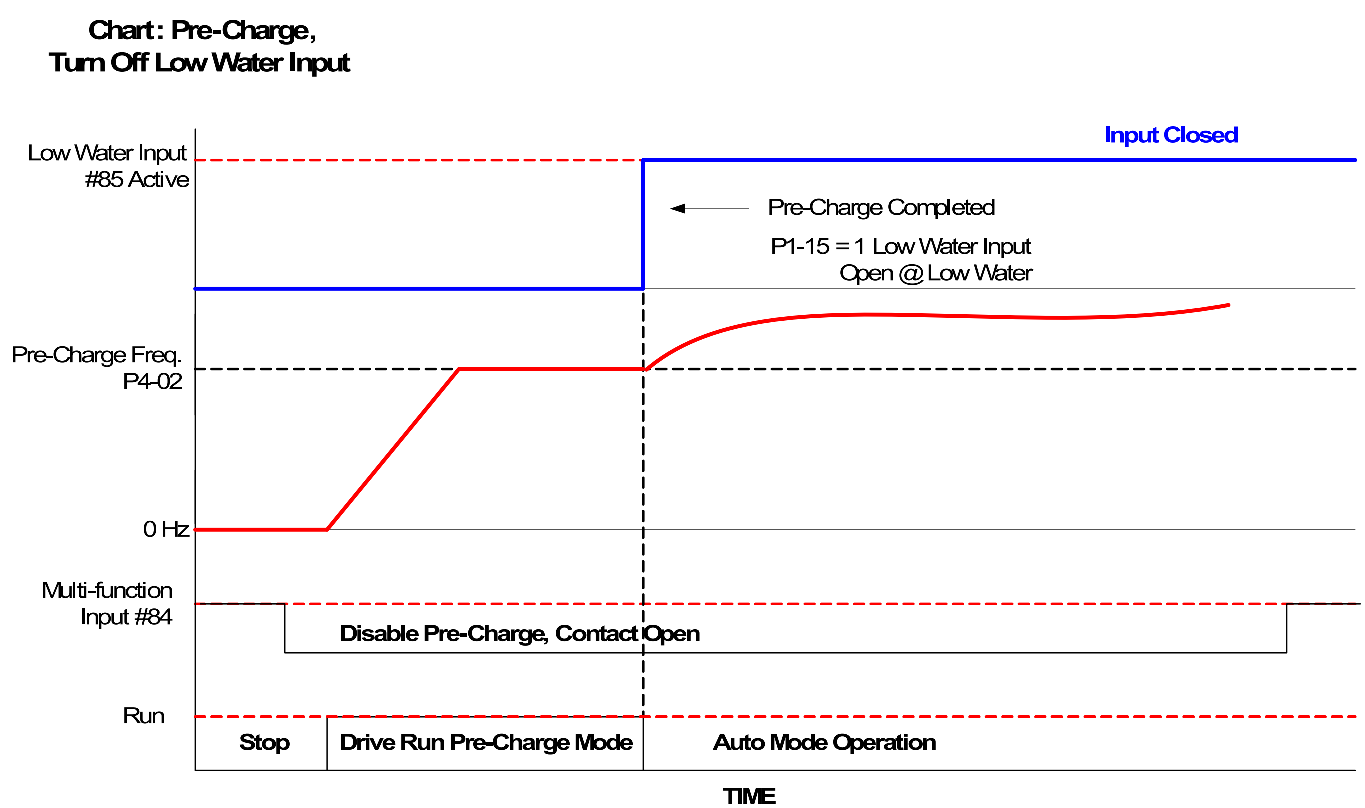


Figure 141.

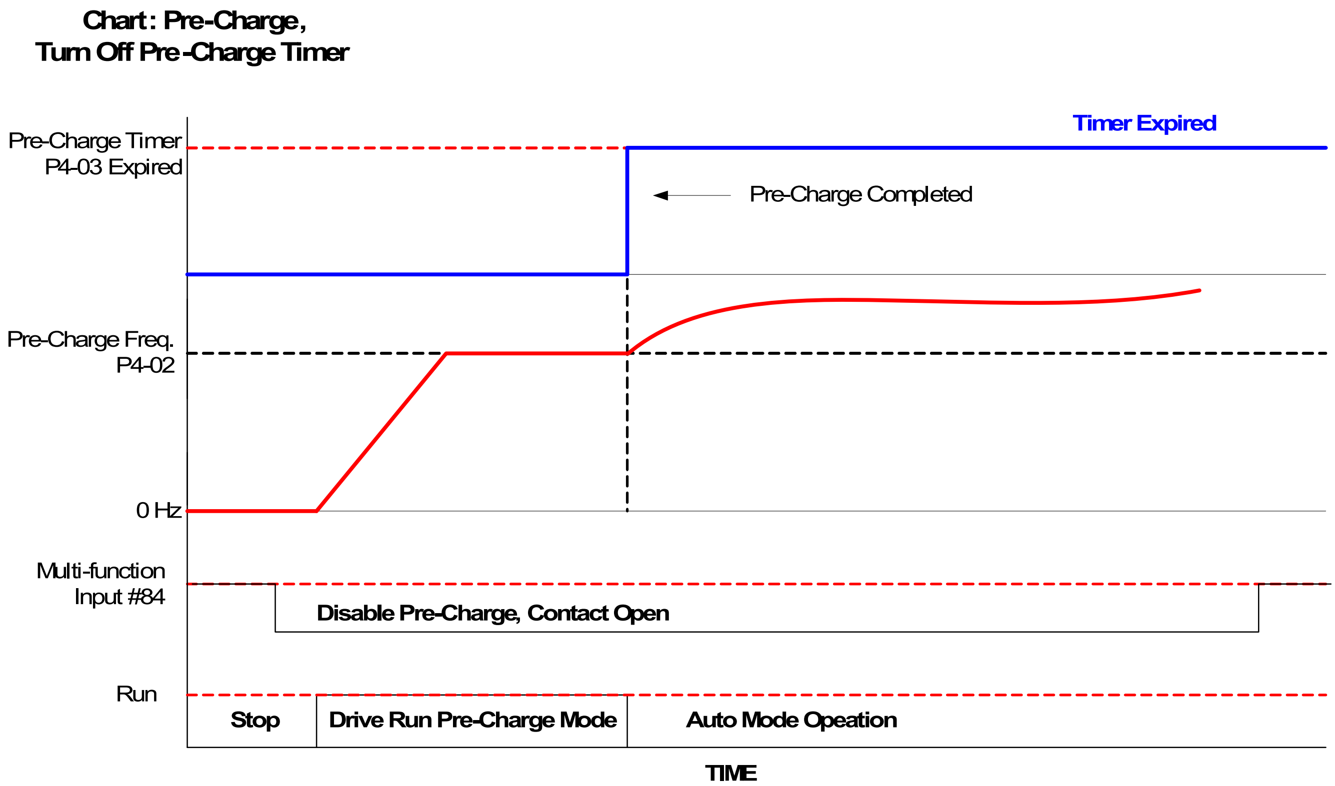


Figure 142.

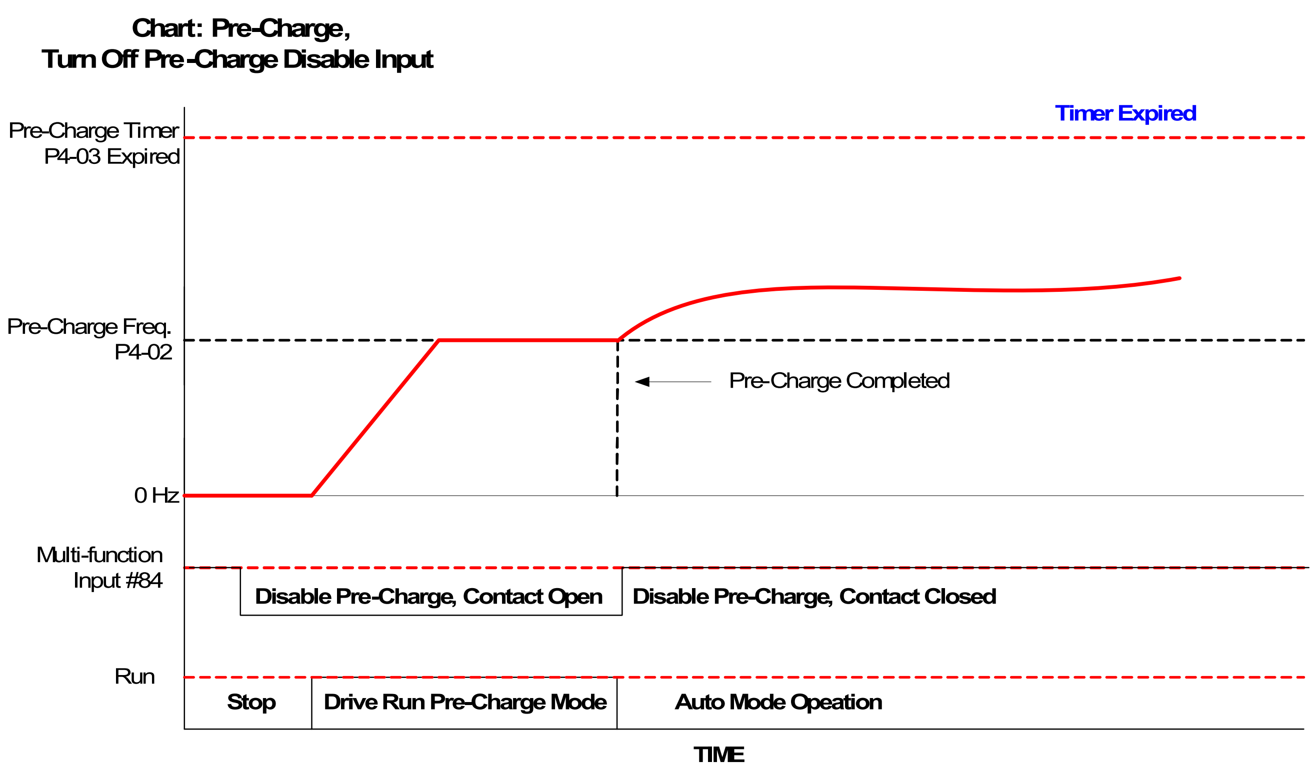


Figure 143.

Pre-charge with Thrust Bearing Function Both Enabled. <0032>

When both Pre-charge and Thrust Bearing modes are enabled, the system will function as follows: Upon receiving a run command, the drive will ramp up to the Thrust Bearing Frequency (P4-05) using the Thrust Bearing Acceleration Time (P4-04). After reaching the Thrust Bearing Frequency (P4-05), the Pre-charge becomes active and P4-05 becomes the new minimum frequency. The drive will ramp up to the Pre-charge Frequency (P4-02) and will remain at this frequency until the Pre-charge has been completed. This can occur when the P4-03 time has expired, P4-01 level has been reached, or the Low Water digital input has been deactivated.

If the drive is to stop at any time after the Thrust Bearing Frequency has been reached, the drive will ramp down to the P4-05 frequency at the rate programmed in Deceleration Time (C1-02). This condition can occur due to loss of run command, auto mode, or drive is in the sleep mode. The drive will then ramp down from a frequency (P4-05) to 0 using Deceleration Time programmed in P4-06. The Thrust Bearing Acceleration is active when working from sleep while the Pre-charge is not.

The Pre-charge Frequency (P4-02) should be set to a value greater than the Thrust Bearing Frequency (P4-05). If the Pre-charge Frequency (P4-02) is less than the Thrust Bearing Frequency (P4-05), the drive will internally use a Pre-charge Frequency equal to the P4-05 value.

If the Pre-charge Frequency (P4-02) is less than the Minimum Pump Frequency (P1-06), the drive will internally use a Pre-charge Frequency equal to the Minimum Pump Frequency (P1-06) value.

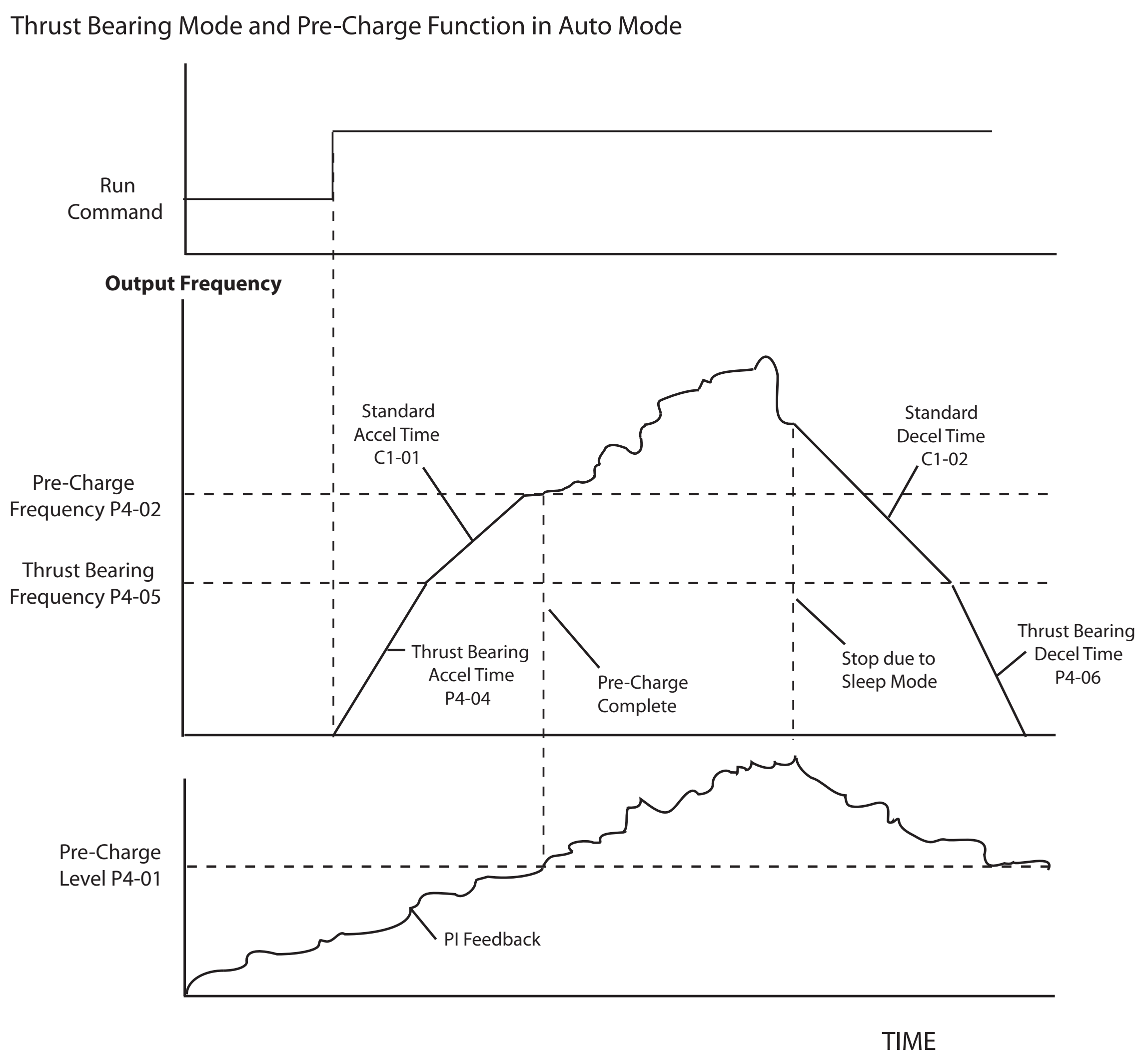


Figure 144.

Thrust Bearing Mode and Pre-Charge Function in Auto Mode (Pre-Charge Time Expired)

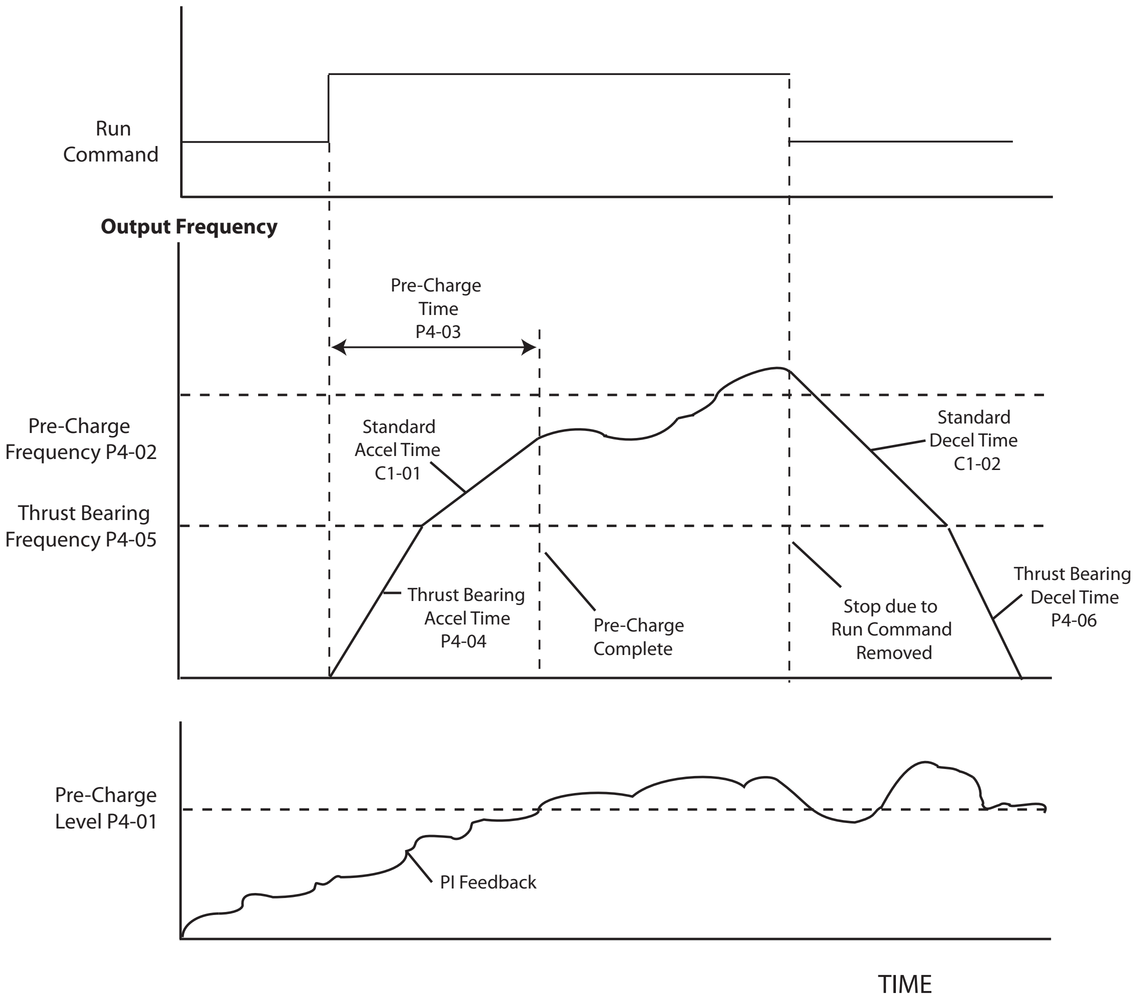


Figure 145.

Thrust Bearing Mode and Pre-Charge Function with Alternating Auto and Hand Mode.

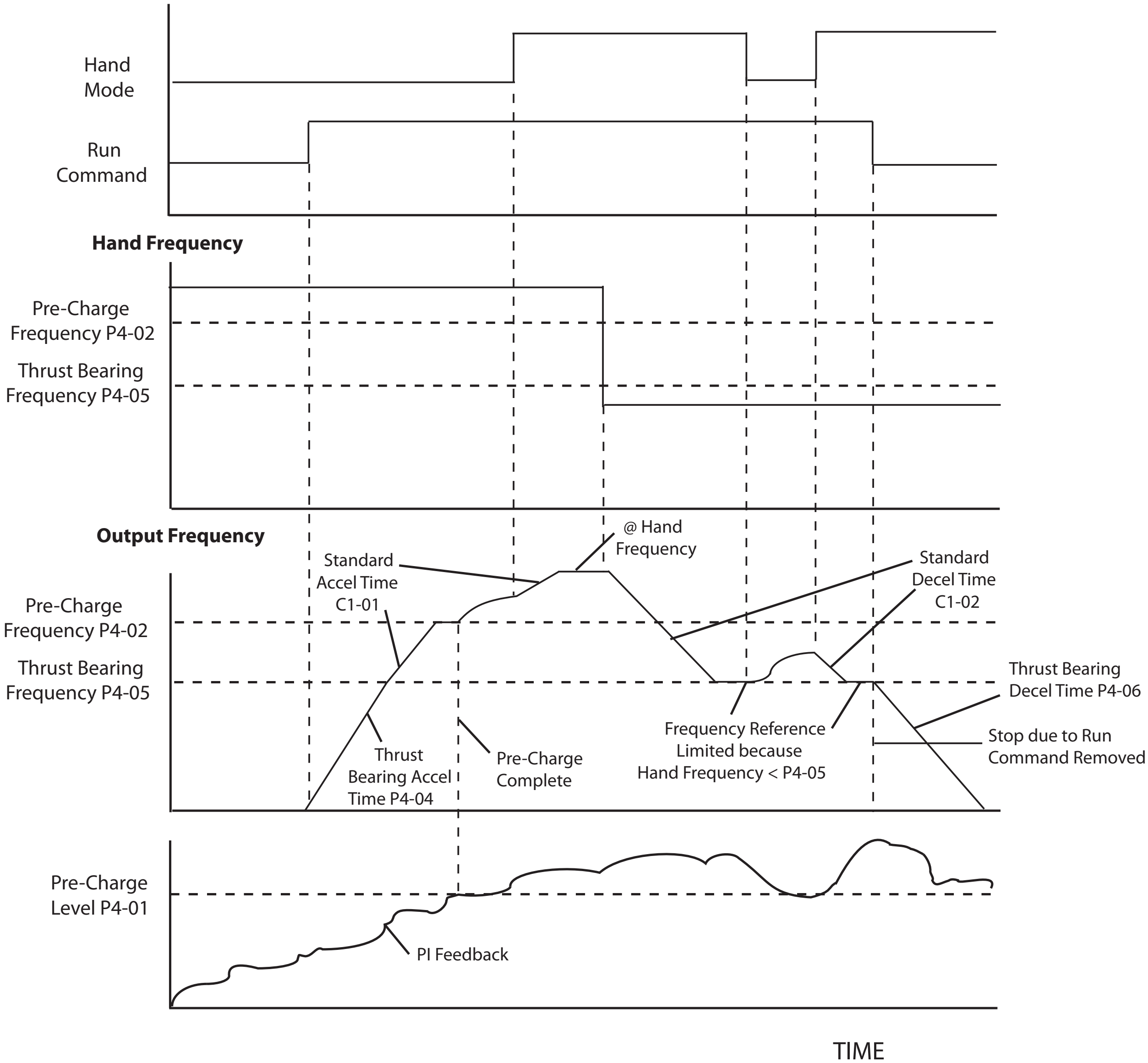


Figure 146.

■ Function Description: <0034>

Disable Low Pressure and Transducer Loss during Pre-charge. During the Pre-charge function, the low pressure and / or transducer loss conditions will be ignored.

Two Stage Pre-charge. In order to get the Two Stage Pre-charge to operate, the normal Pre-charge function needs to be enabled, AND parameter P4-12 needs to be set to a value greater than zero, AND parameter P4-13 must be set to a value greater than zero. When the drive starts and is in Pre-charge Mode and the normal Pre-charge Timer expires (P4-02), the drive will switch to the P4-12 value for the P4-13 time set. The functionality of the “Low Water” and “Disable Pre-charge” digital inputs are un-effected by the Two Stage Pre-charge.

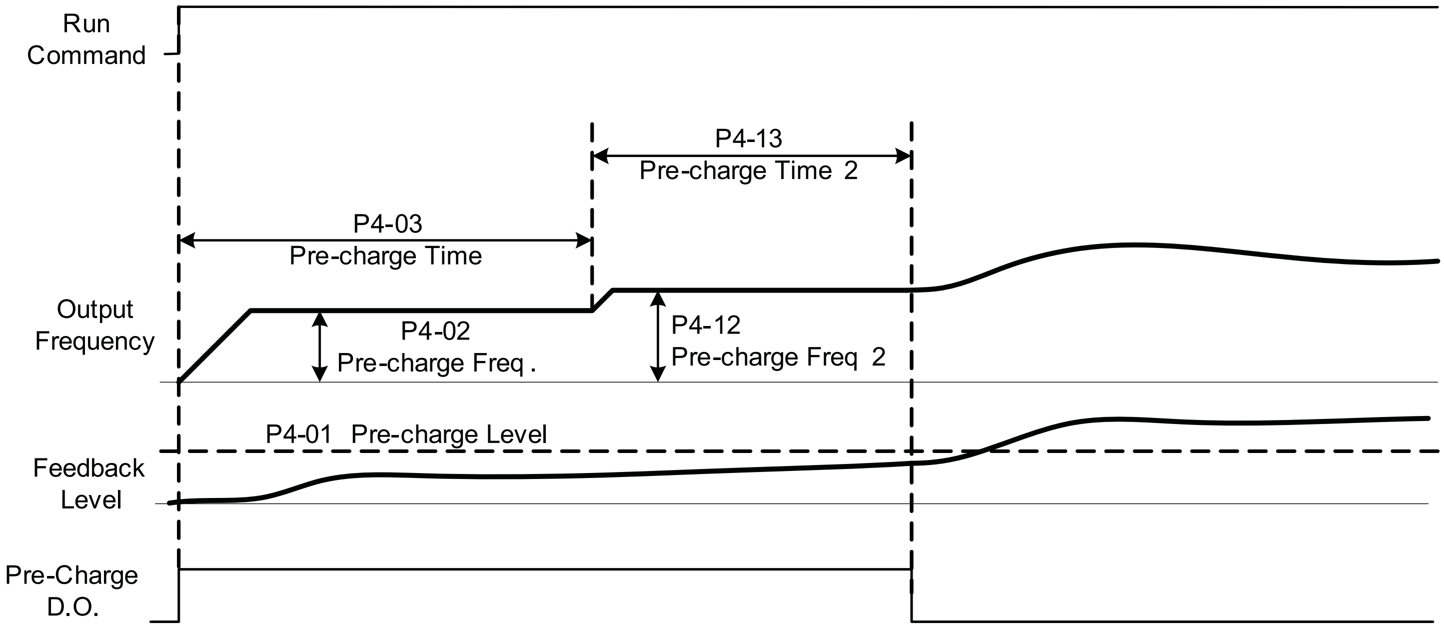


Figure 147. Two Stage Pre-charge - Pre-charge Timer

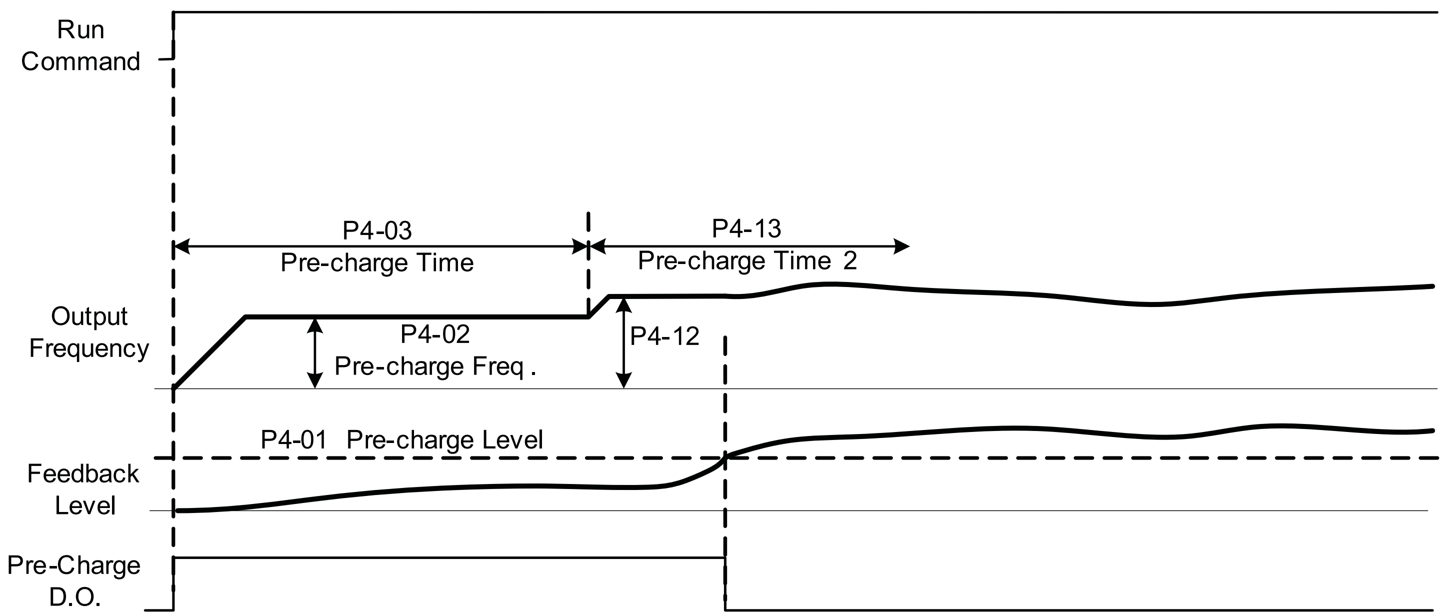


Figure 148. Two Stage Pre-charge - Feedback reaches Pre-charge Level

Table 71 Related Parameters

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Range	Default	Menu Location
P4-01	115	Pre-charge Level **Pre-charge Level**	When enabled drive will run at P4-02 Frequency. 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 (#85).	0.0 ~ 6000.0 (system units P1-02)	0.0 (system units P1-02)	Programming
P4-02	116	Pre-charge Frequency **Pre-charge Freq**	Frequency reference used when Pre-charge function is active.	0.00 ~ 120.00 Hz	0.00 Hz	Programming
P4-03	117	Pre-charge Time **Pre-charge Time**	Maximum allow Pre-charge Time. A value of 0 disables this function.	0.0 ~ 3600.0 min	0.0 min	Programming

Table 72 Parameters

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Range	Default	Menu Location
P4-12 ♦	115	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 ♦	116	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.	0.0 ~ 3600.0 min	0.0 min	Programming
♦ Denotes that parameter can be changed when the drive is running.						

◆ P4-02 Pre-charge Frequency

Setting Range: 0.00 ~ 120.00 <0034>

Factory Default: 0.00 Hz

The iQpump drive can be configured for a pre-charge function. The frequency reference used by the pre-charge function is programmed in the Pre-charge Frequency (P4-02).

Refer to Pre-charge Level (P4-01) for more details.

The Pre-charge Frequency (P4-02) works in conjunction with the Pre-Change Level (P4-01).

◆ P4-03 Pre-charge Time

Setting Range: 0.0 ~ 3600.0 min

Factory Default: 0.0 min

The iQpump drive can be configured for a pre-charge function. The maximum allowable time for the pre-charge function is programmed in the Pre-charge Time (P4-03). Setting P4-03 to a value of 0 will disable the pre-charge function.

Refer to Pre-charge Level (P4-01) for more details.

The Pre-charge Time (P4-03) works in conjunction with the Pre-Change Level (P4-01).

◆ P4-04 Thrust Bearing Acceleration Time <0032>

Setting Range: 0.0 ~ 600.0 <0034>

Factory Default: 1.0 s

The iQpump drive can be configured for a thrust bearing function. The acceleration time, when the thrust bearing function is enabled (P4-05 > 0), is programmed in the Thrust Bearing Acceleration Time (P4-04).

Refer to Thrust Bearing Frequency (P4-05) for more details.

The Thrust Bearing Acceleration Time (P4-04) works in conjunction with the Thrust Bearing Frequency (P4-05).

■ Function Description: <0034>

Thrust Accel Modification. When the drive is started and during Thrust Bearing operation, the drive will accelerate to the Thrust Frequency (P4-05) in the amount of time specified by the Thrust Bearing Acceleration Time Parameter (P4-04). Actual (internal) acceleration time is calculated as follows:

Internal Accel Rate = Thrust Accel Time x (fmax / thrust frequency) = P4-04 x E1-04 / P4-05

The internal accel rate during thrust bearing operation is limited to a maximum of 600 seconds.

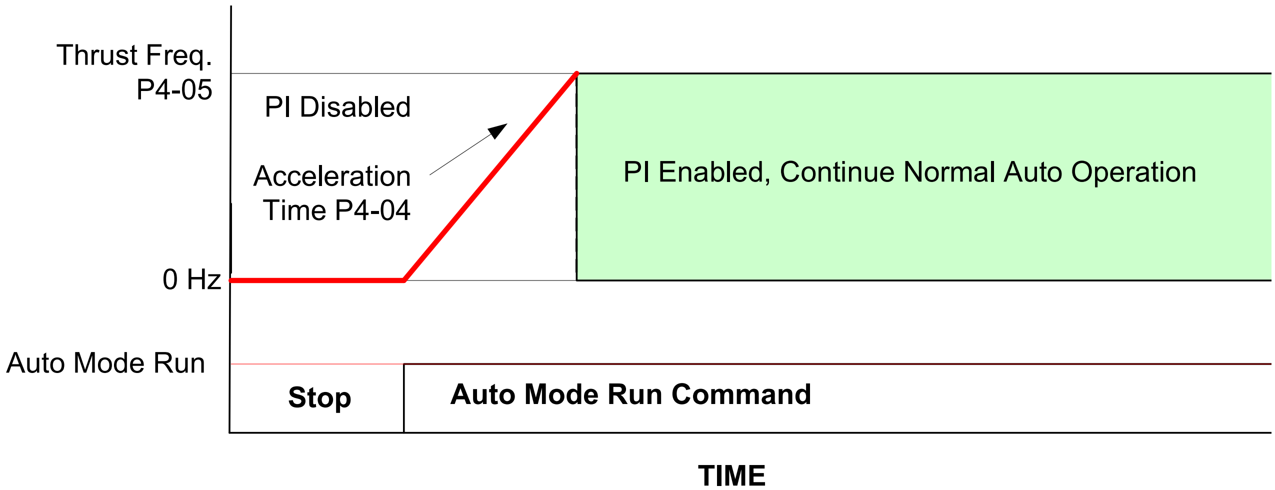


Figure 149.

◆ P4-05 Thrust Bearing Frequency

Setting Range: 0.0 ~ 120.0 Hz

Factory Default: 30.0 Hz

The iQpump drive can be configured for special functions for dedicated pumping applications. These functions are: Pre-charge Level (P4-01) and Thrust Bearing Frequency (P4-05).

Refer to the Pre-charge Level (P4-01) for further description about the pre-charge function.

The thrust bearing function will be activated when the frequency value is greater than 0 for the Thrust Bearing Frequency (P4-05) parameter and the pre-charge function is de-activated. The pre-charge function will de-activate the thrust bearing function.

The thrust bearing frequency of the iQpump drive will operate as determined by programming the Thrust Bearing Frequency (P4-05). The drive's output will ramp up or accelerate up to the thrust bearing frequency based on the acceleration time programmed in the Thrust Bearing Acceleration Time (P4-04).

The PI mode is automatically disabled during the thrust bearing operation. Once the output frequency reaches the thrust bearing frequency programmed in the Thrust Bearing Frequency (P4-05), the drive will automatically switch to the Auto Mode or automatic regulation. The thrust bearing function is available in Hand and Auto Modes.

The Thrust Bearing and Pre-charge functions will work in tandem, if both are enabled.

Setting Thrust Bearing Frequency (P4-05) to a value of 0 will disable this function.

The Thrust Bearing Frequency (P4-05) works in conjunction with the Thrust Bearing Acceleration Time (P4-04).

When the thrust bearing function is activated, a "Thrust Bearing" alarm will be displayed on the digital operator.

■ Function Description: <0034>

Frequency Reference Limiting. Lower-Limit all fixed frequency references to either Minimum Pump Frequency (P1-06) or Thrust Frequency (P4-05), whichever is greater.

If a "fixed" frequency is set below either P1-06 or P4-05, an alarm will display after a 2 second delay. The "fixed" frequencies consists of: P3-02 Maximum Multi Level, P5-02 Hand Reference, P9-06 Lag Fixed Speed - Speed, Analog Hand Reference, Analog Frequency Reference (PID disabled), and the Digital Preset Frequencies (PID disabled). The alarms will only display if the drive is running at or above the thrust frequency (if enabled).

Note:

- In Auto Mode, the Minimum Pump Frequency (P1-06) will become the thrust bearing frequency if the minimum pump frequency is less than the Thrust Bearing Frequency (P4-05).
- In Hand Mode, the minimum frequency will be the Thrust Bearing Frequency (P4-05).
- The thrust bearing function is required when using Electric Submersible Motors. See "CAUTION" statement that follows.

⚠ CAUTION

The following procedures are necessary for proper protection and setup of a submersible pump, for example Franklin Electric Submersible Pumps.

The Franklin Electric Submersible Pump (motor) requires an acceleration and deceleration time of one second when accelerating up from 0 - 30 Hz, or decelerating down from 30 - 0 Hz. The frequency reference of 30 Hz is the minimum allowable speed of the Franklin Electric motors. Please verify that the pump (motor) running at 30 Hz does not produce too much pressure for the pump application. Shut-off pressure at 30 Hz is 25% of shut-off pressure at 60 Hz.

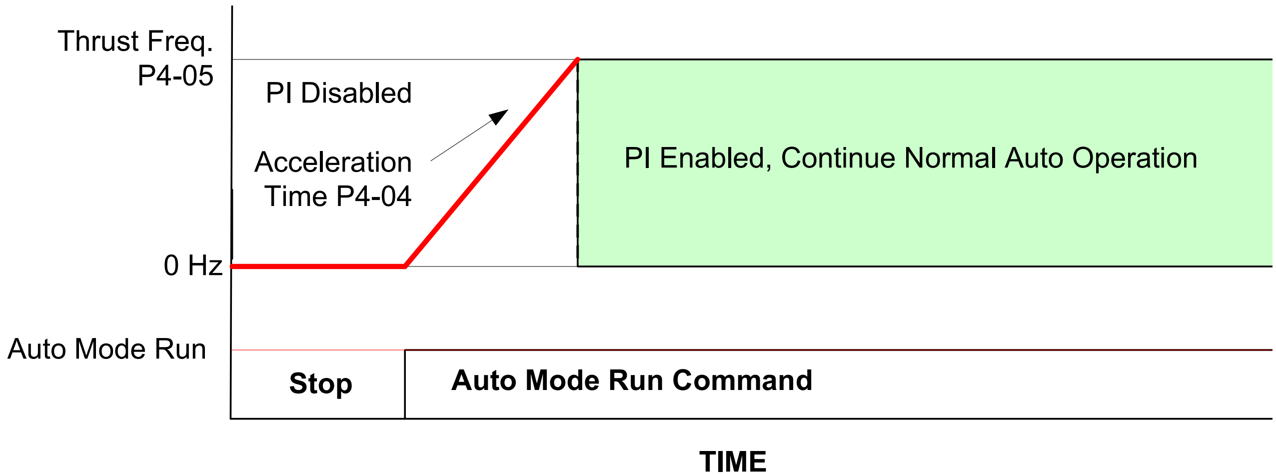


Figure 150.

Table 73 Related Parameters

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Range	Default	Menu Location
P4-04 ♦	0118	Thrust Bearing Acceleration Time **Thrust Acc. 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	1.0 s	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	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	1.0 s	Programming

Table 74 Alarms <0034>

Alarm Display	Description	Countermeasures
Freq. Ref < Pump Min P1-06	The drive's frequency reference is set less than the Minimum Pump Frequency P1-06. The frequency reference will be lower-limited to P1-06 during this time. This will only be active when: - Drive is NOT in PI mode - Drive is running - Minimum Pump Frequency is enabled (P1-06 > 0.00)	Increase the frequency reference to a value greater than P1-06.
Freq. Ref < Thrust P4-05	The drive's frequency reference is set less than the Thrust Bearing Frequency P4-05. Frequency P1-06. The frequency reference will be lower-limited to P4-05 during this time. This will only be active when: - Drive is NOT in PI mode - Drive is running - Thrust Bearing is enabled (P4-05 > 0.00)	Increase the frequency reference to a value greater than P4-05.

◆ P4-06 Thrust Bearing Deceleration Time <0032>

Setting Range: 0.0 ~ 600.0 <0034>

Factory Default: 1.0 s

This deceleration time will be used to bring the drive from Thrust Frequency (P4-05) to a stop when the 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.

■ Function Description: <0034>

Thrust Decel Modification. When the drive is stopped and during Thrust Bearing operation, the drive will decelerate to zero speed from the Thrust Frequency (P4-05) in the amount of time specified by the Thrust Bearing Deceleration Time Parameter (P4-06). Actual (internal) deceleration time is calculated as follows:

Internal Decel Rate = Thrust Decel Time x (fmax / thrust frequency) = P4-06 x E1-04 / P4-05

The internal decel rate during thrust bearing operation is limited to a maximum of 600 seconds.

Note: In the Auto Mode, the Minimum Pump Frequency (P1-06) will become the Thrust Frequency if smaller than the Thrust Frequency (P4-05).
In the Hand Mode, the Minimum Pump Frequency (P1-06) will become the Thrust Frequency if smaller than the Thrust Frequency (P4-05).

◆ P4-07 Feedback Fault Auto Restart Enable <0032>

Setting Range: 0 ~ 7

Factory Default: 0

Setting to enable / disable Auto Restart for the following iQpump transducer / feedback faults:

LL: Low Level Feedback (P1-07)
HL: High Level Feedback (P1-09)
TL: Transducer Loss (b5-12)

Setting	TL	HL	LL
0:	Disable	Disable	Disable
1:	Disable	Disable	Enable
2:	Disable	Enable	Disable
3:	Disable	Enable	Enable
4:	Enable	Disable	Disable
5:	Enable	Disable	Enable
6:	Enable	Enable	Disable
7:	Enable	Enable	Enable

Note: Parameter L5-01 needs to be set to "1" and program L5-03 needs to be set to the applicable time.

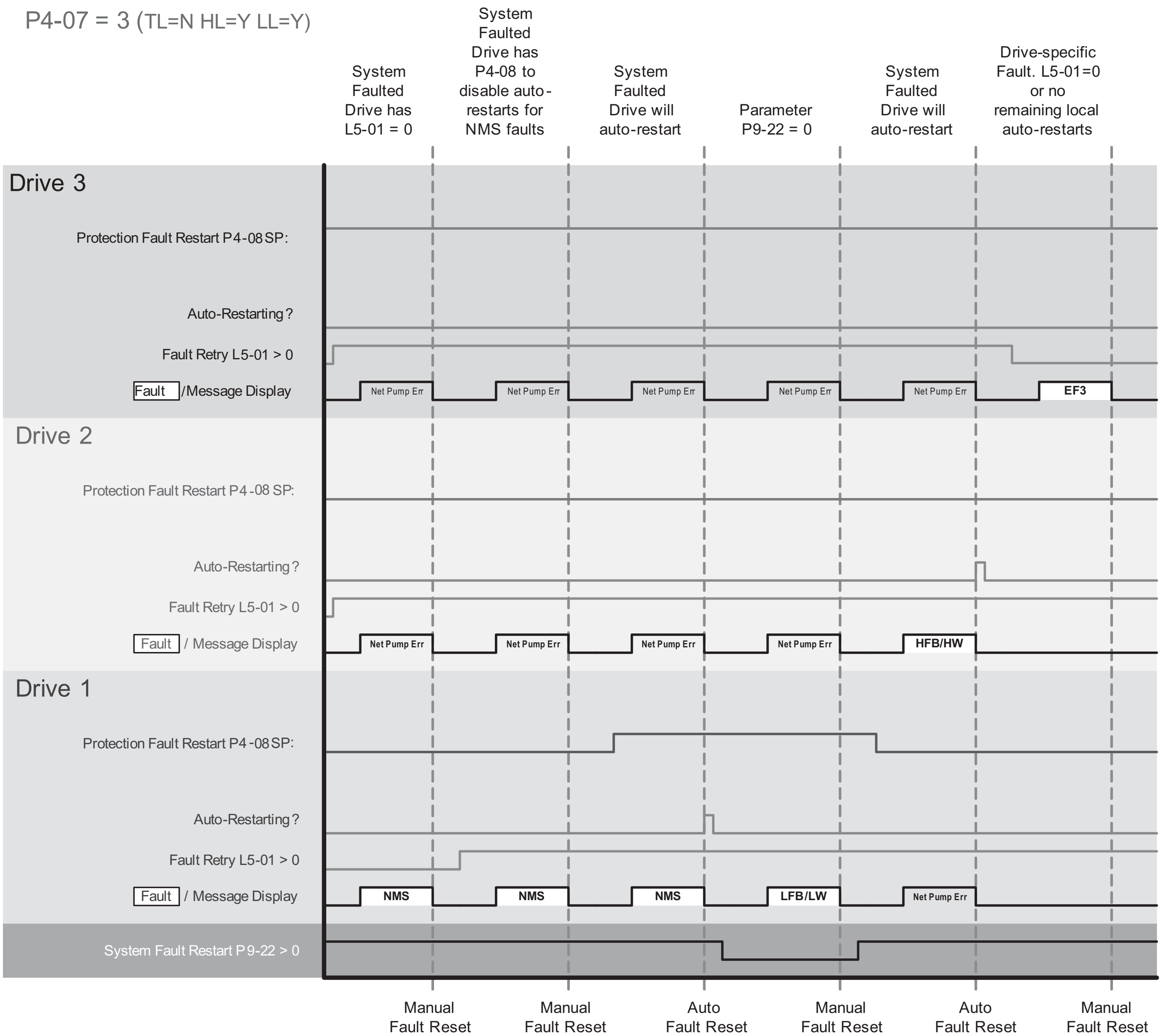


Figure 151. System Fault Auto-Restart Dependencies

◆ P4-08 Protection Fault Auto Restart Enable <0032>

Setting Range: 0 ~ 7

Factory Default: 0

Setting to enable / disable Auto Restart for the following iQpump protection faults:

SP: Not Maintaining Setpoint (P1-11)
LOP: Loss of Prime (P1-16)
POC: Pump Over Cycling (P2-08)

Setting	POC	LOP	SP
0:	Disable	Disable	Disable
1:	Disable	Disable	Enable
2:	Disable	Enable	Disable
3:	Disable	Enable	Enable
4:	Enable	Disable	Disable
5:	Enable	Disable	Enable
6:	Enable	Enable	Disable
7:	Enable	Enable	Enable

Note: Parameter L5-01 needs to be set to "1" and program L5-03 needs to be set to the applicable time.

L5-01 = 5
P4-08 = 7 (POC=Y LOP=Y SP=Y)
P9-22 = 3

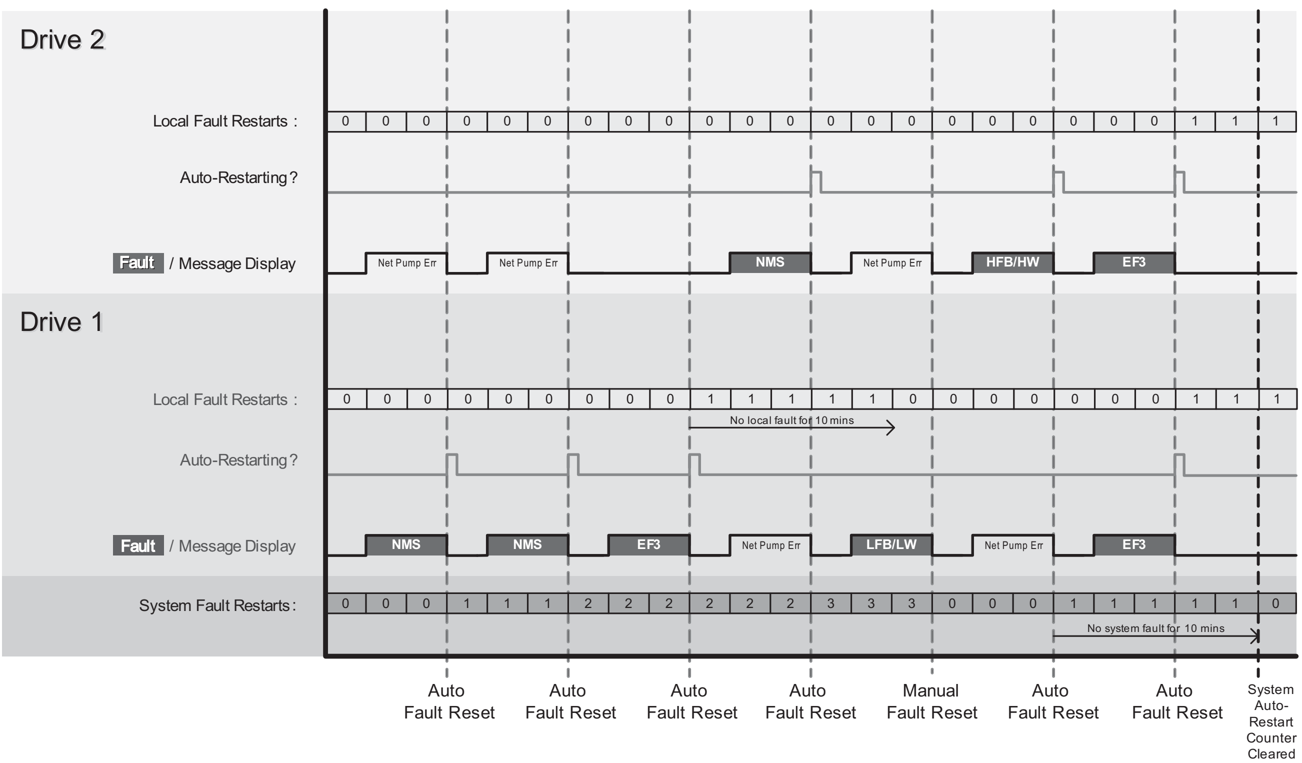


Figure 152. System Fault Auto-Restart Fault Counter

◆ P4-09 Loss of Prime Maximum Restart Time After Restart <0032>

Setting Range: 0.2 ~ 6000.0 min

Factory Default: 0.2 min

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 attempt.

◆ P4-10 Auto Mode Operator Run Power Down Storage

Setting	Description
0	Disabled (***factory default***)
1	Enabled

⚠ WARNING

When the drive is powered down while running, and upon the return of power, the drive will automatically initiate an internal "Run" command. Take extreme caution when using this function.

- Make sure it is safe to use this function in combination with the application requirements.
- This function is the sole responsibility of the user when activated (enabled) and the user accepts application liability.

This "Run" status can be stored when operating from the digital operator (b1-02 = 0) and in the Auto Mode. To enable this function, program the Auto Mode Operator Run Power Down Storage (P4-10) to a value of 1.

The primary use of this function is to automatically restart the pump system after a long period of power loss.

This function does not work if the system is left in the Hand Mode and power is removed.

◆ P4-11 Utility Start Delay <0034>

Setting Range: 0.0 ~ 1000.0 min

Factory Default: 0.2 min

This sets the amount of time the drive will delay starting if a run command is present at the time of power up. A setting of 0.0 disables this function.

Function Description <0034>

Utility Start Delay. The Utility Start Delay function is enabled when parameter P4-11 is set to a value greater than zero. When a run command is present within 1 second of power being applied to the drive, such as, if parameter P4-10 is set to "1", or the run command is jumpered on the terminal strip, the drive will delay running for the time specified in parameter P4-11. At the same time, the message will be shown on the LCD operator "Utility Delay".

If the run command is removed then re-applied during the P4-11 time, the drive will cancel the utility start delay and start running right away.

The Utility Start Delay will also be applied when the drive is auto-restarting after an Undervoltage (UV) or Overvoltage (OV) fault.

If the Start level (P1-04) is enabled, the drive will delay the P4-11 time plus the P1-05 time.

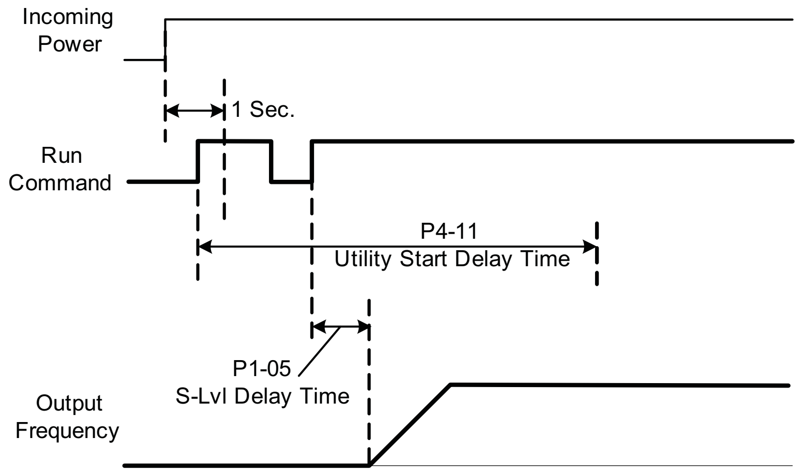


Figure 153. Utility Delay: Cycle Run Command <0034>

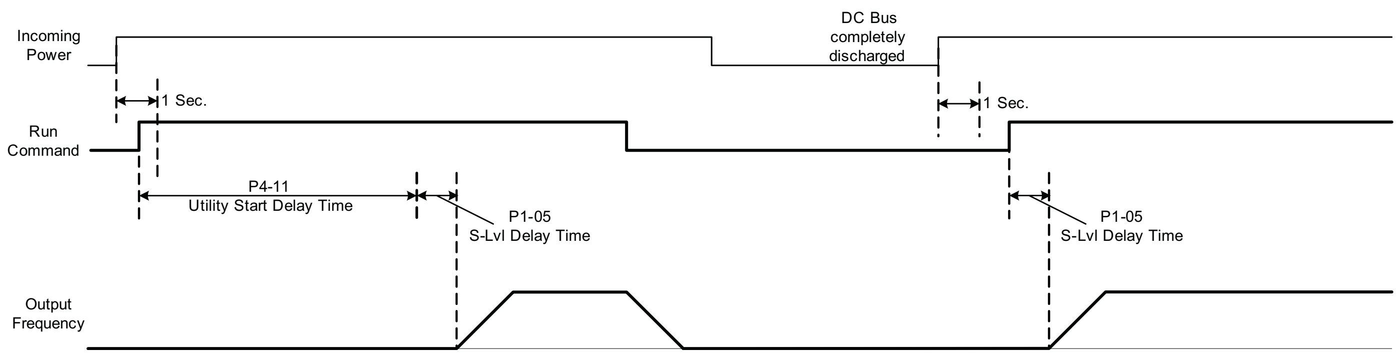


Figure 154. Utility Delay: Run Command <0034>

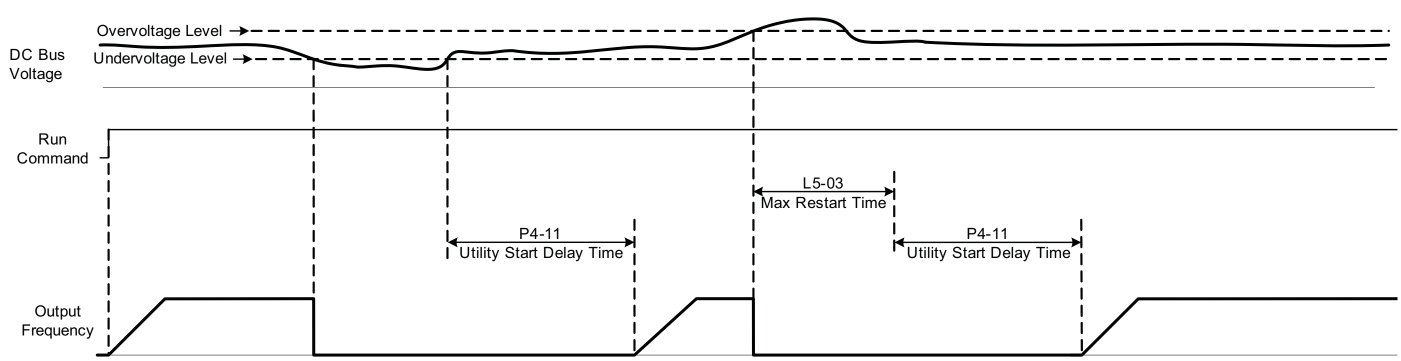


Figure 155. Utility Delay: Undervoltage and Overvoltage <0034>

Table 75 Related Parameters <0034>

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Range	Default	Menu Location
P4-11 ♦	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.	0.0 ~ 1000.0 min	0.2 min	Programming
♦ Denotes that parameter can be changed when the drive is running.						

Table 76 Alarms <0034>

Alarm Display	Description	Cause	Countermeasures
Utility Delay Adjust by P4-11	Utility Delay	This message will appear when the drive is delaying the run command due to the Utility Start Delay Function.	Wait until the P4-11 time to elapse, or cycle the run command.

Table 77 Multi-Function Output Setting <0034>

Setting	Description
50	**Utility Delay** Closed: Drive is stopped and is waiting for the utility delay timer to expire. (configured by P4-11)

◆ P4-12 Pre-charge Frequency 2 <0034>

Setting Range: 0 ~ 120.00 Hz

Factory Default: 0.00 Hz

Refer to parameter P4-12 in Appendix A for description details.

◆ P4-13 Pre-charge Time 2 <0034>

Setting Range: 0 ~ 3600.0 min

Factory Default: 0.0 min

Refer to parameter P4-13 in Appendix A for description details.

◆ P4-14 Two Motor Alternation Selection <0034>

Setting	Description
0	Disabled
1	Enabled
2	Motor 1 Only
3	Motor 2 Only

This parameter allows one drive to power two motors in an “OR” configuration to keep the amount of wear on each motor / pump balanced. This feature will utilize one digital output, which will drive two output contactors via a form-C pilot relay. This feature is only available in Simplex mode (P1-01 = 0).

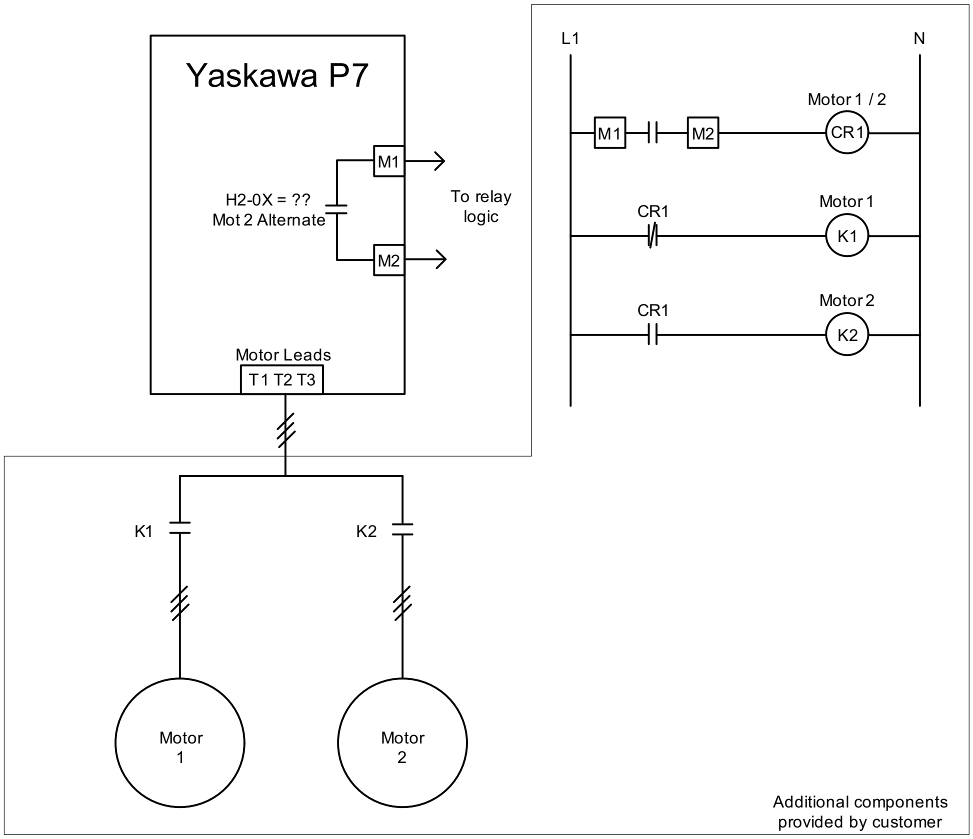


Figure 156. Wiring Diagram

■ Function Description: <0034>

Two Motor Alternation Disabled (P4-14 = 0): When parameter P4-14 = 0, the 2-motor alternation function is disabled. All timers associated with the 2-motor alternation function will be cleared. The digital output (H2-0x = 43) will be de-energized.

Two Motor Alternation Enabled (P4-14 = 1): When parameter P4-14 = 1, the 2-motor alternation function will be enabled. The drive will first hold the "Mot 2 Alternate" digital output (H2-0x = 43) de-energized, which forces the relay / contactor logic to connect the first motor to the drive's output terminals.

Any time the drive is putting power to the motor (running, non-zero speed, not base-blocked), the alternation timer will run. When the timer reaches the time entered into the Alternation Time (P4-16) parameter, the drive will then switch over to the second motor, depending on the setting of parameter P4-15. If P4-15 is set to "Wait For Stop" (P4-15 = 0), the drive will continue to operate on motor 1 until the drive would normally go to zero speed (zero reference, sleep mode, remove run command, fault). Once the drive comes to a stop, the "Mot 2 Alternate" digital output (H2-0x = 43) will energize, so that when the drive restarts it will be running on motor 2.

If P4-15 is set to "Immediate" (P4-15 = 1) and the drive is operating in "Auto" mode when the alternation timer reaches the P4-16 level, the drive will immediately stop using the selected stopping method (b1-03). Once the drive comes to a stop, the "Mot 2 Alternate" digital output (H2-0x = 43) will energize, and the drive will restart and ramp back to speed after the minimum base-block time. However, if the drive is operating in the "Hand" mode and the alternation timer reaches the P4-16 level, the drive will respond as if P4-15 is set to "Wait For Stop".

Once the digital output is switched so that motor 2 is being driven, the alternation timer re-starts. When enough time passes with the drive running that the alternation timer reaches the P4-16 level, the drive will switch back to motor 1 similar to above, depending on the P4-15 setting.

The alternation timer and motor selection are stored to EEPROM once per hour. Whenever parameter P4-14 is changed, the internal alternation timer and the alternation time stored in EEPROM are cleared.

P4-14 special considerations:

- When P4-14 is changed from 0 => 1 - Motor 1 will be used first.
- When P4-14 is changed from 2 => 1 - Motor 2will be used first.
- When P4-14 is changed from 3=> 1 - Motor 1 will be used first.

Motor 1 Only (P4-14 = 2): When parameter P4-14 is set to "Motor 1 Only" (P4-14 = 2), the 2-motor alternation function is disabled. All timers associated with the 2-motor alternation function will be cleared. The digital output (H2-0x = 43) will be de-energized.

Motor 2 Only (P4-14 = 3): When parameter P4-14 is set to "Motor 2 Only" (P4-14 = 3), the 2-motor alternation function is disabled. All timers associated with the 2-motor alternation function will be cleared. The digital output (H2-0x = 43) will be held energized at all times.

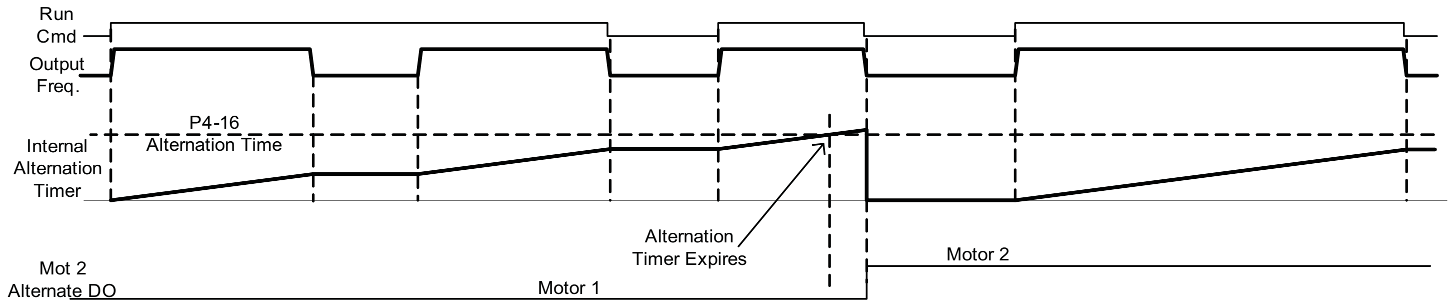


Figure 157. Alternation Cycle: Alternation Operation Select = Wait For Stop (P4-15 = 0)

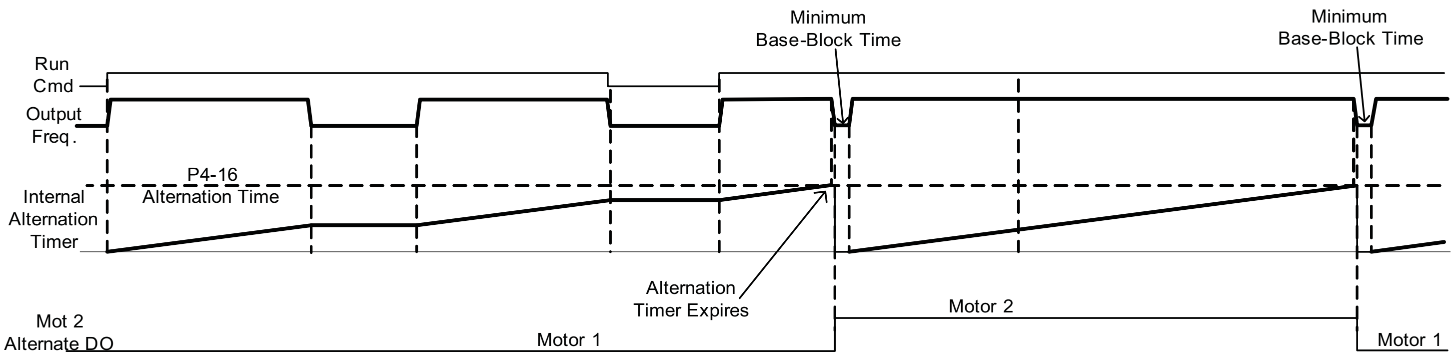


Figure 158. Alternation Cycle: Alternation Operation Select = Immediate (P4-15 = 1)

Table 78 Parameters <0034>

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Range	Default	Menu Location
P4-14	82D	Two Motor Alternation Selection **Mot 2 Alternate**	Selects if the alternation feature is enabled. 0: Disable 1: Enable 2: Motor 1 Only 3: Motor 2 Only	0 ~ 3	0	Programming
P4-15	82E	Alternation Operation Selection **Alternation Oper**	Selects the drive behavior when the internal alternation timer expires. 0: Wait For Stop 1: Immediate (Auto mode only)	0 ~ 1	0	Programming
P4-16	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

Table 79 Multi-Function Output Setting <0034>

Setting	Description
43	**Mot 2 Alternate** 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.

◆ P4-15 Alternation Operation Selection <0034>

Selects the drive behavior when the internal alternation timer expires.

Setting	Description
0	Wait for Stop
1	Immediate

◆ P4-16 Alternation Time <0034>

Setting Range: 1.0 ~ 100.0 hrs

Factory Default: 24.0 hrs

Refer to parameter P4-16 in Appendix A for description details.

◆ P4-17 Dual Zone PID Feedback Bandwidth Range <0034>

Setting Range: 0 ~ 6000.0

Factory Default: 10.0

Refer to parameter P4-17 in Appendix A for description details.

◆ P4-18 Run - Stop Control Run Time <0034>

Setting Range: 0.0 ~ 6000.0 min

Factory Default: 0.0 min

The Run - Stop Control provides a method to have the drive automatically run and stop for given amounts of time for a given number of cycles. This feature is primarily used for clearing the sediment out of new water wells.

The Timed Run feature provides a way to perform a “Tank Fill” operation with only a single “low level” switch.

Note: Refer to parameter b1-02 = 5 (Also applies to parameters P4-19 and P4-20).

Table 80 Additional Parameter

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Range	Default	Menu Location
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

◆ P4-19 Run - Stop Control Stop Time <0034>

Setting Range: 0.0 ~ 6000.0 min

Factory Default: 0.0 min

This parameter sets the amount of time the drive will stop for when the run-stop control is enabled.

◆ P4-20 Run - Stop Control Cycles <0034>

Setting Range: 0 ~ 1000

Factory Default: 0

This parameter determines how many run-stop cycles the drive will execute before staying stopped.

◆ P4-21 Low City Pressure Input Select <0034>

Setting	Description
0	Normally Open (closed indicates the “Low City Pressure” condition)
1	Normally Closed (open indicates the “Low City Pressure” condition)

The Low City Pressure Input Select parameter prohibits the drive from running when low incoming pressure is indicated by a pressure switch.

If the pressure switch is active (sufficient pressure available), the drive will operate normally. If the pressure switch indicates that incoming pressure is to low:

- The lead drive will be forced into a sleep-like state (coast to stop).
- Any drives staged in multiplex mode will immediately be De-Staged (coast to stop).
- The alarm “Low City Pressure” will be displayed on the lead drive.
- The drive will restart but NOT perform a Pre-charge when sufficient pressure returns.
- The drive will start but WILL perform a Pre-charge if the Auto-Run command was given during the Low Pressure condition.

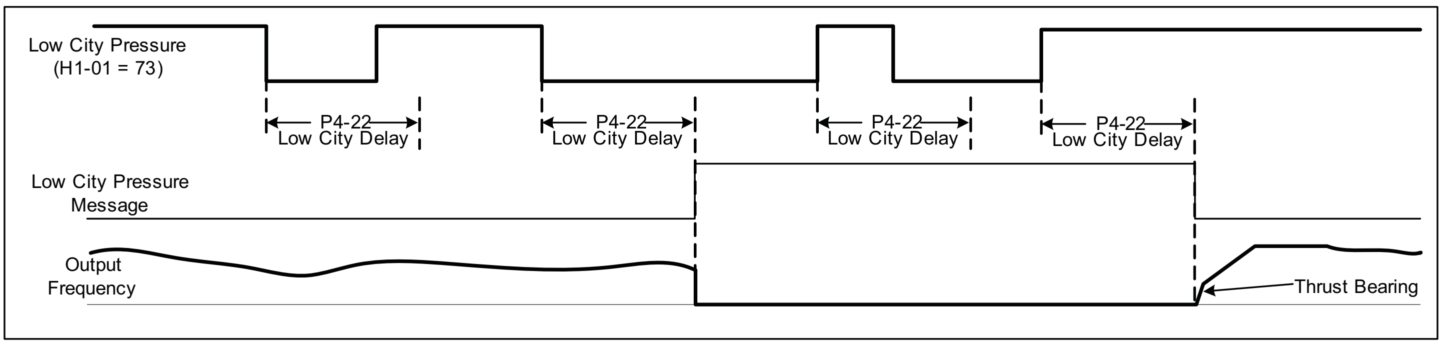


Figure 159. Low City Pressure Digital Input, Normally Closed (P4-21 = 1)

Table 81 Parameters

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Range	Default	Menu Location
P4-21 ♦	834	Low City Pressure Input Select **Low City In Sel**	Selects the type of pressure switch connected to the “Low City Press” 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 ♦	8356	Low City Pressure Input Delay **Low City Delay**	Sets the amount of time a “Low City Pressure” condition needs to be present before the drives will stop. Also sets the amount of time that the pressure needs to be adequate before the drive system will re-start.	1 ~ 1000 s	10	Programming
♦ Denotes that parameter can be changed when the drive is running.						

Table 82 Multi-Function Output Setting <0034>

Setting	Description
73	**Low City Press** Indicates that sufficient / insufficient pressure is present on the inlet to the pump. Used mainly for pressure booster stations.

Table 83 Alarms <0034>

Alarm Display	Description
Low City Pressure	Insufficient pressure is present on the inlet to the pump. Used mainly for pressure booster stations. Uses the “Low City Pressure” digital input (H1-0x = 73) and parameters P4-21 and P4-22.

◆ P4-22 Low City Pressure Input Delay <0034>

Setting Range: 1 ~ 1000 s

Factory Default: 10

Refer to parameter P4-22 in Appendix A for description details.

◆ P4-23 Lube Pump Delay Timer <0034>

Setting Range: 0.0 ~ 300.0 s

Factory Default: 0.0

The Lube Pump Delay Timer parameter provides a digital output to trigger a lube pump or valve prior to starting the motor.

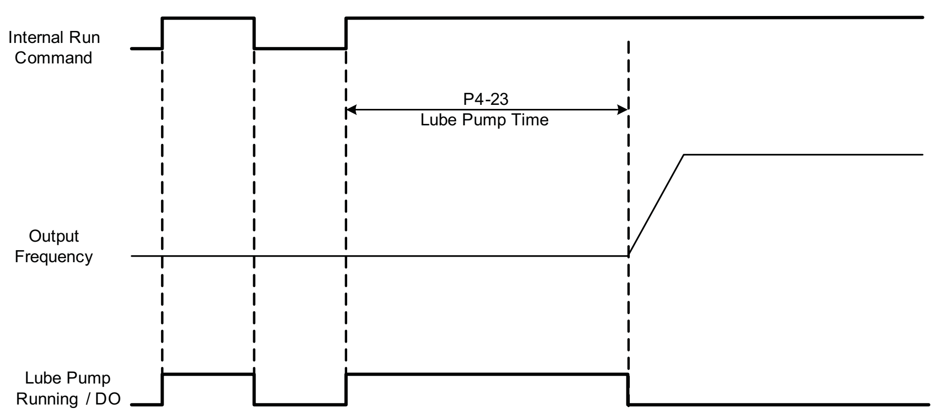
Whenever the drive is supposed to start turning the motor, the “Lube Pump” digital output will energize for a set amount of time before the drive actually starts. This will allow a small lubrication pump or valve to pre-lubricate the pump seals prior to the main pump starting.

If the drive is running but base-blocked via the multi-function digital inputs (H1-0x = 8 or 9), the lube pump output will not energize when the base-block is released.

■ Function Description: <0034>

Lube Pump: The Lube Pump function will operate anytime the drive is going to accelerate from zero speed. Instead of starting, the drive will remain base-blocked at zero speed until the lube pump timer expires. The lube pump timer is configured by parameter P4-23. If parameter P4-23 is set to zero then the lube pump feature is disabled. Whenever the lube pump timer is timing (after a start or re-start), the Lube Pump digital output (H2-0x = 55) will be energized. This digital output is meant to connect to a small lubrication pump or solenoid valve that will lubricate the main pump bearings.

If an Anti-Jam is detected, the Lube Pump will NOT activate between Anti-Jam retries.



NOTE: Internal Run Command consists of the actual run command (auto run, hand, terminals, serial com, operator etc..) and other Iqpump features, including: sleep, fault auto-restart, 2-motor alternate, multiplex control, run/stop control, city pressure, etc...

Figure 160. Lube Pump Enabled

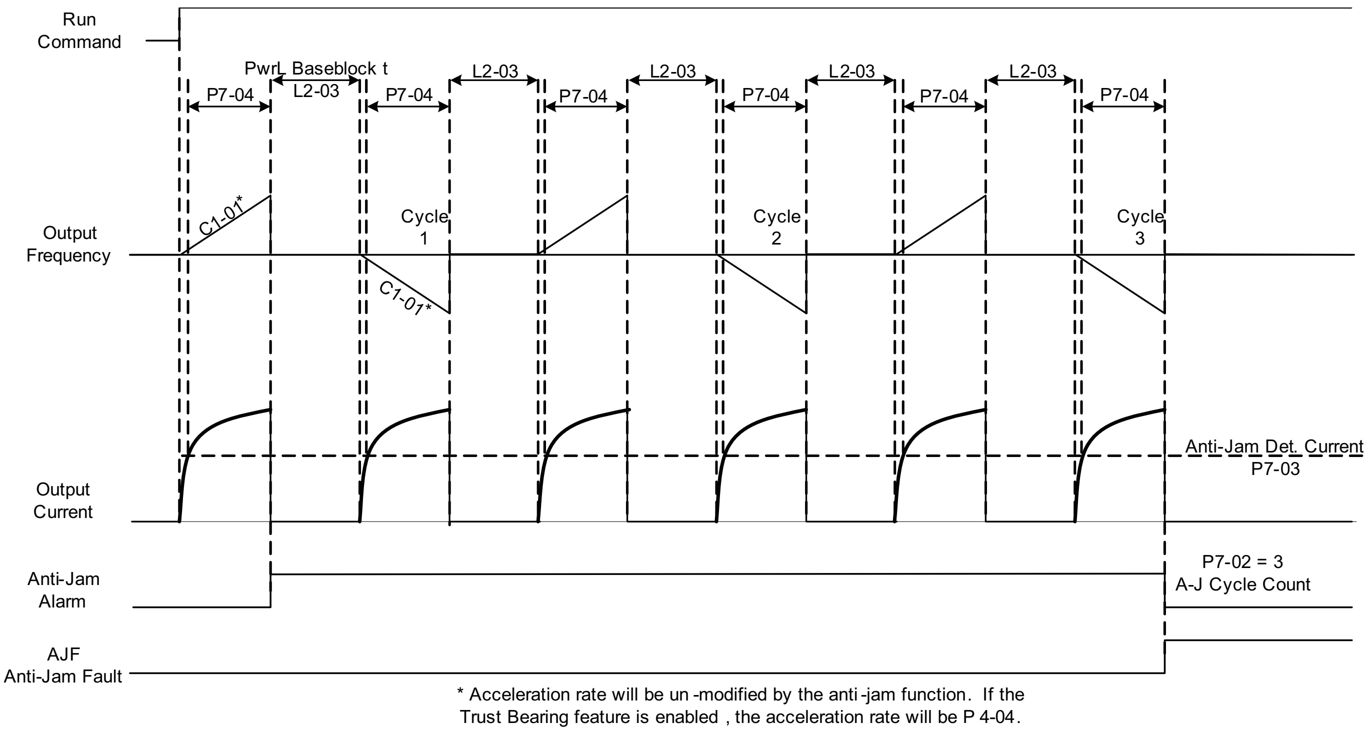


Figure 161. Lube Pump Enabled with Anti-Jam Enabled

Table 84 Parameters

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Range	Default	Menu Location
P4-23 ♦	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 s	0.0	Programming
♦ Denotes that parameter can be changed when the drive is running.						

Table 85 Multi-Function Output Setting <0034>

Setting	Description
55	**Lube Pump** Indicates that sufficient / insufficient pressure is present on the inlet to the pump. Used mainly for pressure booster stations.

Table 86 Message <0034>

Setting	Description
Lube Pump Running	The drive is delaying the start of the motor and the Lube Pump digital output is energized.

P5 Hand Mode

◆ P5-01 Hand Mode Reference

Setting	Description
0	Analog Input A1 (0~10 V)
1	Hand Reference (P5-02) (*factory default*)

The iQpump drive can be operated manually or in the "Hand" mode. The frequency for the hand mode can be an analog input (0 ~ 10 Vdc) or from the digital operator (P5-02).

The hand mode operation is useful when testing the system during initial start-up without the automated regulation functions of the iQpump drive.

The selection to determine the hand mode reference is determined by programming the Hand Mode Reference Source (P5-01). If P5-01 = 1, then the hand reference frequency is set by programming the Hand Reference (P5-02).

The Hand Mode Reference Source (P5-01) works in conjunction with the Hand Reference (P5-02) if P5-01 = 1.

The Hand Mode can be activated from the digital operator or by programming a multi-function digital input for "Hand Mode" (H1-xx = 80).

To change the hand reference requires the P5-02 parameter to be programmed also. U1-01 will be the only monitor available and the Up / Down arrow keys will not operate like a digital MOP.

■ Hand Mode Operation from Keypad (Factory Default)

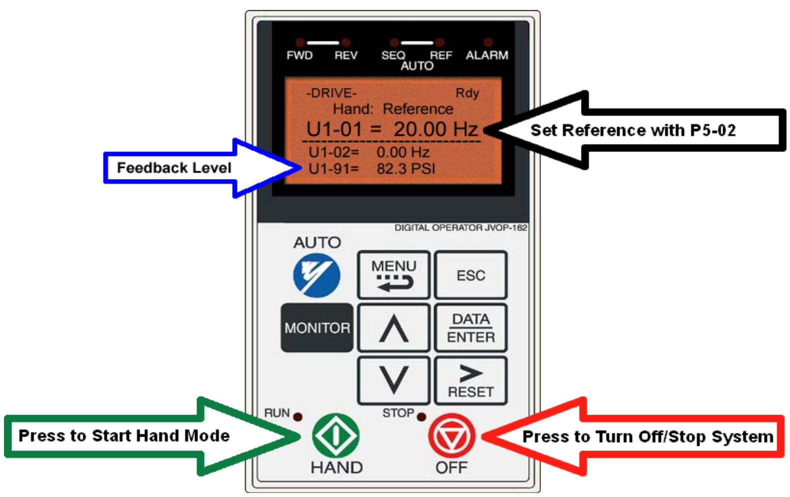


Figure 162.

■ Hand Mode Operation from External Signal (P5-01 = 0)

Connection Diagram of Potentiometer

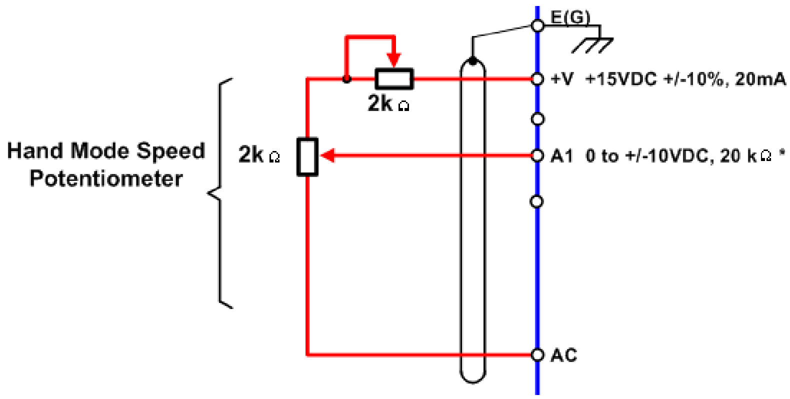


Figure 163.

Connection Diagram of External Signal

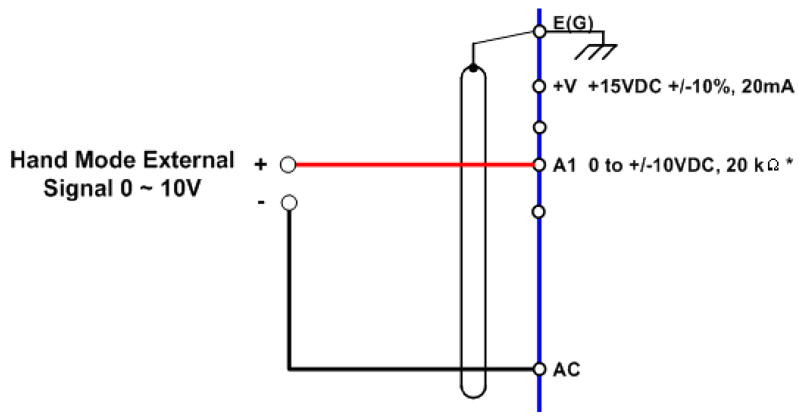


Figure 164.

◆ P5-02 Hand Reference

Setting Range: 0.00 ~ 120.00 Hz

Factory Default: 40.00 Hz

The iQpump drive can be operated manually or in the "Hand" mode. The frequency reference for the hand mode is programmed in the Hand Reference (P5-02).

The Hand Reference (P5-02) is used when the hand mode is active and the Hand Mode Reference Source (P5-01) is set to 1.

Refer to Hand Mode Reference Source (P5-01) for more details.

The Hand Reference (P5-02) works in conjunction with the Hand Mode Reference Source (P5-01). Allow the "Hand Mode" reference to operate the same as a digital preset reference (d1-0x) so that it can be set from the "U1-01" menu. Although P5-02 will act as a normal "d1-xx" frequency reference, it will not be affected by P1-02 / P1-03. The Operator MOP feature will NOT work with the Hand Reference parameter.

If the thrust bearing function is enabled, P4-05 determines the minimum Hand Reference allowed.

■ Function Description: <0034>

Internally forces a 'simulated" frequency reference select MFDI that will then use the P5-02 as the reference.

Table 87 Parameters

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Range	Default	Menu Location
P5-02 ♦	125	Hand Reference **Hand Reference**	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
Note: The MEMOBUS / Modbus address (Addr. Hex) may need to change for this parameter						

◆ P5-03 HAND / AUTO During Run Selection <0032>

Setting Range: 0 ~ 1

Factory Default: 0

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.

◆ P5-04 Hand Key Function Selection <0032>

Setting Range: 0 ~ 1

Factory Default: 1

Enables or disables the “Hand” key on the digital operator.
0: Disabled
1: Enabled

P6 Flow Meter Setup <0034>

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

◆ P6-01 Flow Meter Scaling

Setting Range: 0.0 ~ 6000.0 Gpm

Factory Default: 0.0 Gpm

This parameter allows the connection of an external flow meter to the analog input (Terminal A1).

■ Basic Concepts:

- Flow rate monitoring (digital operator)
- Accumulation of flow over time (volume), stored in EEPROM
- Additional method to activate the sleep function
- Additional method to detect a “No Flow” condition
- Uses Terminal A1

■ Function Description: <0034>

Flow Rate: A voltage (current) from a flow meter, which is installed in the pump discharge stream, is connected into terminals A1 and AC. Terminal A1 will act as a “flow” input only when it isn’t being used as a frequency reference (b1-02 = 1). Parameter P6-01 will then allow the drive to calculate flow rate from the voltage on Terminal A1. The flow rate will then be scaled and displayed on monitor U1-95. Units scaling for monitor U1-95 will be determined by parameter P6-02.

Volume Accumulated: The flow data obtained from Terminals A1 and AC, will be integrated over time in order to calculate total fluid volume. The fluid volume will be displayed in two monitors, U1-96 and U1-97. Parameter P6-03 will reset the volume accumulated data and return the monitors U1-96 and U1-97 to zero. The maximum value that can be displayed on U1-96 is 65535. The maximum value that can be displayed on U1-97 is 61036. An internal register tracking volume accumulated has a maximum range of 4 billion (4,000,000,000) gallons. Accumulated volume will be stored with a resolution of 4 gallons. Accumulated volume will remain at its maximum value until it is reset, it will not “rollover”.

Note: The accumulated volume will NOT be reset if the drive is initialized (A1-03 = 2220 or 3330).

How to calculate accumulated flow from the information in monitors U1-96 and U1-97

Step 1: Take the value in monitor U1-97 and multiply by the number 65535.
Step 2: Take the result from step 1 and add it to the value in monitor U1-96.

Example:
U1-96 = **51079**
U1-97 = **228**

Step 1: **228** x 65,535 = 14,941,980
Step 2: 14,941,980 + **51,079** = 14,993,059

Total accumulated flow = 14,993,059 gallons

Figure 165. Accumulated Input Flow Calculations

Low Flow Alarm: The flow data obtained from Terminals A1 and AC, will be monitored for a “low flow” condition. If the flow rate drops below a level set by parameter P6-04, for more than the time specified by P6-05, the drive will display a “LOWFL - Low Flow” Alarm. The run command must be removed, or the flow rate must remain above the P6-04 for one second to clear the “LOWFL - Low Flow” Alarm. The Low Flow Alarm is disabled when: the drive is not running, the drive is faulted, or when the frequency reference / output frequency is at zero Hz. Once the drive starts running, the Low Flow start timer P6-06 time needs to elapse before the Low Flow Alarm is detected. The Low Flow Alarm is only active when P6-07 = 1.

Low Flow Fault: The flow data obtained from Terminals A1 and AC, will be monitored for a “low flow” condition. If the flow rate drops below a level set by parameter P6-04, for more than the time specified by P6-05, the drive will fault out on a “LOWFL - Low Flow” Fault and coast to stop. The Low Flow Fault is disabled when: the drive is not running, the drive is faulted, or when the frequency reference / output frequency is at zero Hz. Once the drive starts running, the Low Flow start timer P6-06 time needs to elapse before the Low Flow Fault is detected. The Low Flow Fault is only active when P6-07 = 2 or 3. If P6-07, the Low Flow Fault will NOT be auto-restarted.

Low Flow Fault Auto Restart: When parameter P6-07 = 3, the Low Flow Fault will be auto-restarted. It will use the time set in parameter P6-08 before attempting another restart instead of the normal auto-restart time, L5-03. In order for this feature to work, L5-01 needs to be set to a value greater than zero**.**

Accumulated Level Output / Alarm / Fault: A total amount of water can be entered into parameters P6-09 and P6-10. When the amount of water measured using A1 exceeds this amount, the drive will set the “Accum Level” digital output. If parameter P6-11 is set to “1”, an Accumulated Level Alarm will display and the drive will keep running. If parameter P6-11 is set to “2”, an Accumulated Level Fault will occur and the drive will coast to a stop.

How to calculatethe Accumulated Parameters P6-09 and P6-10

Step 1: Take the desired accumulated level and divide it by the number 65,535.
Step 2: Take the result of Step 1 and drop everything to the right of the decimal place. This would leave just the whole number, and that should be entered into parameter P6-10.
Step 3: Take the value you entered into P6-10 and multiply it by 65535. Subtract this value from the desired accumulated leve. This is the number that should be entered into parameter P6-09.

Desired accumulated level: 12,345,678

Step 1: 12,345,678 / 65,535 = 188.38297
Step 2: ~~188,38297~~ = 188
Set **P6-10 = 188**
Step 3: 12,345,678 - (188 x 65,535 = 25,098
Set **P6-09 = 25098**

Figure 166. Accumulated Output Flow Calculations

Sleep Function Using the Flow Meter: The Sleep function can be triggered by the Flow Meter. To enable this feature, the sleep level type to be set to “FlowMtr-Term A1” (P2-01 = 4). Also the Flow Meter needs to be enabled by setting a non-zero value into P6-01.

The drive’s output needs to be active (faster than zero speed) for the time specified in parameter P6-06 before a sleep condition can be detected. The flow will then have to drop below the P2-02 level for more than the P2-03 Sleep Delay Time for the drive to go to sleep.

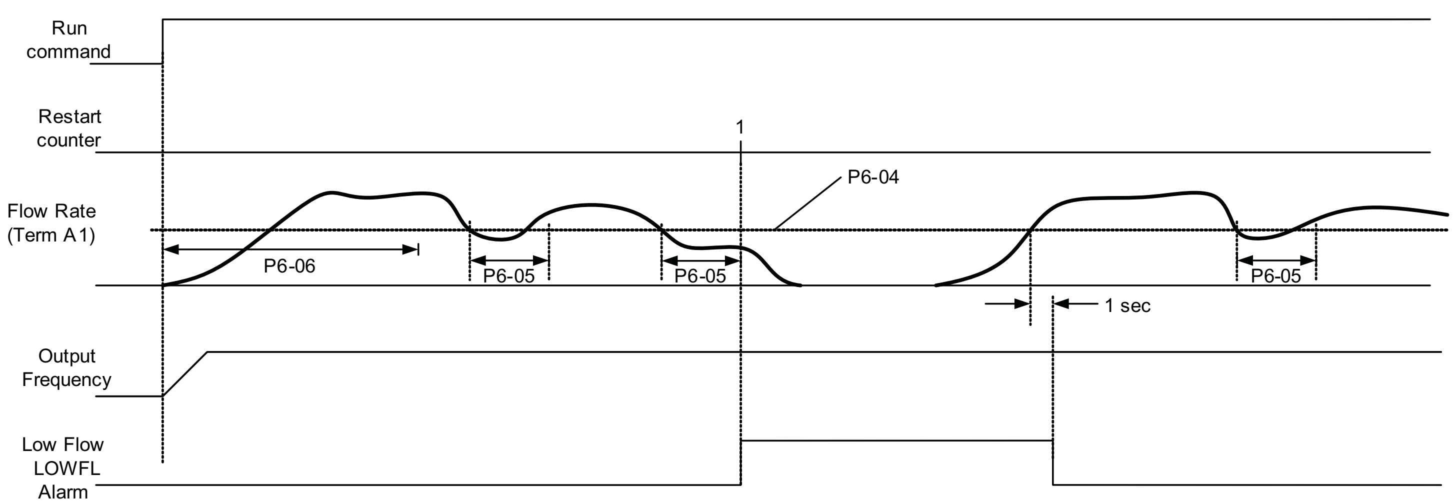


Figure 167. Low Flow Alarm (P6-07 = 1)

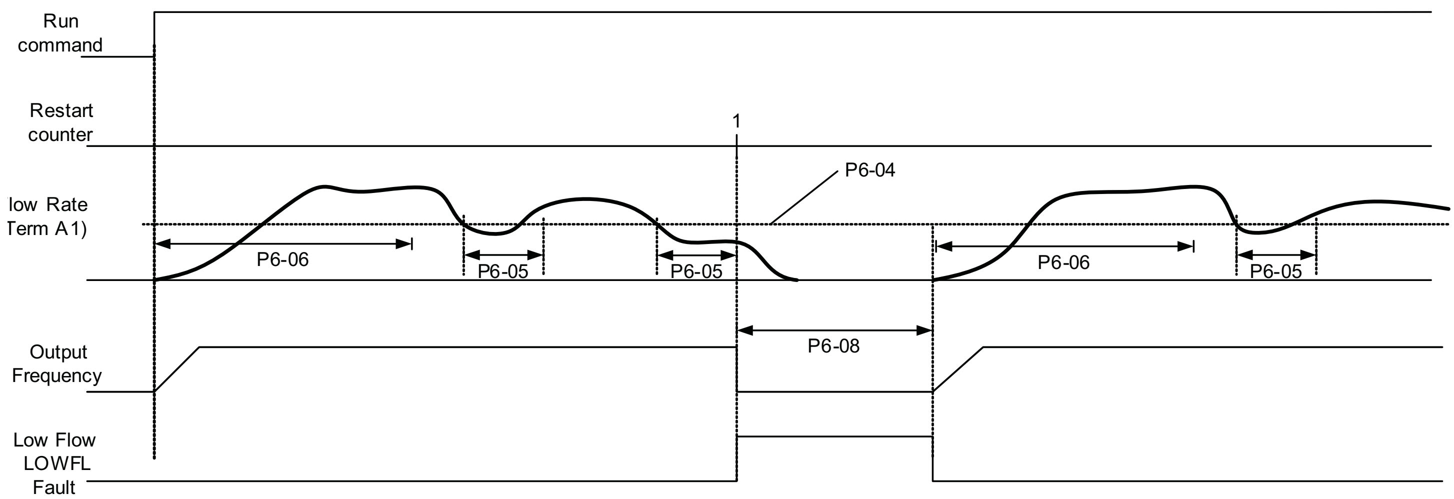


Figure 168. Low Flow Fault Auto Restart (P6-07 = 3)

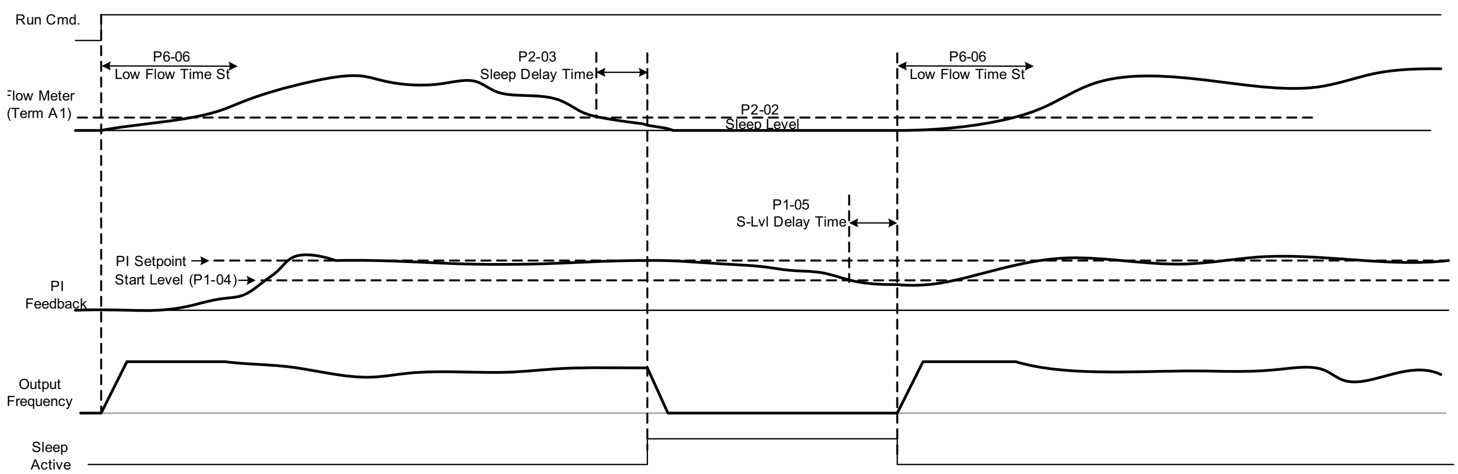


Figure 169. Sleep Level Type = Flow Meter (P2-01 = 4)

Table 88 Parameters <0034>

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
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. 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	5 s	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
♦ Denotes that parameter can be changed when the drive is running.						

Table 89 Related Parameters <0034>

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
P6-01	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	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. 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 ♦	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 ♦	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.	0.0 ~ 6000.0 (*n1)	0.0	Programming
P6-05 ♦	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	0.0 ~ 6000.0 s	10	Programming
P6-06 ♦	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	Programming

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
P6-07	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	847	Low Flow Auto-Restart Time **LowFlow Restrt**	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 ♦	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 * 1000 + P6-09.	0.0 ~ 999.0 gal	0.0	Programming
P6-10 ♦	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 * 1000 + P6-09.	0 ~ 61036 kgl	0	Programming
P6-11 ♦	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 ♦	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.	0.0 ~ 6000.0 (*n1)	0.0	Programming
P6-13 ♦	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 s	10	Programming
P6-14	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

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

Table 90 Function Text

Function Number	Function Name Digital Operator Display
P6	Flow Meter Setup **Flow Meter Setup**

Table 91 Monitors <0034>

Monitor No.	Addr. Hex	Monitor Name Digital Operator Display	Description
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 * 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 * 1000 + U1-96. Value retained in EEPROM.

Table 92 Multi-Function Input Setting (H1-xx) <0034>

Setting	Description
75	**Reset Accum** Closed: Volume accumulated will be reset to zero (and held at zero if digital input remains closed).

Table 93 Multi-Function Output Settings (H2-xx) <0034>

Setting	Description
4E	**Low Flow** 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<2>	**Accum Level** <2> Closed: Accumulated level has exceeded the P6-09 and P6-10 setting OR Closed: During the "Accum Level" Fault.
56<3>	**High Flow** <3> Closed: During the "High Flow Fault" condition OR Closed: During a high flow condition as set by P6-04 ~ P6-06 (includes "High Flow Alarm")

Table 94 Faults <0034>

Fault Display	Description	Cause	Countermeasures
LOWFL Low Flow	Low flow has been detected by the flow meter.	Not enough flow, or incorrect "P6" settings	—
ACCUM Accum Level	Accumulated Level	Accumulated level has exceeded the P6-09 and P6-10 settings.	Reset the accumulated level (P6-03 or via digital input)
OPE13 Terminal A1	Programming error	Terminal A1 is being 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) - Level Control Enabled (P8-01 =1)	Reprogram b1-01, b5-01, P6-01 or P8-01.
OPE14 FlowMtrNotEnable	Programming error	The sleep level type has been set to "FlowMtr-Term A1" (P2-01 = 4) but the flow meter function is not enabled (P6-01 = 0.0)	Reprogram P2-01 or P6-01.
HIFLO High Flow	High flow has been detected by the flow meter.	Too much flow or incorrect "P6" settings.	—

Table 95 Alarms <0034>

Alarm Display	Description	Cause	Countermeasures
LOWFL Low Flow	Low flow has been detected by the flow meter.	Not enough flow, or incorrect "P6" settings	—
ACCUM Accum Level	Accumulated Level	Accumulated level has exceeded the P6-09 and P6-10 settings.	Reset the accumulated level (P6-03 or via digital input)
HIFLO High Flow	High flow has been detected by the flow meter.	Too much flow or incorrect "P6" settings.	—

◆ P6-02 Water Flow Units

Setting Range: 0 ~ 4

Factory Default: 0

Setting	Description
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)

◆ P6-03 Flow Accumulation Reset

Setting Range: 0 ~ 65535

Factory Default: 0

Refer to parameter P6-03 in Appendix A for description details.

◆ P6-04 Low Flow Level

Setting Range: 0.0 ~ 6000.0 (*n1)

Factory Default: 0.0

(*n1) Displayed units are determined by parameter P6-02.

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Range	Default	Menu Location
P6-04 ♦	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 P1-01 = 3, a LOWFL fault will stop all drives running on the network.	0.0 ~ 6000.0 (*n1)	0.0	Programming
♦ Denotes that parameter can be changed when the drive is running. (*n1) Displayed units are determined by parameter P6-02.						

◆ P6-05 Low Flow Detection Delay Time When Already Running

Setting Range: 0 ~ 6000 sec

Factory Default: 10

Refer to parameter P6-05 in Appendix A for description details.

◆ P6-06 Low Flow Detection Wait Time At Start

Setting Range: 0.00 ~ 3600.0 min

Factory Default: 0.00

Refer to parameter P6-06 in Appendix A for description details.

◆ P6-07 Low Flow Select

Setting	Description
0	No Display
1	Alarm Only
2	Fault
3	Auto-Restart (time set by P6-08)

◆ P6-08 Low Flow Auto-Restart Time

Setting Range: 0.1 ~ 6000.0 min

Factory Default: 3.0 min

Refer to parameter P6-08in Appendix A for description details.

◆ P6-09 Accumulation Level Fine

Setting Range: 0.0 ~ 999.0 gal

Factory Default: 0.00

Refer to parameter P6-09 in Appendix A for description details.

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Range	Default	Menu Location
P6-09 ♦	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	Programming
♦ Denotes that parameter can be changed when the drive is running.						

◆ P6-10 Accumulation Level Course

Setting Range: 0 ~ 61036 kgl

Factory Default: 0

Refer to parameter P6-10 in Appendix A for description details.

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Range	Default	Menu Location
P6-10 ♦	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	Programming
♦ Denotes that parameter can be changed when the drive is running.						

◆ P6-11 Accumulation Behavior

Setting	Description
0	No Display
1	Alarm Only
2	Fault
3	Auto-Restart (time set by P6-08)

◆ P6-12 High Flow Level

Setting Range: 0.0 ~ 6000.0 (*n1)

Factory Default: 0.0

(*n1) Displayed units are determined by parameter P6-02).

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Range	Default	Menu Location
P6-12 ♦	48B	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
♦ Denotes that parameter can be changed when the drive is running. (*n1) Displayed units are determined by parameter P6-02.						

◆ P6-13 High Flow Detection Delay Time

Setting Range: 1 ~ 6000 s

Factory Default: 10

Refer to parameter P6-13 in Appendix A for description details.

◆ P6-14 High Flow Select

Setting	Description
0	No Display
1	Alarm Only
2	Fault
3	Auto-Restart (time set by L5-03)

P7 Anti-Jam / De-Scale <0034>

◆ P7-01 Anti-Jam / De-Scale Operation Selection

NOTICE: *Use of the Anti-Jam or De-Scale Functions can force the motor to run in reverse for brief periods. This can cause pump damage to pumps not designed to run in the reverse direction. To avoid possible pump damage, do not "Enable" the Anti-Jam or De-Scale Functions.*

Setting Range: 0 ~ 3

Factory Default: 0

This parameter provides a method to detect and attempt to expel solids which are keeping the pump impeller from turning. It also provides rapid bi-directional acceleration at the start to help dislodge scale and buildup attached to the impeller.

Setting	Description
0	Disabled
1	Anti-Jam Enabled
2	De-Scale Enabled
3	Force DeScale

Basic Concepts:

Anti-Jam: The drive will monitor output current when starting from zero speed. If the current goes too high, it will coast to a stop then switch into reverse. The drive will then repeat this cycle until the output current remains below the detection level, or until it faults out on an "AJF - Anti-Jam Fault".

De-Scale: The drive will monitor the number of operating hours of the motor. After a set amount of operating time, the drive will go into the De-Scale function the *next* time the drive is started, either in hand or auto mode. This function will run the drive forward, then reverse for a specified number of times before normal operation will automatically resume.

Anti-Jam and De-Scale are only effective when P1-01 = 0.

■ Function Description: <0034>

Anti-Jam Function: The Anti-Jam function will only operate when all of the following conditions are met:

- P7-01 = 1 Anti-Jam is enabled
- P1-01 = 0 Simplex Operation Only

It will keep monitoring the output current for the time specified by parameter P7-11.

If the drive's output current goes above the value set in the Anti-Jam Detection Current Level (P7-03), or the drive goes into current limit for more than the time set in the Anti-Jam Detection Time parameter (P7-04), the "Anti-Jam / De-Scale" alarm will display and the drive will coast to a stop. After the time set into the Momentary Power Loss Minimum Base Block Time parameter (L2-03) expires, the drive will attempt to run in reverse at the Anti-Jam / De-Scale Frequency Reference (P7-05). If the current again exceeds the Anti-Jam Detection Current Level (P7-03) level for more than the time set in Anti-Jam Detection Time (P7-04), the drive will again coast to a stop and the internal cycle counter will be incremented. This process will then repeat. During this time the integrator of the PI controller will be held and not allowed to wind-up.

If the internal cycle counter reaches the value set into the Anti-Jam / De-Scale Cycle Count parameter (P7-02), the drive will then fault-out on an "AJF - Anti-Jam Fault".

If during the Anti-Jam function the motor current drops below the level set in Anti-Jam Detection Current Level (P7-03) for more than the time set in Anti-Jam Detection Time parameter (P7-04), the drive will then operate normally. The "Anti-Jam / De-Scale" alarm will clear, the PI controller will be released and the internal cycle counter will be reset.

De-Scale Function: The De-Scale function will only be allowed to operate when all of the following conditions are met:

- P7-01 = 2 De-Scale is Enabled
- P1-01 = 0 Simplex Operation Only
- b1-02 < 5 "Timed Run" feature is disabled
- P4-14 = 0 Two-Motor Alternation is disabled
- P4-18, P4-29 or P4-20 = 0 Run / Stop control is disabled

While the pump is running (Auto or Hand mode), an internal run timer is activated. This timer is stored in EEPROM at power-down. If the amount of time accumulated in the timer is less than the De-Scale Pump Run Time parameter (P7-10), the drive starts normally. When the timer is equal to or greater than the De-Scale Pump Run Time parameter (P7-10) value, the drive will automatically perform the De-Scale Function the next time the drive comes out of zero speed in the “Auto” mode.

For the whole time the drive is executing the De-Scale function, the “De-Scale Active” alarm will flash on the display. The drive will first accelerate using the De-Scale Acceleration Time (P7-08) time. It will then decelerate using the De-Scale Deceleration Time (P7-09). Once the drive reaches zero speed, it will immediately repeat the cycle for as many times as specified by the Anti-Jam / De-Scale Cycle Count (P7-02) parameter.

During the De-Scale Function, many iQpump features are disabled: Thrust Bearing, PI control, Pre-charge, Low Feedback fault and Not Maintaining Setpoint fault. The other protective functions, however, will remain active.

If the De-Scale function is interrupted by a fault or by removing the run command, all timers associated with the De-Scale function will be reset.

The “Not Maintaining Setpoint”, “Loss Of Prime”, and “Low Feedback” faults will be disabled while the drive is performing the De-Scale operation.

The De-Scale run timer will be stored to EEPROM when:

- Once per hour that the drive is running
- Right after a successful De-Scale Cycle (timer set to zero then stored to EEPROM)
- If the run command is removed during a De-Scale Cycle (timer set to zero then stored to EEPROM)
- If a fault occurs during the De-Scale Cycle (timer set to zero then stored to EEPROM)

Forced De-Scale Operation: When parameter P7-01 = 3 (Forced De-Scale), the drive will perform a De-Scale every time it starts. This mode is intended to be used during the setup of the De-Scale function only. The internal De-Scale run timer is forced to zero (reset) when the drive is in this mode.

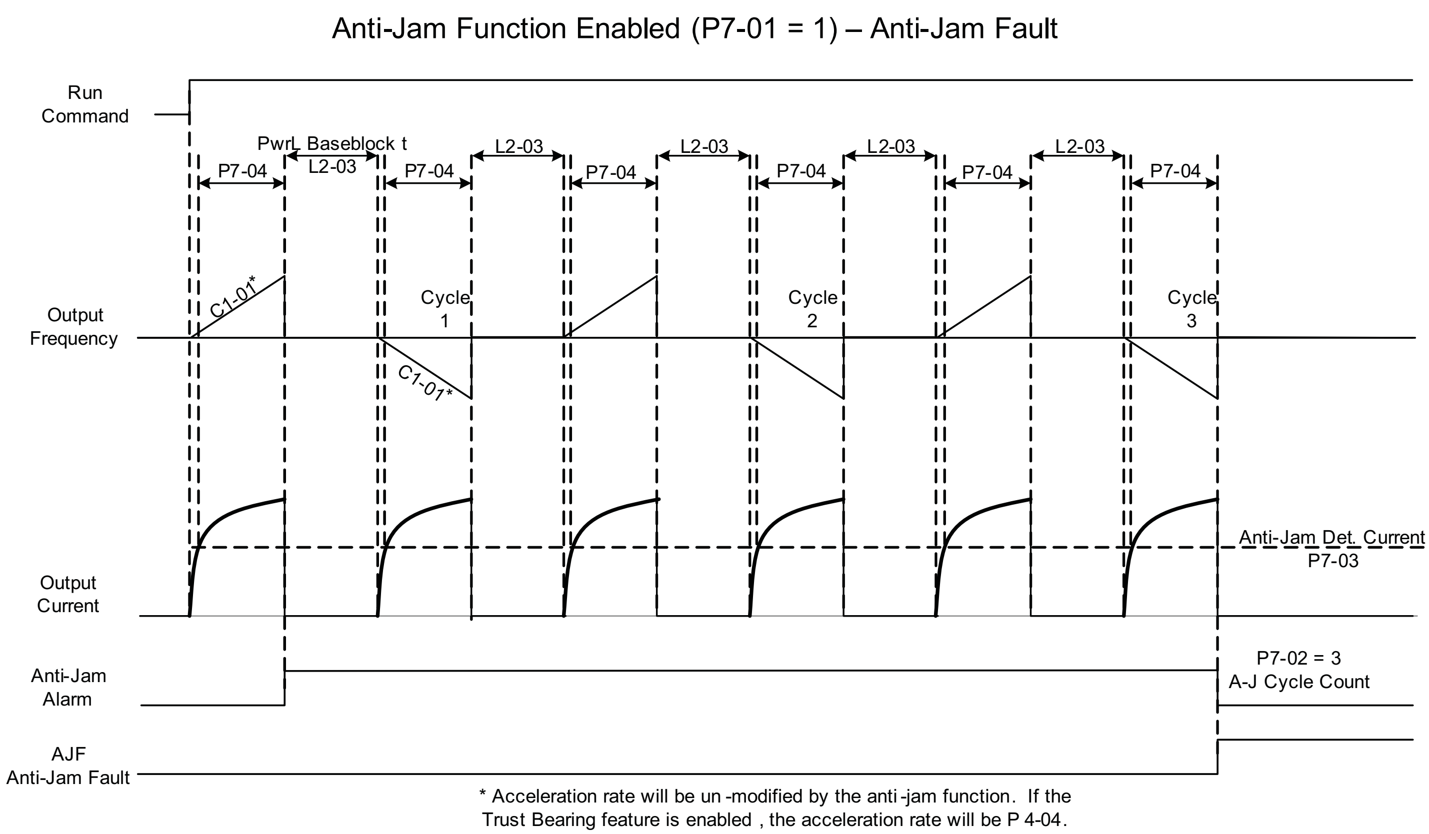


Figure 170. Anti-Jam Function Enabled (P7-01 = 1) - Anti-Jam Fault

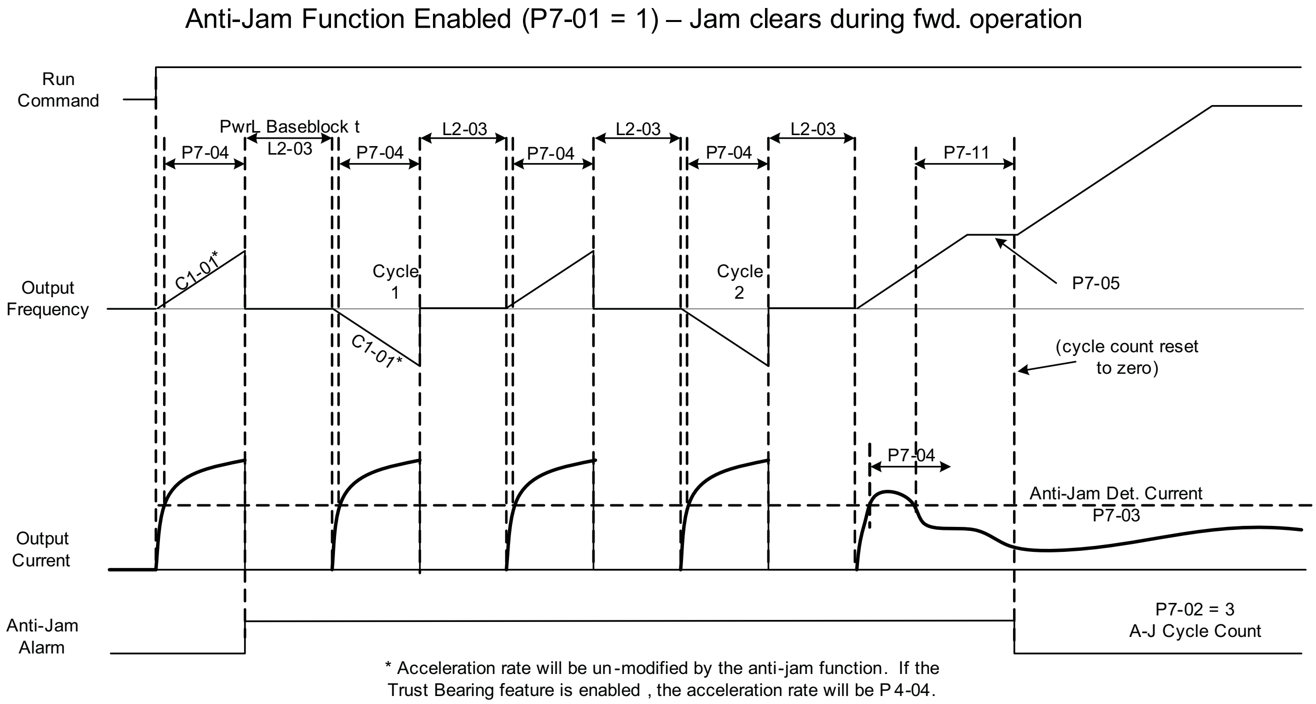


Figure 171. Anti-Jam Function Enabled (P7-01 = 1) - Jam clears during forward operation

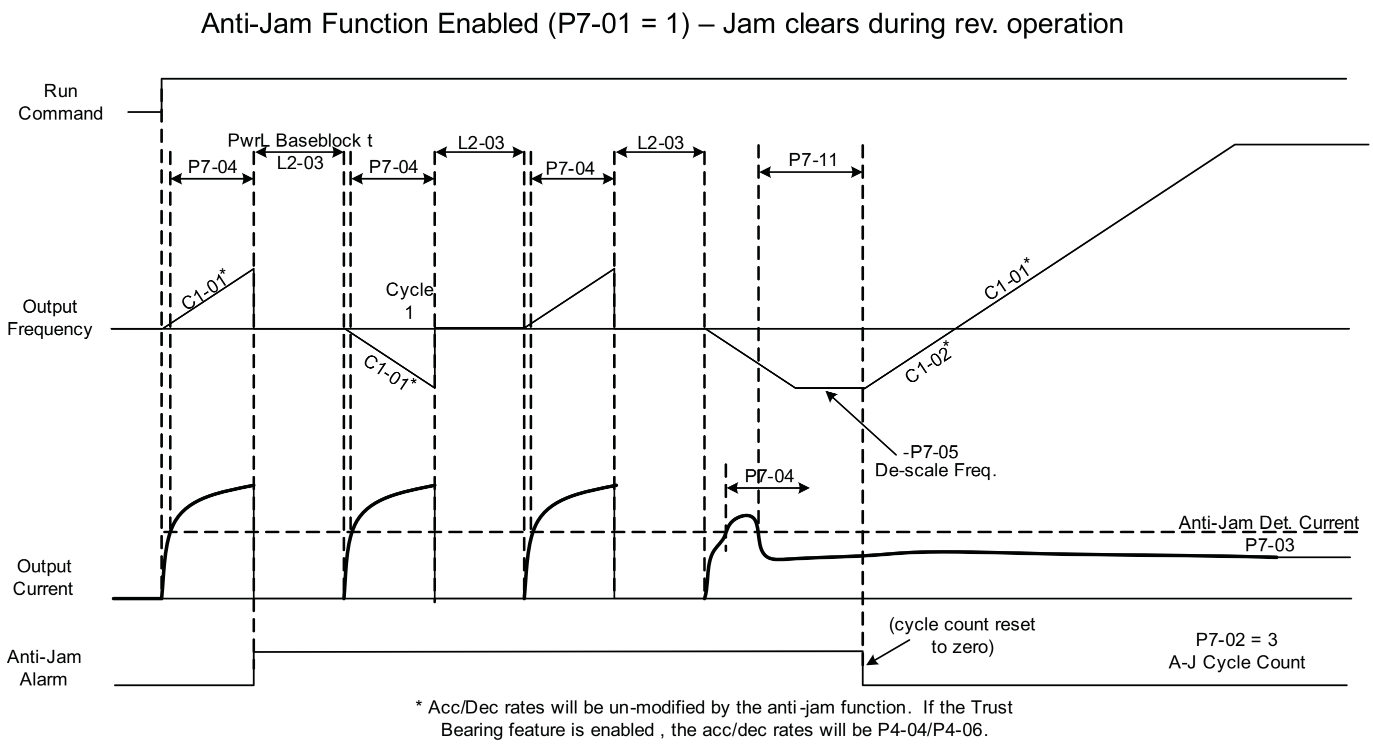


Figure 172. Anti-Jam Function Enabled (P7-01 = 1) - Jam clears during reverse operation

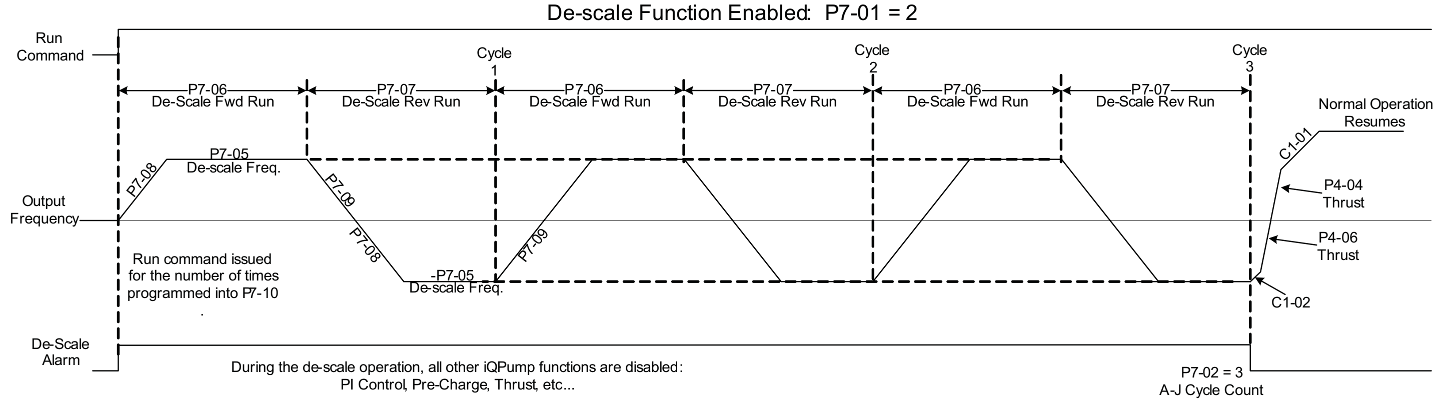


Figure 173. De-Scale Function Enabled (P7-01 = 2)

Table 96 Related Parameters <0034>

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
P7-01	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 ♦	850	Anti-Jam / De-Scale Cycle Count **AJ / DeScaleCycles**	Sets the current level (at start) that will trigger the Anti-Jam function. Set as a percentage of motor rated current.	1 ~ 100	1	Programming
P7-03 ♦	851	Anti-Jam Detection Current Level **A-J Detection 1**	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 ♦	852	Anti-Jam Detection Time **A-J Det. Time**	Sets the amount of time the current has to be above the P7-03 level to trigger the Anti-Jam function.	0.1 ~ 2.0 s	0.3 s	Programming
P7-05 ♦	853	Anti-Jam / De-Scale Frequency Reference **AJ / DeScale 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 ♦	445	De-Scale Forward Run Time **DeScale Fwd Run**	Sets the amount of time the drive will run in forward each cycle during the De-Scale function.	1 ~ 6000 s	10 s	Programming
P7-07 ♦	855	De-Scale Reverse Run Time **DeScale Rev Run**	Sets the amount of time the drive will run in reverse each cycle during the De-Scale function.	1 ~ 6000 s	10 s	Programming
P7-08 ♦	856	De-Scale Acceleration Time **DeScale 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 s)	0.0 ~ 600.0 s	2.0 s	Programming
P7-09 ♦	857	De-Scale Deceleration Time **DeScale Decel**	Sets the amount of time it will take the drive to decelerate from zero to the De-Scale frequency reference P7-05. (internally limited 0.1 ~ 6000.0 s)	0.0 ~ 600.0 s	2.0 s	Programming
P7-10 ♦	858	De-Scale Pump Run Time **DeScale Time**	Sets the number of pump operating hours (pump speed > 0) before a De-Scale routine will run.	0.1 ~ 2000.0 hr.	168.0 hr.	Programming
P7-11 ♦	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 s	2.0 s	Programming
♦ Denotes that parameter can be changed when the drive is running.						

Table 97 Function Text

Function Number	Function Name Digital Operator Display
P7	Anti-Jam / De-Scale **Anti-Jam / De-Scale**

Table 98 Faults <0034>

Fault Display	Description	Cause	Countermeasures
AJF Anti-Jam Fault	Anti-Jam Fault	The drive was not able to clear the debris from the impeller in less than the P4-22 attempts.	Check for proper pump operation Adjust the P4-23 level or the P4-22 counts.

Fault Display	Description	Cause	Countermeasures
oPE16 De-Scale SEt Err	De-Scale Setting Error	A feature incompatible with the De-Scale function is enabled. Included would be Timed Run, Run / Stop, Multiplex, or 2-motor alternation.	Reprogram P7-01, b1-02, P4-18 ~ P4-20, P1-01, or P4-14.

Table 99 Alarm <0034>

Alarm Display	Description	Cause	Countermeasures
Anti-Jam Active	During the Anti-Jam function	The drive is performing an Anti-Jam function.	Alarm will clear when the function is complete.

Table 100 Message <0034>

Alarm Display	Description	Cause	Countermeasures
De-Scale Active	During the De-Scale function	The drive is performing a De-Scale function.	Message will clear when the function is complete.

Table 101 Multi-Function Output Setting

Setting	Description
53	**Anti-Jam / De-Scale** Closed: When the Anti-Jam or the De-Scale features are active (configured by P7-xx)

◆ P7-01 Anti-Jam / De-Scale Operation Selection

Setting	Description
0	Disabled
1	Anti-Jam Enabled
2	De-Scale Enabled
3	Force DeScale

◆ P7-02 Anti-Jam / De-Scale Cycle Count

Setting Range: 1 ~ 100

Factory Default: 1

Refer to parameter P7-02 in Appendix A for description details.

◆ P7-03 Anti-Jam Detection Current Level

Setting Range: 50 ~ 200%

Factory Default: 120%

Refer to parameter P7-03 in Appendix A for description details.

◆ P7-04 Anti-Jam Detection Time

Setting Range: 0.1 ~ 2.0 s

Factory Default: 0.3 s

Refer to parameter P7-04 in Appendix A for description details.

◆ P7-05 Anti-Jam / De-Scale Frequency Reference

Setting Range: 0.00 ~ 120.00 Hz

Factory Default: 25.00 Hz

Refer to parameter P7-05 in Appendix A for description details.

◆ P7-06 De-Scale Forward Run Time

Setting Range: 1 ~ 6000 s

Factory Default: 10 s

Refer to parameter P7-06 in Appendix A for description details.

◆ P7-07 De-Scale Reverse Run Time

Setting Range: 1 ~ 6000 s

Factory Default: 10 s

Refer to parameter P7-07 in Appendix A for description details.

◆ P7-08 De-Scale Acceleration Time

Setting Range: 0.0 ~ 600.0 s

Factory Default: 2.0 s

Refer to parameter P7-08 in Appendix A for description details.

◆ P7-09 De-Scale Deceleration Time

Setting Range: 0.0 ~ 600.0 s

Factory Default: 2.0 s

Refer to parameter P7-09 in Appendix A for description details.

◆ P7-10 De-Scale Pump Run Time

Setting Range: 1.0 ~ 2000.0 hrs

Factory Default: 168.0 hrs

Refer to parameter P7-10 in Appendix A for description details.

◆ P7-11 Anti-Jam Release Time

Setting Range: 0.5 ~ 10.0 s

Factory Default: 2.0 s

Refer to parameter P7-11 in Appendix A for description details.

P8 Pressure and Level Control <0034>

For Quick Set-up procedures refer to TM.iQp.06 iQpump Drive User Manual, Appendix G.

◆ P8-01 Pressure and Level Control Select

Setting Range: 0 ~ 1

Factory Default: 0

Controls the Constant Pressure With Well Draw Down Control.
0: Disabled
1: Enabled

■ Overview

This parameter will allow the drive to control pressure when there is adequate water inside of the well. When the well level drops to the Water Level Setpoint (P8-03), it will regulate the well level and the pressure will be allowed to drop. The drive will also go to sleep, wake up, and / or alarm / fault based on well water level.

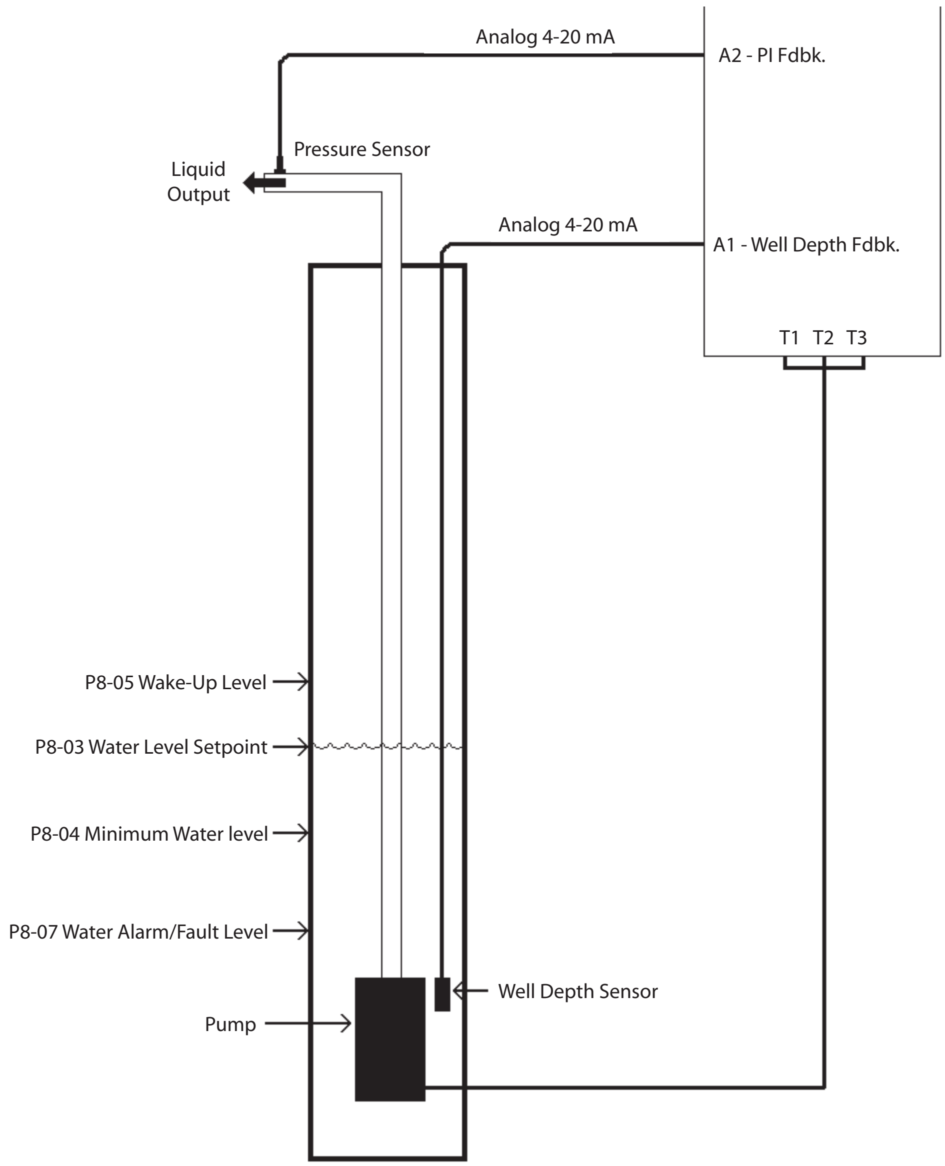


Figure 174. System Overview

■ Basic Concept

When this feature is enabled, the drive will still use the standard iQpump PI controller to control pressure. If the water in the well drops to the Water Level Setpoint (P8-03), the drive will seamlessly switch over and control water level instead using an additional PI controller. Under most circumstances this will cause a reduction in flow rate and pressure, as the drive is then attempting to match the output of the pump to the rate that water is recharging the well. If the pressure returns to the pressure Setpoint at any time, the drive will seamlessly switch back to controlling pressure.

If the well level drops below the Minimum Water Level (P8-04) for more than the Sleep Delay Time (P2-03), the drive will go to sleep. The drive will resume operation when the level in the well goes above the Wake-Up Level (P8-05) for more than the Start Level Delay Time (P1-05).

There is a water level detection feature as well. If the water level drops below the Low Level Detection Level (P8-07) for more than the Low Level Detection Time (P8-08), the drive will respond depending on the setting of the Low Level Behavior (P8-09) parameter. This feature is also active in "Hand" mode.

The drive will NOT perform a sleep boost if it is being forced to sleep based on the water level.

■ Function Description <0034>

Enabling Level Control Features

The level control features, pressure and level control plus Low Level Detection can be enabled by setting parameter P8-01 to 1 (Enabled). The drive will only perform the pressure and level control when "normal" PI mode is enabled
(b5-01 > 0, not jogging, not disabled via MFDI, etc.), and drive is not in a multiplex mode (P1-01 > 0).

Sensing Water Level

Terminal A1 will act as the water level analog input. An analog pressure sensor, mounted down in the well at the pump will provide the required signal. Parameter P8-02 should be set to the full-scale pressure of the transducer. The drive will then convert the reported pressure into an amount of water above the pump. (2.308966 ft / psi) This level will be displayed on the U1-98 monitor.

Wire break will be detected on Terminal A1 when:

- PI Feedback Loss Detection is enabled (b5-12 = 1 or 2)
- Pressure and Level control is enabled (P8-01 = 1)
- PI is NOT disabled via Multi-Function Digital Input
- Signal on Terminal A1 goes below -6.25% or above 106.25% for more than 1 second

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

The drive will then react depending on how parameter b5-12 is programmed.

Note: To convert Terminal A1 to 4-20 mA signal, connect a 250 Ohm precision resistor (1/4 Watt or greater) between A1 and AC. Then program H3-02 = 231.2% and H3-03 = 25.0%.

Pressure and Level Control

When there is adequate water available in the well, the drive will regulate pressure using virtually all of the standard iQpump features, including but not limited to: sleep, sleep boost, minimum pump speed, thrust bearing, pre-charge, utility delay, etc.

The drive can respond in one of two ways to a drop in water level inside of the well. If the Water Level Setpoint (P8-03) is programmed to a value greater than the Minimum Water Level (P8-04), the drive will attempt to regulate the water level in the well to the P8-03 level. As the water level approaches the P8-03 level, the drive will slow down which will cause pressure and flow will also decrease. The drive will then regulate output speed in order to maintain the level in the well. The response of the drive when regulating level can be adjusted using parameters P8-10 and P8-11. However, if the level in the well drops below the Minimum Water Level (P8-04), for more than the Sleep Delay Time (P2-03), the drive will go to sleep. When the water recharges the well to above the P8-05 level for more than the P1-05 time, normal operation (pressure regulation) will resume.

Note: The Level Control Minimum Speed parameter (P8-06) should be set to a high enough value to insure flow.

The other way that the drive can respond is to try and maintain the pressure setpoint, then go to sleep immediately based on water level. This can be accomplished by programming the Water Level Setpoint (P8-03) to a value less than the Minimum Water Level (P8-04). When the level in the well drops below the Minimum Water Level (P8-04), for more than the Sleep Delay Time (P2-03), the drive will go to sleep. When the water recharges the well to above the P8-05 level for more than the P1-05 time, normal operation (pressure regulation) will resume.

Sleep and Wake-Up Methods

The drive will go to sleep in one of two ways. As described above, if the actual water level drops below the Minimum Water Level (P8-04) for more than the Sleep Delay Time (P2-03), the drive will go to sleep without performing a sleep boost. The drive can also go to sleep based upon the standard sleep settings, controlled by parameters P2-01 and P2-02. If the drive goes to sleep due to P2-01 and P2-02, a sleep boost will be performed.

When the level control is enabled (P8-01 = 1), the drive will only wake up (or start) once the water level goes above the wake-up level (P8-05) AND the standard sleep function calls for a wake-up (set by parameters P1-04 and P1-05.

Low Level Detection

Independent of the pressure and level control is a low level detection feature. This feature is active all of the time, when running, when not running, and in “Hand” mode. If 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), the drive will respond according to the Low Level Behavior (P8-09) parameter. The Low Water Level digital output (H2-0x = 57) will activate anytime 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 the drive is faulted on a LOWWL - Low Water Level fault.

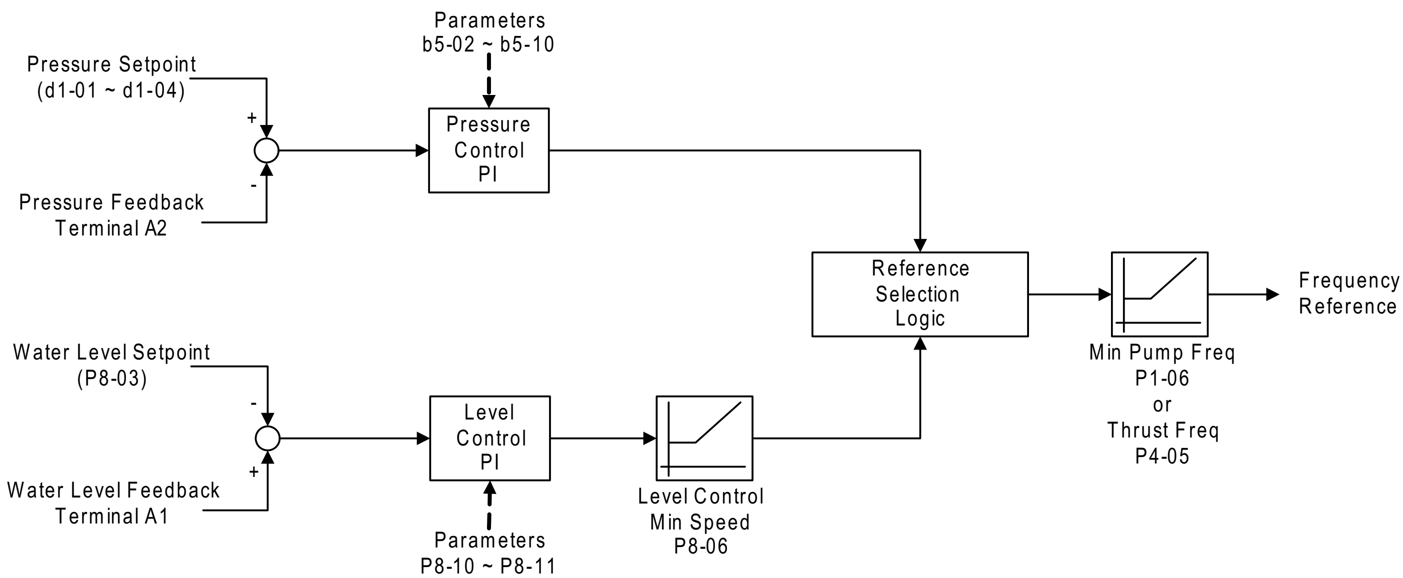


Figure 175. Simple Block Diagram of Pressure & Level Control

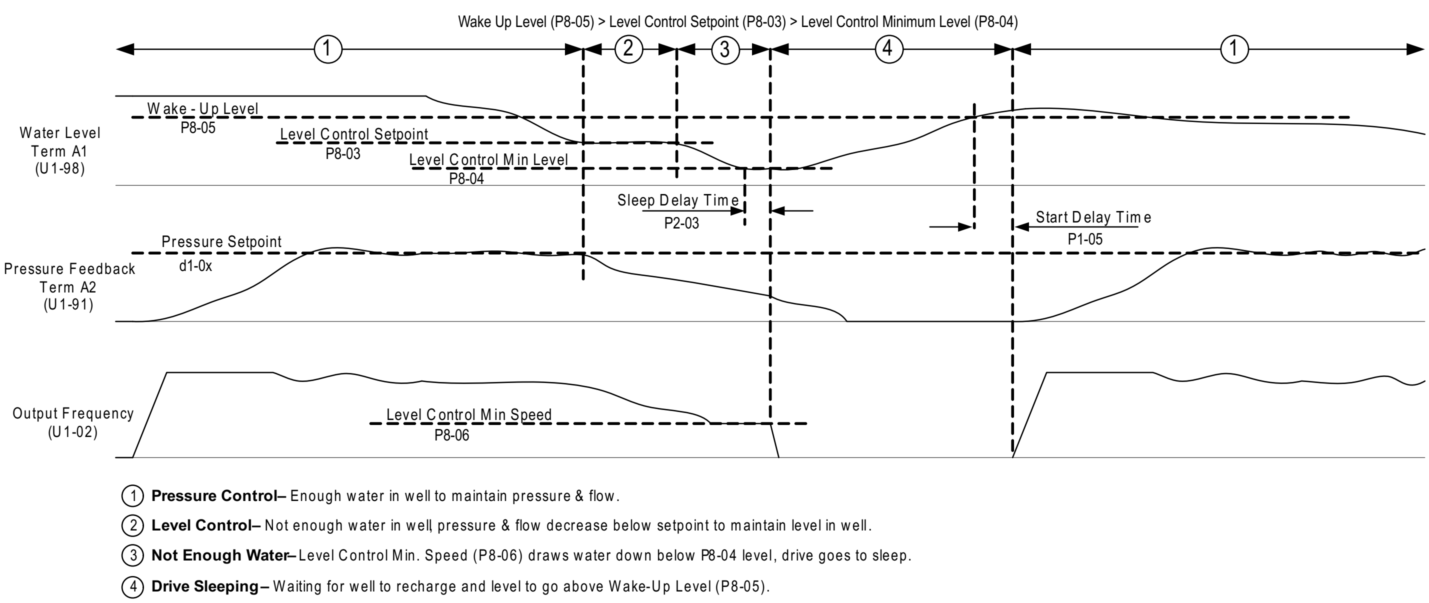


Figure 176. Constant Pressure with Well Draw Down Control - Regulate Water Level (reduced flow & pressure)

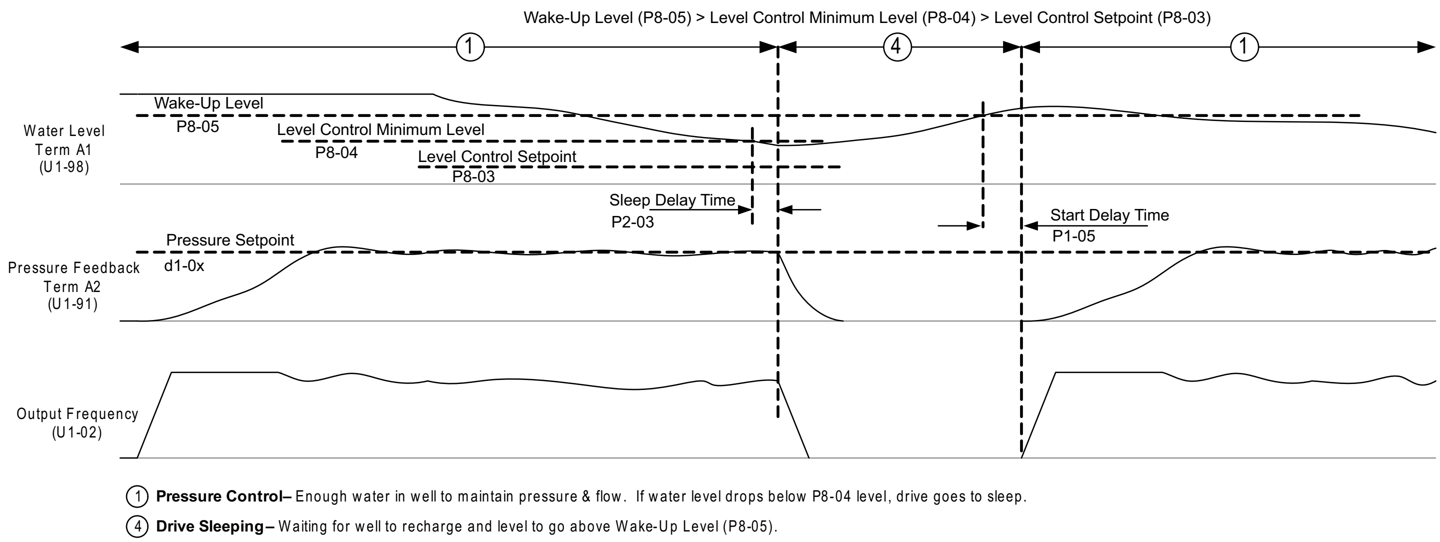


Figure 177. Constant Pressure with Well Draw Down Control - Maintain Flow and Pressure

Table 102 Related Parameters

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
P8-01	860	Pressure and Level Control Select **Pres&Lvl Control**	Enables / Disables the Constant Pressure With Well Draw Down Control. 0: Disabled 1: Enabled	0 ~ 1	0	Programming
P8-02	861	Water Level Scaling **Water Lvl Scale**	Sets the full scale (20 mA) output of the pressure transducer that is connected to Terminal A1.	5 ~ 500 psi	100	Programming
P8-03 ♦	862	Water Level Setpoint **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	Programming
P8-04 ♦	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	Programming
P8-05 ♦	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 will have to go above this level for more than the P1-05 time in order to wake up.	0.0 ~ 1200.0 ft	30.0	Programming
P8-06 ♦	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 & P4-05, P1-06 & P4-05 will be used as the minimum speed.	0.00 ~ 120.0 Hz	0.00	Programming
P8-07 ♦	866	Low Level Detection Level **Low Level Detect**	When the amount of water above the sensor 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 ft	0.0	Programming
P8-08 ♦	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 min	0.1	Programming
P8-09	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	0 ~ 2	1	Programming
P8-10 ♦	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
P8-11 ♦	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 s	5.00	Programming
♦ Denotes that parameter can be changed when the drive is running.						

Table 103 Function Text

Function Number	Function Name Digital Operator Display
P6	Flow Meter Setup **Flow Meter Setup**
P8	Pressure and Level Control **Pres&Lvl Control**

Table 104 Monitors

Monitor No.	Addr. Hex	Monitor Name Digital Operator Display	Description
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 * 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 * 1000 + U1-96. Value retained in EEPROM.
U1-98	72C	Water Level **Water Level**	Displays the amount of water above the water level sensor.

Table 105 Multi-Function Input Setting

Setting	Description
75	**Reset Accum** Closed: Volume accumulated will be reset to zero (and held at zero if digital input remains closed).

Table 106 Multi-Function Output Setting

Setting	Description
57	**Low Water Level** This will energize if 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.

Table 107 Faults

Fault Display	Description	Cause	Countermeasures
LOWFL Low Flow	Low flow has been detected by the flow meter.	Not enough flow, or incorrect “P6” settings	—
LOWWL Low Water Level	Low Water Level	Water Level has gone below the P8-07 level for more than the P8-08 time.	—
ACCUM Accum Level	Accumulated Level	Accumulated level has exceeded the P6-09 and P6-10 settings.	Reset the accumulated level (P6-03 or via digital input)
OPE13 Terminal A1	Programming error	Terminal A1 is being 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) - Level Control Enabled (P8-01 =1) - Hand Mode Ref Term A1 (P5-01 = 0)	Reprogram b1-01, b5-01, P6-01 or P8-01.
OPE14 FlowMtrNotEnable	Programming error	The sleep level type has been set to “FlowMtr-Term A1” (P2-01 = 4) but the flow meter function is not enabled (P6-01 = 0.0)	Reprogram P2-01 or P6-01.
HIFLO High Flow	High flow has been detected by the flow meter.	Too much flow or incorrect “P6” settings.	—

Table 108 Alarms

Alarm Display	Description	Cause	Countermeasures
LOWFL Low Flow	Low flow has been detected by the flow meter.	Not enough flow, or incorrect “P6” settings	—
LOWWL Low Water Level	Water Level has gone below P8-07 level for more than the P8-08 time.		
ACCUM Accum Level	Accumulated Level	Accumulated level has exceeded the P6-09 and P6-10 settings.	Reset the accumulated level (P6-03 or via digital input)

Alarm Display	Description	Cause	Countermeasures
HIFLO High Flow	High flow has been detected by the flow meter.	Too much flow or incorrect “P6” settings.	—

◆ P8-02 Water Level Scaling

Setting Range: 5 ~ 500 psi

Factory Default: 100

Refer to parameter P8-02 in Appendix A for description details.

◆ P8-03 Water Level Setpoint

Setting Range: 0.0 ~ 1200.0 ft

Factory Default: 20.0

Refer to parameter P8-03 in Appendix A for description details

◆ P8-04 Minimum Water Level

Setting Range: 0.0 ~ 1200.0 ft

Factory Default: 10.0

Refer to parameter P8-04 in Appendix A for description details.

◆ P8-05 Wake-Up Water Level

Setting Range: 0.0 ~ 1200.0 ft

Factory Default: 30.0

Refer to parameter P8-05 in Appendix A for description details.

◆ P8-06 Level Control Minimum Speed

Setting Range: 0.00 ~ 120.00 Hz

Factory Default: 0.00

Refer to parameter P8-06 in Appendix A for description details.

◆ P8-07 Low Level Detection Level

Setting Range: 0.0 ~ 1200.0 ft

Factory Default: 0.0

Refer to parameter P8-07 in Appendix A for description details.

◆ P8-08 Low Level Detection Time Delay

Setting Range: 0.0 ~ 300.0 min

Factory Default: 0.1

Refer to parameter P8-08 in Appendix A for description details.

◆ P8-09 Low Level Behavior

Setting Range: 0 ~ 2

Factory Default: 1

Refer to parameter P8-09 in Appendix A for description details.

◆ P8-10 Level Control Proportional Gain

Setting Range: 0.00 ~ 25.00

Factory Default: 2.00

Refer to parameter P8-10 in Appendix A for description details.

◆ P8-11 Level Control Integral Time

Setting Range: 0.0 ~ 360 s

Factory Default: 5.00

Refer to parameter P8-11 in Appendix A for description details.

P9 Network Options <0034>

Note: For P9 group to be active, set P1-01 = 3 (MEMOBUS / Modbus)

◆ P9-01 Lead Drive Selection

Setting	Description
0	Next Available
1	Lowest Runtime

◆ P9-02 Feedback Source

Setting	Description
0	Analog Only
1	Ana => Net, No Alarm
2	Ana => Net, Alarm
3	Network Only

This parameter has the ability to run the iQpump MEMOBUS/Modbus Network with just one drive connected to a PI Feedback Source and automatically switch from the Analog Feedback Source to the Network PI Feedback Source in case of transducer or wire breaks.

The drive Analog PI feedback signal and status is sent to the iQpump MEMOBUS/Modbus network. The status is dependent on the regular PI Feedback Loss (b5-13 and b5-14) that is run in the background per drive. If the status is good and the drive is the current Lead drive, that feedback signal is then used as the Network PI Feedback and will be constantly sent to all the drives in the network. If the current Lead drive does not have a good status, then the Network PI Feedback is taken from another drive which has a good status.

When there is no Analog Feedback signal for PI Feedback, then the drive will use the Network PI Feedback register if it's allowed (see P9-02 modes) and flash an alarm if desired.

When P1-01 = 3 and P9-02 = 1 or 2, parameter b5-12 will only do the specified action when the Network Feedback signal is lost (will happen when none of the drives in the system has a valid PI feedback signal).

■ Function Description: <0034>

When P1-01 = 3 and b5-12 > 0, the analog feedback detection process is started automatically for all drives on the network that has P9-02 ≠ 3 as soon as one of the drive gets a run command and is not running in pre-charge mode. When using the same parameters on a 4-20mA feedback source (H3-08 = 2 and H3-09 = B), the analog feedback detection process is always active. Drives that fail on the feedback detection will indicate that their feedback signals are invalid and will not be considered by the iQpump MEMOBUS/Modbus Network as good sources. The network in turn will read out the valid signals, select using lead-drive priority, and send it back to all the drives as the Network PI Feedback. If the current lead drive has a valid analog feedback signal, then it will be the Network PI Feedback signal. Otherwise, the Network PI Feedback signal is set to a drive with a good analog signal based on the Drive Discovery of the iQpump MEMOBUS/Modbus Network. In both cases, a status bit is also sent out indicating that the network has a good feedback source.

When P9-02 = 0 (Analog Only), the drive will never read the Network PI Feedback register as the feedback source, even though the drive will still transmit its own PI Feedback signal to the network. The feedback detection is based solely on parameter b5-12.

When P9-02 = 1 (Ana => Net, No Alrm), the drive will read the Network PI Feedback register if the analog feedback detection determines a signal loss. If the network Feedback signal is invalid as well, it will act according to b5-12 (= 1 or 2). Note that setting b5-12 = 0 and H3-09 = B will disable analog feedback detection and will prevent the drive from switching to the Network PI Feedback.

When P9-02 = 2 (Ana => Net, Alarm), the drive will read the Network PI Feedback register if the analog feedback detection determines a signal loss. In addition, an alarm will be displayed indicating that the analog has been lost, and that the feedback source is now the network. If the network Feedback signal is invalid as well, it will act according to b5-12 (= 1 or 2). Note that settings b5-12 = 0 and H3-09 = B will disable analog feedback detection and will prevent the drive from switching to the Network PI Feedback.

When P9-02 = 3 (Network Only), the drive will always read the Network PI Feedback register. If the network feedback signal is invalid, it will act according to b5-12 with the following differences:

- b5-12 = 1: Instead of alarm, NetwrkFB Lost message
- b5-12 = 2: Instead of fault, NetwrkFB Lost message, drive will not accept iQpump Network run commands, and coasts-to-stop

Note: Any drive with b5-12 = 0, H3-09 = B, and P9-02 ≠ 3 will effectively have no feedback loss detection (unless Wire Break detection is used) and will continuously send the Analog PI Feedback to the iQpump Network regardless of whether it is a healthy signal or not.

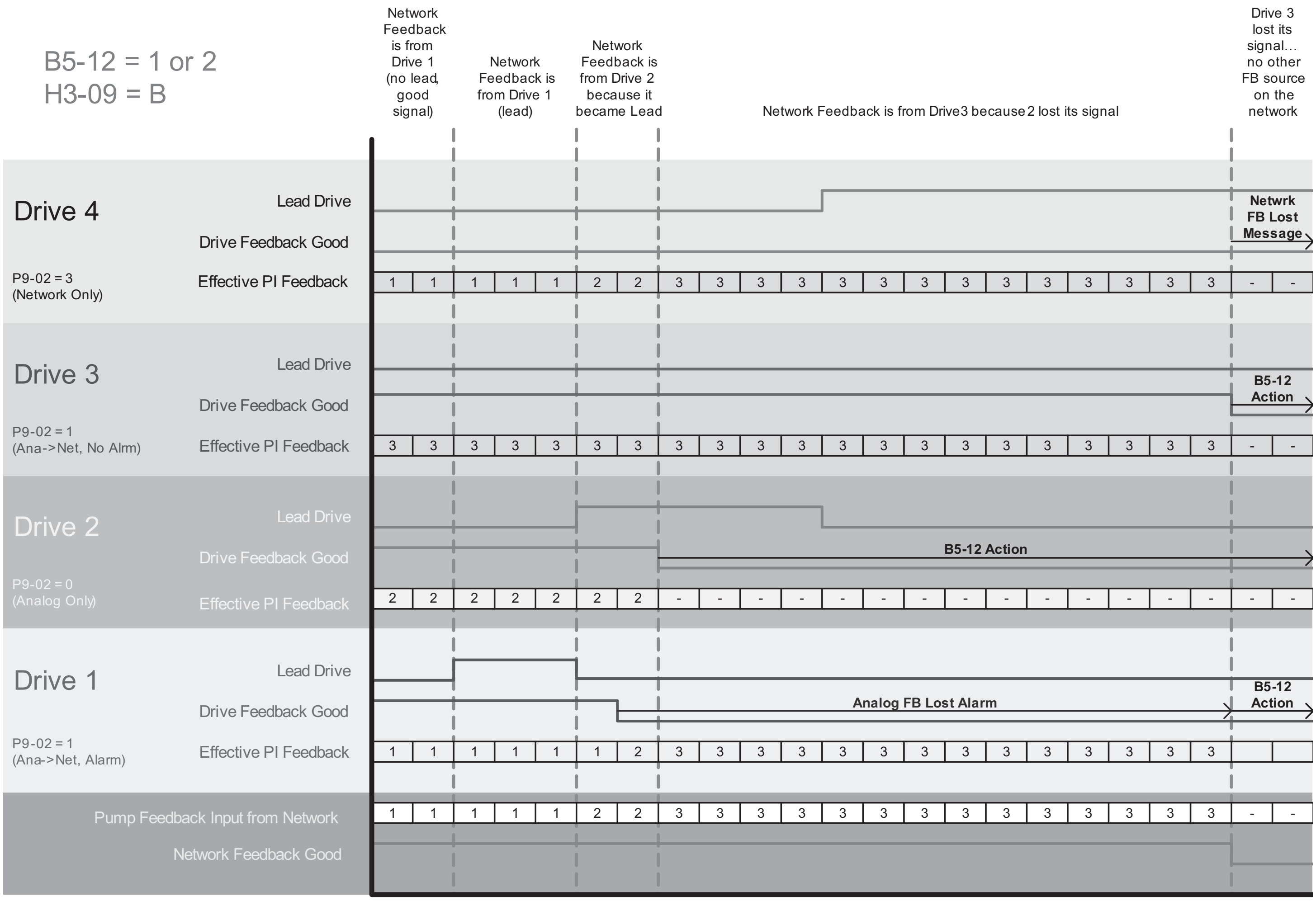


Figure 178. PI Network Feedback Selection

Table 109 Related Parameters

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
b5-12	1B0	PI Feedback Reference Missing Detection Selection **Fb los Det Sel**	0: Disabled 1: Alarm 2: Fault	0 ~ 2	2	Programming
b5-13	1B1	PI Feedback Loss Detection Level **Fb los Det Lvl**	Sets the PI feedback lost detection level as a percentage of maximum frequency (E1-04).	0 ~ 100	0%	Programming
b5-14	1B2	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 s	2.0 s	Programming

Table 110 Parameters

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
P9-02	088	Feedback Source **Feedback Source**	Defines which signal to use for PI Feedback 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

Table 111 Multi-Function Input Setting

Setting	Description
75	**Reset Accum** Closed: Volume accumulated will be reset to zero (and held at zero if digital input remains closed).

Table 112 Alarms

Alarm Display	Description	Cause	Countermeasures
Analog FB Lost Switched to Net	Analog Feedback has not been detected and the Network PI Feedback signal is now used.	Feedback level dropped below b5-13 for the time set in b5-14.	If the feedback source is functional, change b5-13 or b5-14 to the correct level and time delay.
		H3-09 ≠ B (PI Feedback)	Set H3-09 = B (PI Feedback) if the analog input source is to be used for PI Feedback. Otherwise, set P9-02 = 3 if the drive does not have an analog PI Feedback source
		Defective or broken analog input source.	Check to ensure the PI Feedback source is installed and working properly. If there is

Table 113 Messages

Message Display	Description	Cause	Countermeasures
Network FB Lost Check FB Source	Network PI Feedback has been lost	No valid analog PI Feedback source can be found on the network.	Check the feedback source on drives configured as P9-02 ≠ 3.

◆ P9-03 Alternation Time

Setting Range: 0 ~ 1000 hr

Factory Default: 24 hr

Refer to parameter P9-03 in Appendix A for description details.

◆ P9-04 Alternation Mode

Setting	Description
0	FIFO Auto
1	FIFO Forced
2	LIFO
3	FIFO @ Sleep
4	LIFO @ Sleep

This parameter minimizes uneven run-times in a multi-pump system.

The First Drive is defined as the first pump that was run in the system (see MEMOBUS / Modbus Multiplex Diagrams 1 and 2: Run Order / Pump #). The Last Drive is defined as the Lead Drive.

Alternation can be requested by a drive when a specified time has expired. Two basic modes allow the timer to either run from the lead drive (LIFO - Last In, First Out), or from the first drive (FIFO - First In, First Out). When the timer expires, the drive is removed from the system and consequently turned-off, and a new lead drive is brought online to replace it. In FIFO, another mode (FIFO Auto) gives control to the Multiplex system on bringing the new lead drive online.

Since the iQpump MEMOBUS / Modbus Network uses monitor U1-13 when P9-01 = 1 (Lowest Runtime), lead drive selection is thus directly affected by o2-07 and o2-08. It is recommended to keep o2-08 = 1 (Running Time). It should be noted that when U1-13 goes past 65535 hours, it gets reset to zero.

■ Function Description: <0034>

When the Alternation Time P9-03 (with unit based on P9-19) is not set to 0, the Alternation feature is enabled, and is based on the P9-04 (Alternation Mode) parameter. In FIFO, the timer is run on the first drive while in LIFO it is on the lead drive. When the timer expires, the drive requests alternation based on the P9-04 setting and sends that information to the MEMOBUS / Modbus network.

Setting P9-04 to “0: FIFO Auto” will remove the first drive in the running queue and will start the lead drive automatically (if needed) using the MEMOBUS / Modbus Multiplex function. If there is only one drive running, then the new lead drive is forced to run since the MEMOBUS / Modbus Multiplex function can not run if there is no lead drive.

Setting P9-04 to “1: FIFO Forced” will remove the first drive in the running queue and will force a new lead drive to run.

Setting P9-04 to “2: LIFO” will remove the current lead drive and replace it with a new lead drive.

Setting P9-04 to “3: FIFO @ Sleep” acts the same as P9-04 =1 except alternation is only requested when the drive is in Sleep Mode. The new lead drive is selected using parameter P9-01.

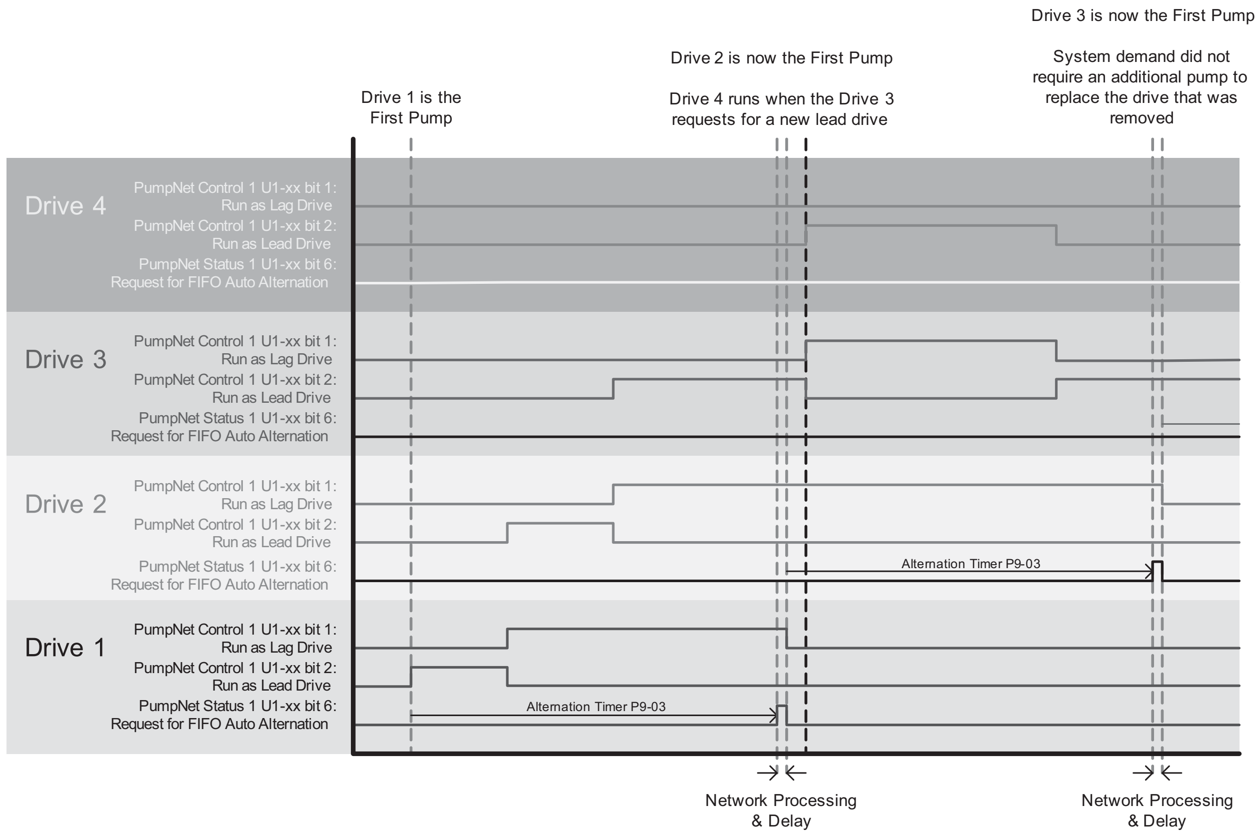


Figure 179. Alternation Mode is FIFO Auto

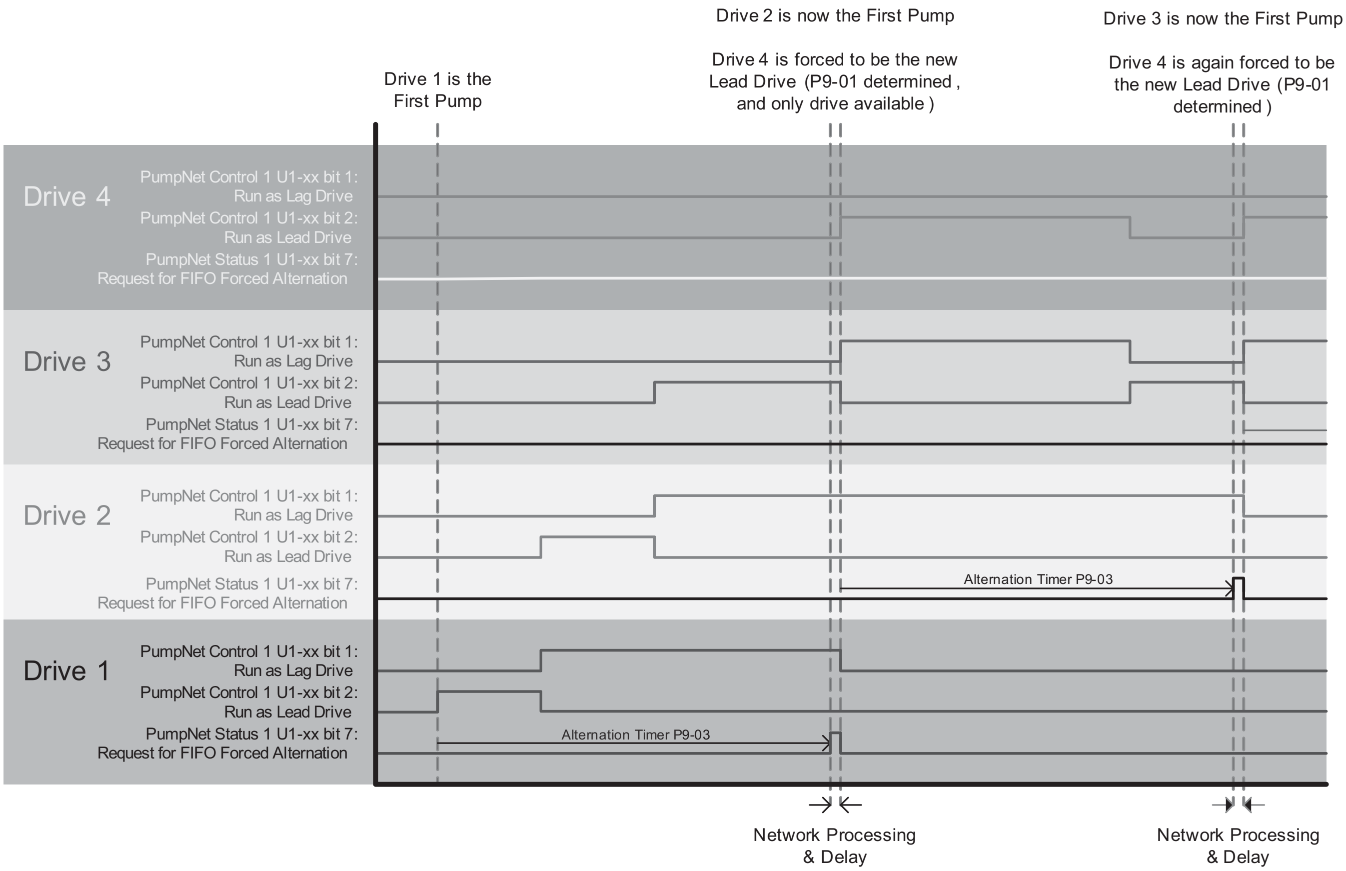


Figure 180. Alternation Mode is FIFO Forced

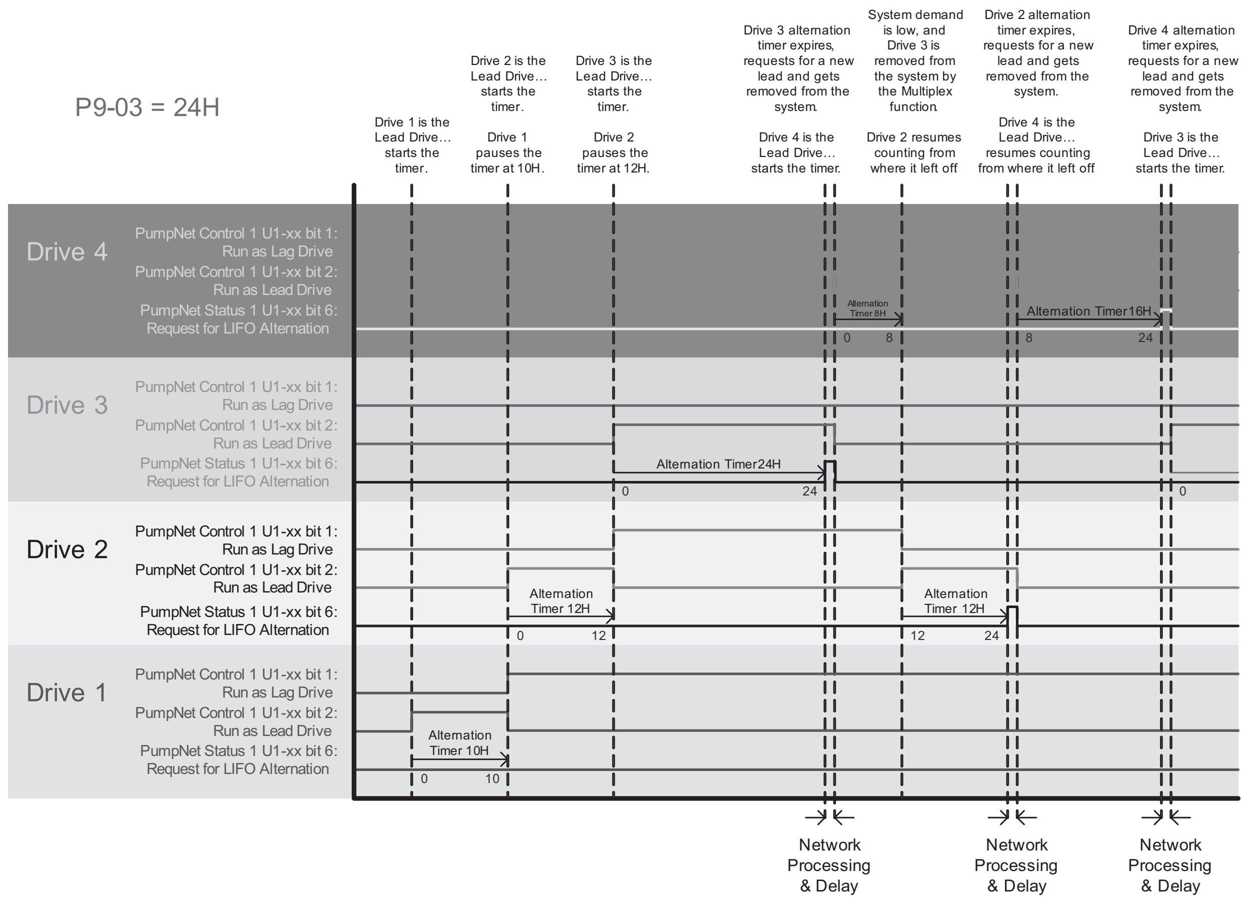


Figure 181. Alternation Mode is LIFO

Table 114 Related Parameters

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
P9-01	0880	Lead Drive Selection **Lead Drive Sel**	Specifies how the next Lead Drive is selected: 0: Next Available 1: Lowest Runtime	0 ~ 1	0	Programming

Table 115 Parameters

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location
Parameter functionality stated below only applies when P1-01 = 3 (MEMOBUS / Modbus Network)						
P9-03 ♦	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 the parameter is set to 0.	0 ~ 1000 H	24 H	Programming
P9-04	0883	Alternation Mode **Alternation Mode**	Determines how alternation is performed: 0: FIFO Auto 1: FIFO Forced 2: LIFO 3: FIFO @ Sleep	0 ~ 3	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
♦ Denotes that parameter can be changed when the drive is running.						

Table 116 Monitors

Monitor No.	Addr. Hex	Monitor Name Digital Operator Display	Description
U1-68	0009C	Time to Alternate **Time to Alternate**	Time remaining before a drive requests alternation which is dependent on P9-04.

Monitor shown only when P1-01 = 3 (MEMOBUS / Modbus Network)

◆ P9-05 Lag Drive Mode

Setting	Description
0	Fixed Speed - Runs at the P9-06 setting.
1	PI Regulation - Uses PI to determine speed.

◆ P9-06 Lag Fixed Speed

Setting Range: 0.00 ~ 120.00 Hz

Factory Default: 55.00 Hz

Refer to parameter P9-06 in Appendix A for description details.

◆ P9-07 Lag Fixed Speed Delay

Setting Range: 0.0 ~ 1000 s

Factory Default: 5 s

Refer to parameter P9-07 in Appendix A for description details.

◆ P9-08 Add Pump Mode

Setting	Description
0	Output Frequency
1	Feedback
2	Feedback + Fout

◆ P9-09 Add Freq Level

Setting Range: 0.0 ~ 120.0 Hz

Factory Default: 56.0 Hz

Refer to parameter P9-09 in Appendix A for description details.

◆ P9-10 Add Delta Level

Setting Range: 0 ~ 6000.0

Factory Default: 5.0

Refer to parameter P9-10 in Appendix A for description details.

◆ P9-11 Add Delay Time

Setting Range: 0 ~ 3600 s

Factory Default: 10 s

Refer to parameter P9-11 in Appendix A for description details.

◆ P9-12 Remove Pump Mode

Setting	Description
0	Output Frequency
1	Feedback
2	Feedback + Fout

◆ P9-13 Remove Freq Level

Setting Range: 0.0 ~ 120.0 Hz

Factory Default: 40.0 Hz

Refer to parameter P9-23 in Appendix A for description details.

◆ P9-14 Remove Delta Level

Setting Range: 0 ~ 6000.0

Factory Default: 0.0

Refer to parameter P9-24 in Appendix A for description details.

◆ P9-15 Remove Delay Time

Setting Range: 0 ~ 3600 s

Factory Default: 10 s

Refer to parameter P9-15 in Appendix A for description details.

◆ P9-16 Stabilization Time

Setting Range: 0 ~ 3600 s

Factory Default: 3 s

If Stabilize Time P9-16 > 0, then whenever a pump becomes a lag drive, or gets de-staged that disables lead-lag control and pump protection. It will resume these functions when the timer P9-16 expires, which counts only when the drive becomes a lead drive once again.

◆ P9-17 Setpoint Modifier

Setting Range: -6000.0 ~ 6000.0

Factory Default: 0.0

Setpoint Modifier P9-17 is used to increase or decrease the setpoint each time an additional pump is brought online to compensate for system losses or gains. The drive's setpoint is modified using this calculation:

Pump X: Setpoint + ((X-1)(P9-17))

Thus, if there is only one pump running, the setpoint is not modified.

◆ P9-18 High Feedback Quick De-Stage

Setting Range: 0.0 ~ 100.0%

Factory Default: 90.0%

Refer to parameter P9-18 in Appendix A for description details.

◆ P9-19 Alternation Unit

Setting	Description
0	Hours (hr)
1	Minutes (min)

Refer to parameter P9-19 in Appendix A for description details.

◆ P9-20 Allow Network Run

Setting	Description
0	Always
1	First / Alternation
2	First Only
3	Alternation Only

Refer to parameter P9-20 in Appendix A for description details.

◆ P9-21 Run Priority

Setting Range: 1 ~ 16

Factory Default: 8

Refer to parameter P9-21 in Appendix A for description details.

◆ P9-22 System Fault Retry

Setting Range: 0 ~ 10

Factory Default: 5

Refer to parameter P9-22 in Appendix A for description details.

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Range	Default	Menu Location
Parameter functionality below only applies when P1-01 = 3 (MEMOBUS / Modbus Network)						
P9-22 ♦	0895	System Fault Retry **System Flt Retry**	Determines the number of times the iQpump MEMOBUS / Modbus 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 networked drives. Only applies when P1-01 = 3 (MEMOBUS / Modbus Network)	0 ~ 10	0	Programming

◆ P9-23 Max Number of Running Pumps

Setting Range: 1 ~ 16

Factory Default: 16

Refer to parameter P9-23 in Appendix A for description details.

◆ P9-24 Lead Swap @ Sleep

Setting Range: 0 ~7200 s

Factory Default: 0 s

Refer to parameter P9-24 in Appendix A for description details.

◆ P9-25 Highest Node Address

Setting Range: 02 h ~ 10 h

Factory Default: 08 h

Refer to parameter P9-25 in Appendix A for description details.

◆ P9-26 Master Time-Out

Setting Range: 3.0 ~ 10.0 s

Factory Default: 4.0 s

Refer to parameter P9-26 in Appendix A for description details.

◆ P9-27 Network Recovery

Setting Range: 3.0 ~ 10.0 s

Factory Default: 4.0 s

Refer to parameter P9-27 in Appendix A for description details.

◆ P9-28 NETSCAN Alarm Time

Setting Range: 1.0 ~ 10.0 s

Factory Default: 2.0 s

Refer to parameter P9-28 in Appendix A for description details.

◆ P9-29 Net Start Delay

Setting Range: 0.0 ~ 60.0 sec

Factory Default: 2.0 s

Refer to parameter P9-29 in Appendix A for description details.

◆ iQpump MEMOBUS / Modbus Multiplex

■ MEMOBUS / Modbus Multiplex

In order to run and control networked pumps, multiplexing needs to be implemented

After the iQpump memobus network is established, it will continually look for a drive that is ready to run (has Auto mode run, and not faulted). It will command that drive to run in PI (thus becoming the lead drive) so that it can regulate the system pressure. When the pressure is too low that it can no longer be maintained, the lead drive will attempt to pass the lead responsibility either to the next available or to drive with the lowest runtime. The previous lead drive becomes a lag drive and will run at either PI regulation or a set frequency thus making the new lead drive regulate the system pressure. This process is referred to as staging.

If the system pressure gets too high that a drive needs to shut down (unless it's the only drive left), the lead drive will attempt to shut off and pass the lead responsibility back to the previous drive. This process is referred to as de-staging.

The selection of the new lead drive depends on the setting of a new parameter, P9-01 (Lead Drive Selection). When P9-01 = 0, the next lead drive will be the next drive that the iQpump MEMOBUS / Modbus network has detected during its drive discovery scan. When P9-01 = 1, the next lead drive will be the drive with the lowest run-time based on U1-13 (affected by o2-07 and o2-08).

Since the iQpump MEMOBUS / Modbus network uses monitor U1-13 when P9-01 = 1 (Lowest Runtime), lead drive selection is thus directly affected by o2-07 and o2-08. It is recommended to keep o2-08 = 1 (Running Time). It should be noted that when U1-13 goes past 65535 hours, it gets reset to zero.

■ Function Description: <0034>

When P1-01 = 3 (Pump Mode = MEMOBUS / Modbus Network), issuing an Auto mode run will add it to the list of networked drives that are available to run. At system start-up, the iQpump MEMOBUS / Modbus network will look for a drive available to run based on parameter P9-01 (Lead Drive Selection). If there's an available drive, it will send a network command to run it as a lead drive (running in PI). When P9-29 Net Start Delay is greater than 0.0s and the system is stopped, the system will wait the P9-29 setting after the first Auto mode drive has been detected. This will allow other drives to be put on Auto mode and be considered for lead selection. All the drives in the system will show a Net Start Dly message when the timer is still counting.

The P9-01 parameter is always used when there is a network request to stage.

A setting of "0: Next Available", will look for the next drive ready-to-run in the network queue which is based on when the drive was detected in the network. If the search reaches the end of the queue without finding a suitable drive, it will loop around to the first detected drive. *Figure 182.* shows an example of how the lead-lag operation will work for this setting.

A setting of "1: Lowest Runtime" will look for the drive that is ready-to-run on the network that has the lowest runtime (based on monitor U1-13, which is affected by parameters o2-07 and o2-08). *Figure 187.* shows an example of how the lead-lag operation will work for this setting.

Parameter P9-05 (Lag Drive Mode) defines how lag drives function: running in either PI regulation or fixed speed. If P9-05 = 0, anytime the drive shifts from being a lead to a lag, the drive will hold the current speed for the time set in P9-07 and then force it to the P9-06 level. If P9-05 = 1, the lag drive will continue to regulate its speed based on the PI conditions. This setting is not commonly used and could result in an unstable system if not properly adjusted. If P9-05 = 2, the drive will turn off when the drive shifts from being a lead to a lag and becomes available for the system to run as a lead again.

The lead drive uses parameters P9-08 to P9-11 to determine if it needs to stage, and parameters P9-12 to P9-15 to determine if it needs to de-stage. Staging will request for a new lead drive and make the current one a lag drive. A stage request is only made when there are drives available to run and the number of drives running is below P9-23. De-staging will make the previous lead drive (which is now a lag drive) a lead drive once again, and stops the current lead drive. A de-stage request is only made when there are 2 or more drives running. With this setup, there can only be 1 lead drive on the network at any given time. A quick de-stage function is invoked when high feedback (based on P1-09 and P9-18) is detected for 2 seconds.

Staging:

P9-08 = 0: Output Frequency:

This mode monitors the lead drive output frequency and determines if staging is needed to maintain the setpoint. If the output frequency of the lead drive rises above the P9-09 level for the time set in P9-11, the drive will issue a network stage request if there is a drive available to run. Refer to *Figure 184.*

P9-08 = 1: Feedback Level:

This mode monitors the feedback level and determines if staging is needed. If the difference in setpoint and feedback (setpoint - feedback) has exceeded the P9-10 level for the time set in P9-11, the lead drive will issue a network stage request if there is a drive available to run. Refer to *Figure 185.*

P9-08 = 2: Feedback + Output Frequency:

This mode monitors both the feedback level and the output frequency to determine if staging is needed. When the output frequency rises above the P9-09 level and the delta feedback (setpoint - feedback) has exceeded the level set in P9-10 for the time set in P9-11, the lead drive will issue a network stage request if there is a drive available to run. Refer to *Figure 186.*

De-staging:

P9-12 = 0: Output Frequency:

This mode monitors the lead drive output frequency and determines if de-staging is needed to maintain the setpoint. If the output frequency of the lead drive drops below the P9-13 level for the time set in P9-15, then a de-stage request is issued if this is not the only drive running. Refer to *Figure 187.*

P9-12 = 1: Feedback Level:

This mode monitors the feedback level and determines if de-staging is needed. If the difference in feedback and setpoint (feedback - setpoint) has exceeded the P9-14 level for the time set in P9-15, then a de-stage request is issued if this is not the only drive running. Refer to *Figure 188.*

P9-12 = 2: Feedback + Output Frequency:

This mode monitors both the feedback level and the output frequency to determine if de-staging is needed. the output frequency of the lead drive drops below the P9-13 level and the delta feedback (feedback - setpoint) has exceeded the P9-14 level for the time set in P9-15, then a de-stage request is issued if this is not the only drive running. Refer to *Figure 189.*

Quick De-stage (P9-18 x P1-09 < PI Feedback):

If the feedback level goes above P9-18 (set as a percentage of P1-09) for 2 seconds, a de-stage request is issued if this is not the only drive running. Refer to *Figure 190.*

If Stabilize Time P9-16 > 0, then whenever a pump becomes a lag drive, or gets de-staged that disables lead-lag control and pump protection. It will resume these functions when the timer P9-16 expires, which counts only when the drive becomes a lead drive once again.

Setpoint Modifier P9-17 is used to increase or decrease the setpoint each time an additional pump is brought online to compensate for system losses or gains. The drive's setpoint is modified using this calculation:

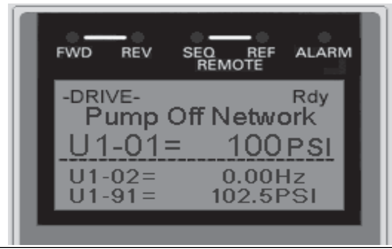
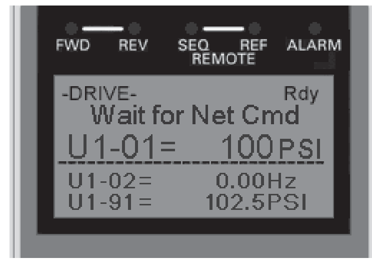
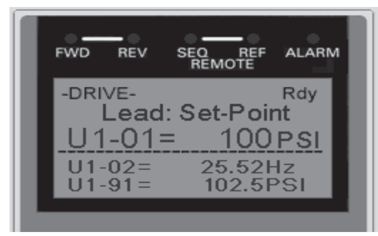
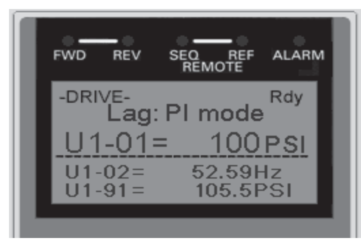
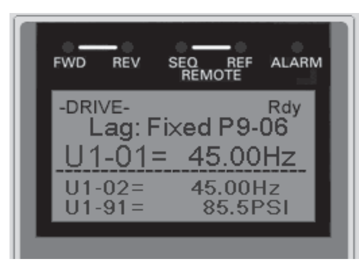
Pump X: Setpoint + ((X-1)(P9-17))

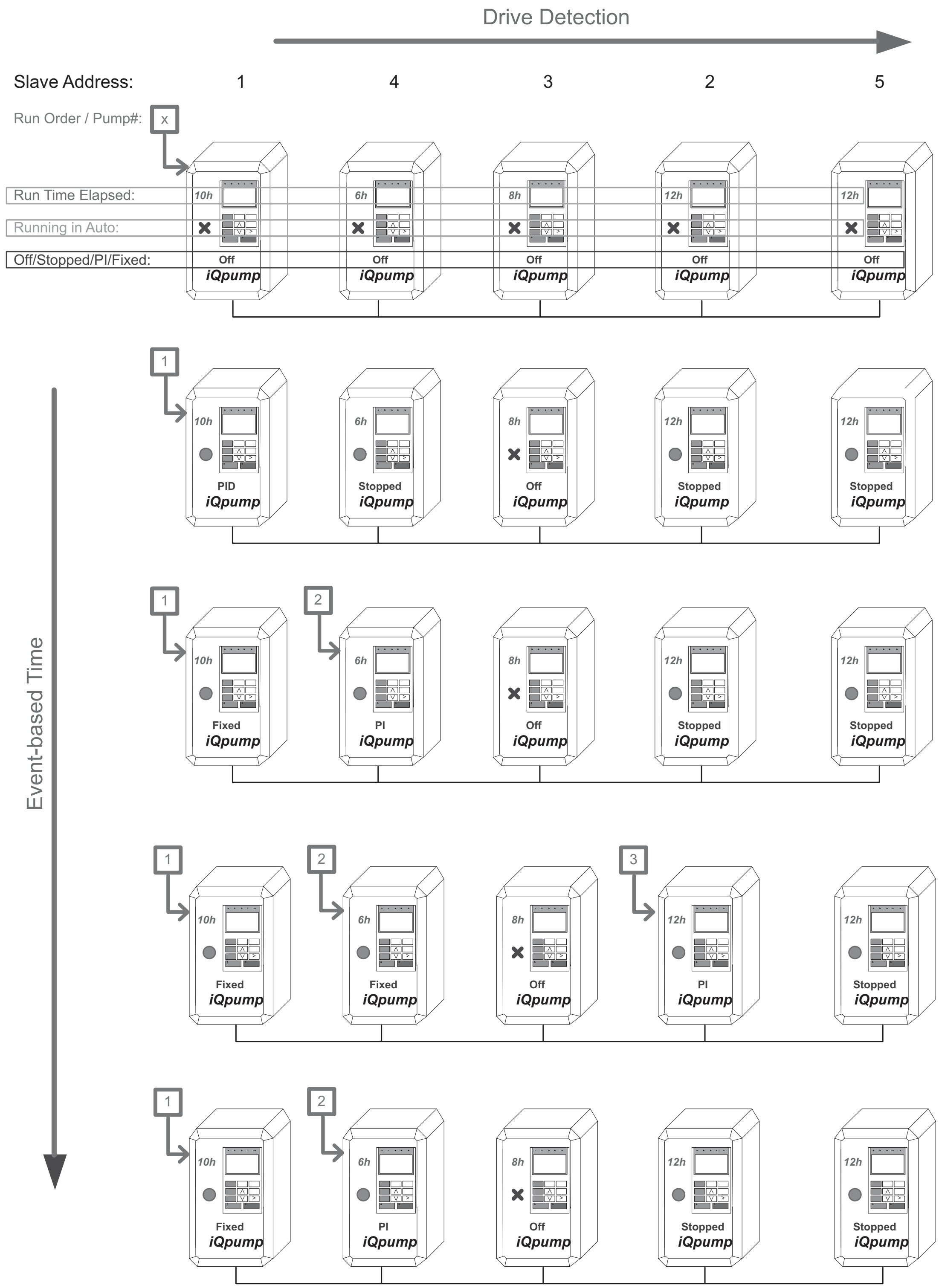
Thus, if there is only one pump running, the setpoint is not modified.

Monitor U1-62 is only available when P1-01 = 3. The monitor displays the drive’s network run queue number. The first drive to run will show U1-62 = 1, the second drive U1-62 = 2 and so on.

When P1-01 = 3 (MEMOBUS / Modbus Network), the U1-01 Display text will change depending on the Auto Mode run command and the network run command as can be seen in *Table 117 on page 245*.

Table 117 Auto Mode vs. Network RUN Cmd Display Text

<table>
<tr><th>Network State</th><th>Display</th></tr>
<tr><td>Drive is not able to accept commands form the iQpump MEMOBUS / Modbus Network because the drive is not in Auto Mode Run.</td><td>
</td></tr>
<tr><td>Drive is in Auto Mode and waiting for a run command from the iQpump MEMOBUS / Modbus Network.</td><td>
</td></tr>
<tr><td>Drive is in Auto Mode, Lead operation and is currently regulating the system using PI control.</td><td>
</td></tr>
<tr><td>Drive is in Auto Mode, Lag operation and is currently regulating the system using PI control.</td><td>
</td></tr>
<tr><td>Drive is in Auto Mode, Lag operation and is holding the speed at the time it made the switch from being a lead drive to a lag. Speed is held until P9-07 time expires. U1-01 will display Frequency instead of System Units.</td><td>
</td></tr>
<tr><td>Drive is in Auto Mode, Lag operation and is running at the speed set in P9-06. U1-01 will display Frequency instead of System Units.</td><td>
</td></tr>
</table>



- Power-On
- No Auto-Run Command

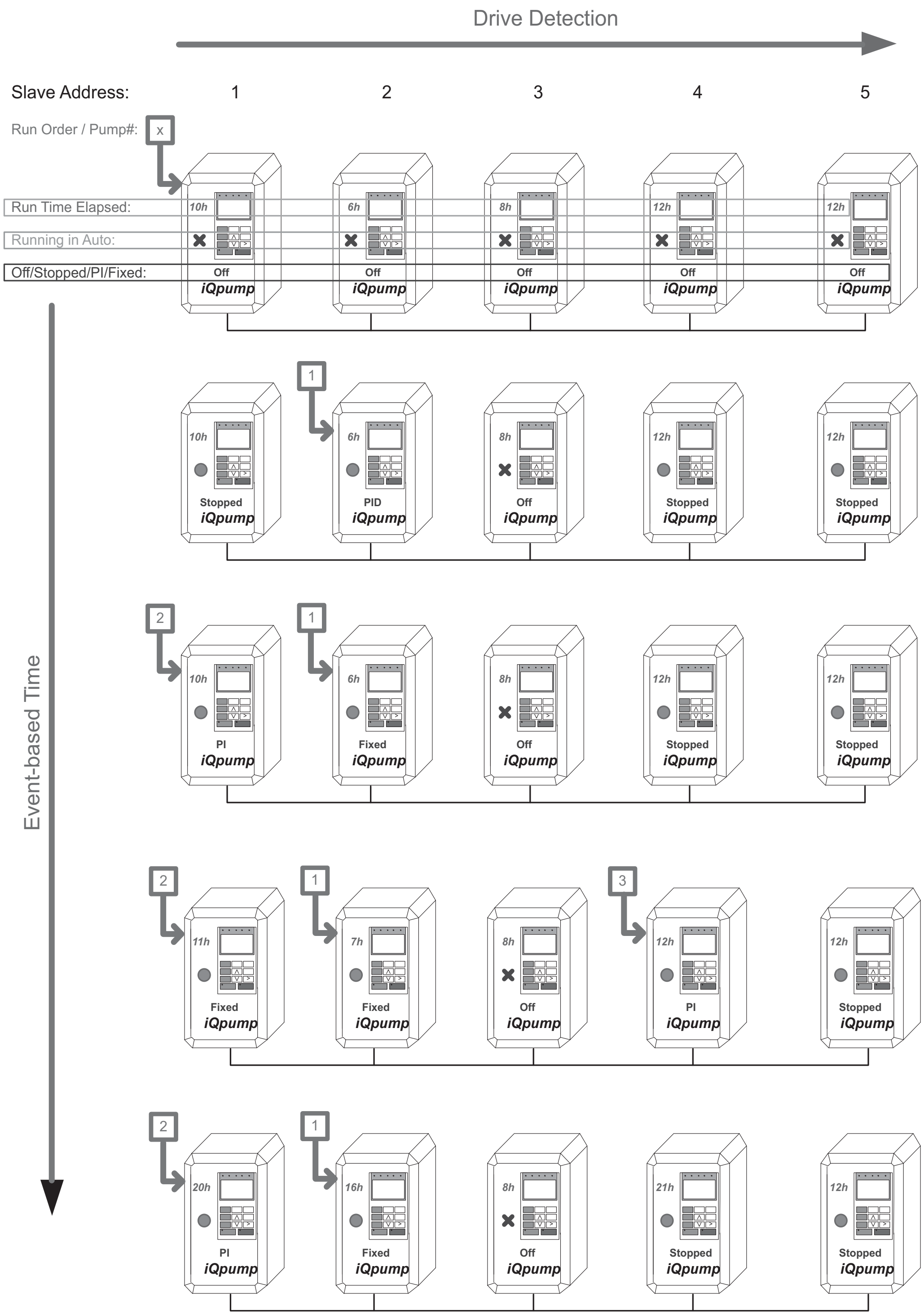
- Auto-run Closed Simultaneously for Slaves 1, 2, 4, & 5
- Master Runs First Available Drive in PI

- Feedback Level is too low, and Pump 1 already maxed-out
- Based on the Multiplex parameters, Pump 1 requests for the NEXT drive
- Master Runs Pump 2 in PI, and fixes the speed of Pump 1.

- Feedback Level is still low, and Pump 2 already maxed-out
- Based on the Multiplex parameters, Pump 2 requests for the NEXT drive
- Master Runs Pump 3 in PI, and fixes the speed of Pump 2.

- Feedback Level is too high, and Pump 3 running at minimum frequency
- Based on the Multiplex parameters, Pump 3 requests for the PREVIOUS drive
- Master Runs Pump 2 in PI, and issues a Baseblock on Pump 3.

Figure 182. Multiplex Operation when P9-01 = 0 (Next Available) and P9-05 = 0 (Lag Fixed)



- Power-On
- No Auto-Run Command

- Auto-run Closed Simultaneously for Slaves 1, 2, 4, & 5
- Master Runs Drive with Lowest Run-time in PI

- Feedback Level is too low, and Pump 1 already maxed-out
- Based on the Multiplex parameters, Pump 1 requests for the NEXT drive
- Master Runs Pump 2 in PI, and fixes the speed of Pump 1.

- Feedback Level is low, and Pump 2 already maxed-out
- Based on the Multiplex parameters, Pump 2 requests for the NEXT drive
- Master Runs Pump 3 in PI, and fixes the speed of Pump 2.

- Feedback Level is too high, and Pump 3 running at minimum frequency
- Based on the Multiplex parameters, Pump 3 requests for the PREVIOUS drive
- Master Runs Pump 2 in PI, and issues a Baseblock on Pump 3.

Figure 183. Multiplex Operation when P9-01 = 0 (Lowest Run-Time) and P9-05 = 0 (Lag Fixed)

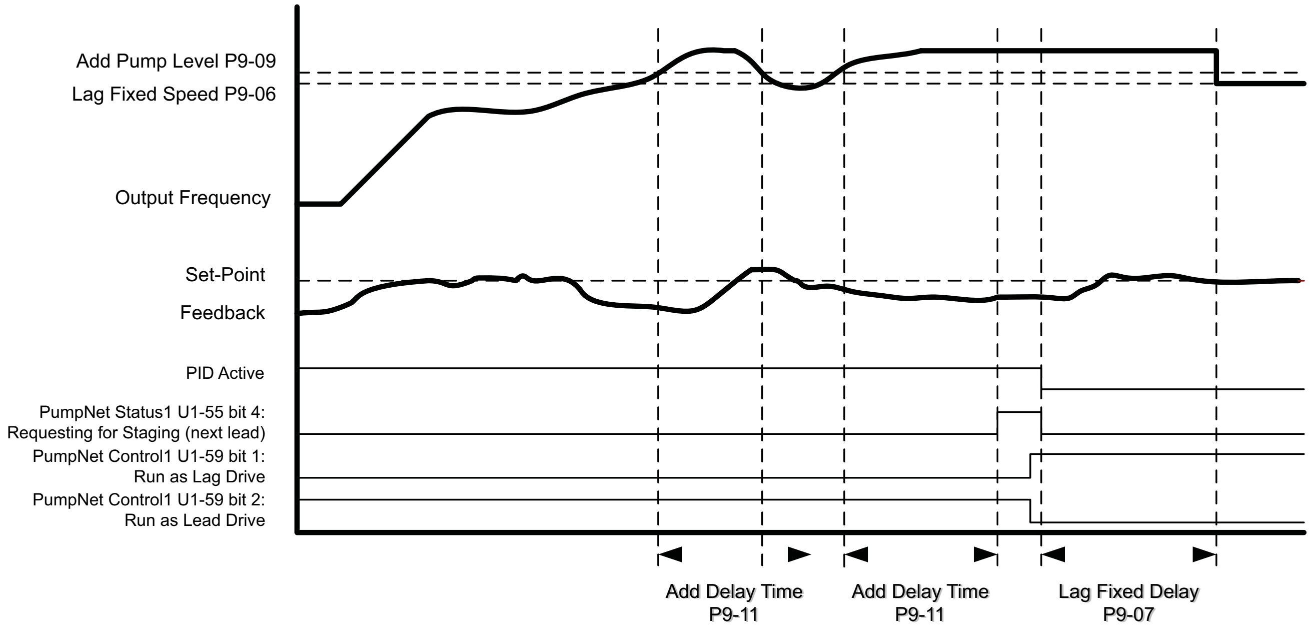


Figure 184. Drive Requests for a New Lead Drive using Output Frequency (P9-08 = 0)

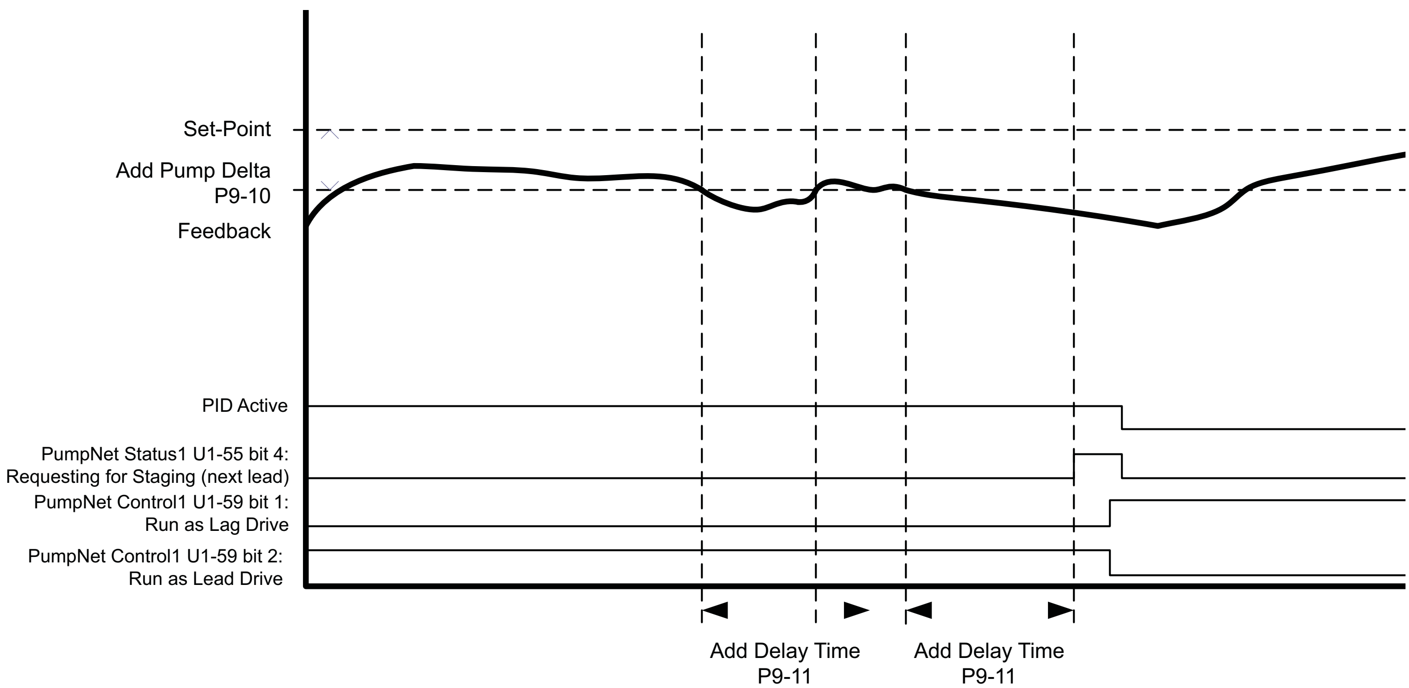


Figure 185. Drive Requests for a New Lead Drive using Feedback (P9-08 = 1)

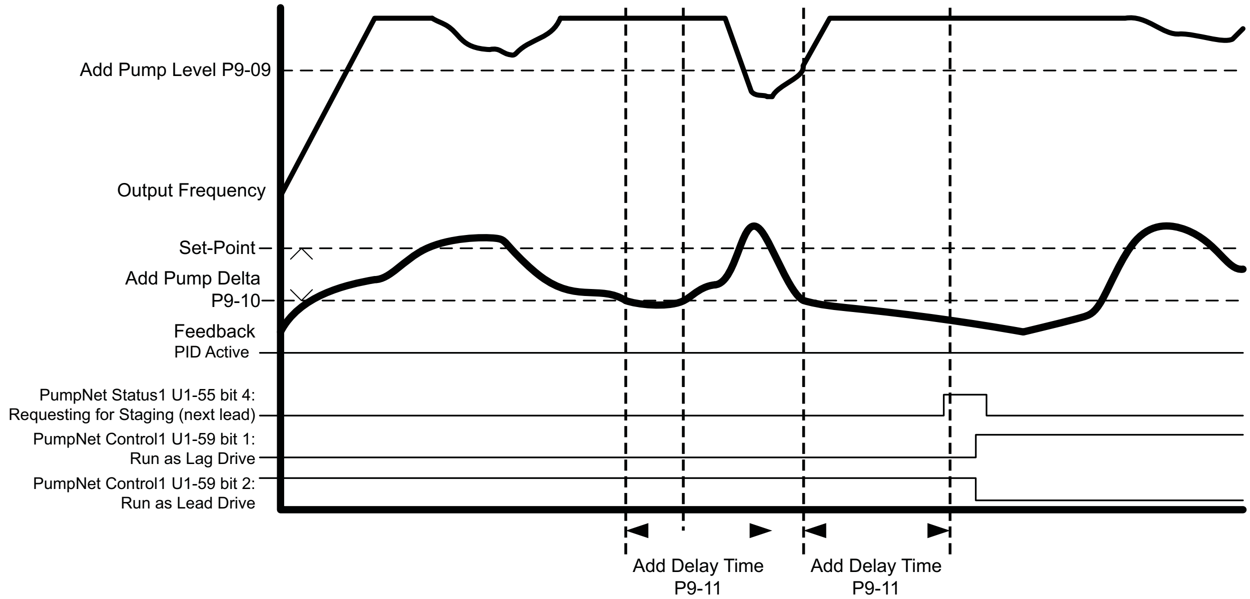


Figure 186. Drive Requests for a New Lead Drive using Feedback and Output Frequency (P9-08 = 2)

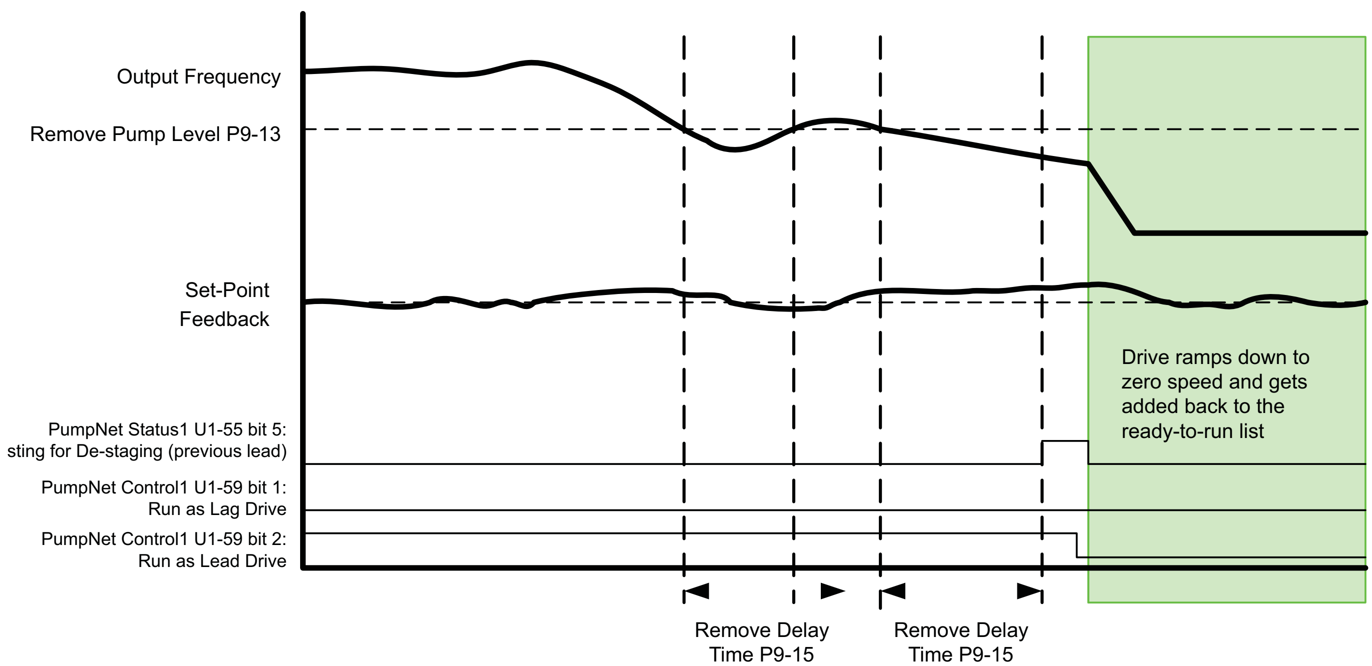


Figure 187. Drive Requests for a De-Stage using Output Frequency (P9-12 = 0)

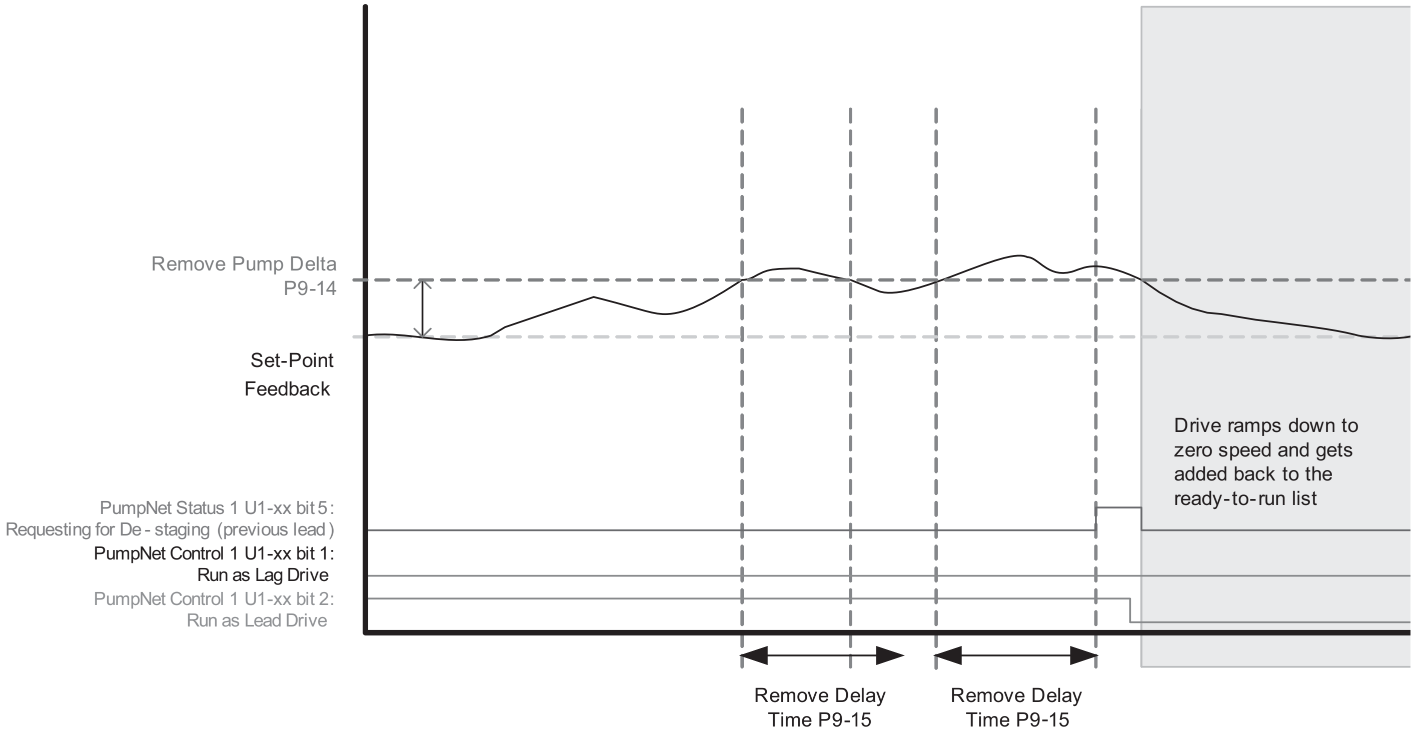


Figure 188. Drive Requests for a De-Stage using Feedback (P9-12 = 1)

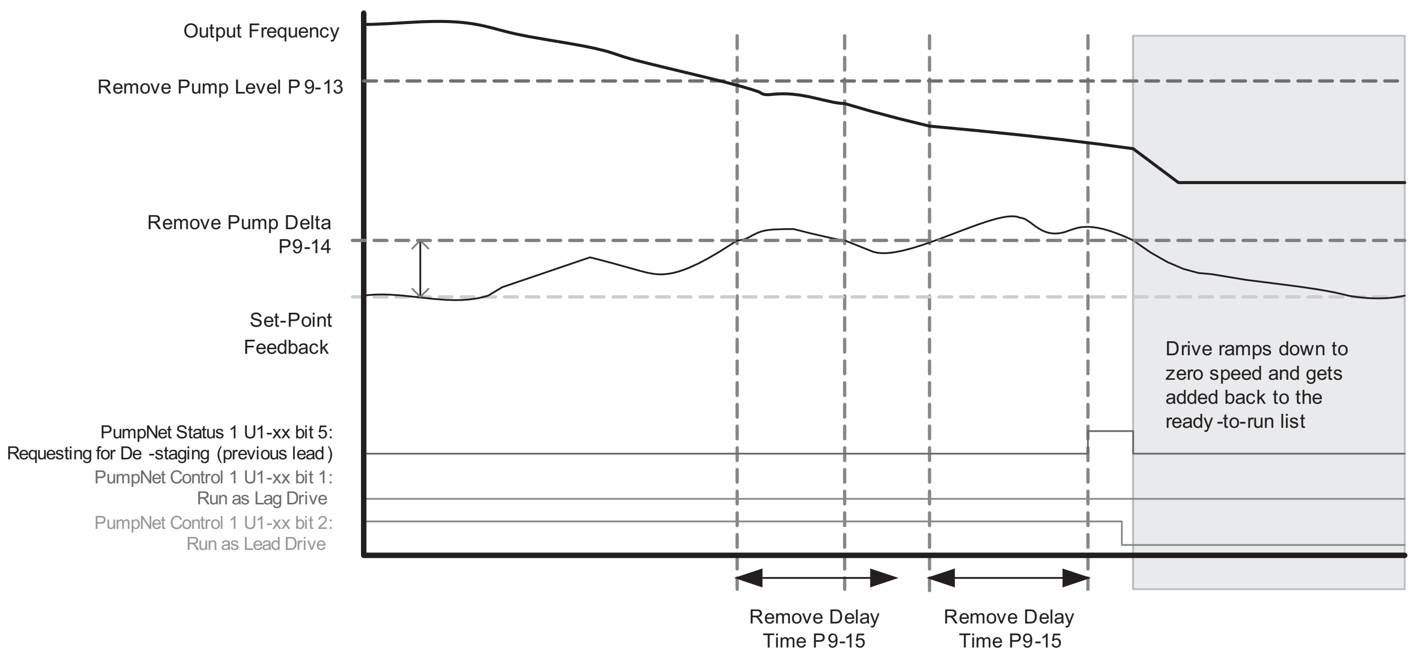


Figure 189. Drive Requests for a De-Stage using Feedback and Output Frequency (P9-12 = 2)

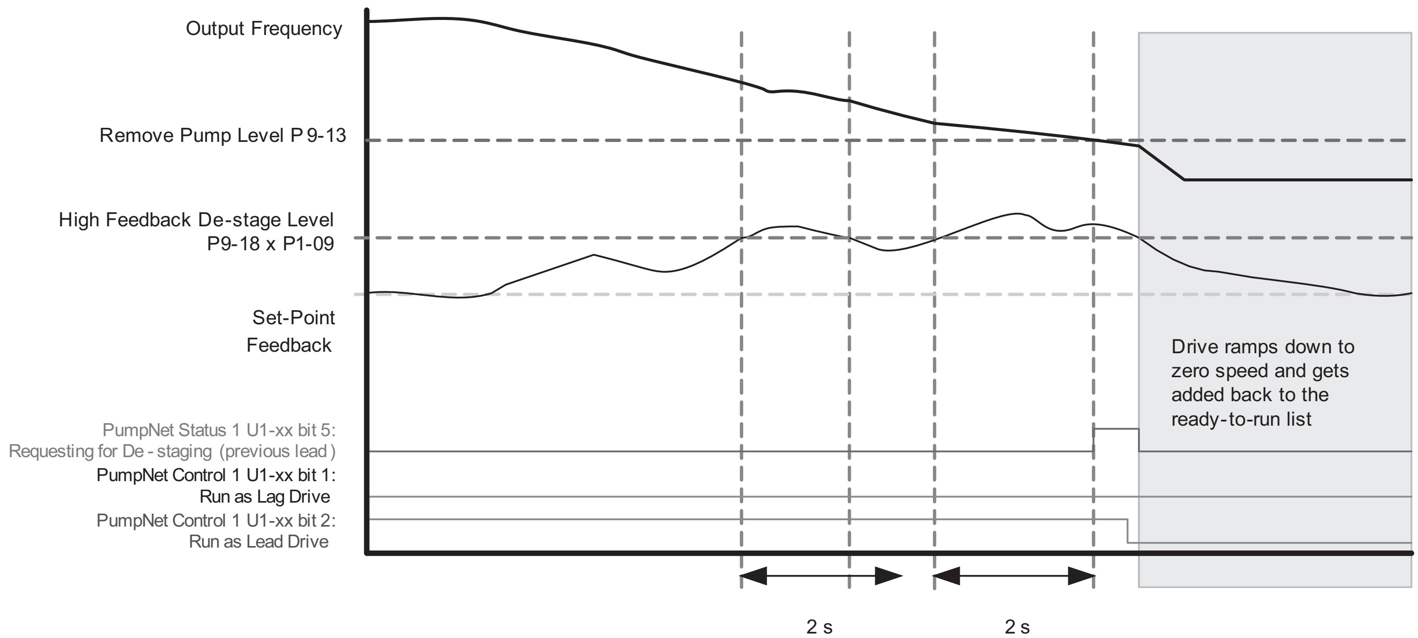


Figure 190. High Feedback Quick De-Stage

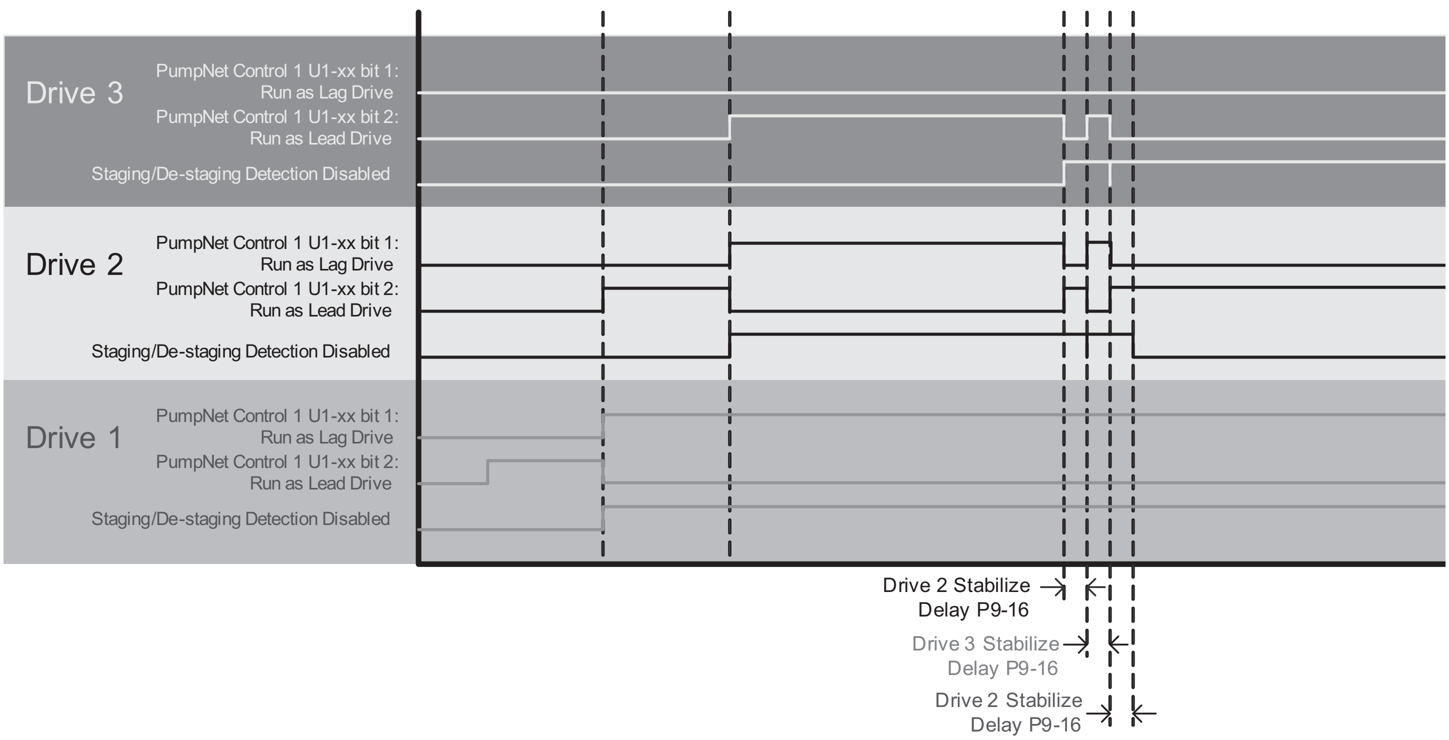


Figure 191. Stabilize Active Time and Off Delay

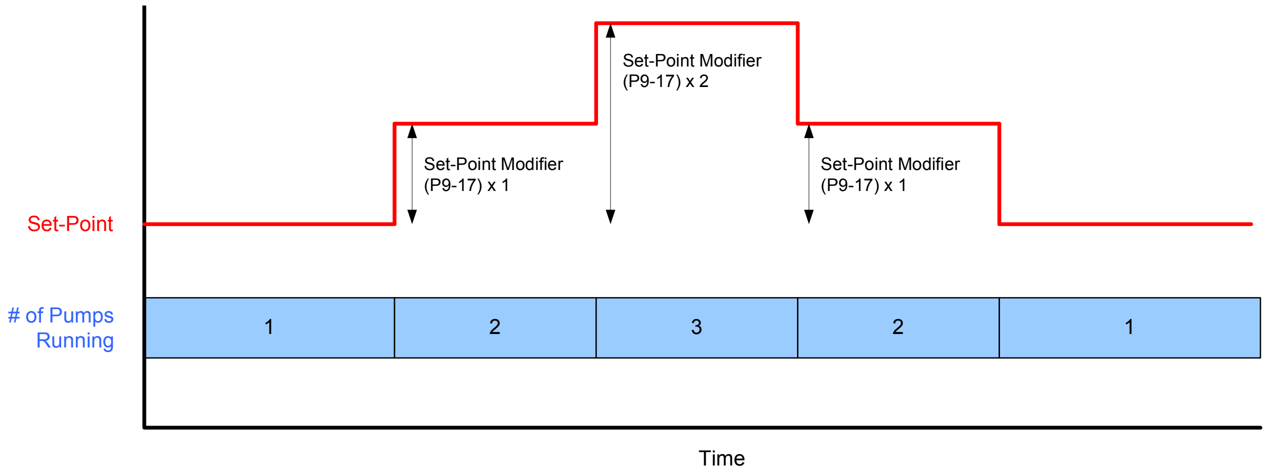


Figure 192. Setpoint Modifier P9-17

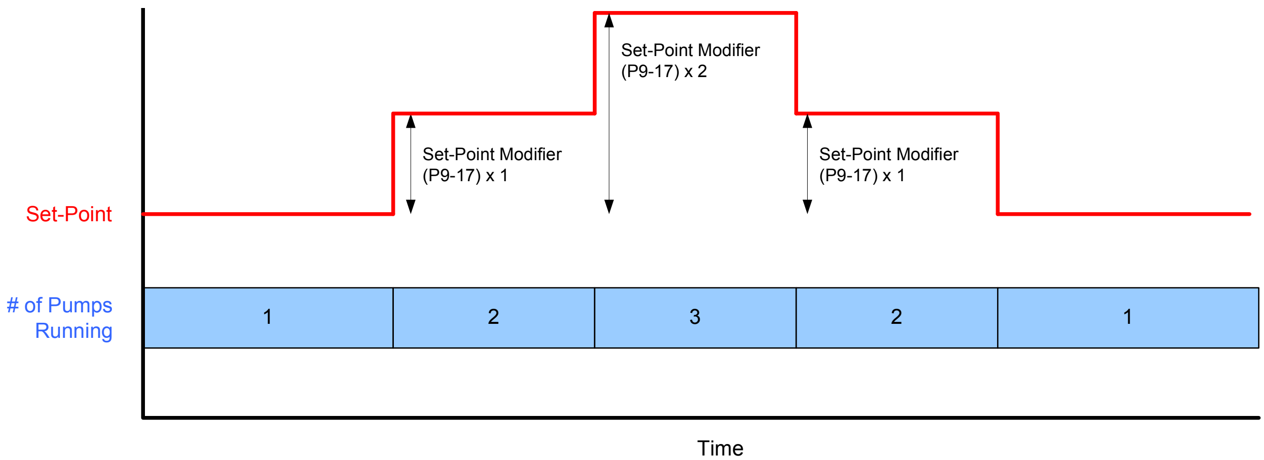


Figure 193. Network Start Delay P9-29

Table 118 Related Parameters

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Range	Default	Menu Location
P1-09 ♦	608	High Feedback Level **High FB Level**	System will show alarm (HFB) when 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 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.	0 ~ 6000.0 (system units P1-02)	155.0 (system units P1-02)	Programming
♦ Denotes that parameter can be changed when the drive is running.						

Table 119 Parameters

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Range	Default	Menu Location
Parameter functionality stated below only applies when P1-01 = 3 (MEMOBUS / Modbus Network)						
P9-01	0880	Lead Drive Selection **Lead Drive Sel**	Specifies how the next Lead drive is selected. 0: Next Available 1: Lowest Run-time	0 ~ 1	1	Programming
P9-05	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.	0 or 2	0	Programming
P9-06 ♦	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

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Range	Default	Menu Location
P9-07 ♦	0886	Lag Fixed Speed Delay **Lag Fix Spd Dly**	When the drive changes from a lead to a lag and P9-05 = 0, this time specifies how long before the drive runs at the P9-06 speed.	0 ~ 1000 s	5 s	Programming
P9-08	0887	Add Pump Mode **Add Pump Mode**	Selects the detection method for staging a new pump. 0: Output Frequency 1: Feedback 2: Feedback + Fout	0 ~ 2	0	Programming
P9-09 ♦	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 / Modbus network. When P9-08 = 2 and the output frequency rises above this level and 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 / Modbus network.	0.0 ~ 120.0 Hz	56.0 Hz	Programming
P9-10 ♦	0889	Add Delta Level **Add Delta Lvl**	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 s)	0 ~ 6000.0 (system units P1-02)	5.0 (system units P1-02)	Programming
P9-11 ♦	088A	Add Delay Time **Add Dly Time**	Delay time before a new lead drive is added to the system.	0.~ 3600 s	10 s	Programming
P9-12	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	0 ~ 2	0	Programming
P9-13 ♦	088C	Remove Freq Level **Remove Freq Lvl**	When P9-12 = 0 and the output frequency is 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 / Modbus 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 / Modbus network.	0.0 ~ 120.0 Hz	40.0 Hz	Programming
P9-14 ♦	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 / Modbus network. When P9-12 = 2 and the delta feedback 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 / Modbus network.	0 ~ 6000.0 (system units P1-02)	0.0 (system units P1-02)	Programming
P9-15 ♦	088E	Remove Delay Time **Remove Dly Time**	Delay time before the lead drive is removed from the system.	0.~ 3600 sec	10 s	Programming
P9-16 ♦	088F	Stabilization Time **Stabilize 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 s	Programming
P9-17 ♦	0890	Setpoint Modifier **Set-Pt Modifier**	System Setpoint is incremented with this value depending on the number of pumps running. Pump 1: Setpoint Pump X: Setpoint + ((X-1) (P9-17))	-6000.0 ~ 6000.0 (system units P1-02)	0.0 (system units P1-02)	Programming
P9-18 ♦	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 s delay. A setting of 0 disables the High FB De-stage feature.	0.0 ~ 100.0%	90.0%	Programming
P9-23 ♦	0896	Max Number of Running Pumps **MaxPumps Running**	Limits the maximum number of pumps that can run on the system.	1 ~ 16	16	Programming
P9-29 ♦	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 s	2.0 s	Programming
♦ Denotes that parameter can be changed when the drive is running.						

Table 120 Monitors <0034>

Monitor No.	Addr. Hex	Monitor Name Digital Operator Display	Description
U1-62	007D	Running Queue No **Running Queue No**	Position in the iQpump MEMOBUS / Modbus Multiplex Running Queue

Table 121 Message

Message Display	Description	Cause	Countermeasures
Net Start Dly P9-29 Active	System was on the Pump Off Network State and a drive has been put on Auto Mode.	The iQpump MEMOBUS / Modbus Network is waiting for the P9-29 timer to elapse.	Change P9-29 timer.

This mode monitors both the feedback level and the output frequency to determine if de-staging is needed. the output frequency of the lead drive drops below the P9-13 level and the delta feedback (feedback - setpoint) has exceeded the P9-14 level for the time set in P9-15, then a de-stage request is issued if this is not the only drive running.

◆ iQpump MEMOBUS / Modbus Layered Sequencing and Control

■ MEMOBUS / Modbus Layered Sequencing and Control

Several applications of multiplexed drives require priority sequencing and run restrictions. For example, a drive designated as a back-up pump would be restricted for alternation only or will have a low run priority. A jockey pump would be designated as a first drive only and may never be allowed to alternate with a bigger-sized pump. Because of the variety of applications, a flexible set of parameters need to complement the Multiplex and Alternation parameters.

- Provide more staging control over the MEMOBUS / Modbus Multiplex and Alternation features.
- Ability to restrict drives to first drive only, alternation only or either one.
- Provide a way to return Lead Drive control to a drive with higher priority.

■ Function Description: <0034>

Setting Allow Net Run P9-20 = 0 allows that drive to respond to all network run commands (first drive, stating, alternation). When P9-20 = 1, the drive is limited to being either the first drive or for alternation. When P9-20 = 2, the drive can only be a first drive. When P9-20 = 3, the drive is only available for alternation. Note that when Alternation Mode P9-04 = FIFO Auto and there are 2 drives or more running, the iQpump MEMOBUS / Modbus Network does not actually alternate a drive in. It simply removes the expired first drive and allows the iQpump MEMOBUS / Modbus Multiplex feature to stage a new drive. Explicit alternation still happens in FIFO Auto when there is only one drive running at time of alternation.

Setting Run Priority P9-21 the same for all drives on the iQpump MEMOBUS / Modbus Network obviously nullifies the functionality. Drives will simply use P9-01 at this point to select the next lead drive.

By setting P9-21 differently for a drive on the iQpump MEMOBUS / Modbus Network, sequential lead drive selection can be achieved. Drives with the same P9-21 level will use the P9-01 parameter to determine the next lead drive.

As a way to give First Drive (and Lead Drive) control back to the drive with the highest priority level P9-21, the Lead Swap @ Sleep Time P9-24 can be set on the other drives (with a lower priority level) so that if the drive sleeps continuously for the time set, the control will be passed to the higher priority drive.

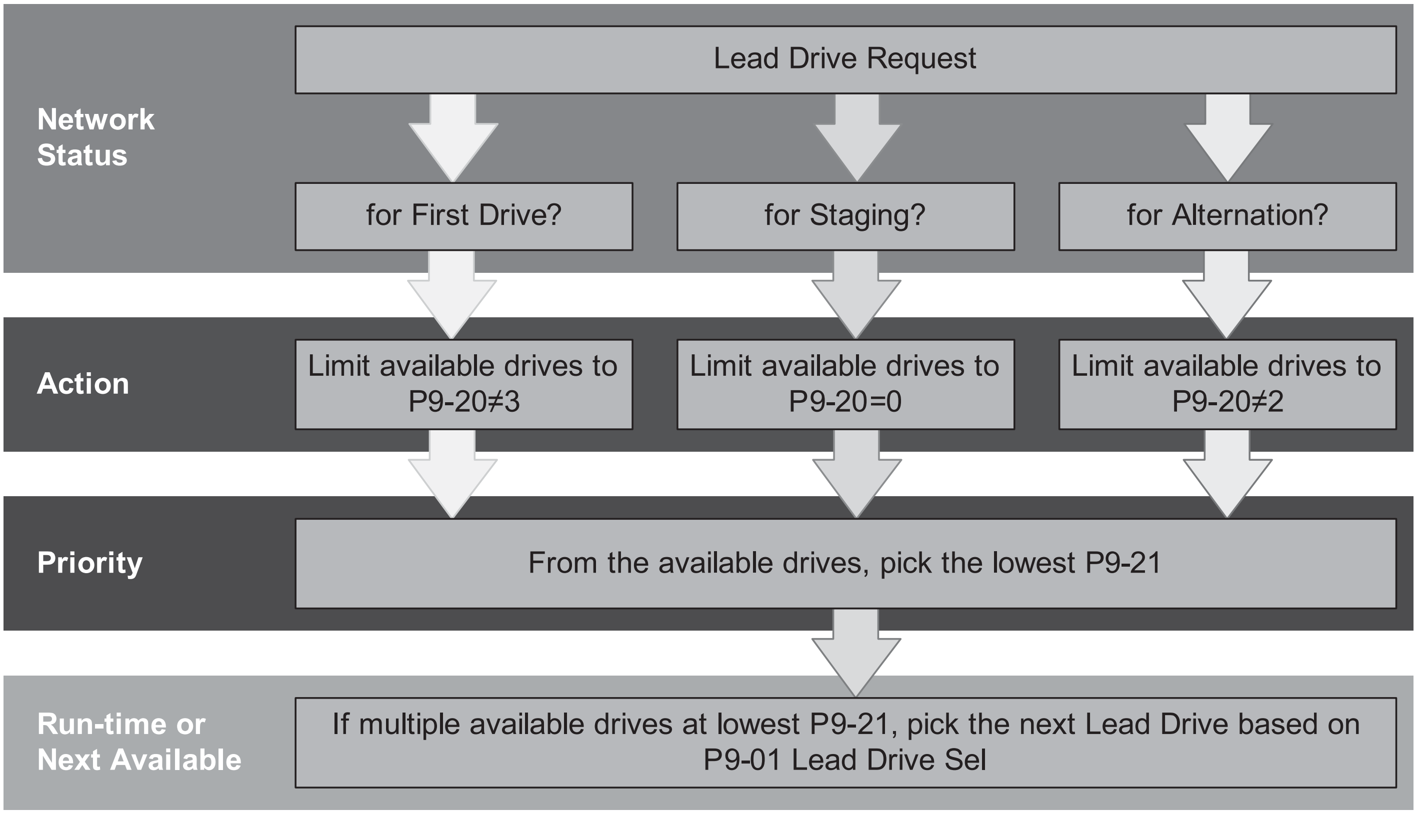


Figure 194. Lead Drive Selection Layers

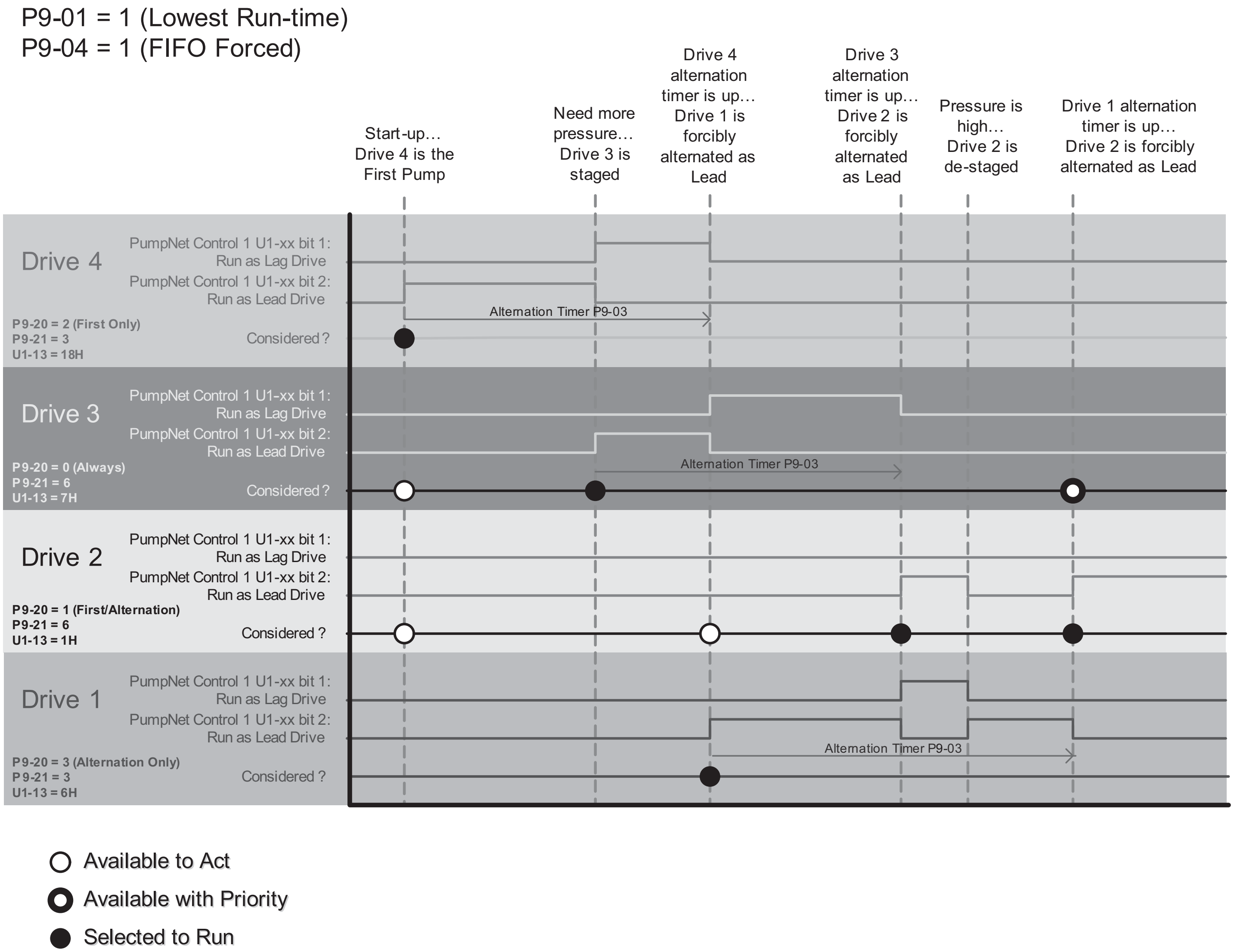


Figure 195. P9-01, P9-20 and P9-21 Interaction Example

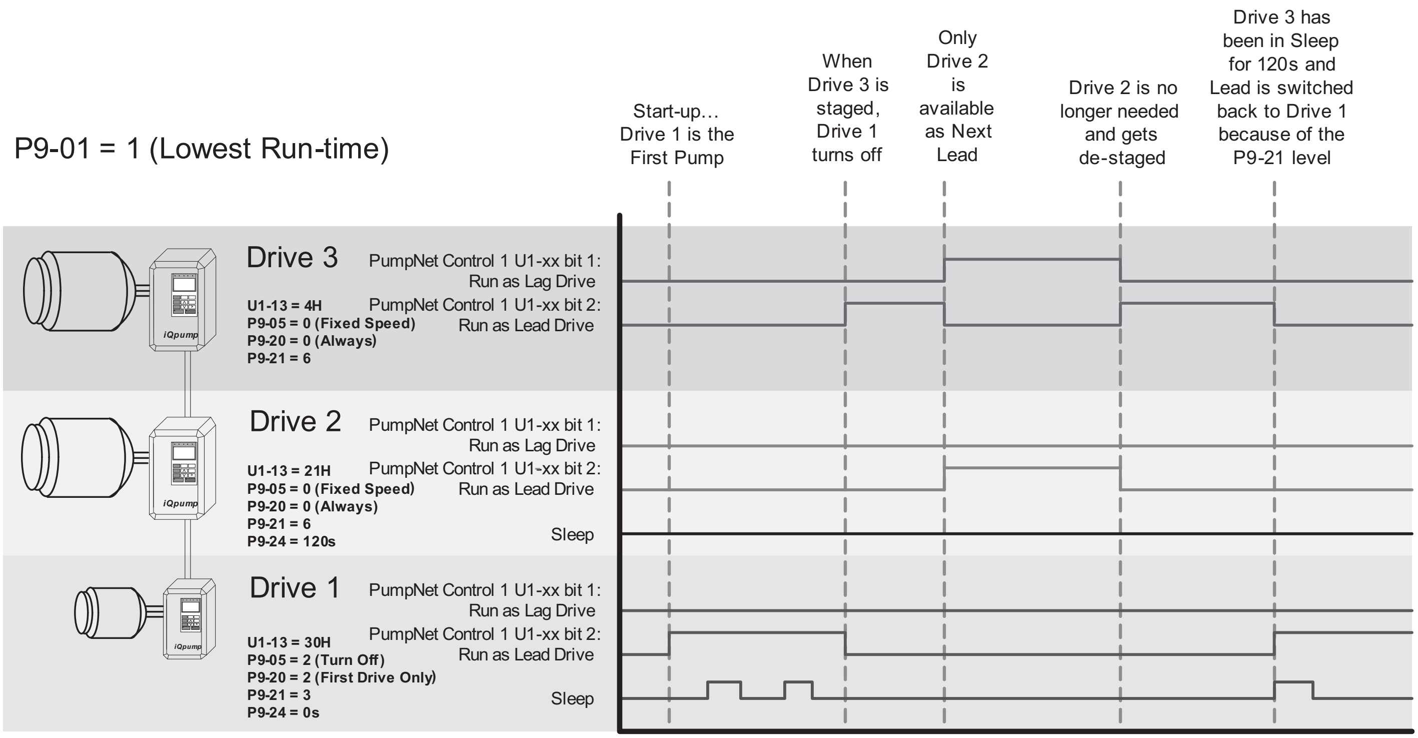


Figure 196. P9-20, P9-21 and P9-24 Interaction Example

Table 122 Parameters

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Range	Default	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
P9-24 ♦	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 s	0 s	Programming
♦ Denotes that parameter can be changed when the drive is running.						

◆ MEMOBUS / Modbus Interaction with other iQpump Functions

Function Description <0034>

All functions will work as before when P1-01 ≠ 3. The functions listed below will behave slightly different when P1-01 = 3.

- **Start Level:** Active on the first pump in the network. Drives that are in the process of Alternation will not undergo this process.
- **Sleep:** Active when the drive is the only drive running on the network.
- **Over-cycle Protection:** Active when the drive is the only drive running on the network.
- **No-Flow Detection:** Active on the lead drive. When No-Flow is confirmed, the lead-drive is de-staged, or if it is the only drive left, it goes to sleep.
- **Pre-charge:** Active only on the first drive to run in the network.
- **Low City Pressure:** Active on any drive in the network. An alarm condition will cause other drives in the network to stop running and show a "Net Pump Err" message.
- **Utility Delay:** When this function is active the drive is unavailable to the iQpump MEMOBUS / Modbus Network and will force the U1-01 text to show "Pump Off Network".

T1 Auto-Tuning

◆ T1-02 Motor Rated Power

Setting Range: 0.00 ~ 650.00 kW

Factory Default: Model Dependent

Refer to parameter T1-02 in Appendix A for description details.

◆ T1-04 Motor Rated Current

Setting Range: Model Dependent

Factory Default: Model Dependent

Auto tuning is recommended to achieve optimum performance. In addition, the iQpump drive requires Line-To-Line Resistance auto-tuning before it can properly perform the Estimated Speed Search method. This method of speed search allows for bi-directional speed search. The T1 parameters are found under the Auto-Tuning menu.

To perform auto-tuning follow these steps:

1. T1-02 should be left at the default value (the last 3 digits of the iQpump drive model number).
2. In T1-04, enter the Full Load Amps (FLA) as stamped on the motor's nameplate.
3. Press the INCREASE key once to display this:

```
-ATUNE-              Rdy
     Auto: ATUNE
 ------------------------
     0 Hz/ 0.00A
     Tuning Ready?
     Press HAND key
```

4. If ready, press the HAND key once to start auto-tuning. This process will last for approximately 15 seconds. Once auto-tuning is finished, the digital operator will display this:

```
        -ATUNE-
     Tune Successful
 ------------------------
     0 Hz/ 0.00A
```

5. To exit the Auto-Tuning menu, press the MENU key once.
   Note: It is possible to a get a "Data Invalid" error if the either T1-02 or T1-04 fall outside the range of what the iQpump drive will accept as reasonable levels for the programmed size of the iQpump drive (o2-04).

Appendix: A

Parameters

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

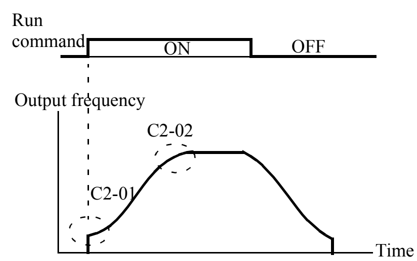
Table 123 Parameter List

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location	Page No.
			Initialization				
A1-00 ♦	0100	Language Selection **Select Language**	Language selection for digital operator display. 0: English 2: Deutsch 3: Francais 4: Italiano 5: Espanol 6: Portugues *Not returned to factory setting by initialization	0 ~ 6	0	Programming	*12*
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	*12*
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	0 ~ 3330	0	Programming	*12*
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. 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	*13*
A1-05	0105	Password 2 **Select Password**		0 ~ 9999	0	Programming	*13*
♦ 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	0 ~ 3	0	Programming	*14*
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	*17*
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	0	Programming	*21*
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 s	0 s	Programming	*24*
			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	*25*

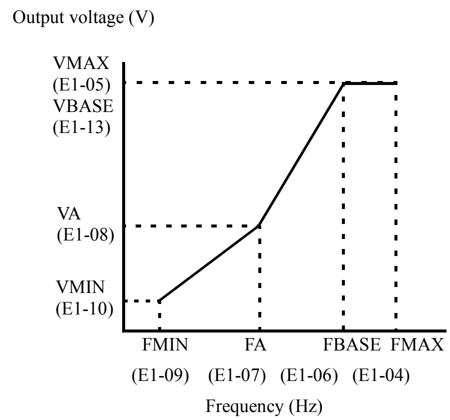
Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location	Page No.
b2-02	018A	DC Injection Braking Current **DCInj Current**	Selects the DC injection braking current as a percentage of the drive rated current.	0 ~ 100 %	50 %	Programming	*25*
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 s	0.00 s	Programming	*25*
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 s	0.5 s	Programming	*25*
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	*26*
			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	*27*
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	*29*
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 s	2.0 s	Programming	*29*
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 s	0.2 s	Programming	*30*
b3-14	019E	Bidirectional Speed Search Selection **Bidir Search Sel**	0: Disabled 1: Enabled	0 ~ 1	1	Programming	*30*
			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 s	0.0 s	Programming	*31*
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 s	0.0 s	Programming	*31*
			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	*33*
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 s	3.0 s	Programming	*36*
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	*36*
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	*36*

♦ 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	Page No.
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	*36*
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 s	0.00 s	Programming	*37*
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	*37*
b5-10	01AE	PI Output Gain Setting **Output Gain**	Sets the output gain of the PI controller.	0.0 ~ 25.0	1.0	Programming	*37*
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	*38*
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 s	2.0 s	Programming	*38*
b5-17	01B5	PI Accel / Decel Time **Acc/Dec Time**	Applies an accel / decel time to the PI setpoint reference.	0.0 ~ 25.5 s	0.0 s	Programming	*39*
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	*40*
b8-04	01CF	Energy Saving Coefficient Value **Energy Save COEF**	Used to fine-tune the energy savings function.	0.0 ~ 655.0	kVA Dependent	Programming	*40*
b8-05	01D0	Power Detection Filter Time **kW Filter Time**		0 ~ 2000 ms	20 ms	Programming	*40*
b8-06	01D1	Search Operation Voltage Limit **Search V Limit**		0 ~ 100 %	0 %	Programming	*40*
			Accel/Decel				
C1-01 ♦	0200	Acceleration Time 1 **Accel Time 1**	Sets the time to accelerate from zero to maximum frequency.	0.0 ~ 6000.0 s	20.0 s	Programming	*41*
C1-02 ♦	0201	Deceleration Time 1 **Decel Time 1**	Sets the time to decelerate from maximum frequency to zero.		10.0 s	Programming	*41*
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.		10.0 s	Programming	*41*
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 s	Programming	*41*
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 s	Programming	*41*
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 s	Programming	*41*
♦ 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	Page No.
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 s	10.0 s	Programming	*41*
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	*42*
			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 s	0.20 s	Programming	*43*
C2-02	020C	S-Curve Characteristic at Accel End **SCrv Acc @ End**		0.00 ~ 2.50 s	0.20 s	Programming	*43*
			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	*44*
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	*44*
♦ 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	1 ~ F	kVA Dependent	Programming	*45*
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	*45*

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location	Page No.
			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	*47*
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	*47*
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	*47*
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	*47*
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	*47*
♦ 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	*49*
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	*49*
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	*49*
			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	*50*
d3-02	0295	Jump Frequency 2 **Jump Freq 2**			0.0 Hz	Programming	*50*
d3-03	0296	Jump Frequency 3 **Jump Freq 3**			0.0 Hz	Programming	*50*
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	*50*
			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	*51*
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	*51*

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location	Page No.
E1-04	0303	Maximum Output Frequency **Max Frequency**		0.0 ~ 120.0 Hz	60.0 Hz	Programming	*53*
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	*53*
E1-06	0305	Base Frequency **Base Frequency**		0.0 ~ 200.0 Hz	60.0 Hz	Programming	*53*
E1-07	0306	Mid Output Frequency A **Mid Frequency A**		0.0 ~ 200.0 Hz	3.0 Hz	Programming	*53*
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	*53*
E1-09	0308	Minimum Output Frequency **Min Frequency**	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 ~ 200.0 Hz	1.5 Hz	Programming	*53*
E1-10	0309	Mid Output Voltage **Min Voltage**		0.0 ~ 255.0 (240V) 0.0 to 510.0 (480V)	10.3 Vac 20.7 Vac	Programming	*53*
E1-11	030A	Mid Output Frequency B **Mid Frequency B**		0.0 ~ 200.0 Hz	0.0 Hz	Programming	*54*
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	*54*
E1-13	030C	Base Voltage **Base Voltage**		0.0 ~ 255.0 (240V) 0.0 to 510.0 (480V)	0.0 Vac	Programming	*54*
			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	*56*
E2-03	030F	**No-Load Current**	Sets the magnetizing current of the motor.	kVA Dependent	kVA Dependent	Programming	*56*
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	*56*
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	*56*
			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	*57*
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	*57*
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	*57*

<table>
<tr><th>Parameter No.</th><th>Addr. Hex</th><th>Parameter Name
Digital Operator Display</th><th>Description</th><th>Setting Range</th><th>Factory Setting</th><th>Menu Location</th><th>Page No.</th></tr>
<tr><td>F6-05</td><td>03A6</td><td>Current Monitor Display Unit Selection
Current Unit Sel</td><td>0: A Display
1: 100 % / 8192 (Drive Rated Current)</td><td>0 ~ 1</td><td>0</td><td>Programming</td><td>57</td></tr>
<tr><td colspan="3"></td><td>Digital Inputs</td><td colspan="4"></td></tr>
<tr><td>H1-01</td><td>0400</td><td>Terminal S3 Function Selection
Terminal S3 Sel</td><td rowspan="3">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.
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.
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.</td><td>0 ~ 87</td><td>24</td><td>Programming</td><td>58</td></tr>
<tr><td>H1-02</td><td>0401</td><td>Terminal S4 Function Selection
Terminal S4 Sel</td><td>0 ~ 87</td><td>14</td><td>Programming</td><td>58</td></tr>
<tr><td>H1-03</td><td>0402</td><td>Terminal S5 Function Selection
Terminal S5 Sel</td><td>0 ~ 87</td><td>3: 2-wire
0: 3-wire</td><td>Programming</td><td>58</td></tr>
</table>

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location	Page No.
H1-04 (continued on next page)	0403	Terminal S6 Function Selection **Terminal S6 Sel**	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 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 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.	0 ~ 87	80	Programming	*58*

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location	Page No.
H1-04	0403		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.				
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	*58*
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 s	0.00 s	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 s	0.00 s	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 s	0.00 s	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 s	0.00 s	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 s	0.00 s	Programming	

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

<table>
<tr><th>Parameter No.</th><th>Addr. Hex</th><th>Parameter Name Digital Operator Display</th><th>Description</th><th>Setting Range</th><th>Factory Setting</th><th>Menu Location</th><th>Page No.</th></tr>
<tr><td></td><td></td><td></td><td>Digital Outputs</td><td></td><td></td><td></td><td></td></tr>
<tr><td>H2-01</td><td>040B</td><td>Terminal M1-M2 Function Selection
Term M1-M2 Sel</td><td rowspan="2">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).
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.</td><td>0 ~ 57</td><td>40</td><td>Programming</td><td>76</td></tr>
<tr><td>H2-02 (continued on next page)</td><td>040C</td><td>Terminal M3-M4 Function Selection
Term M3-M4 Sel</td><td>0 ~ 57</td><td>41</td><td>Programming</td><td>76</td></tr>
</table>

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location	Page No.
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). -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-XX). 54: During Run 2 <0034> Closed: Whenever the drive is outputting voltage to the motor (not base-blocked).	0 ~ 57	41	Programming	*76*

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location	Page No.
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 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.	0 ~ 57	41	Programming	*76*
			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	*85*
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	*85*
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	*87*
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 1F: Not Used	0 ~ 1F	B	Programming	*88*
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	*90*
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	*91*
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 s	0.30 s	Programming	*92*
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	*92*
♦ Denotes that parameter can be changed when the drive is running.							
			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	*93*

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location	Page No.
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	*95*
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	*95*
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	*95*
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	*96*
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	*96*
H4-07	0423	Terminal FM Signal Level Selection **AO Level Select1**	0: 0 - 10 Vdc 2: 4 - 20 mA*	0 or 2	0	Programming	*96*
H4-08	0424	Terminal AM Signal Level Selection **AO Level Select2**	0: 0 - 10 Vdc 2: 4 - 20 mA*	0 or 2	0	Programming	*96*
♦ 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	*108*
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	*108*
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	*108*
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	*109*
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	*109*

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location	Page No.
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	*109*
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	*109*
H5-08	042C	Communication Protocol Selection **Com Protocol Sel**	0: MEMOBUS / Modbus 1: N2 (Metasys) 2: FLN (APOGEE)	0 ~ 2	0	Programming	*109*
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 s	2.0 s	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	*114*
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	*114*
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	*115*
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	*115*
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 s	0.20 s	Programming	*115*
			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.* 2: CPU Power Active - Drive will restart if power returns prior to internal power supply shut down.* * In order for a restart to occur, the run command must be maintained throughout the ride thru period.	0 ~ 2	2	Programming	*117*
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 s	kVA Dependent	Programming	*117*
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 s	kVA Dependent	Programming	*117*
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 s	kVA Dependent	Programming	*117*
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	*118*

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location	Page No.
			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	*119*
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	*119*
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	*120*
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	*121*
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	*121*
			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	*122*
L4-02	049A	Speed Agreement Detection Width **Spd Agree Width**		0.0 ~ 20.0 Hz	2.0 Hz	Programming	*122*
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	*123*
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	*123*
			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	*123*
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	*123*
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 s <0032>	20.0 s	Programming	*123*

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location	Page No.
			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	*125*
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	*125*
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 s	10.0 s	Programming	*125*
			Hardware Protection				
L8-01	04AD	Internal Dynamic Braking Resistor Protection Selection **DB Resistor Prot**	0: Not Provided 1: Provided	0 ~ 1	0	Programming	*127*
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	*127*
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	*127*
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	*128*
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	*128*
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	*128*
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	*128*
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	*128*
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 s	300 s	Programming	*129*

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location	Page No.
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	*129*
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	*129*
L8-18	04BE	Soft CLA Selection **Soft CLA Sel**	Enables and disables current limit “A”. 0: Disabled 1: Enabled	0 ~ 1	1	Programming	*130*
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	*130*
			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	*131*
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	*131*
			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 s	1.0 s	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 s	40 s	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	*133*
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	*133*
o1-05	0504	LCD Brightness Adjustment **LCD Contrast**	**Set Value** – **Description** 5 – LCD display becomes dark 3 – Standard setting 1 – LCD display becomes light	0 ~ 5	3	Programming	*134*
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	*134*

♦ 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	Page No.
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	*134*
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	*134*
			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	*135*
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	*135*
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	*135*
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	*135*
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	*136*
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	*137*
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	*137*
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	*137*
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	*137*
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	*138*
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	*138*
			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	*139*

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location	Page No.
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	*139*
			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	*141*
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 (*su1) <0034> 14: Hz: Hertz (*su1) <0034>	0 ~ 14	1	Programming	*145*
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	*146*
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	*147*
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 s	1 s	Programming	*148*
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 has to 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	*148*
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	*148*
P1-08 ♦	0607	Low Feedback Level Fault Delay Time **Low Lvl Flt Tim**e	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 s	5 s	Programming	*149*

♦ Denotes that parameter can be changed when the drive is running.
(*su1) When P1-02 = 3, parameter P1-03 will have to be set to (120x E1-04 / E2-04) for proper display. When P1-02 = 14, parameter P1-03 will have to 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	Page No.
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	*149*
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 s	2 s	Programming	*149*
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	*150*
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 s	60 s	Programming	*151*
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	*152*
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	*153*
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-XX=85) needs to 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	*152*
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 s	20 s	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	*155*

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location	Page No.
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	*160*
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 s	5 s	Programming	*161*
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	*161*
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 s	10 s	Programming	*162*
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	*162*
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 s	300 s	Programming	*163*
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	*163*
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	*164*
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	*164*
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	*164*
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	*166*
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 s	5.0 s	Programming	*167*
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 s	5.0 s	Programming	*167*

♦ 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	Page No.
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	*167*
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	*167*
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 s	2.0 s	Programming	*168*
P2-18	0121	No-Flow Motor RPM Sample Time **NF RPM Sample Tm**	No-flow detection motor rpm sample rate.	0.1 ~ 1000.0 s	2.0 s	Programming	*168*
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	*168*
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	*168*
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 s	5.0 s	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 s	10.0 s	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	*172*

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location	Page No.
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-XX = 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-XX = 40, 41).	0.0 ~ 120.00 Hz	59.0 Hz	Programming	*178*
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-XX = 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-XX = 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	*179*
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 s	2 s	Programming	*179*
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-XX = 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-XX = 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	*179*
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 s	5 s	Programming	*180*
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	*180*
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	*181*

♦ 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	Page No.
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-XX = 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-XX = 40, 41).	0.0 ~ 120.0 Hz	40.0 Hz	Programming	*182*
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-XX = 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-XX = 40, 41).	0.0 ~ 120.0 Hz	40.0 Hz	Programming	*182*
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 s	2 s	Programming	*182*
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	*183*
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	*184*
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	*185*

♦ 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	Page No.
			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-XX = 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	*186*
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	*193*
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	*193*
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 s	1.0 s	Programming	*193*
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	*194*
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 s	1.0 s	Programming	*194*
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 needs to be set to "1" and program L5-03 needs to be set to the applicable time.	0 ~ 7	0	Programming	*194*

♦ 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	Page No.
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 needs to be set to “1” and program L5-03 needs to be set to the applicable time.	0 ~ 7	0	Programming	*194*
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 attempt.	0.2 ~ 6000.0 min	0.2 min	Programming	*194*
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	*199*
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	

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Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location	Page No.
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 needs to be present before the drives will stop. Also sets the amount of time that the pressure needs to be adequate before the drive system will re-start.	1 ~ 1000 s	10 s	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 s	0.0 s	Programming	
			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	*208*
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	*209*
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	*209*
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	*209*
			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. 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 s	10 s	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	Page No.
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	
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 s	10 s	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 has to be above the P7-03 level to trigger the Anti-Jam function.	0.1 ~ 2.0 s	0.3 s	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 s	10 s	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 s	10 s	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	Page No.
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 s).	0.0 ~ 600.0 s	2.0 s	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 s).	0.0 ~ 600.0 s	2.0 s	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 s	2.0 s	Programming	
			Pressure and Level Control				
P8-01 <0034>	860	Pressure and Level Control Select **Pres&Lvl Control**	Enables / Disables the Constant Pressure With Well Draw Down Control. 0: Disabled 1: Enabled	0 ~ 1	0	Programming	
P8-02 <0034>	861	Water Level Scaling **Water Lvl Scale**	Sets the full scale (20 mA) output of the pressure transducer that is 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	
P8-04 ♦ <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.		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 will have to go above this level for more than the P1-05 time in order to wake up.		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	
P8-07 ♦ <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	
P8-08 ♦ <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 min	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	0 ~ 2	1	Programming	
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	
P8-11 ♦ <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 s	5.0 s	Programming	
			Network Options				
P9-01 <0034>	0880	Lead Drive Selection **Lead Drive Sel**	Specifies how the next Lead Drive is selected. 0: Next Available 1: Lowest Runtime	0 ~ 1	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.

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location	Page No.
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.	0 ~ 1	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 = 0, this time specifies how long before the drive runs at the P9-06 speed.	0 ~ 1000 s	5 s	Programming	
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	0 ~ 2	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>	0889	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 s	10 s	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	0 ~ 2	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 s	10 s	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 s	3 s	Programming	

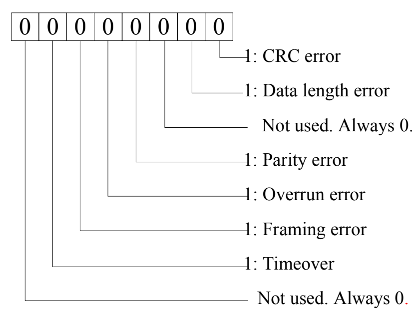
♦ Denotes that parameter can be changed when the drive is running.

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting	Menu Location	Page No.
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	
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 ~ 16	16	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 s	0 s	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.	02 h ~ 10 h	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 s	4.0 s	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 s	2.0 s	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 s	2.0 s	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	*258*
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	*258*
♦ Denotes that parameter can be changed when the drive is running.							

Monitor List

Table 124 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. 0 0 0 0 0 0 0 0 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. 0 0 0 0 0 0 0 0 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**	0 0 0 0 0 0 0 0 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**	
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.
U1-90	0720	Pump Set-point **Pump Set-point**	Displays drive setpoint. Resolution 0.1 **Note:** Does not include setpoint compensation (U1-93).
U1-91	0721	Pump Feedback **Pump Feedback**	Displays scaled feedback. Resolution 0.1

Parameter No.	Addr. Hex	Parameter Name Digital Operator Display	Description
			Monitor
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.
U1-98	72C	Water Level **Water Level**	Displays the amount of water above the water level sensor.
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 125 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 126 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 127 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

Appendix: B

Factory Default Settings

This appendix lists the factory default settings for the parameters affected by setting of o2-04.

Factory Default Settings

The following tables detail the factory default settings for the parameters that are affected by the setting of parameter o2-04.

Table 1 208/240 VAC Drives

Drive Model CIMR-P7U-□-107	Nominal Hp	Factory Default for b8-04	Factory Default for E2-01	Factory Default for E2-03	Factory Default for E2-05	Factory Default for L2-02	Factory Default for L2-03	Factory Default for L2-04	Factory Default for L8-02	Factory Default for L8-06
20P4	0.5/0.75	288.2	1.9	1.2	9.842	0.1	0.1	0.3	95 °C	5
20P7	2	223.7	3.3	1.8	5.156	0.1	0.2	0.3	95 °C	7.5
21P5	1.5/2	169.4	6.2	2.8	1.997	0.2	0.3	0.3	95 °C	10
22P2	3	156.8	8.5	3.0	1.601	0.3	0.4	0.3	100 °C	12
23P7	5	122.9	14.0	4.5	0.771	0.5	0.5	0.3	95 °C	12
25P5	7.5	94.75	19.6	5.1	0.399	1.0	0.6	0.3	95 °C	10
27P5	10	72.69	26.6	8.0	0.288	1.0	0.7	0.3	95 °C	17
2011	15	70.44	39.7	11.2	0.230	1.0	0.8	0.3	95 °C	21
2015	20	63.13	53.0	15.2	0.138	2.0	0.9	0.3	90 °C	17
2018	25	57.87	65.8	15.7	0.101	2.0	1.0	0.6	100 °C	15
2022	30	51.79	77.2	18.5	0.079	2.0	1.0	0.6	90 °C	24
2030	40	46.27	105.0	21.9	0.064	2.0	1.1	0.6	90 °C	20
2037	50	38.16	131.0	38.2	0.039	2.0	1.1	0.6	95 °C	18
2045	60	35.78	160.0	44.0	0.030	2.0	1.2	0.6	100 °C	20
2055	75	31.35	190.0	45.6	0.022	2.0	1.2	0.1	105 °C	17
2075	75/100	23.10	260.0	72.0	0.023	2.0	1.3	0.1	110 °C	16
2090	125	20.65	260.0	72.0	0.023	2.0	1.5	0.1	100 °C	18
2110	150	18.12	260.0	72.0	0.023	2.0	1.7	0.1	95 °C	20

Note: b8-04 = Energy Savings Coefficient
E2-01 = Motor Rated Current
E2-03 = Motor No-Load Current
E2-05 = Motor Line-to-Line Resistance
L2-02 = Momentary Power Loss Ride-Thru Time
L2-03 = Momentary Power Loss Minimum Base Block Time
L2-04 = Momentary Power Loss Voltage Recovery Ramp Time
L8-02 = Overheat Pre-Alarm Level
L8-06 = Input Phase Loss Detection Level

Table 2 480 VAC Drives

Drive Model CIMR-P7U-□-107	Nominal Hp	Factory Default for b8-04	Factory Default for E2-01	Factory Default for E2-03	Factory Default for E2-05	Factory Default for L2-02	Factory Default for L2-03	Factory Default for L2-04	Factory Default for L8-02	Factory Default for L8-06
40P4	0.5/0.75	576.40	1.0	0.6	38.198	0.1	0.1	0.3	95 °C	5
40P7	1	447.40	1.6	0.8	22.459	0.1	0.2	0.3	95 °C	7.5
41P5	1.5/2	338.80	3.1	1.4	10.100	0.2	0.3	0.3	95 °C	10
42P2	3	313.60	4.2	1.5	6.495	0.3	0.4	0.3	90 °C	10
43P7	5	245.80	7.0	2.3	3.333	0.5	0.5	0.3	95 °C	12
45P5	7.5	189.50	13.3	2.6	1.595	1.0	0.6	0.3	95 °C	10
47P5	10	145.38	19.9	4.0	1.152	1.0	0.7	0.3	90 °C	20
49P0	15	145.46	21.0	4.4	0.922	1.0	0.8	0.3	95 °C	23
4011	15/20	140.88	26.5	5.6	0.922	2.0	0.8	0.3	95 °C	23
4015	25	126.26	32.9	7.6	0.550	2.0	0.9	0.3	95 °C	17
4018	30	115.74	52.3	7.8	0.403	2.0	1.0	0.6	98 °C	17
4024	40	89.08	52.0	8.6	0.269	2.0	1.1	0.6	85 °C	20
4030	40/50	92.54	65.6	10.9	0.269	2.0	1.1	0.6	85 °C	20
4037	60	76.32	79.7	19.1	0.155	2.0	1.1	0.6	85 °C	20
4045	75	71.56	95.0	22.0	0.122	2.0	1.2	0.6	90 °C	20
4055	100	67.20	130.0	24.0	0.088	2.0	1.2	1.0	90 °C	20
4075	125	46.20	130.0	36.0	0.092	2.0	1.3	1.0	98 °C	16
4090	150	38.91	156.0	40.0	0.056	2.0	1.5	1.0	108 °C	16
4110	200	36.23	190.0	49.0	0.046	2.0	1.7	1.0	100 °C	16
4160	250	30.13	270.0	70.0	0.029	2.0	1.8	1.0	108 °C	14
4185	300/350	30.57	310.0	81.0	0.025	2.0	0.7	1.0	95 °C	15
4220	400/450	27.13	370.0	96.0	0.020	2.0	0.8	1.0	100 °C	15
4300	500+	21.76	500.0	130.0	0.014	2.1	0.9	1.0	95 °C	15

Note: b8-04 = Energy Savings Coefficient
E2-01 = Motor Rated Current
E2-03 = Motor No-Load Current
E2-05 = Motor Line-to-Line Resistance
L2-02 = Momentary Power Loss Ride-Thru Time
L2-03 = Momentary Power Loss Minimum Base Block Time
L2-04 = Momentary Power Loss Voltage Recovery Ramp Time
L8-02 = Overheat Pre-Alarm Level
L8-06 = Input Phase Loss Detection Level

Carrier Frequency Parameter Factory Defaults:

208V – 240V Drives		
Model CIMR-P7	C6-02 Carrier Frequency (kHz)	C6-03 Carrier Frequency (kHz)
20P4	3	8.0 kHz*
20P7	3	8.0 kHz*
21P5	3	8.0 kHz*
22P2	3	8.0 kHz*
23P7	3	8.0 kHz*
25P5	3	8.0 kHz*
27P5	3	8.0 kHz*
2011	3	8.0 kHz*
2015	3	8.0 kHz*
2018	3	8.0 kHz*
2022	3	8.0 kHz*
2030	3	8.0 kHz*
2037	2	5.1 kHz
2045	2	5.1 kHz
2055	3	8.0 kHz*
2075	1	2.0 kHz
2090	1	2.0 kHz
2110	1	2.0 kHz

480V Drives		
Model CIMR-P7	C6-02 Carrier Frequency (kHz)	C6-03 Carrier Frequency (kHz)
40P4	3	8.0 kHz*
40P7	3	8.0 kHz*
41P5	3	8.0 kHz*
42P2	3	8.0 kHz*
43P7	3	8.0 kHz*
44P0	3	8.0 kHz*
45P5	3	8.0 kHz*
47P5	3	8.0 kHz*
49P0	3	8.0 kHz*
4011	3	8.0 kHz*
4015	3	8.0 kHz*
4018	3	8.0 kHz*
4022	3	8.0 kHz*
4024	3	8.0 kHz*
4030	3	8.0 kHz*
4037	3	8.0 kHz*
4045	3	8.0 kHz*
4055	2	5.1 kHz
4075	2	5.1 kHz
4090	3	8.0 kHz*
4110	2	5.1 kHz
4132	2	5.1 kHz
4160	2	5.1 kHz
4185	1	2.0 kHz
4220	1	2.0 kHz
4300	1	2.0 kHz

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

iQpump Controller

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