INSTRUCTION MANUAL
176R0649
REVISION **C**

INSTALLER: PLEASE LEAVE THIS MANUAL FOR THE OWNER'S USE.

Technologic® 502 Series Pump Controller

Bell & Gossett
a xylem brand

⚠WARNING

EQUIPMENT HAZARD!

DRIVES AND PANELS CONTAIN DANGEROUS VOLTAGES WHEN CONNECTED TO LINE VOLTAGE. IT IS STRONGLY RECOMMENDED THAT ALL ELECTRICAL WORK CONFORM TO THE NATIONAL ELECTRICAL CODE (NEC) AND ALL NATIONAL AND LOCAL REGULATIONS. INSTALLATION, START-UP AND MAINTENANCE SHOULD BE PERFORMED ONLY BY QUALIFIED PERSONNEL. FAILURE TO FOLLOW THE NEC OR LOCAL REGULATIONS COULD RESULT IN DEATH OR SERIOUS INJURY.

Motor control equipment and electronic controls are connected to hazardous line voltages. Extreme care should be taken to protect against shock. The user must be protected against supply voltage and the motor must be protected against overload in accordance with applicable national and local regulations. Be sure equipment is properly grounded. Wear safety glasses whenever working on electric control or rotating equipment.

⚠WARNING

UNINTENDED START!

WHEN DRIVE OR OPTION PANEL IS CONNECTED TO AC INPUT POWER, MOTOR MAY START AT ANY TIME. THE DRIVE, OPTION PANEL, MOTOR, AND ANY DRIVEN EQUIPMENT MUST BE IN OPERATIONAL READINESS. FAILURE TO BE IN OPERATIONAL READINESS WHEN PANEL AND DRIVE ARE CONNECTED TO AC INPUT POWER COULD RESULT IN DEATH, SERIOUS INJURY, OR EQUIPMENT OR PROPERTY DAMAGE.

Warning Against Unintended Start

When the drive or option panel is connected to the AC line, the motor may be started by means of an external switch, a serial bus command, an input reference signal, or a cleared fault condition. Use appropriate cautions to guard against an unintended start.

⚠WARNING

GROUNDING HAZARD!

FOR OPERATOR SAFETY, IT IS IMPORTANT TO GROUND DRIVE, OPTION PANEL, AND MOTOR PROPERLY. FOLLOW THE GROUNDING GUIDELINES OF LOCAL AND NATIONAL CODES. FAILURE TO FOLLOW GROUNDING GUIDELINES COULD RESULT IN DEATH OR SERIOUS INJURY.

Grounding

Proper protective grounding of the equipment must be established in accordance with national and local codes. Ground currents are higher than 3 mA. Use high stranded wire whenever possible.

Safety Guidelines

1. The drive and option panel must be disconnected from the AC line before any service work is done.

2. DO NOT touch electrical parts of the option panel or drive when the AC line is connected. After the AC line is disconnected, wait 30 minutes before touching any electrical components.

3. The user must be protected against supply voltage and the motor must be protected against overload in accordance with applicable national and local regulations.

4. While programming parameters, the motor may start without warning. Activate the STOP/OFF key on the control keypad when changing parameters.

5. The STOP/OFF key on the local control panel keypad of the drive does not isolate the drive from the AC line voltage and is not to be used as a safety switch.

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Section 1 Introduction

Purpose of the Manual

This manual is intended to provide detailed information for the installation and operation of the option panel used in conjunction with the Technologic 502 Pump Controller. To enable efficient handling of the equipment, requirements are provided for mechanical installation, power and control wiring, proper grounding, and environmental considerations. Pre-start and start up procedures are detailed. Also included is a detailed overview of the option panel bypass function. In addition, programming, identification and operation of optional components, and basic troubleshooting instructions are included as well.

Overview

The Technologic 502 Pump Controller is a variable frequency drive with embedded pump control software. It is available in several different configurations.

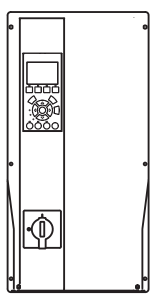


Figure 1-1. Technologic 502 Pump Controller

Drives on a common backpanel are factory-wired between the master and follower drives and contain a main disconnect. Configurations may include a fused disconnect or bypass.

Type A-1 Controller (1 Pump/1 Drive)

The type A-1 consists of a stand-alone Technologic 502 master with embedded pump controller software and an electronically controlled automatic bypass. The bypass can also be activated manually through the drive keypad.

Type B-3 Controller (2 Pumps/1 Drive)

The type B-3 controller consists of a Technologic 502 master with embedded pump controller software, contact motor selection, and an electronically controlled bypass. Contact motor selection allows the controller to alternate between two motors of equal size, a duty pump and a standby. The duty pump is controlled to maintain a set point. Selection between motors is made automatically by the Technologic 502 or by manual selection through a selector switch. The bypass enables either motor to be driven by 100% line power while bypassing the controller circuitry. The Technologic 502 and electronically controlled bypass are factory wired and mounted to a common backplate.

Type C-4 Controller (2 Pumps/2 Drives)

The type C-4 bypass consists of a Technologic 502 master and (1) follower drive each with embedded pump controller software and an electronically controlled automatic bypass. The C-4 controller allows for duty/standby operation where only one pump is run at any time. Selection between drive mode or automatic bypass is determined by the master. The bypass can also be activated manually through each drive's keypad.

Type D-4 Controller (2 Pumps/2 Drives)

The type D-4 bypass consists of a Technologic 502 master and (1) follower drive each with embedded pump controller software and an electronically controlled automatic bypass. The D-4 controller allows parallel operation between the master and follower drive in response to a set point. Drive mode or automatic bypass is determined by the master. The bypass can also be activated manually through each drive's keypad.

Type S-1 Controller (with or without manual by-pass)

The type S-1 controller comes in two different configurations. One consists of a Technologic 502 master with embedded pump controller software with up to three follower drives. The other S-1 configuration is the same with the addition of a manual bypass for the master and a manual bypass for each follower drive. The controller allows parallel operation between the master and follower drives in response to a set point. All drives will run at the same synchronized speed.

A-0 (1 Technologic 502 Master 0nly)

A-M (1 Technologic 502 Master only with manual bypass)

C-0 (1 Technologic 502 Master with (1) follower – No Staging)

C-M (1 Technologic 502 Master with (1) follower each with manual bypass – No Staging)

D-0 (1 Technologic 502 Master with (up to 3) followers – Staging Allowed)

D-M (1 Technologic 502 Master with (up to 3) followers each with manual bypass – Staging Allowed)

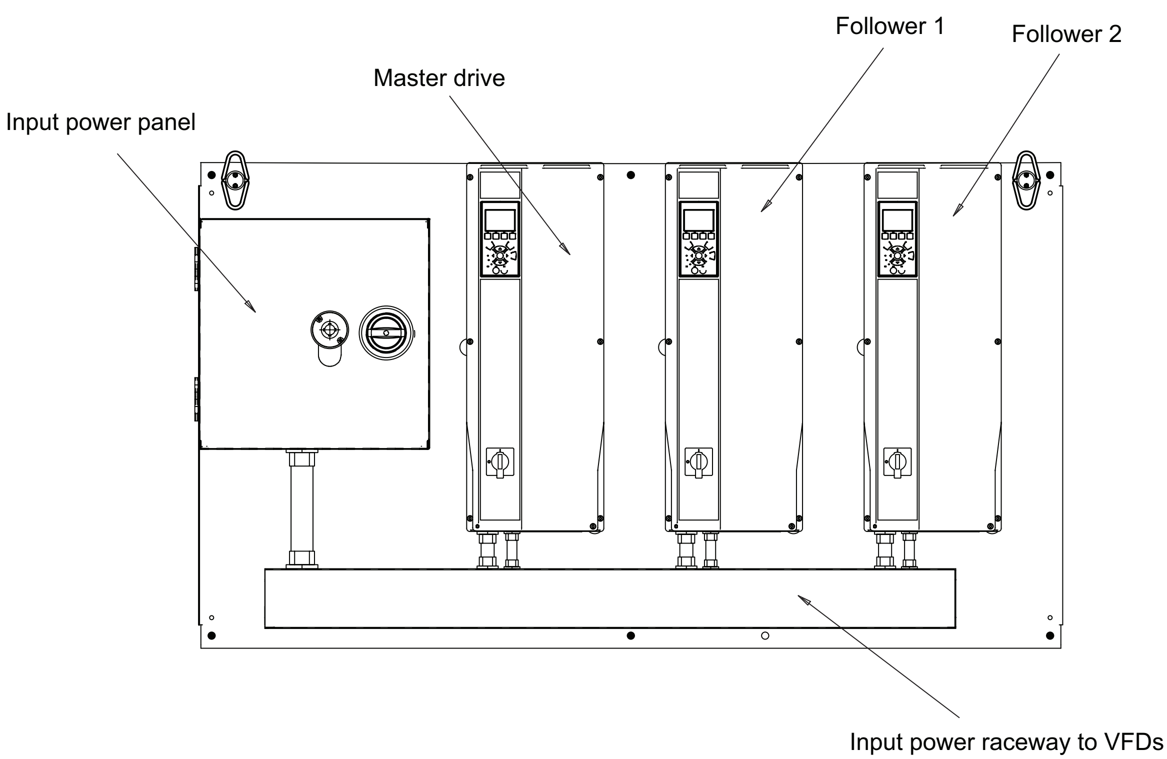


Figure 1-2. Master Drive with Two Followers

Typical Bypass Operation

With contactors M1 and M2 closed and contactor M3 open (see Figure 1-3), the pump is controlled by the drive. Opening contactor M2 removes power to the pump but allows the controller to remain powered. This is the test mode and only available in the three-contactor configuration shown. With contactors M1 and M2 open and contactor M3 closed, the pump runs in bypass from the line input. For a two-contactor configuration, M1 is absent. In this case, contactors M2 and M3 control the options for running in drive or bypass mode. The figure illustrates a drive disconnect and fuses.

Overload Protection.

This thermally activated device provides mechanical overload protection for the pump(s) while in bypass operation. It measures motor current and is factory set to the full load amps (FLA) of the pump. A 1.2 x FLA service factor is built-in and maintained. Should the motor current increase above that value, the overload will calculate the level of increase to activate timing for the trip function. The higher the current draw, the quicker the trip response. The overload provides Class 20 motor protection.

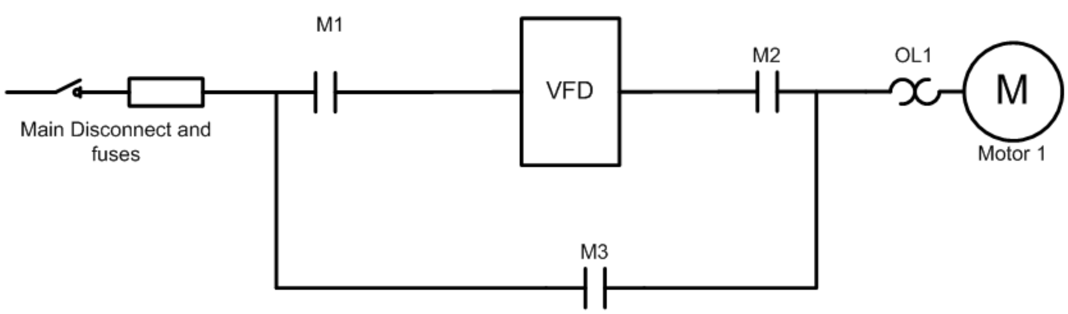


Figure 1-3. Basic 3-contactor Bypass Functions

Disconnects

Main disconnect. The main disconnect removes line input power to the controller and bypass. A main disconnect is available in two options. For safety, the switch must be in the OFF position before the panel door can be opened. (See Figure 1-4.)

- **Main disconnect with built-in fuses.** Two-position (ON/OFF) rotary switch, with three built-in fuses, one on each phase.
- **Main disconnect with separate fuses**. Two-position (ON/OFF) rotary switch with a fuse block mounted separately from the disconnect. Three fuses, one on each phase, are located on the fuse block.

Drive disconnect. Two-position (ON/OFF) rotary switch disconnects main AC line input power to the drive only.

Motor Alternation Selector Switch

The B3 option includes contactor motor selection. It provides motor alternation with one drive alternating operation between two motors. The panel mounted Motor 1/Auto/Motor 2 selector switch provides local control of either motor along with an auto setting that allows auto selection through the master drive.

Power Fusing

Two types of fusing are available for the units—main and drive fusing. For all power fuses, use the specified fuse or an equivalent replacement only. See the fuse ratings label on the inside cover of the unit for ratings.

Main fusing. Main fuses are located ahead of the drive. Main fuses are designed to protect the circuitry within the panel but are not adequate to protect the drive. Main fuses are dual-element, time-delay type and mount inside the bypass enclosure.

Drive fusing. Drive fuses are located ahead of the drive and are a fast-acting type. Drive fuses are standard in two-contactor and three-contactor bypasses. A fuse/disconnect enclosure may be used if no options other than a fuse block and disconnect switch are required.

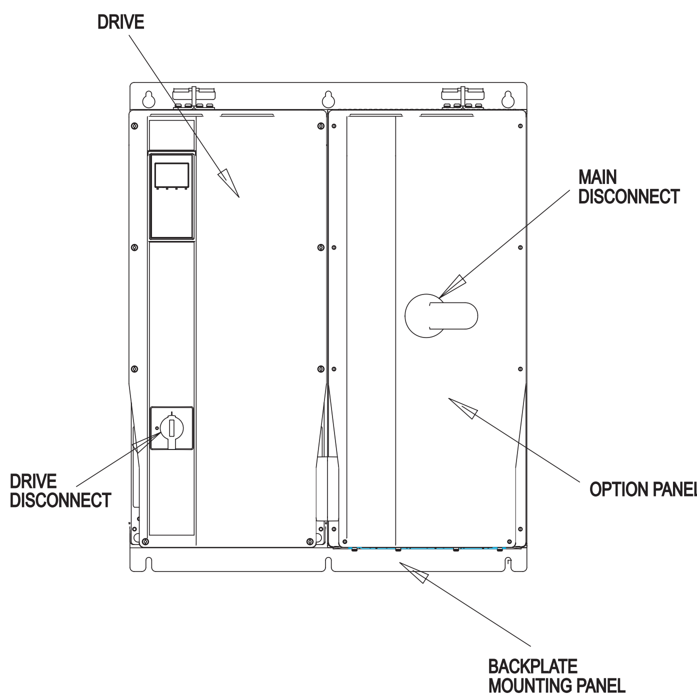
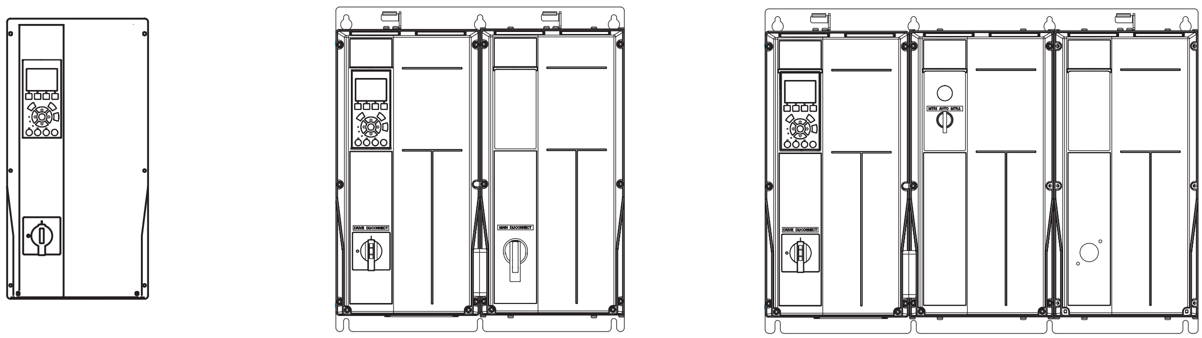


Figure 1-4. Disconnects

Drive Option Panel Configurations

The Technologic 502 Drive Series has three tiers of option panel enclosure types. The option panel contains the bypass as in Tier 2. Two option panels are provided in Tier 3 with one containing the bypass and the other the contactor motor selector. (See Figure 1-5)

Tier 1 **Tier 2** **Tier 3**



Drive with fuses and disconnect

Drive with bypass

Drive with bypass and contactor motor selector (B3)

Figure 1-5. Tier Definitions and Features

Option Panel Voltage and Frame Ratings

Table 1-1 defines the voltage and hp ratings of the frames sizes for the drive and option panel. See the mechanical drawing shipped with the unit for dimensions.

Frame A2 - A5	
Volts VAC	**hp**
208-230	2-5
460-480	3-10
575-600	3-10

Frame B1	
Volts VAC	**hp**
208-230	7.5-15
460-480	15-25
575-600	15-25

Frame B2	
Volts VAC	**hp**
208-230	15-20
460-480	30-40
575-600	30-40

Frame C1	
Volts VAC	**hp**
208-230	25-30
460-480	50-75
575-600	50-75

Frame C2	
Volts VAC	**hp**
208-230	40-60
460-480	100-125
575-600	100-125

Frame D1	
Volts VAC	**hp**
460-480	150-200
575-600	150-200

Frame D2	
Volts VAC	**hp**
460-480	250-350
575-600	250-400

Table 1-1. Panel Voltage and Frame Ratings

Section 2 Pre-installation

Pre-installation Check

1. Compare model number to what was ordered.

2. Ensure each of the following are rated for same voltage:
    - Power line
    - Drive
    - Option panel
    - Motor

3. Ensure that option panel output rating is equal to or greater than motor total full load current for full motor performance.

- Motor power size and option panel must match for proper overload protection.

- If panel rating is less than motor, full motor output cannot be achieved.

4. Check motor wiring:

- Any disconnect between drive and motor should be interlocked to drive safety interlock circuit to avoid unwanted drive trips.

- Do not connect power factor correction capacitors between drive and motor.

- Two speed motors must be wired permanently for full speed.

- Y-start, △-run motors must be wired permanently for run.

Installation Site Check

- Because the option panel relies on the ambient air for cooling, it is important to observe the limitations on ambient air temperature. Derating starts above 40°C (104°F) and 3300 feet (1000m) elevation above sea level.

- It is important with backpanel mounted units to check support strength. Make sure that the proper mounting screws or bolts are used.

- Keep the option panel interior free from dust and similar dirt. In construction areas, if the unit is not powered, provide a protective covering. It is important to ensure that the components stay as clean as possible. It may be necessary to clean the interior once construction is completed.

- Keep wiring diagrams, drawings and manuals accessible for detailed installation and operation instructions. It is important that the manuals be available for equipment operators.

Harsh Environments

The mechanical and electrical components within the option panel can be adversely affected due to the environment. The effects of contaminants in the air, either solid, liquid, or gas, are difficult to quantify and control. Depending upon the severity of the environment, optional NEMA 12, NEMA 3R or NEMA 4 enclosures may be used.

Airborne Liquids

Liquids in the air can condense in components. Water vapor carried in the air is easily measured as relative humidity, but other vapors are often more difficult to measure or control. Steam, oil, and salt water vapor (near sea locations) may cause corrosion of components. In such environments, use NEMA 12 enclosures to limit the exchange of outside air into the option enclosure. Extremely harsh environments may require a higher level of protection.

Airborne Solids

Particles in the air may cause mechanical, electrical or thermal failure in components. A NEMA 1 enclosure provides a reasonable degree of protection against falling particles, but it will not prevent the fan from pulling dirty air into the enclosure. A typical indicator of excessive levels of airborne particles is dust around the fan. In dusty environments, use NEMA 12 enclosures.

Corrosive Chemicals

In environments with high temperatures and humidity, *corrosive gases* such as sulfur, nitrogen and chlorine compounds cause corrosion to occur in components. Indications of corrosion are blackened copper or rust on steel or oxidized aluminum. In such environments, it is recommended that the equipment be mounted in a cabinet with fresh air ventilation and that corrosive compounds be kept away. A non-ventilated cabinet fitted with an air conditioner as a heat exchanger may be used. Conformal coated circuit boards may be specified to reduce the corrosive effects of a harsh environment.

Section 3 Installation
Common Backpanel Mounted Units

Branch Circuit Protection

⚠WARNING

BRANCH CIRCUIT PROTECTION REQUIRED!

PROVIDE BRANCH CIRCUIT PROTECTION IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE. FAILURE TO PROVIDE BRANCH CIRCUIT PROTECTION IN ACCORDANCE WITH THE NEC MAY RESULT IN EQUIPMENT OR PROPERTY DAMAGE.

Drive Fuses

If specified as an option, drive input fuses will be factory installed in the enclosure. If not factory supplied, they must be provided by the installer as part of installation.

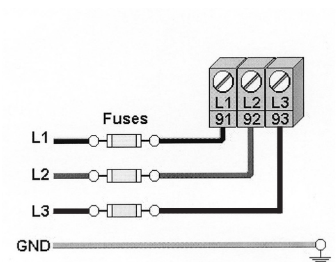


Figure 3-1. Drive Input Fuses

Internal Option Panel Fuses

Use the specified fuse or an equivalent replacement only for internal option panel fuses. Fuse options include the drive disconnect and contactor fuses.

Tools and Equipment Required

In addition to the standard tool kit, the tools and devices in Table 3-1 are recommended for installation of the unit.

Table 3-1. Tools and Equipment Required

TOOLS
Spreader bar capable of lifting up to 1000 lbs. Max diameter 0.875 in.
Forklift, crane, hoist or other lifting device capable of handling up to 1000 lbs. (Qualified device operator available for operating the equipment.)
Metric socket set: 7 - 19mm
Socket extensions: 4 & 6 in
Torx driver set: T10 - T40
Torque wrench: 6 - 170 in-lbs

Table 3-2. Connection Tightening Torques

Power (hp)				Torque (in-lbs)				
Frame	200-240 V	380-480 V	525-600 V	Line	Motor	DC Brake	Ground	Relay
A2	2 - 5	3 - 5	3 - 5	17	17	17	28	5
A3	5	10	5 - 10	17	17	17	28	5
A5	1.5 - 5	1.5 - 10	1.5 - 10	17	17	17	28	5
B1	7.5 - 15	15 - 25	--	17	17	13	28	5
B2	20	30 - 40	--	22, 40	22, 40	32	29	5
C1	25 - 40	50 - 75	--	88	88	88	28	5
C2	50 - 60	100 - 125	--	124, 212	124, 212	124	29	5
D1	--	150-200	150-200	168	168	84	29	7
D2	--	250-350	250-400	168	168	84	29	7

Mechanical Installation

Lifting

Check the weight of unit to determine the safety of the lifting method. (See the mechanical drawing supplied with the equipment for unit weight.) Ensure that the lifting device is suitable for the task. If necessary, plan for a hoist, crane or forklift with appropriate rating to move the units. For lifting, use hoist rings provided.

Cooling

- Mount the controller and panel vertically.
- Option panels rely on the ambient air for cooling. It is important to observe the limitations on ambient air temperature. Derating start above 104°F (40°C) and 3300 feet elevation above sea level.
- Top and bottom clearance is required for cooling (Figure 3-2). Generally, 4 to 10 inches (100 to 250 mm) minimum clearance is required, depending upon the hp of the unit. See the mechanical drawing shipped with the unit for specific requirements.

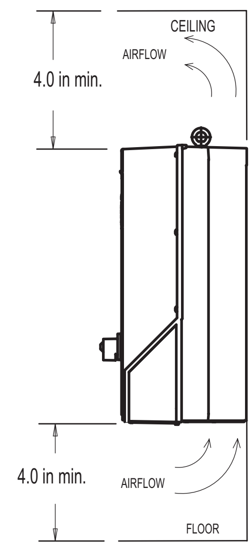


Figure 3-2. Cooling Airflow

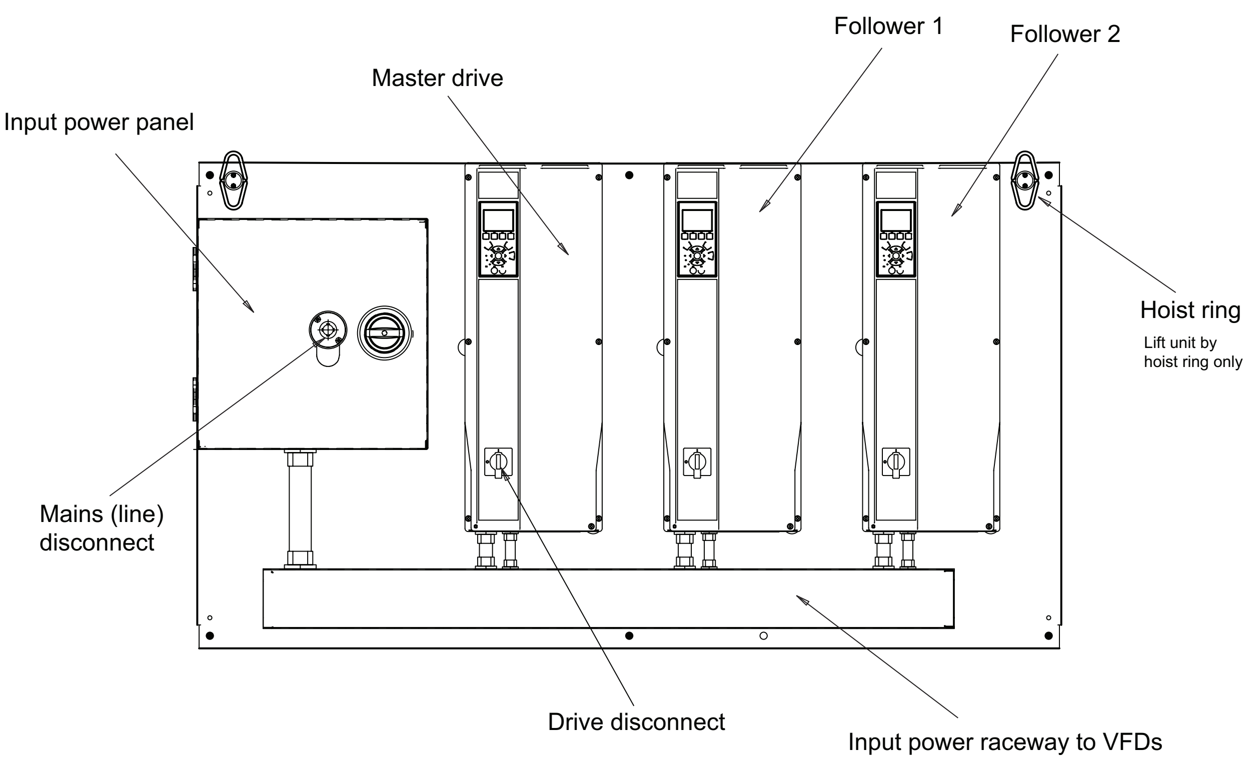


Figure 3-3. Typical Unit Components

Electrical Installation

⚠WARNING

Equipment Hazard!

Rotating shafts and electrical equipment can be hazardous. It is strongly recommended that all electrical work conform to all national and local regulations. Installation, start-up, and maintenance should be performed only by qualified personnel. Failure to follow local regulations could result in death or serious injury.

- Motor control equipment and electronic controls are connected to hazardous line voltages. Extreme care should be taken to protect against electrical hazard.
- Proper protective grounding of the equipment must be established. Ground currents are higher than 3 mA.
- A dedicated ground wire is required.
- Wear safety glasses whenever working on electric control or rotating equipment.

NOTE

Make all power connections with minimum 75° C rated copper wiring for installations in North America.

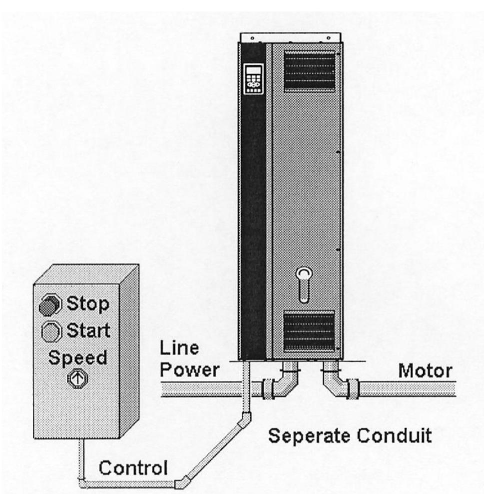


Figure 3-4. Power Connections

⚠WARNING

Induced Voltage!

Run output motor cables from multiple drives separately. Induced voltage from output motor cables run together can charge equipment capacitors even with the equipment turned off and locked out. Failure to run output cables separately could result in death or serious injury.

NOTE

Run drive input power, motor wiring, and control wiring in three separate metallic conduits or raceways for high frequency noise isolation. Failure to isolate power, motor, and control wiring could result in less than optimum controller and associated equipment performance.

- Because the wiring from the option enclosure to the motor carries high frequency electrical pulses, it is important that no other wires are run in this conduit. If the incoming power wiring is run in the same conduit as the motor wiring, these pulses can couple electrical noise back onto the building power grid.

At least three separate conduits must be connected to the panel option. (See Figure 3-4.)

- Power wiring into the enclosure (and ground back to the distribution panel)
- Power wiring from the enclosure to the motor (and earth ground)
- Control wiring

Control wiring should always be isolated from the high voltage power wiring.

Avoid getting metal chips into electronics.

Follow the connection procedures as illustrated in the drawing provided with the unit.

For internal component identification, see Figure 3-5.

Wire Type Rating

- Use wiring corresponding to the wire rating specification provided.
- The wire rating specification is located on the wire rating label inside the cover of the option panel.

Terminal Tightening Torques

- Tighten all connections to the torque specification provided in Table 3-2.

Line Input (Mains) Connection

- Size wiring based upon the input current of the drive. Recommended wire sizes are provided on the connection drawing of the unit.
- Local codes must be complied with for cable sizes.

WARNING

RUN INPUT POWER, MOTOR WIRING AND CONTROL WIRING IN THREE SEPARATE METALLIC CONDUITS OR RACEWAYS FOR HIGH FREQUENCY NOISE ISOLATION. FAILURE TO ISOLATE POWER, MOTOR AND CONTROL WIRING COULD RESULT IN LESS THAN OPTIMUM DRIVE AND ASSOCIATED EQUIPMENT PERFORMANCE.

- Connect 3-phase AC input power wire to terminals L1, L2, and L3 on the main disconnect located in the input power panel (see Figure 3-3).
- Depending on the configuration of the equipment, input power may be connected to a circuit breaker or input disconnect.
- **Use with Isolated Input Source.** Many utility power systems are referenced to earth ground. Although not as common, the input power may be an isolated source. All drives may be used with an isolated input source as well as with ground reference power lines.

NOTE

SEE FIGURES 3-12 AND 3-13 FOR POWER, MOTOR AND CONTROL WIRING DIAGRAMS.

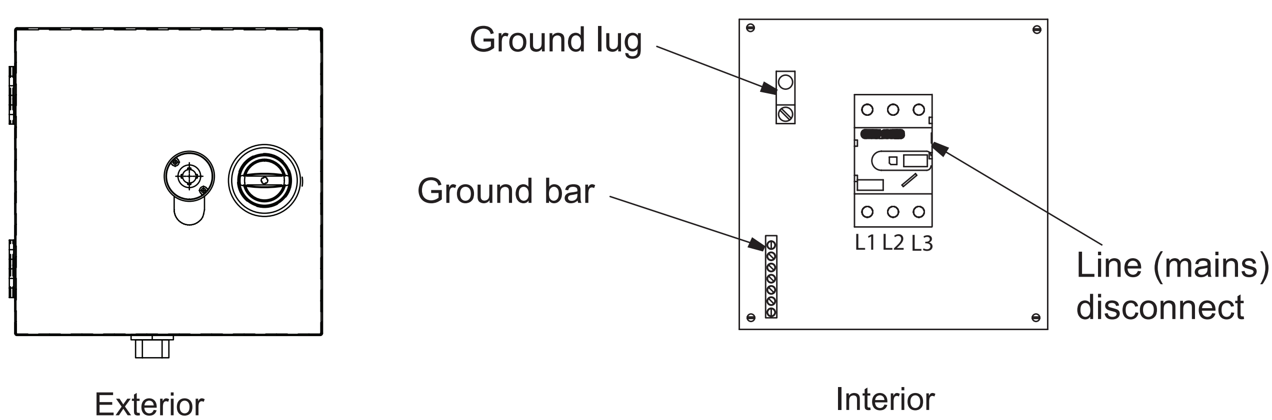


Figure 3-5. Input Power Panel with Line Disconnect

Motor Wiring

⚠WARNING

INDUCED VOLTAGE!

RUN OUTPUT MOTOR CABLES FROM MULTIPLE DRIVES SEPARATELY. INDUCED VOLTAGE FROM OUTPUT MOTOR CABLES RUN TOGETHER CAN CHARGE EQUIPMENT CAPACITORS EVEN WITH THE EQUIPMENT TURNED OFF AND LOCKED OUT. FAILURE TO RUN OUTPUT MOTOR CABLES SEPARATELY COULD RESULT IN DEATH OR SERIOUS INJURY.

⚠WARNING

WIRING ISOLATION!

RUN INPUT POWER, MOTOR WIRING AND CONTROL WIRING IN THREE SEPARATE METALLIC CONDUITS OR RACEWAYS FOR HIGH FREQUENCY NOISE ISOLATION. FAILURE TO ISOLATE POWER, MOTOR AND CONTROL WIRING COULD RESULT IN LESS THAN OPTIMUM DRIVE AND ASSOCIATED EQUIPMENT PERFORMANCE.

- Motor wiring access panels are provided at the base of the units as shown in Figure 3-6:
- Connect the 3-phase motor wiring to bypass terminals T1 (U), T2 (V), and T3 (W). See the connection drawing provided with unit.
- Depending on the configuration of the equipment, motor wiring may be connected to an electrical or mechanical overload, a contactor, or terminal block (see Figure 3-7).
- Torque terminals in accordance with the information provided in Table 3-2.
- Motor wiring should never exceed the following maximum distances:

  1000 ft (300m) for unshielded
  500 ft (150m) for shielded

- Motor wiring should always be as short as practical.

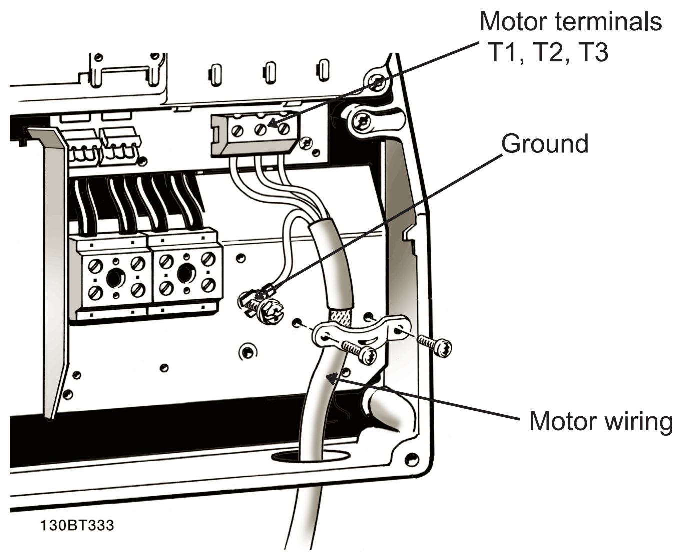


Figure 3-7. Sample Motor Wiring

NOTE

SEE FIGURES 3-12 AND 3-13 FOR POWER, MOTOR AND CONTROL WIRING DIAGRAMS.

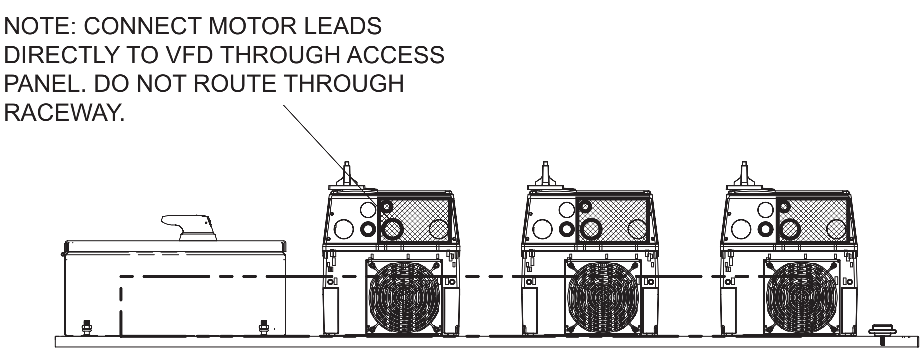


Figure 3-6. Wiring Access Panels (bottom view)

Grounding (Earthing)

⚠WARNING

GROUNDING HAZARD!

FOR OPERATOR SAFETY, IT IS IMPORTANT TO GROUND DRIVE AND OPTION PANEL PROPERLY. FAILURE TO GROUND DRIVE AND OPTION PANEL PROPERLY COULD RESULT IN DEATH OR SERIOUS INJURY.

NOTE

IT IS THE RESPONSIBILITY OF THE USER OR CERTIFIED ELECTRICAL INSTALLER TO ENSURE CORRECT GROUNDING (EARTHING) OF THE EQUIPMENT IN ACCORDANCE WITH NATIONAL AND LOCAL ELECTRICAL CODES AND STANDARDS.

- Follow all local and national codes for proper electrical equipment grounding (earthing).
- Proper protective grounding of the equipment must be established. Ground currents are higher than 3 mA.
- A dedicated ground wire is required.
- Connect the ground wire directly to a reliable earth ground. Grounding studs are provided on the back plate of the option panel for grounding.
- Do not use conduit connected to the option panel as a replacement for a ground wire.
- Do not ground one panel to another in a “daisy chain” fashion. Each panel must have a dedicated ground connection.
- A high strand count ground wire is preferred for dissipating high frequency electrical noise.
- Keep the ground wire connections as short as possible.

NOTE

SEE FIGURES 3-12 AND 3-13 FOR POWER, MOTOR AND CONTROL WIRING DIAGRAMS.

Control Wiring

WARNING

RUN INPUT POWER, MOTOR WIRING AND CONTROL WIRING IN THREE SEPARATE METALLIC CONDUITS OR RACEWAYS FOR HIGH FREQUENCY NOISE ISOLATION. FAILURE TO ISOLATE POWER, MOTOR AND CONTROL WIRING COULD RESULT IN LESS THAN OPTIMUM DRIVE AND ASSOCIATED EQUIPMENT PERFORMANCE.

- It is recommended that control wiring is rated for 600 volts for 480 V and 600 V drives and 300 volts for 200-240 V drives.

- Isolate control wiring from high power components in the drive.

Control Wiring Access

- For units 5 hp or less (208 V) and 10 hp or less (480 V), remove access cover plate with screw driver. (See Figure 3-8.)

- For larger size units, remove front cover of unit to access internally mounted control terminals. (See Figure 3-8.)

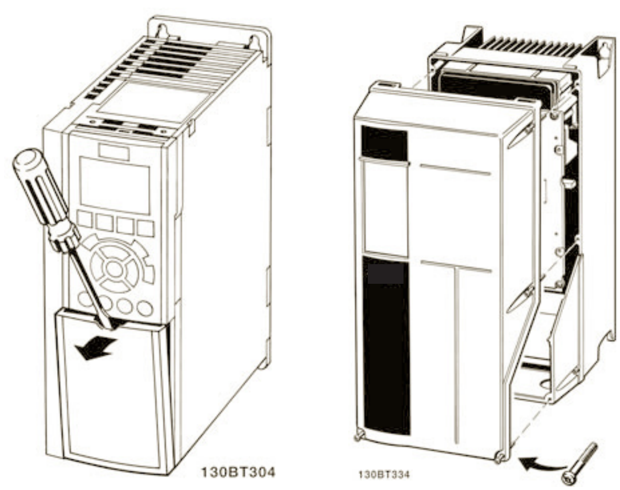


Figure 3-8. Control Terminals Access

Drive Control Terminals

Definitions of the drive terminals are summarized in Table 3-3. Figure 3-9 shows the removable controller connectors and terminals.

- **Connector 1** provides four programmable digital inputs, two additional digital terminals programmable as input or output, a 24 VDC terminal supply voltage, and a common for optional customer supplied 24 VDC voltage.

- **Connector 2** is for the serial communications EIA-485 connector with terminal 68 (+) and 69 (-).

- **Connector 3** provides two analog inputs, one analog output, 10 VDC supply voltage, and commons for the inputs and output.

- **Connector 4** is a USB port available for use with the MCT-10 drive programming software.

- Also provided are two Form C relay outputs that are in various locations depending upon the controller configuration and size.

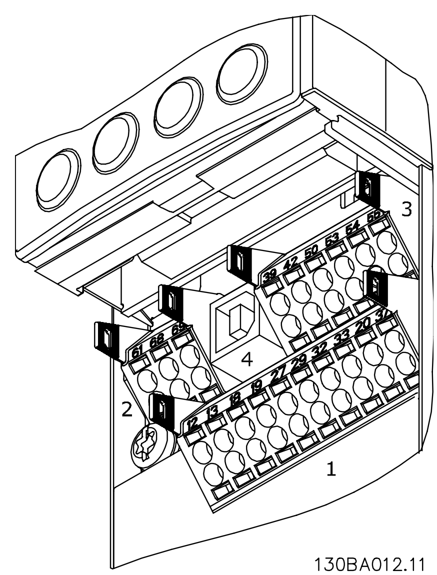


Figure 3-9. Drive Control Terminals

Table 3-3. Drive Control Terminals Functions

Terminal No.	Function
01, 02, 03 04, 05, 06	*Form-C relay output.* Useable for AC or DC voltage and resistive or inductive loads. See drive support materials for details on voltage and current ratings and relay location.
12, 13	*24 VDC digital supply voltage.* Useable for digital inputs and external transducers. To use the 24 VDC for digital input common, program parameter 5-00 for PNP operation. Maximum output current is 200 mA total for all 24V loads.
18, 19, 32, 33	*Digital inputs.* Selectable for NPN or PNP function in parameter 5-00. Default is PNP.
27, 29	*Digital inputs or outputs.* Programmable for either. Parameter 5-01 for terminal 27 and 5-02 for 29 selects input/output function. Default setting is input.
20	*Common for digital inputs.* To use for digital input common, program parameter 5-00 for NPN operation.
39	*Common for analog output*.
42	*Analog output*. Programmable for various functions in parameter 6-5x. The analog signal is 0 to 20 mA or 4 to 20 mA at a maximum of 500 Ω.
50	*10 VDC analog supply voltage*. 15 mA maximum commonly used for a potentiometer or thermistor.
53, 54	*Analog input*. Selectable for voltage (0-10 V) or current (0- or 4-20 mA). Closed is for current and open is for voltage. Switches are located on the drive control card behind the removable LCP. See drive support materials for details.
55	*Common for analog inputs*.
61	*Common for serial communication*. Do not use to terminate shields. See drive support materials for proper shield termination.
68 (+), 69 (-)	*RS-485 interface*. When the drive is connected to an RS-485 serial communication bus, a drive control card switch is provided for termination resistance. ON for termination and OFF for no termination. See drive support materials for details.

NOTE

SEE FIGURES 3-12 AND 3-13 FOR POWER, MOTOR AND CONTROL WIRING DIAGRAMS.

MCB-101 Master Control Board

The Master drive only contains the MCD-101 Master Board which features additional programmable connection terminals (see Figure 3-10). Typically, differential pressure switches, remote system run and system status, and an optional low suction pressure switch are connected to these terminals. (See *Figure 3-12, Control Wiring Schematic Diagram*.)

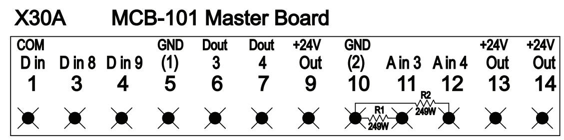


Figure 3-10. Master Board Control Terminals

NOTE

SEE FIGURES 3-12 AND 3-13 FOR POWER, MOTOR AND CONTROL WIRING DIAGRAMS.

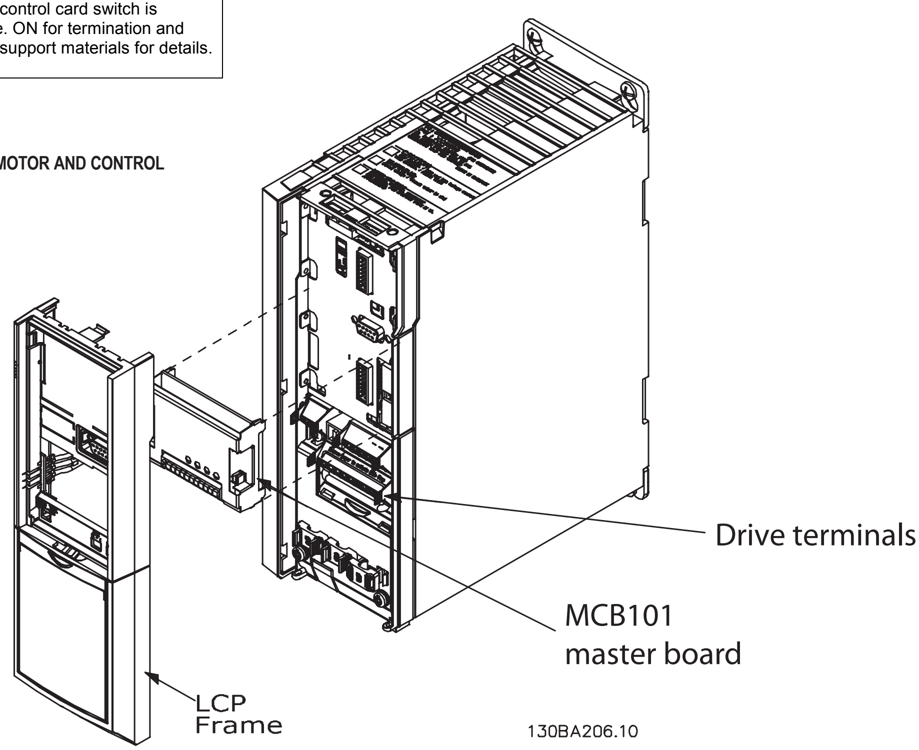


Figure 3-11. Master Board Terminals Location

Pressure and Feedback Wiring

Connect differential pressure wiring and feedback transmitter wiring to terminals as shown in Figure 3-9.

Control Terminal Programming

Control terminals must be programmed. Terminals are multi-functional. Each terminal has a parameter associated with it for setting the desired function. It is essential for operation of the equipment that the control terminals are programmed correctly. Installation programming for units is factory set. See programming in this manual for more details.

See Figure 3-13 for the control terminals schematic diagram.

Serial Communication Bus Connection

The bypass reports serial communication data to host systems through the drive. Connection to the serial communication network is made either through the EIA-485 terminals on the controller (Figure 3-9) or, for other protocols, terminals located on the communication option card. For option card connection, see the option card instructions provided with the unit.

- For bypass serial communication protocols using the EIA-485 terminals, make connections in the following manner.

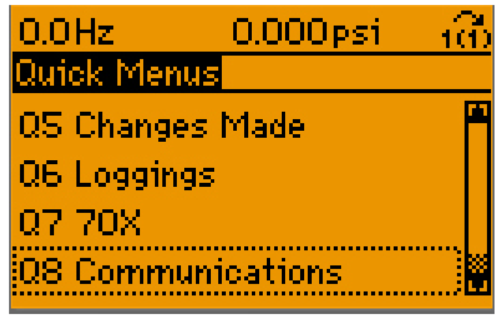
NOTE

It is recommended to use braided-shielded, twisted-pair cables to reduce noise between conductors.

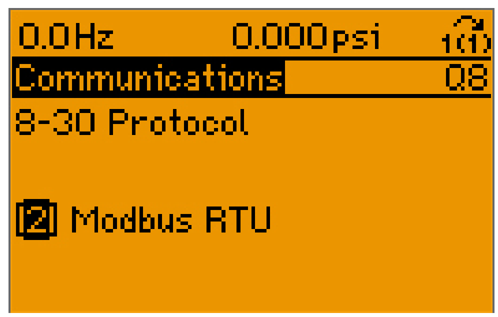
1. Connect signal wires to terminal (+) 68 and terminal (-) 69 on control terminals of controller.
2. Terminate shield to grounded restraining clip provided by stripping wire insulation at point of contact.
3. If shielded cabling is used, do not connect end of shield to terminal 61.

Serial Communications Programming

Select the serial communication protocol type in Quick Menu item *Q8, Communications*.



Press the OK key to access the parameter choices and scroll to parameter *8-30, Protocol* to select the protocol in use.



NOTE

Detailed serial communication instructions are shown in the appendix at the end of this manual.

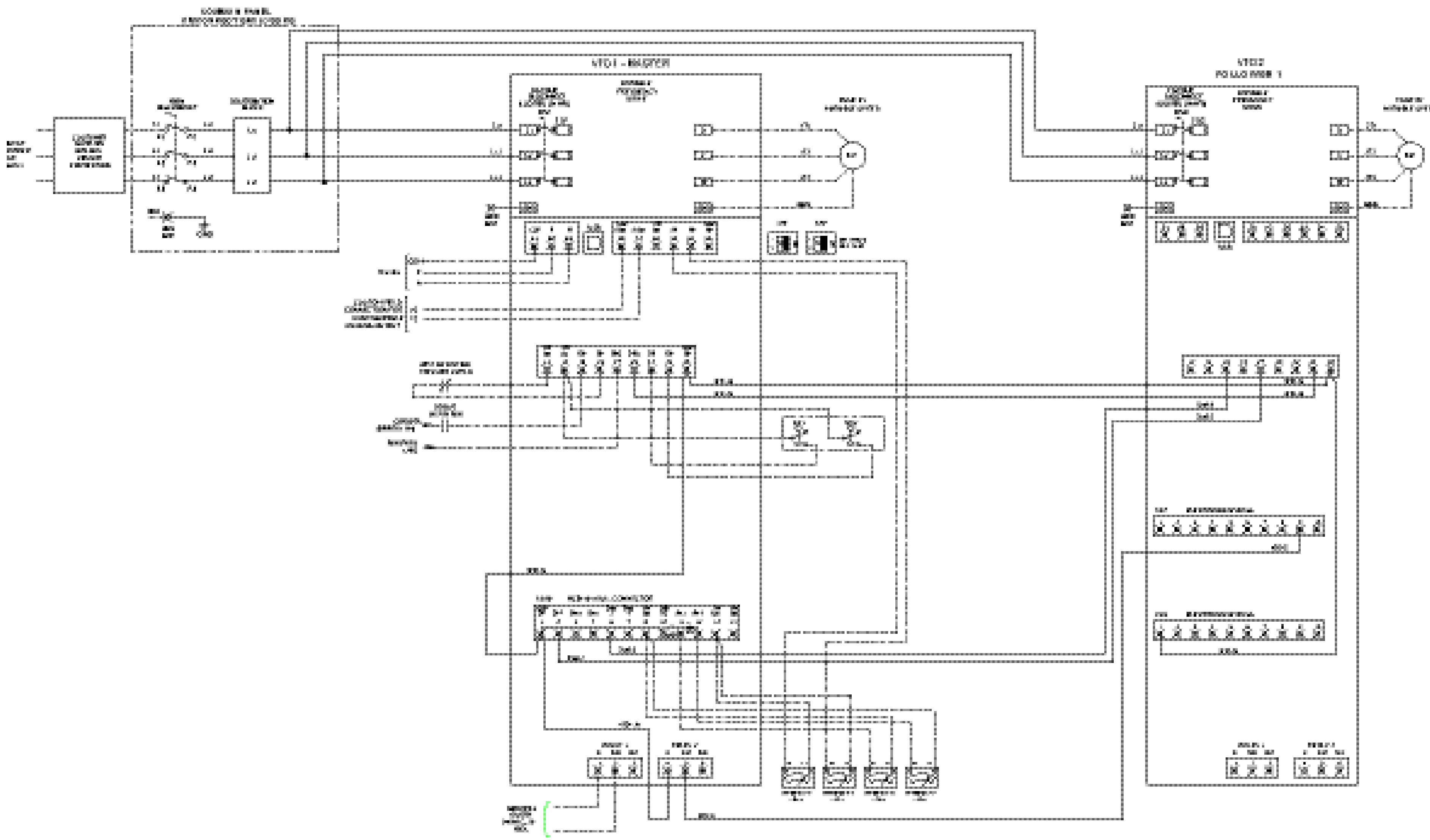


Figure 3-12. Customer Wiring Schematic Diagram, VFD with 1 Follower

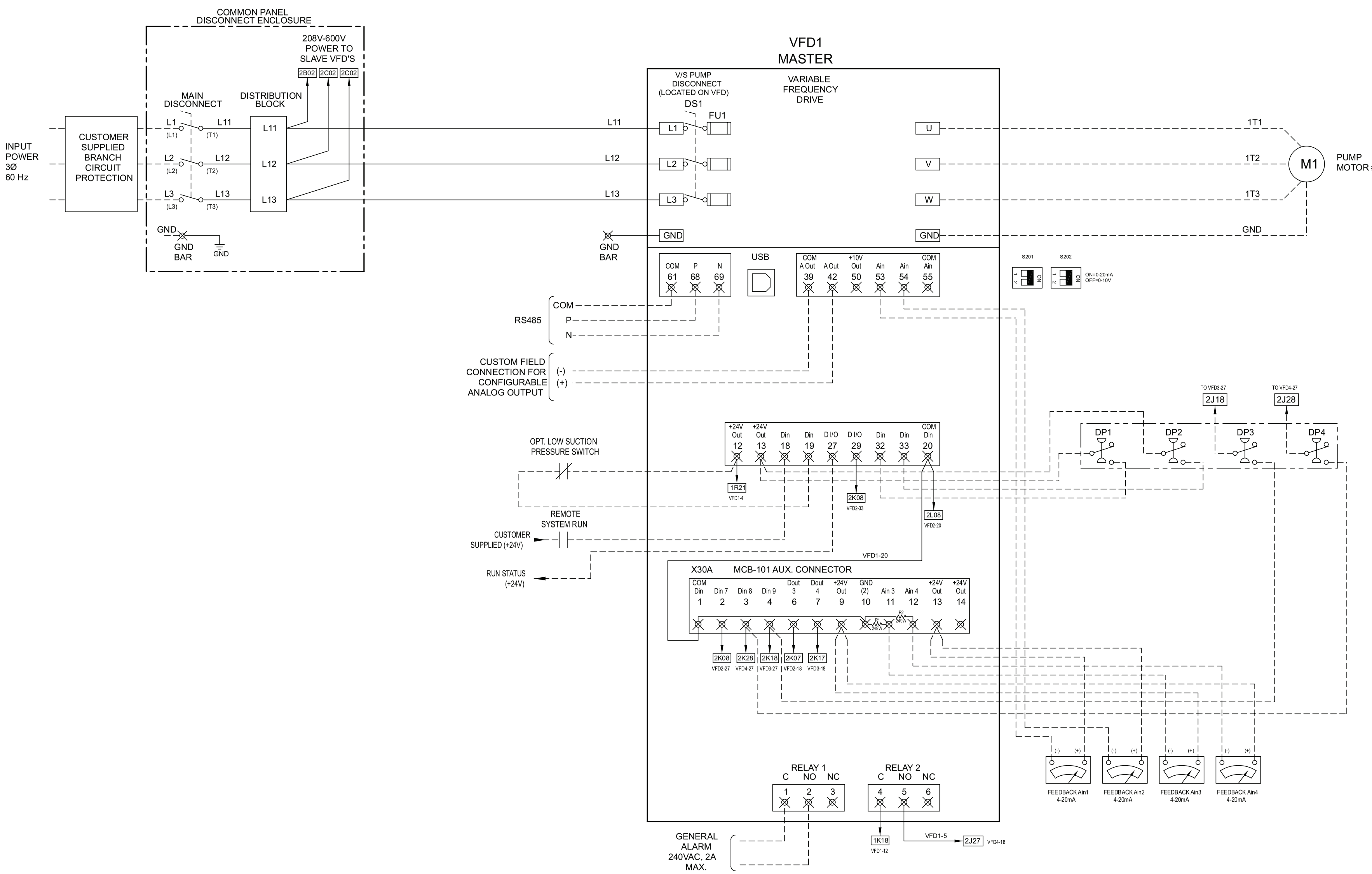


Figure 3-13.1. Customer Wiring Schematic Diagram, VFD with 2 or 3 Followers (1 of 2)

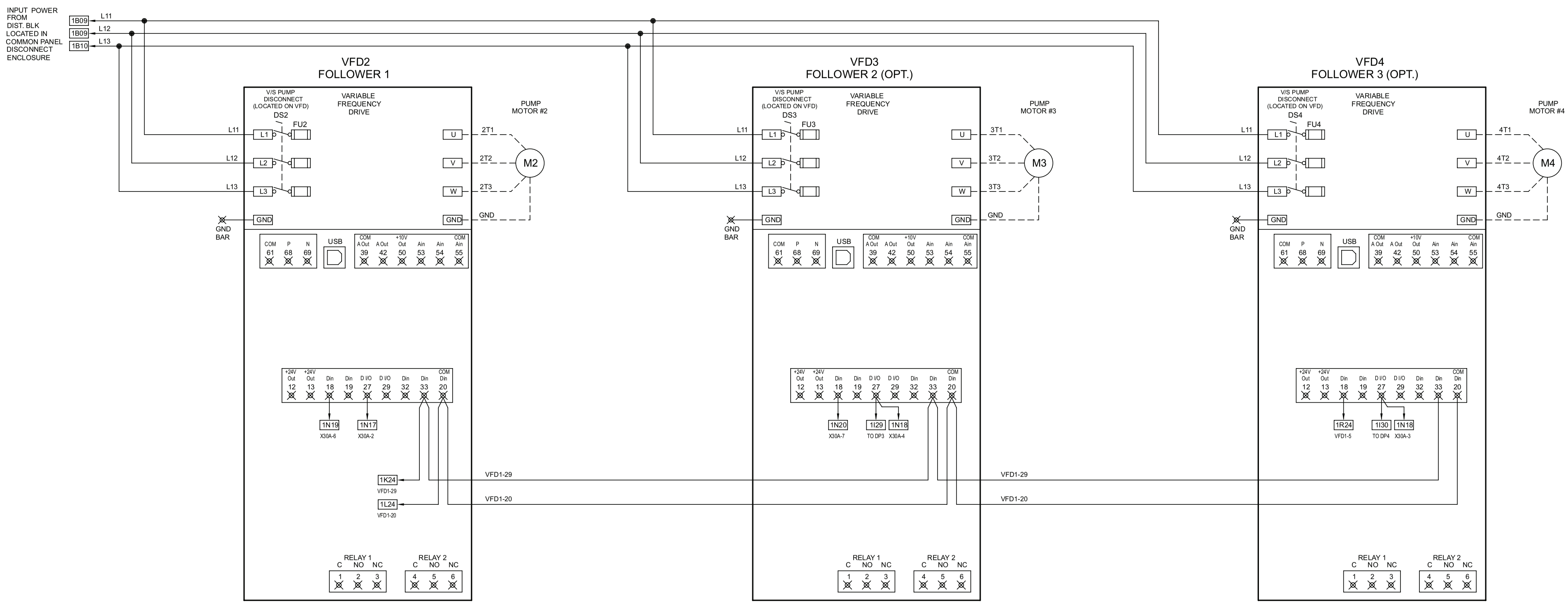


Figure 3-13.2. Customer Wiring Schematic Diagram, VFD with 2 or 3 Followers (2 of 2)

Installation of Backpanel Mounted Drives and Pumps

For Installation of drives and pumps mounted on a common backpanel (see Figure 3-14), follow the installation procedures in Section 3 minus the motor wiring information since this will be factory installed. Also, the motor and system control parameters will be factory set for the Master drive and Followers prior to shipping.

NOTE

SEE FIGURES 3-12 AND 3-13 FOR POWER, MOTOR AND CONTROL WIRING DIAGRAMS.

Follow the pre-start up and start up procedures as described in Section 4.

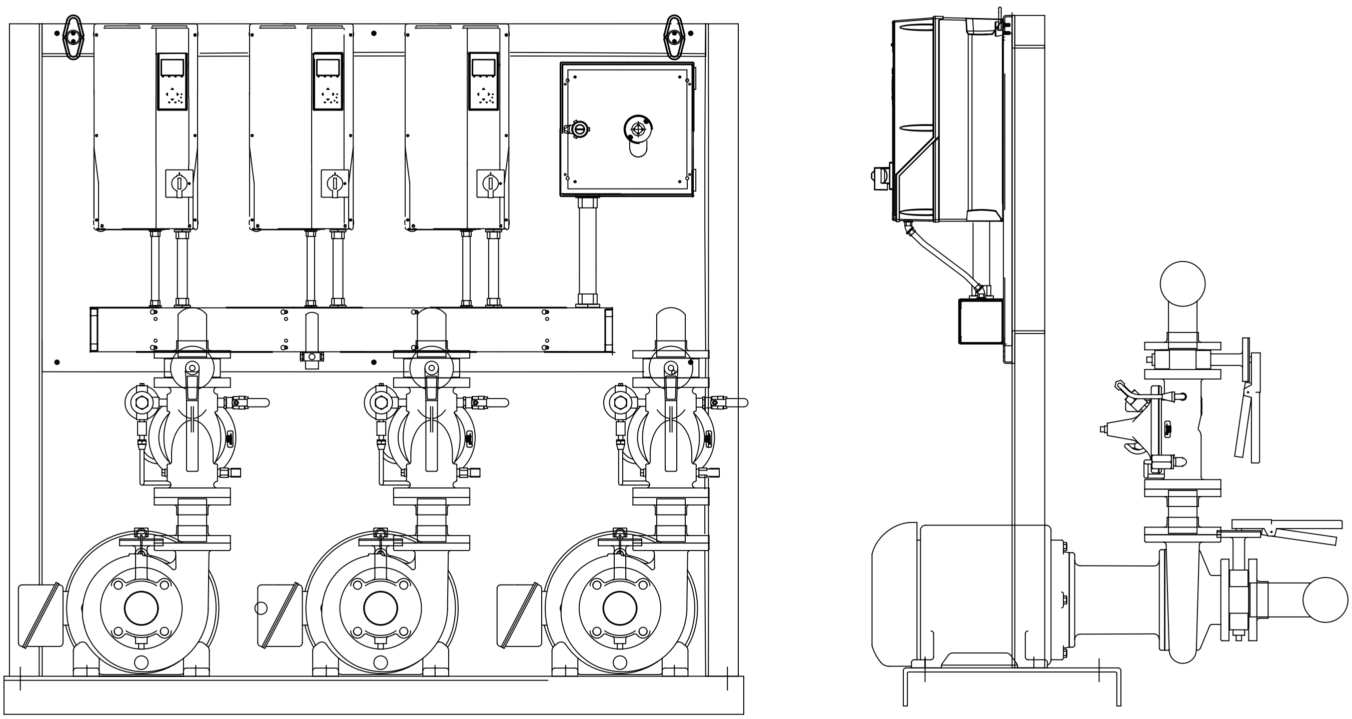


Figure 3-14. Backpanel Mounted Drives and Pumps (front and side views)

Installation of 70X Series Drives and Pumps

A 70X configuration consists of one variable speed pump (lead pump) connected to the 70X controller, and from 1 to 3 constant speed pumps connected to mains through a contactor controlled by the 70X controller. (See Figure 3-15.)

The 70X controller monitors system pressure and stages on and off constant speed pumps as needed to maintain system pressure. Parameter *27-20, Normal Operating Range %* is used to define the acceptable deviation from the setpoint before staging or destaging takes place. This parameter is defined as a % of parameter 3-03, *Maximum Reference*. (See Figure 3-16 for customer connection schematic diagram.)

Staging:

When the system demand increases the 70X controller will increase the speed of the lead pump until it reaches its maximum speed. If the system demand continues to increase, it will no longer be able to maintain the desired system pressure. Once the pressure drops below the Normal Operating Range for the time set in parameter *39-11, Stage Proof Timer*, the controller will stage on a constant speed pump and ramp the lead pump to its minimum speed.

De-Staging:

When system demand decreases, the 70X controller will decrease the speed on the lead pump until it reaches its minimum speed. If the system demand continues to decrease, the pressure will exceed the Normal Operating Range. If this continues for the time set in parameter *39-14, De-Stage Proof Timer*, the controller will destage a constant speed pump and ramp the lead pump to maximum speed.

Alternation:

Since timed alternation only applies to changing the lead pump, it is not part of a 70X system which has only one lead pump. It is possible however to manually alternate constant speed pumps using the right and left arrows on the LCP.

Pump Running Order:

Parameter *39-33, Pump Running Order* can be used to determine the sequence with which constant speed pumps are staged on and off.

AFD Failure and Fixed Speed Only mode:

Parameter *39-40, AFD Fail Proof Timer* is active in the 70X configuration. If the AFD fails, the 70X system will switch to Fixed Speed Only mode. In this mode, the controller will stage on and off constant speed pumps if the system pressure deviates from the setpoint more than parameter *27-22, Fixed Speed Only Operating Range*. Setting 27-22 to zero disables this mode.

Pump Failures:

The DP switch inputs can be used in the 70X configuration. If a failure is detected in the lead pump, the controller will switch to Fixed Speed Only mode as described above. If a failure is detected in a constant speed pump, the controller will alternate to a different constant speed pump and mark the pump as failed.

Zone Failure Detection:

All of the normal Zone Failure detections can be used in the 70X configuration. The loss of a single sensor will disable that sensor. The loss of all sensors will pump the system into jog mode. 70X jog mode will run the designated number of pumps at full speed by default.

High and Low Suction Cut-out:

The High and Low suction cut-out features can be used in the 70X configuration. Low suction cut-out will destage any running constant speed pumps before turning off the lead pump.

High and Low System Pressure:

The High and Low System Pressure feature can be used in 70X configuration. If High System Pressure is detected all pumps will be turned off without destaging.

No Flow Shutdown:

The No Flow SHutdown feature can be used in the 70X configuration. It will only work when all of the constant speed pumps are off.

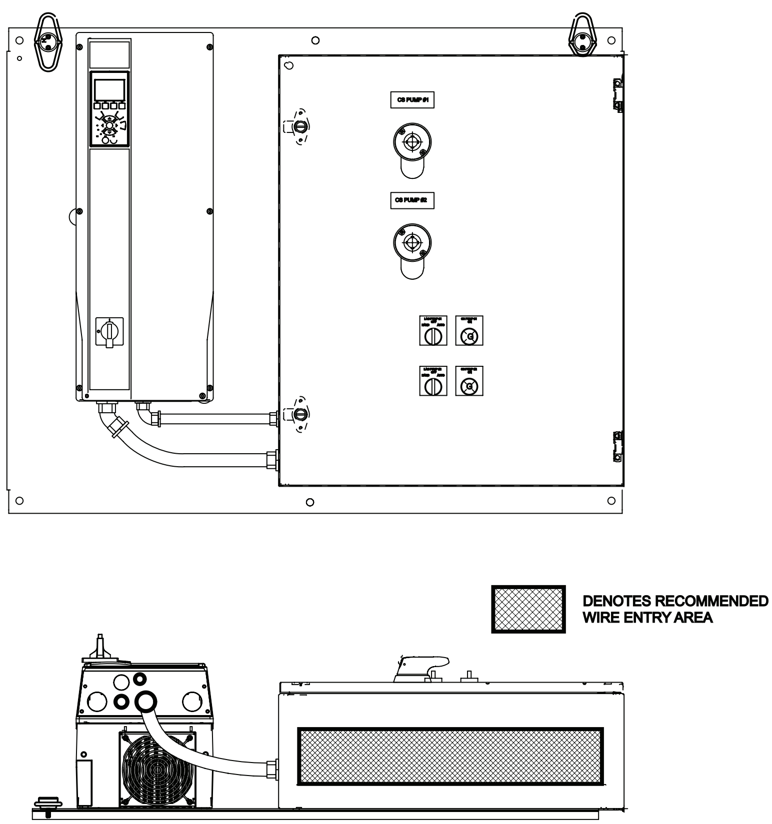


Figure 3-15. 70X Series Drive (front and bottom views)

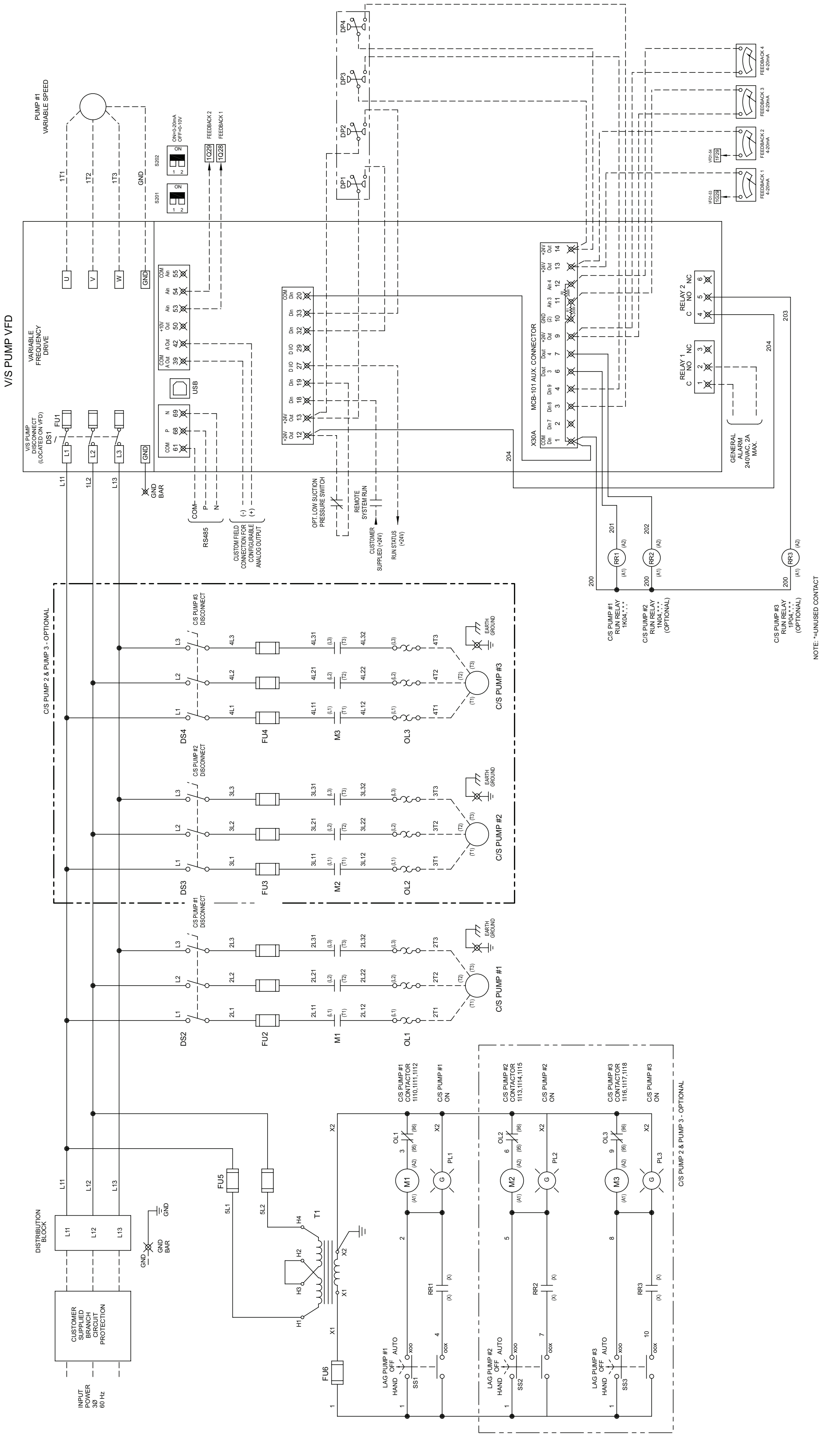


Figure 3-16. 70X Series Customer Wiring Diagram

Section 4 Start Up

Pre-start Procedure

1. Input power to unit must be OFF and locked out per OSHA requirements. Do not rely on panel disconnect switches.

⚠WARNING

HIGH VOLTAGE!

IF INPUT AND OUTPUT CONNECTIONS HAVE BEEN CONNECTED IMPROPERLY, THERE IS POTENTIAL FOR HIGH VOLTAGE ON THESE TERMINALS. IF POWER LEADS FOR MULTIPLE MOTORS ARE IMPROPERLY RUN IN SAME CONDUIT, THERE IS POTENTIAL FOR LEAKAGE CURRENT TO CHARGE CAPACITORS WITHIN OPTION PANEL, EVEN WHEN DISCONNECTED FROM LINE INPUT. FOR INITIAL START UP, MAKE NO ASSUMPTIONS ABOUT POWER COMPONENTS. FOLLOW PRE-START PROCEDURES DESCRIBED BELOW. FAILURE TO FOLLOW PRE-START PROCEDURES DESCRIBED BELOW COULD RESULT IN PERSONAL INJURY OR DAMAGE TO EQUIPMENT.

2. Use AC voltmeter to verify there is no voltage on input terminals L1, L2, and L3, phase-to-phase and phase-to-ground, and output terminals T1, T2, and T3, phase-to-phase and phase-to-ground.
3. Use ohmmeter to confirm continuity of motor by measuring T1-T2, T2-T3, and T3-T1.
4. Use ohmmeter to confirm open on input by measuring L1-L2, L2-L3, and L3-L1. Note that if an isolation transformer is between the power source and panel, continuity will be present. In this case, visually confirm that motor and power leads are not reversed.
5. Inspect the panel for loose connections on terminals.
6. Check for proper ground: option panel to main building distribution ground, and to motor ground.
7. Confirm control connections terminated per connection diagrams supplied with the equipment.
8. Check for external devices between drive option panel output and motor. It is recommended that no devices be installed between motor and drive.
9. Record motor nameplate data; hp, voltage, full load amps (FLA), and RPM. It will be needed to match motor and drive data later on.
10. Confirm that incoming power matches drive label voltage and motor nameplate voltage.
11. For multiple winding motors, motors must be wired on run winding Delta, not Y-start winding.

CAUTION

EQUIPMENT DAMAGE!

IF MOTOR FLA (FULL LOAD AMPERAGE) IS GREATER THAN UNIT MAXIMUM AMPS, CONTROLLER AND OPTION PANEL MUST BE REPLACED WITH ONE OF APPROPRIATE RATING. DO NOT ATTEMPT TO RUN UNIT. FAILURE TO MATCH FLA TO UNIT MAXIMUM AMP RATING MAY RESULT IN EQUIPMENT DAMAGE.

12. Confirm motor FLA is equal to or less than maximum option panel output current. Some motors have higher then normal NEMA currents.
13. Check that overload relay(s) is set for FLA of connected motor. Service factor is built into overload relay.

Inspection Prior to Start Up

Before applying power to the unit, inspect the entire installation as detailed in Table 4-1.

Table 4-1. Inspection Prior to Start Up

Inspect For	Description	✓
Auxiliary equipment	Look for auxiliary equipment, switches, disconnects, or input fuses/circuit breakers that may reside on input power side of drive or output side to motor. Examine their operational readiness and ensure they are ready in all respects for operation at full speed. Check function and installation of pressure sensors or encoders (etc.) used for feedback to drive. Remove power factor correction caps on motor(s), if present.	
Cable routing	Ensure that input power, motor wiring and control wiring are in three separate metallic conduits for high frequency noise isolation. Failure to isolate power, motor and control wiring could result in less than optimum drive and associated equipment performance.	
Control wiring	Check for broken or damaged wires and connections. Check the voltage source of the signals, if necessary. The use of shielded cable or twisted pair is recommended. Ensure the shield is terminated correctly.	
EMC considerations	Check for proper installation with regard to electromagnetic capability.	
Environmental conditions	See equipment label for the maximum ambient operating temperature limits. Temperature is not to exceed 104F (40ºC). Humidity levels must be less than 95% non-condensing.	
Fan clearance	Cooling fan are located below the drive and require sufficient clearance for fan removal. See the installation drawing supplied with the unit for clearance requirements.	
Proper clearance	Units require top and bottom clearance adequate to ensure proper air flow for cooling in accordance with the unit size.	
Fusing and circuit breakers	Check that all fuses are inserted firmly and in operational condition and that all circuit breakers are in the open position.	
Grounding	The equipment requires a dedicated ground wire from its chassis to the building ground. It is highly recommended that the motor be grounded to the backpanel chassis. The use of conduit or mounting of the backpanel to a metal surface is not considered a suitable ground. Check for good ground connections that are tight and free of oxidation.	
Input and output power wiring	Check for loose connections. Check for proper fusing or circuit breakers.	
Panel interior	Equipment interior must be free of dirt, metal chips, moisture, and corrosion. Check for harmful airborne contaminates such as sulfur based compounds.	
Switches	Ensure that all switch and disconnect settings are in the proper position.	
Vibration	Look for any unusual amount of vibration the equipment may be subjected to. The panel should be mounted solidly or use shock mounts as necessary.	

CHECKED BY:__________________________ DATE:__________________

Start Up Procedure

In the following procedures, changing the equipment between drive mode and bypass mode is required. Be familiar with the operation of these devices in both modes prior to start up.

Drive Power Up

⚠WARNING

EQUIPMENT HAZARD!

DRIVE AND OPTION PANELS CONTAIN DANGEROUS VOLTAGES WHEN CONNECTED TO LINE VOLTAGE. INSTALLATION, START-UP AND MAINTENANCE SHOULD BE PERFORMED ONLY BY QUALIFIED PERSONNEL. FAILURE TO PERFORM INSTALLATION, START-UP AND MAINTENANCE BY QUALIFIED PERSONNEL ONLY COULD RESULT IN DEATH OR SERIOUS INJURY.

1. Perform pre-start up procedure.
2. Ensure that all operator devices are in OFF position. Panel door(s) closed.
3. Keep main disconnect switch in OFF position. Apply voltage to unit. DO NOT operate drive or bypass at this time.
4. Confirm input line voltage is balanced within 3%. If not, correct input voltage imbalance before proceeding. Repeat procedure after voltage correction, when applicable.
5. Identify master drive in multi-unit configurations.
6. Confirm wiring matches installation diagram supplied with unit.
7. Ensure sensor wiring matches installation application.
8. Turn main panel disconnect into ON position.
9. Turn main disconnect on Master drive to ON position.
10. Turn main disconnect on Follower drive(s) to ON position.

Required Drive Programming

Both Master and Follower drives require basic operational programming, which includes nameplate motor data for the motor being operated and basic motor operation speeds. Enter this data in accordance with the following procedures. See the *Section 5, User Interface* in this manual for detailed programming instructions. This data needs to be entered with power ON but prior to operating the system.

NOTE

Press Quick Menu or Menu key on drive keypad to access programming parameters. Use up/down arrow keys on keypad to scroll through parameter lists. Press OK key to enter parameter and press OK key again to access parameter data. Once parameter is entered, use side arrow keys to scroll sideways and up/down arrow keys to increase or decrease a value. Press OK key to store setting or Cancel key to cancel. Use Back key to return to menu. Press Info key to access short description of current parameter option. See User Interface section in this manual for detailed instructions.

1. Access Quick Menu on Master drive keypad.

2. Go to parameter group *Q2 Motor Setup* and press OK key.

3. Scroll down list of all nine important motor data parameters in this section and enter motor data from motor nameplate, along with ramp up and down times, and high and low motor speed limits. It is important for maximum system efficiency that this data be accurate. It is recommended to set ramp times to 10 seconds in parameters 3-41 and 3-42.

4. Repeat steps 2 and 3 for each Follower drive in system.

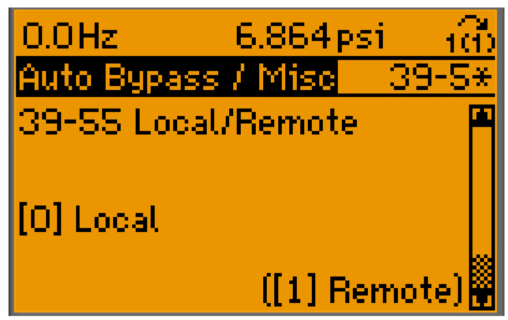
For Master drives only:

1. Press Quick Menu key and go to parameter group *Q3, System Setup*. Press OK key to enter.

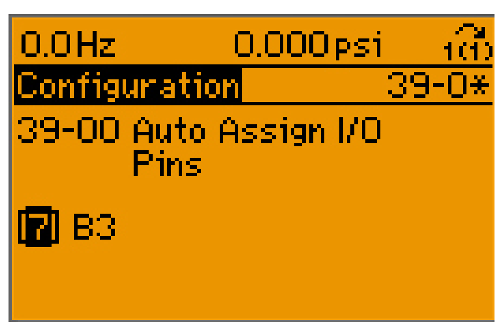
2. Scroll down parameter list and either confirm default setting is appropriate to system application, or enter new setting, as required.

3. In Quick Menu, go to *Q1, My Personal Menu* and press OK key to enter.

4. Scroll down parameter list and enter setpoint values. Ensure parameter *39-55, Local/ Remote*, is set for local operation.



5. In Main Menu, go to parameter *39-** Tech 502 Setup*, and press OK key to enter. In parameter *39-0*, Configuration*, scroll to *39-00, Auto Assign I/O Pins* and scroll to the system type for the master drive being programmed. Press OK key to select. See *Table 6-2, Parameter 39-** Group, Detailed Description* for more details.



System Start Up

WARNING

UNINTENDED START!

WHEN DRIVE IS CONNECTED TO AC INPUT POWER, MOTOR MAY START AT ANY TIME. THE DRIVE, OPTION PANEL, MOTOR, AND ANY DRIVEN EQUIPMENT MUST BE IN OPERATIONAL READINESS. FAILURE TO BE IN OPERATIONAL READINESS WHEN PANEL AND DRIVE ARE CONNECTED TO AC INPUT POWER COULD RESULT IN DEATH, SERIOUS INJURY, OR EQUIPMENT OR PROPERTY DAMAGE.

WARNING

MOTOR START!

ENSURE THAT MOTOR, SYSTEM, AND ANY ATTACHED EQUIPMENT IS READY FOR START. FAILURE TO ENSURE MOTOR, SYSTEM, AND ANY ATTACHED EQUIPMENT IS READY FOR START COULD RESULT IN PERSONAL INJURY OR EQUIPMENT DAMAGE.

1. Put drive in Hand Mode by pressing the Hand On key on keypad.

2. DO NOT run motor at full speed at this time. Check motor rotation by bumping motor speed using up arrow on keypad. Ensure motor is spinning in proper direction. Put motor to OFF by pressing OFF key.

3. Set each Follower drive to Auto On by pressing the Auto On key on each Follower drive keypad.

4. Check Follower responses by putting Master drive in Hand On mode and use up arrow to increase Master drive speed. Check that each Follower responds to speed reference signal from Master drive.

5. Place Master drive in OFF mode.

6. Set system into operational mode by pressing Auto On key on Master drive. Master drive is now ready to receive remote signals to operate, and Follower drives are in response mode.

7. To shut off system, press OFF key on Master drive and turn drive disconnect switch to OFF position.

Full Speed Operation and Checkout

⚠CAUTION

FULL SPEED OPERATION!

ENSURE THAT THE MOTOR, SYSTEM, AND ANY ATTACHED EQUIPMENT IS READY FOR FULL SPEED OPERATION. USER ASSUMES ALL RESPONSIBILITY FOR ASSURING SYSTEM IS ABLE TO SAFELY RUN AT FULL SPEED. FAILURE TO ENSURE THAT THE MOTOR, SYSTEM, AND ANY ATTACHED EQUIPMENT IS READY FOR FULL SPEED OPERATION COULD RESULT IN EQUIPMENT DAMAGE.

1. Check full load amps in drive mode on motor terminals.

    a. Put unit into drive mode by pressing Hand On key on keypad.

    b. Use up arrow to run drive up to full speed.

    c. Check full load amps on motor terminals T1, T2, and T3. Verify motor amps are within drive and motor rated current and are balanced within 3%. If incorrect, see Troubleshooting Section in this manual for isolation procedures.

2. Check full load amps in bypass mode on motor terminals.

    a. Put unit into bypass mode. (Motor will run at full speed from line voltage.)

    b. Check full load amps on terminals T1, T2, and T3. Verify motor amps are within motor FLA rated current and balanced within 3%. If incorrect, see Troubleshooting Section in this manual for isolation procedures.

3. Check operation of any optional functions to confirm they work, as applicable.

4. Exercise safety circuit and verify that unit stops running. Safety circuits include E-Stop, interlock, or overloads.

5. Exercise start/stop circuit and verify that unit starts and stops with system in auto mode of operation.

Section 5 User Interface

Operation and Programming Through the LCP

The combined display and keypad on the front of the unit is the local control panel (LCP). The LCP is the user interface to the controller.

The LCP has several user functions: to start, stop, and control pump speed when in local control; to manually alternate pump selection along with displaying operational data, warnings and cautions; for programming drive functions; and to manually reset the controller after a fault when auto-reset is inactive.

Local control panel (LCP)

The LCP is divided into four functional groups (see Figure 5-1):

1. LCD display area.
2. Menu display keys for status options, programming, and error message history.
3. Navigation keys for programming functions, moving the display cursor, and speed control in local operation (along with status indicator lights).
4. Operation mode keys and reset.

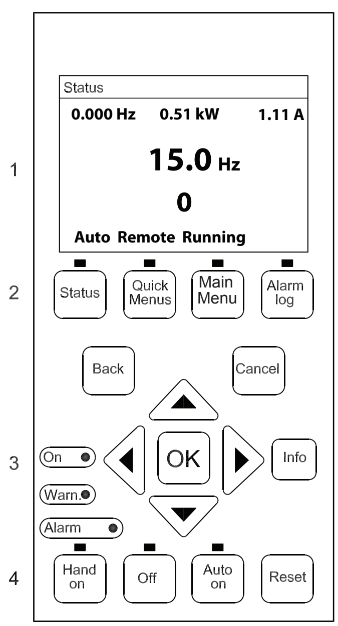


Figure 5-1. Local Control Panel

LCD display values

Line 1. Drive frequency (Hz), Feedback (psi), Motor current (A)
Line 2. Drive frequency (Hz)
Line 3. Cascade system status
Line 4. Status messages (see *Section 7, Status Messages)*

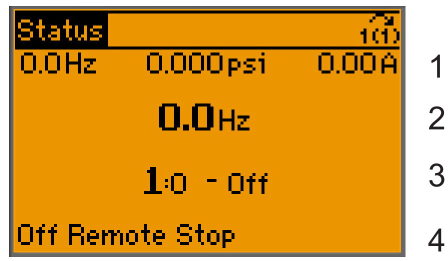
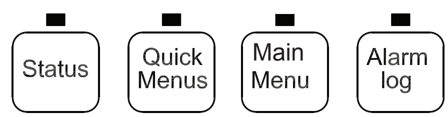


Figure 5-2. LCP Display Area

Menu keys

Menu keys are used for parameter set-up, toggling through status display modes during normal operation, and viewing fault log data.



Status Press and hold the Status key to toggle between status read-out displays in the LCP display area. Press status in any other display mode to return to the status display. Pressing Status plus UP or DOWN arrows adjusts the display brightness.

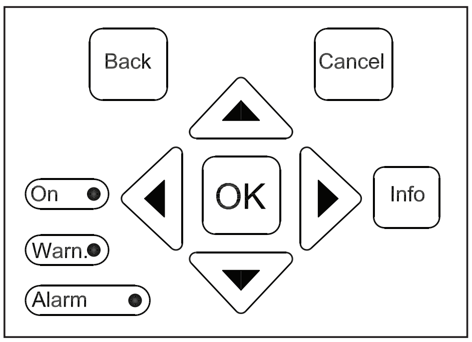
Quick Menu Allows access to the most common functions for initializing the drive.

Main Menu Provides access to all programming parameters.

Alarm Log Displays a list of the last 10 alarms along with current warnings and the maintenance log. For additional details about an alarm, select the alarm number using the arrow keys and press OK. Details about the drive before it entered the alarm mode are displayed.

Navigation keys

Navigation keys are used for programming functions and moving the display cursor. The up and down keys also provide speed control in local (hand) drive operation. Drive status indicator lights are also located in this area.



Back Reverts to the previous step or list in the navigation structure.

Cancel The last change or command will be cancelled, as long as the display mode has not changed.

Info Displays information about a parameter, command, or function in any display mode. For example, in status mode, each display is defined. In menu mode, menu options are explained. Exit Info mode by pressing Info, Back, Cancel, or Status.

Navigation Arrow Keys The four navigation arrows are used to move a cursor between the different items available in menu or alarm log modes. For operation in Hand Mode, the up and down arrows regulate drive speed. For the Master drive in a Master/Follower system, the arrows control the system speed.

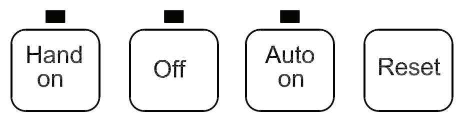
OK Used to select a highlighted parameter from a parameter list or to enable a parameter choice.

LED indicator lights The green ON LED is activated and display panel lit when the drive receives power from mains voltage, a DC bus terminal, or an external 24 V supply.

When a pending fault condition is being approached, the yellow warning light will come on and a text display appears in the display area. A fault condition causes the alarm LED to flash red and a text display appears in the display area.

Drive operation keys

Operation keys for local (hand) or remote (auto) control are found at the bottom of the control panel along with the OFF and Reset keys. The functions of these keys change based on whether the drive is a Master or Follower.



Master drive The Hand ON, OFF and Auto On keys for the master drive control those functions for the system, made up of the Master drive and any number of Follower drives. The Hand On key starts the drive in local control so that the up/down arrows control system speed including any Follower drives. The Auto On key puts the system in operational mode depending on an external start command to run. The Reset key only resets the Master drive itself.

Follower drives The four operation keys on Follower drives control the action only for the functions of that specific Follower drive and no other drive units. Follower drives must be in Auto On mode for normal system operation.

Section 6 Programming and Operation

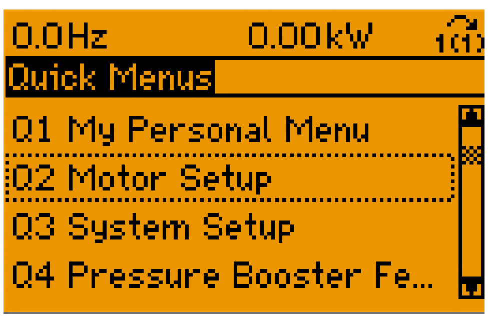
Basic Drive Programming

The following section demonstrates how to enter basic motor and system data into the drive's internal memory. Most, if not all, of these functions are commonly factory programmed when specific applications are known prior to shipment. For other applications, the information provided here must be entered. (See *Section 5, User Interface* for details on using the local control panel.)

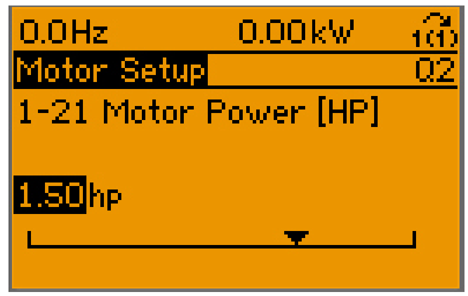
Entering Basic Motor Data

1. Enter the Quick Menu by pressing the Quick Menu Key on the keypad.

2. Use the up/down arrows to find parameter *Q2, Motor Setup* and press the OK key.



3. Press the OK key again to access the parameter. Use the up/down arrows to change values. From the motor nameplate, enter the correct information for the following settings.



1-21 Motor Power (HP)

1-22 Motor Voltage (VAC)

1-23 Motor Frequency (Hz)

1-24 Motor Current (A)

1-25 Motor Nominal Speed (Hz)

4-12 Motor Speed Low Limit (Hz)

4-14 Motor Speed High Limit (Hz)

Designating Master or Follower Drives

Master drives contain the optional MCB101 master board located behind the LCP (see Figure XX). Programming for the Master drive is factory installed.

Table 6-1. Quick Menu Layout

Quick Menu		
Q1	**My Personal Menu**	
	20-21	Sensor Setpoint #1
	20-22	Sensor Setpoint #2
	20-23	Sensor Setpoint #3
	20-24	Sensor Setpoint #4
	39-55	Local / Remote
	31-00	Bypass Mode (only available with bypass option)
	39-46	Active Zone
Q2	**Motor Setup**	
	1-21	Motor Power
	1-22	Motor Voltage
	1-23	Motor Frequency
	1-24	Motor Current
	1-25	Motor Nominal Speed
	4-12	Motor Speed Low Limit
	4-14	Motor Speed High Limit
Q3	**System Setup**	
	39-06	Last Configuration Setting
	20-93	PID Proportional Gain
	20-94	PID Integral Time
	20-00	Feedback 1 Source
	20-03	Feedback 2 Source
	20-06	Feedback 3 Source
	20-09	Feedback 4 Source
	39-26	Flow Measurement Source
	6-15	Terminal 53 High Ref./Feedb. Value
	6-18	Terminal 53 Reference/Feedback Units
	6-25	Terminal 54 High Ref./Feedb. Value
	6-28	Terminal 54 Reference/Feedback Units
	6-35	Terminal X30/11 High Ref./Feedb. Value
	6-38	Terminal X30/11 Reference/Feedback Units
	6-45	Terminal X30/12 High Ref./Feedb. Value
	6-48	Terminal X30/12 Reference/Feedback Units
	3-03	Max Reference Units
	39-20	Max Pump Flow (Old Par. 763)
	39-31	Pump Alternation Time (Old Par. 770)
	39-32	Start Alternation Start Delay Time (NEW)

Table 6-1. Quick Menu Layout (continued)

	39-44	No. of Pumps Active In AZF (Old Par. 772)
	3-11	Jog Speed
Q4	**Pressure Booster Features**	
	39-65	Suction Pressure Source
	39-60	Low Suction Cut-Out Time (Old Par. 773)
	39-61	Low Suction Cut-Out Pressure
	39-62	High Suction Cut-Out Time
	39-63	High Suction Cut-Out Pressure
	39-64	High Suction Reset Pressure
	39-75	Low/High System Sensor Source
	39-70	High System Pressure Level(Old Par. 774)
	39-71	High System Pressure Proof Time(Old Par. 775)
	39-72	Low System Pressure Level
	39-73	Low Pressure Proof Time
	39-74	Low System Reset Pressure
	39-76	Low System Pressure Alert Level
	39-80	No Flow Shut Down Proof Time (Old Par. 776)
	39-81	Minimum Speed Proof Time (Old Par. 777)
	39-82	Restart Pressure Drop (Old Par. 778)
	39-83	Minimum Run Time (Old Par. 779)
	39-84	No Flow Shut Down Bandwidth (Old Par. 789)
Q5	**Changes Made**	
	Last 10 Changes	
	Since Factory Settings	
Q6	**Loggings**	
Q7	**70X**	
	3-03	Maximum Reference
	27-20	Normal Operating Range (%) - Staging Band
	27-22	Fixed Speed Only Operating Range
Q8	**Communications**	
	8-30	Protocol
	8-31	Address
	8-32	Baud Rate
	8-33	Parity
	8-70	BACnet Device Instance (only available with BACnet installed)

Table 6-2. Parameter 39-** Group, Detailed Description

No.	Name		Min	Max	Default	Description
39-0*	**Config.**					
39-00		Auto Assign I/O Pins 0 - Done 1 - A0 2 - C0 - 1 Followers 3 - D0 - 1 Follower 4 - D0 - 2 Followers 5 - D0 - 3 Followers 6 - A1 7 - B3 8 - C4 9 - D4 10 - 70X - 1CS 11 - 70X - 2CS 12 - 70X - 3CS 13 - Follower	0	13	0	Selecting one of these Configurations will automatically set the input and output parameters and default values correctly for the configuration.
39-02		System Status Word				Status flags used for fieldbus communications
39-03		System Operating Mode	0	2	1	Status used for fieldbus communications 0 - Manual 1 - Auto 2 - Auto Bypass
39-04		Warning Status 1				Warning flags used for fieldbus communications
39-05		Warning Status 2				Warning flags used for fieldbus communications
39-06		Last Configuration Setting	0	13	13	Last Configuration setting selected through P39-00. Warning: Individual parameter settings of the configuration may be changed manually so there is no guarantee that it is still set to this standard configuration.
39-1*	**Stage/ Destage**					
39-10		Stage Speed (Old Par. 750)	0%	100%	95%	When a variable speed pump reaches this percentage of maximum speed, the controller will start a timer, set in parameter P39-11. After this timer expires, the controller will stage on another pump.
39-11		Stage Proof Timer (Old Par. 751)	0s	999s	30s	After a variable speed pump reaches the speed percentage set in parameter P39-10, this timer will start. After this timer expires the controller will stage on an additional pump.

Table 6-2. Parameter 39-** Group, Detailed Description (continued)

39-12		Stage Stab. Proof Timer (Old Par. 752)	0s	999s	60s	After a new pump is staged on or off, the system will wait at least this long before allowing a pump to be staged on or off. After a pump has been staged on, the speed that the system reaches after this timer expires is used to calculate the de-stage speed.
39-13		De-Stage Percentage (Old Par. 753)	0%	100%	80%	After a pump is staged on, the controller waits until the stage stabilization proof timer expires. It then calculates the de-stage speed by multiplying the pump speed by the value in this parameter. The controller will de-stage a pump when the system speed reaches this value.
39-14		De-Stage Proof Timer (Old Par. 754)	0s	999s	30s	After a pump has been de-staged, the controller will wait for the time set in this parameter before allowing another pump to be staged ON or OFF.
39-15		Min. De-Stage Speed (Old Par. 755)	0%	100%	50%	The staging set in parameter P39-13 depends on the system speed after the time delay of parameter P39-14. If demand drops after the staging, the de-stage speed could be too low. This parameter sets an absolute minimum de-stage speed. If the system runs below this speed for the time in P39-16, a pump will de-stage.
39-16		Min. De-stage Proof Timer (NEW)	0s	999s	30s	After the speed set in P39-15 is reached, the controller will wait for the time set in this parameter before destaging.
39-2*	**EOC Staging**					
39-20		Max Pump Flow (Old Par. 763)	0.0	999999.000GPM 227124.500 M3/h	0.000	This is used to initiate end-of-curve staging on of an additional pump. This represents the maximum flow per pump at the end of the pump curve. When the flow per pump is greater than his value times the pump speed in percent, the controller will begin to stage on an additional pump.
39-21		EOC Staging Proof Timer (Old Par. 764)	0s	999s	30s	After the feedback signal from the flow meter indicates that the flow per pump is greater than the expected flow, this timer starts. The expected flow is calculated by the product of the maximum flow from the pump times the percent of output speed If the condition continues until the timer expires, an additional pump will be staged on.

Table 6-2. Parameter 39- Group, Detailed Description (continued)**

39-22		EOC De-Stage Percentage (Old Par. 765)	0%	100%	45%	This parameter works with the flow feedback sensor to determine if a pump needs to be staged off. If the flow per pump is less than this parameter times the expected pump flow, the controller will begin to stage off a pump. For this to de-stage a pump, the pressure feedback signal must also indicate a need to de-stage.
39-23		EOC De-Stage Proof Timer (Old Par. 766)	0%	100%	30s	After the controller calculates that end of curve staging is required, this timer starts. If the condition continues until the timer expires, a pump will be staged off.
39-24		Flow Destage Value (Old Par. 767)	0.0	999999.000GPM 227124.500 M3/h	0.000	If the flow per pump measured by the flow meter is less than this value, the controller will initiate the process of staging off a pump, regardless of the pressure feedback.
39-25		Flow Destage Proof Timer (Old Par. 768)	0s	999s	0s	When the controller initiates a flow de-stage, this timer will start. If the condition continues until the timer expires, a pump will be staged off.
39-26		Flow Measurement Source - No function - Analog input 54 - Analog input X30/11 - Analog input X30/12				This parameter tells the controller which analog input is connected to the system flow meter.Input scaling for the meter is defined in parameter group P06-xx.
39-27		Flow Measurement Unit - GPM - M3/h				This parameter defines the units used in measuring the sysem flow as well as the units used in EOC calculation and P39-20 and P39-24.
39-29		Measured Flow	0.0	999999.000GPM 227124.500 M3/h		This parameter displays the current system flow from the flow meter attached to the input selected by parameter P39-26. Input scaling for the meter is defined in parameter group P06-xx.
39-3*						
39-30		Transition Time (Old Par. 769)	0s	60s	20s	When the alternation timer determines that it is necessary to stop one pump and start another one, the controller will first start the second pump and allow both to run together for the time set by this parameter. After this timer expires, the pump that was initially running will be stopped.

Table 6-2. Parameter 39-** Group, Detailed Description (continued)

39-31		Pump Alternation Time (Old Par. 770)	0s	999s	0s	When not all pumps are operating, this determines the number of hours of pump operation before pump alternation occurs. When the pumps are manually alternated using the right or left arrow keys on the Local Control Panel, this timer is reset.
39-32		Alternation Start Delay Time	0s	999s	0s	It is often desirable to have alternation occur at off peak times, such as at night. To allow the system to be setup during normal hours to alternate every night this start delay parameter is used. It defines the length of time before the next alternation.
39-33		Pump Run Order 0 - Runtime Order 1 - First On First Off 2 - Sequential Order	0	2	2	The controller selects the next pump to stage, destage or alternate. Equal Running Hrs will cause the controller to turn on the pump with the fewest running hours and to trun off the piump with the most running hours. Sequential Order will turn on the pump to the right of the lead pump and will turn off the pump to the farthest left of the lead pump regardless of running hours.
39-34		Lead Pump Number	1	4		A display of the current lead pump number used by the controller for sequential staging and destaging. This is only significant if Sequenctial Order is selected in P39-33.
39-35		"Alternate Lead Pump Now [0] - No [1] - yes"	0	1	0	Selecting [1] Yes will cause the immediate alternation of the lead pump. After alternation the parameter returnes to [0] No.
39-39		Time Until Daily Alternation				A display of the time remaining before the next alternation will occur.
39-4*	**Alms/ Sensor Fault**					
39-40		AFD Fail Proof Timer (Old Par. 771)	0s	200s	10s	After the controller commands a pump to run, it will check for confirmation that the pump is running. If the controller does not receive run confirmation before the timer set in this parameter expires, it will stage on a different pump and display WARINIG, DRIVE FAILED.
39-41		Pump Fail Proof Timer (Old Par. 771)	0s	200s	10s	After the controller commands a pump to run, it will check for confirmation that the pump is running. If the controller does not receive run confirmation before the timer set in this parameter expires, it will stage on a different pump and display WARINIG, PUMP FAILED.

Table 6-2. Parameter 39- Group, Detailed Description (continued)**

39-42		AI Low Warning Proof Time	0s	200s	5s	The length of time that an analog input is below 3 mA before it is considered to have failed.
39-43		AI High Warning Proof Time	0s	200s	60s	The length of time that an analog input is above or equal to 20 mA before it is considered to have failed.
39-44		No. of Pumps Active In AZF (Old Par. 772)	1	4	1	All zone failure occurs when all pressure feedback signals are lost (*i.e.* drop below 3 mA). During this condition, a predefined number of pumps will run at a predefined speed. This parameter sets the number of pumps and parameter P03-19 determines the speed. Parameter P39-45 sets the time delay before the controller activates all zone failure operation.
39-45		AZF Timeout (Old Par. 317)	0s	99s	10s	If the feedback signal to all active analog inputs drops below 3 mA, the controller will begin its All Zone Failure mode. After the time delay set in this parameter expires, the display will show ALARM, ALL ZONE FAILURE. The controller will then activate the number of pumps specified by parameter P39-44 and run them at the frequency specified in parameter P03-19.
39-46		Active Zone Number	1	4		The number of the analog input that has the the largest deveation form it's defined setpoint. This is the input that is used to determine the speed of the Drive.
39-5*	**Auto Bypass/ Misc**					
39-50		No. Of AFD Fail To Go To Bypass	1	2	1	In a multiple drive system, when one drive fails another drive is staged on. This parameter determines the number of drives that must fail before the system will automatically operate the number of pumps selected in parameter P39-51 in full speed bypass. Automatic bypass is not initiated if pump failure is detected.
39-51		No. Of Pumps To Run In Bypass	0	2	1	This parameter selects the number of pumps that should operate at full speed in bypass when the system goes into automatic bypass mode.

Table 6-2. Parameter 39-** Group, Detailed Description (continued)

39-53		No. Of Pumps In Duty Standby	0	2	1 - C4 0 - else	The number of pumps that must remain idle during operation. The controller will rotate between pumps but will not turn on more than then total number of pumps minus this number.
39-54		% Full Speed	0 -> 0Hz	100% -> 50/60Hz		A display of the current % of full speed of the Drive. 100% = 60Hz. This is used by fieldbus communications.
39-55		Run Signal - Local - Remote	0	1	1	This parameter allows the system to be run in local mode without an external start signal. It is used for dianostics and to run the system in the event of a remote controller failure. Selecting Local allows the motor to start and run in closed loop control just by pressing AutoOn. Selecting Remote requires a remote start signal through Pin18 or from a fieldbus.
39-6*	**Pressure Suction Feat.**					
39-60		Low Suction Cut-Out Time (Old Par. 773)	0s	999s	30s	When control voltage is applied to digital input 19, the controller will display WARNING, LOW SUCTION CUT OUT. After the time delay set in this parameter, the controller will stop all pumps and display ALARM, LOW SUCTION CUT OUT. If parameter P14-20 is programmed for automatic restart, after the low suction cut-out signal is removed and the timer set in parameter P14-21 expires, the drive will restart.
39-61		Low Suction Cut-Out Pressure	0.0	Depends on P3965	0.0	If a Suction Pressure source is selected in P39-65 then this parameter sets the pressure below which the timer in P39-60 is started. If the timer expires while the suction pressure remains below this value then the system is turned off.
39-62		High Suction Cut-Out Time	0s	999s	0s	This is the timer used to determine if the pumps should be shut off because they are no longer needed to maintain output pressure.

Table 6-2. Parameter 39-** Group, Detailed Description (continued)

39-63		High Suction Cut-Out Pressure	0.0	Depends on P3965	0.0	If a Suction Pressure source is selected in P39-65 then this parameter sets the pressure above which the timer in P39-62 is started. If the timer expires while the suction pressure remains above this value then the pumps are not needed and are shut off.
39-64		High Suction Reset Pressure	0.0	Depends on P3965	0.0	If the pumps have been shut off due to High Suction Pressure and if the pressure drops below this point then the first pump will be turned on.
39-65		Suction Pressure Source - No function - Analog input 54 - Analog input X30/11 - Analog input X30/12				This parameter tells the controller which analog input is connected to the suction pressure sensor. Input scaling for the sensor is defined in parameter group P06-xx.
39-69		Suction Pressure				A display of the current Suction Pressure.
39-7*	**PB Sys Press Feat.**					
39-70		High System Pressure Level (Old Par. 774)	0.0 PSI	999999.0PSI	0.0 PSI	If the pressure feedback signal exceeds this value for the amount of time set in parameter P39-71, the controller will cause a system shutdown and display ALARM, HIGH SYSTEM PRESSURE. It will be necessary to cycle power to the controller to reset this alarm if P39-77 is set to Alarm Trip Lock.
39-71		High System Pressure Proof Time (Old Par. 775)	0s	999s	0s	This determines the amount of time that the system must have pressure greater than the value set in parameter P39-70 before it goes into an alarm condition.
39-72		Low System Pressure Level	0.0	Depends on P3965	0.0	If a System Pressure source is selected in P39-75 then this parameter sets the pressure below which the timer in P39-73 is started. If the timer expires while the system Pressure remains below this value then the action defined in P39-76 is performed.
39-73		Low System Pressure Proof Time	0s	60s	0s	This determines the amount of time that the system pressure must be lower than the value set in parameter P39-73 before it performs the action selected by P39-76.

Table 6-2. Parameter 39-** Group, Detailed Description (continued)

39-74		Low System Reset Pressure	0.0	Depends on P3965	0.0	If the pumps have been shut off due to Low System Pressure and if the pressure increases above this point then the first pump will be turned on.
39-75		Low/High System Pressure Source - No function - Analog input 53 - Analog input 54 - Analog input X30/11 - Analog input X30/12	0s	60s	0s	This parameter tells the controller which analog input is connected to the System Pressure sensor. Input scaling for the sensor is defined in parameter group P06-xx.
39-76		Low System Pressure Alert Level - Warning - Warning and Stop				Action to perform when the Low System Pressure Proof Timer P39-73 expires while the system pressure remains below the value in P39-72.
39-8*	**No Flow Shut Down**					
39-80		No Flow Shut Down Proof Time (Old Par. 776)	0s	9999s	0s	If minimum speed, as set by parameter P04-11 is reached, the timer set in this parameter will activate. After the timer expires, the minimum speed proof timer, set in parameter P39-81 will activate. After these timers expire, the controller stops the pump and displays WARNING, NO FLOW SHUT DOWN.
39-81		Minimum Speed Proof Time (Old Par. 777)	0s	9999s	0s	When only one pump is running at minimum speed, the controller will activate a sequence to stop the pump. First the timer set in parameter P39-80 must expire. Then the timer set in this parameter must expire. After these timers expire, the controller stops the pump. When the system pressure drops below the value set in parameter P39-82, the system will automatically restart.
39-82		Restart Pressure Drop (Old Par. 778)	0.0 PSI	999999.0 PSI	0.0 PSI	After the system has been shut down by the No Flow Shut Down function, it will automatically restart when the pressure in the system drops below this value. If this is set to OFF, the system will not activate No Flow Shut Down.

Table 6-2. Parameter 39- Group, Detailed Description (continued)**

39-83		Minimum Run Time (Old Par. 779)	60s	600s	600s	Before the controller stops a pump using No Flow Shut Down, the timers set in parameters P39-80 and P39-81 must expire. If the system has previously been stopped using No Flow Shut Down, the timer set in this parameter must also expire before the No Flow Shut Down occurs.
39-84		No Flow Shut Down Bandwidth (Old Par. 789)	0.0%	5.0%	2.5%	If the difference between the setpoint and the feedback is less than this parameter's percent of the maximum feedback value, the controller will continue to decelerate the drive.

Section 7 Status Messages

Status Messages

Status messages are generated automatically and appear in the bottom line of the display as shown.

A. The first part of the status line indicates where the stop/start command originates.

B. The center part of the status line indicates where the speed control originates.

C. The last part of the status line gives the present drive status.

The table below defines the status massage display words.

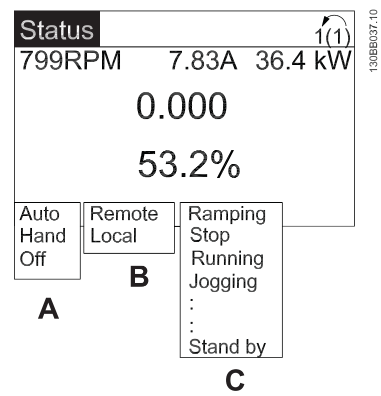


Figure 7-1. Display Status Line

Table 7-1. Status Message Definitions

Operation Mode	
Off	The drive does not react to any control signal until Auto On or Hand On is pressed.
Auto On	The drive is controlled via the control terminals and/or the serial communication.
Hand On	The drive can be controlled by up and down arrows on the LCP keypad. Stop commands, alarm resets, reversing, DC brake, and other signals can be applied to the control terminals that override local control.
Reference Site	
Remote	The speed reference is given via internal preset references and/or external signals (analog or digital) or via serial communication.
Local	The drive uses the reference values set via the LCP. For further information, please examine parameter 3-13.
Operation Status	
AC Brake	AC Brake was selected in parameter 2-10 *Brake Function*. The motor is slowed down via the active down ramp and feeds the drive with generative energy. The AC brake over-magnetizes the motor to achieve a controlled end of the active ramp.
AMA finish OK	Automatic motor adaptation (AMA) was carried out successfully.
AMA ready	Automatic motor adaptation (AMA) is ready to start. Press Hand On on the LCP to start.

Table 7-1. Status Message Definitions (continued)

AMA running	Automatic motor adaptation (AMA) process is in progress.
Braking	The brake chopper is in operation. Generative energy is absorbed by the brake resistor.
Braking max.	The brake chopper is in operation. The power limit for the brake resistor defined in parameter 2-12 Brake Power Limit (kW) is reached.
Bypass	Indicates the drive is operating in bypass mode, meaning the drive control is being bypassed and the motor run off of mains power input directly.
Catch up	The output frequency is corrected by the value set in parameter 3-12 *Catch Up/Slow Down Value*.
	1. Catch up is selected as a function for a digital input (parameter group 5-1). The corresponding terminal is active.
	2. Catch up was activated via serial communication.
Coast	1. Coast inverse has been selected as a function for a digital input (parameter group 5-1). The corresponding terminal (e.g. Terminal 27) is not connected.
	2. Coast is on 0 on serial communication
Ctrl. Ramp-down	A function with *Ctrl. Ramp-down* was selected in parameter 14-10 *Mains Failure*. The mains voltage is below the value set in parameter 14-11 *Mains Voltage* at mains fault. The drive ramps down the motor using a controlled ramp down.
Current High	In parameter 4-51 *Warning Current High*, a current limit is set. The output current of the drive is above this limit.
Current Low	In parameter 4-52 *Warning Speed Low*, a current limit is set. The output current of the drive is below this limit.
DC Hold	The motor is driven with a permanent DC current, parameter 2-00 *DC Hold Current*. DC hold is selected in parameter 1-80 *Function at Stop*. A Stop command, e.g. Stop
DC Stop	The motor is momentarily driven with a DC current (parameter 2-01 *DC Brake Current*) for a specified time (parameter 2-02 *DC Braking Time*).
	1. DC Brake is activated (OFF) in parameter 2-03 *DC Brake Cut In Speed [RPM]* and a Stop command, e.g. Stop (inverse) is active.
	2. DC Brake (inverse) is selected as a function for a digital input (parameter group 5-1). The corresponding terminal is not active.
	3. The DC Brake is activated via serial communication.
Feedback high	In parameter 4-57 *Warning Feedback High*, an upper feedback limit is set. The sum of all active feedbacks is above the feedback limit.
Feedback low	In parameter 4-56 *Warning Feedback Low*, a lower feedback limit is set. The sum of all active feedbacks is below the feedback limit.
Feedback low	In parameter 4-56 *Warning Feedback Low*, a lower feedback limit is set. The sum of all active feedbacks is below the feedback limit.
Freeze output	The remote reference is active and the momentarily given speed is saved.
	1. Freeze output was selected as a function for a digital input (Group 5-1). The corresponding terminal is active. Speed control is only possible via the terminal functions speed up and speed down.
	2. Hold ramp is activated via serial communication.
Freeze output request	A freeze output command has been given, but the motor will remain stopped until a run permissive signal is received via a digital input.
Freeze Ref.	Freeze Ref. was chosen as a function for a digital input (parameter group 5-1). The corresponding terminal is controlled. The drive saves the actual reference. Changing the reference is now only possible via terminal functions speed up and speed down.
Jog request	A JOG command has been given, but the motor will be stopped until a run permissive signal is received via a digital input.

Table 7-1. Status Message Definitions (continued)

Jogging	The motor is running with parameter 3-19 *Jog Speed [RPM]*.
	1. Jog was selected as function for a digital input (parameter group 5-1). The corresponding terminal (e.g. Terminal 29) is active.
	2. The Jog function is activated via the serial communication.
	3. The Jog function was selected as a reaction for a monitoring function (e.g. No signal). The monitoring function is active.
Motor check	In parameter 1-80 *Function at Stop*, the Motor check function was selected. A stop command, e.g. Stop (inverse) is active. To ensure that a motor is connected to the drive, a permanent test current is applied to the motor.
OVC control	Overvoltage control is activated in parameter 2-17 *Over-voltage Control*. The connected motor is supplying the drive with generative energy. The Overvoltage control adjusts the V/Hz ratio to run the motor in controlled mode and to prevent the drive from tripping.
PowerUnit Off	Only with controllers with installed option (external 24 V supply). The mains supply to the controller is cut off, but the control card is still supplied with 24 V.
Pre-magnetize	Pre-magnetization is selected in parameter 1-80 *Function at Stop*. A stop command (e.g. Stop inverse) is activated. A suitable constant magnetizing current is applied to the motor.
Protection md	The unit has detected a critical status (e.g. an overcurrent or overvoltage). To avoid tripping the controller (alarm), protection mode is activated, which includes reducing the switching frequency to 4 kHz. If possible, protection mode ends after approximately 10 sec. Activation of protection mode can be restricted by adjusting the parameter 14-26 Trip Delay at Inverter Fault.
QStop	The motor is stopped using a quick stop ramp parameter 3-81 *Quick Stop Ramp Time*.
	1. Quick stop inverse was chosen as a function for a digital input (parameter group 5-1). The corresponding terminal (e.g. Terminal 27) is not active.
	2. The Quick stop function was activated via serial communication.
Ramping	The motor is accelerating/decelerating using the active Ramp Up/Down. The reference, a limit value or a standstill is not yet reached.
Ref. high	In parameter 4-55 *Warning Reference High* a reference high limit is set. The sum of all active references is above the reference limit.
Ref. low	In parameter 4-55 *Warning Reference High* a reference low limit is set. The sum of all active references is below the reference limit.
Run on ref.	The drive is running in the reference range. The feedback value matches the set reference value.
Run request	A start command has been given, but the motor will be stopped until a run permissive signal is received via digital input.
Running	The motor is driven by the drive, the ramping phase is done and the motor revolutions are outside the On Reference range. Occurs when one of the motor speed limits (Parameter 4-11/4-12/4-13 or 4-14) is set, but the maximum reference is outside this range.
Sleep Mode	The energy saving function in parameter 403 *Sleep Mode Timer* is enabled. This means that at present the motor has stopped, but that it will restart automatically when required.
Speed down	The output frequency is corrected by the value set in parameter 3-12 *Catch Up/Slow Down Value*.
	1. Speed down was selected as a function for a digital input (parameter group 5-1). The corresponding terminal is active.
	2. Speed down was activated via serial communication.

Table 7-1. Status Message Definitions (continued)

Speed high	In parameter 4-53 *Warning Speed High* , a value is set. The speed of the motor is above this value.
Speed low	In parameter 4-52 *Warning Speed Low,* a value is set. The speed of the motor is below this value.
Standby	[Auto On] The drive starts the motor using a start signal in a digital input (if the parameter is programmed accordingly) or via serial communication.
Start delay	In parameter 1-71 Start Delay, the delay of the starting time was set. A Start command was activated and the delay time is still running. The motor will start after the delay time has expired.
Start fwd/rev	*Enable start forward* and *Enable start reverse* were selected as functions for two different digital inputs (parameter group 5-1). To start the motor, a direction dependent start signal has to be given and the corresponding terminal has to be active.
Stop	OFF was pressed on the LCP or Stop inverse was selected as a function for a digital input (Group 5-1). The corresponding terminal is not active.
Trip	An alarm occurred. It is possible, provided the cause of the alarm is cleared, to reset the alarm via a Reset signal ([RESET key on the LCP, a control terminal or serial communication).
Trip lock	A serious alarm occurred. It is possible, provided the cause of the alarm was cleared, to reset the alarm after the mains have been switched off and on again. This can be done via a reset signal (RESET on the LCP, a control terminal or serial communication).

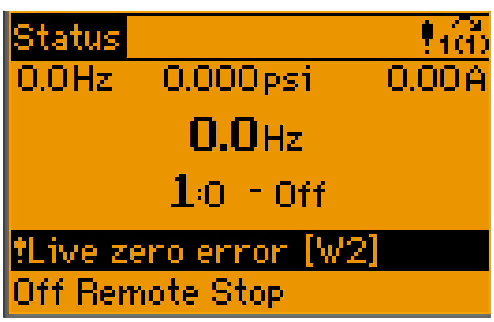
Section 8 Warnings and Alarms

System Monitoring

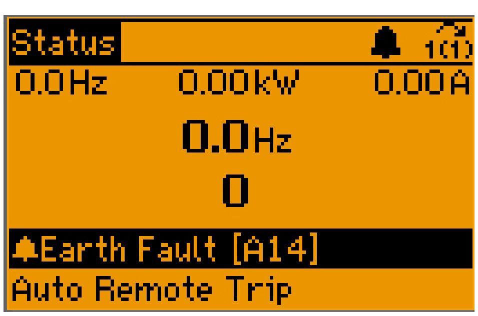
The variable frequency drive monitors the condition of its input power, drive output, and motor factors as well as other system performance indicators. A warning or alarm may not necessarily indicate a problem internal to the drive itself. In many cases it indicates failure conditions from input voltage, motor load, temperature, pump performance, or other areas monitored by the drive's internal logic. Be sure to investigate those areas exterior to the drive as indicated in the alarm or warning message. A master drive in a multiple drive system also conducts limited monitoring of follower drives, but each drive has its own internal monitoring capability.

Warning and Alarm Displays

A warning will flash on display line 4 along with the warning number.



An alarm will flash on display line 4 along with the alarm number.



Description and Remedy

A warning is issued when an alarm condition is impending.

An alarm is issued when the drive is tripped. The controller will continue to operate with power removed from the motor. The motor will coast to a stop. After a reset, the drive will be ready to start operation again.

A trip can be reset in any one of three ways:

1) Pressing the RESET key on the keypad

2) Digital reset input command

3) Serial communication reset input command

An alarm may also result in a trip-lock fault. A trip-lock requires that input power be removed, the cause of the fault corrected, and input power restored to reset the drive. Power must be cycled with a trip-lock.

NOTE

Cycling power to the drive is required after a trip-lock to restore the drive to a trip condition when parameter 14-20, Reset Functions, is set to manual. After cycling power, press the reset key on the keypad to place the drive in run mode.

The warnings and alarms definitions on the following pages will define the condition, explain the probable cause or troubleshooting procedure, and provide a remedy.

NOTE

Fault Log entries are based on priority levels and may not necessarily be in the order in which they occurred.

Table 8-1. Warnings and Alarms

WARNING 1, 10 volts low

The control card voltage is below 10V from terminal 50.

Remove some of the load from terminal 50, as the 10V supply is overloaded. Max. 15 mA or minimum 590 ohms.

This condition can be caused by a short in a connected potentiometer or improper wiring of the potentiometer.

Troubleshooting: Remove the wiring from terminal 50. If the warning clears, the problem is with the customer wiring. If the warning does not clear, replace the control card.

WARNING/ALARM 2, Live zero error

This warning or alarm will only appear if programmed by the user in parameter 6-01 *Live Zero Timeout Function*. The signal on one of the analog inputs is less than 50% of the minimum value programmed for that input. This condition can be caused by broken wiring or faulty device sending the signal.

Troubleshooting:

Check the connections on all the analog input terminals. Control card terminals 53 and 54 for signals, terminal 55 common. Make sure that the controller programming and switch settings match the analog signal type.

WARNING/ALARM 3, No motor

No motor has been connected to the output of the controller. This warning or alarm will only appear if programmed by the user in parameter 1-80 *Function at Stop*.

Troubleshooting: Check the connection between the controller and the motor.

WARNING/ALARM 4, Mains phase loss

A phase is missing on the supply side, or the mains voltage imbalance is too high. This message also appears for a fault in the input rectifier on the controller. Options are programmed at parameter 14-12 *Function at Mains Imbalance*.

Troubleshooting: Check the supply voltage and supply currents to the controller.

WARNING 5, DC link voltage high

The intermediate circuit voltage (DC) is higher than the high voltage warning limit. The limit is dependent on the controller voltage rating. The controller is still active.

WARNING 6, DC link voltage low

The intermediate circuit voltage (DC) is lower than the low voltage warning limit. The limit is dependent on the controller voltage rating. The controller is still active.

WARNING/ALARM 7, DC overvoltage

If the intermediate circuit voltage exceeds the limit, the controller trips after a time.

Troubleshooting:

Connect a brake resistor

Extend the ramp time

Change the ramp type

Activate functions in parameter 2-10 *Brake Function*

Increase parameter 14-26 *Trip Delay at Inverter Fault*

WARNING/ALARM 8, DC undervoltage

If the intermediate circuit voltage (DC) drops below the undervoltage limit, the controller checks if a 24V backup supply is connected. If no 24V backup supply is connected, the controller trips after a fixed time delay. The time delay varies with unit size.

Troubleshooting:

Make sure that the supply voltage matches the controller voltage.

WARNING/ALARM 9, Inverter overloaded

The controller is about to cut out because of an overload (too high current for too long).

The counter for electronic, thermal inverter protection gives a warning at 98% and trips at 100%, while giving an alarm. The controller cannot be reset until the counter is below 90%. The fault is that the controller is overloaded by more than 100% for too long.

Troubleshooting:

Compare the output current shown on the LCP with the controller rated current.

Compare the output current shown on the LCP with measured motor current.

Display the Thermal Drive Load on the LCP and monitor the value. When running above the controller continuous current rating, the counter should increase. When running below the controller continuous current rating, the counter should decrease.

WARNING/ALARM 10, Motor overload temperature

According to the electronic thermal protection (ETR), the motor is too hot. Select whether the controller should give a warning or an alarm when the counter reaches 100% in parameter 1-90 Motor Thermal Protection. The fault is that the motor is overloaded by more than 100% for too long.

Troubleshooting:

Check if motor is overheating.

If the motor is mechanically overloaded.

Table 8-1. Warnings and Alarms (continued)

Motor parameter 1-24 *Motor Current* is set correctly.
Motor data in parameters 1-20 through 1-25 are set correctly.
The setting in parameter 1-91 *Motor External Fan*.
Run AMA in parameter 1-29 *Automatic Motor Adaptation (AMA)*.

WARNING/ALARM 11, Motor thermistor overtemp

The thermistor or the thermistor connection is disconnected. Select whether the controller gives a warning or an alarm when the counter reaches 100% in parameter 1-90 *Motor Thermal Protection*.

Troubleshooting:

Check if motor is overheating.
Check if the motor is mechanically overloaded.
Check that the thermistor is connected correctly between terminal 53 or 54 (analog voltage input) and terminal 50 (+10V supply), or between terminal 18 or 19 (digital input PNP only) and terminal 50.
If a KTY sensor is used, check for correct connection between terminal 54 and 55.
If using a thermal switch or thermistor, check the programming of parameter 1-93 *Thermistor Resource* matches sensor wiring.
If using a KTY sensor, check the programming of parameters 1-95, 1-96, and 1-97 match sensor wiring.

WARNING/ALARM 12, Torque limit

The torque is higher than the value in parameter 4-16 *Torque Limit Motor Mode* (in motor operation) or the torque is higher than the value in parameter 4-17 *Torque Limit Generator Mode* (in regenerative operation). parameter 14-25 *Trip Delay at Torque Limit* can be used to change this from a warning only condition to a warning followed by an alarm.

WARNING/ALARM 13, Overcurrent

The inverter peak current limit (approx. 200% of the rated current) is exceeded. The warning lasts about 1.5 sec., then the controller trips and issues an alarm. If extended mechanical brake control is selected, trip can be reset externally.

Troubleshooting:

This fault may be caused by shock loading or fast acceleration with high inertia loads.
Turn off the controller. Check if the motor shaft can be turned.
Make sure that the motor size matches the controller.
Incorrect motor data in parameters 1-20 through 1-25.

ALARM 14, Earth (ground) fault

There is a discharge from the output phases to earth, either in the cable between the frequency converter and the motor or in the motor itself.

Troubleshooting:

Turn off the controller and remove the earth fault.
Measure the resistance to earth of the motor leads and the motor with a meter to check for earth faults in the motor.

ALARM 15, Hardware mismatch

A fitted option is not operational with the present control board hardware or software. Contact your supplier.

ALARM 16, Short circuit

There is short-circuiting in the motor or on the motor terminals. Turn off the controller and remove the short-circuit.

WARNING/ALARM 17, Control word time-out

There is no communication to the controller. The warning will only be active when parameter 8-04 *Control Word Timeout Function* is NOT set to OFF. If parameter 8-04 *Control Word Timeout Function* is set to Stop and Trip, a warning appears and the controller ramps down until it trips, while giving an alarm.

Troubleshooting:

Check connections on the serial communication cable.
Increase parameter 8-03 *Control Word Timeout Time*.
Check the operation of the communication equipment.
Verify a proper installation based on EMC requirements.

WARNING 22, Hoist mechanical brake

The report value will show what kind it is.
0 = The torque reference was not reached before time-out.
1 = There was no brake feedback before the time-out.

WARNING 23, Internal fan fault

The fan warning function is an extra protective function that checks if the fan is running/mounted.
The fan warning can be disabled in parameter 14-53 *Fan Monitor* ([0] Disabled).

Troubleshooting:

Check fan resistance.
Check soft charge fuses.

Table 8-1. Warnings and Alarms (continued)

WARNING 24, External fan fault

The fan warning function is an extra protective function that checks if the fan is running/mounted.
The fan warning can be disabled in parameter 14-53 *Fan Monitor* ([0] Disabled).
Troubleshooting:
Check fan resistance.
Check soft charge fuses.

WARNING 25, Brake resistor short circuit

The brake resistor is monitored during operation. If it short circuits, the brake function is disconnected and the warning appears. The controller still works, but without the brake function. Turn off the controller and replace the brake resistor.

WARNING/ALARM 26, Brake resistor power limit

The power transmitted to the brake resistor is calculated: as a percentage, as a mean value over the last 120 seconds, on the basis of the resistance value of the brake resistor, and the intermediate circuit voltage. The warning is active when the dissipated braking power is higher than 90%. If Trip [2] has been selected in parameter 2-13 *Brake Power Monitoring*, the controller cuts out and issues this alarm, when the dissipated braking power is higher than 100%.
Warning: There is a risk of substantial power being transmitted to the brake resistor if the brake transistor is short-circuited.

WARNING/ALARM 27, Brake chopper fault

The brake transistor is monitored during operation and if it short-circuits, the brake function disconnects and issues a warning. The controller is still able to run, but since the brake transistor has short-circuited, substantial power is transmitted to the brake resistor, even if it is inactive. Turn off the controller and remove the brake resistor.
This alarm/warning could also occur should the brake resistor overheat. Terminal 104 to 106 are available as brake resistor.

WARNING/ALARM 28, Brake check failed

Brake resistor fault: the brake resistor is not connected or not working.
Check parameter 2-15 *Brake Check*.

ALARM 29, Heatsink temp

The maximum temperature of the heatsink has been exceeded. The temperature fault will not be reset until the temperature falls below a defined heatsink temperature. The trip and reset point are different based on the controller power size.
Troubleshooting:
Ambient temperature too high.
Motor cable too long.
Incorrect clearance above and below the controller.
Dirty heatsink.
Blocked air flow around the controller.
Damaged heatsink fan.
Check fan resistance.
Check soft charge fuses.
IGBT thermal sensor.

ALARM 30, Motor phase U missing

Motor phase U between the controller and the motor is missing.
Turn off the controller and check motor phase U.

ALARM 31, Motor phase V missing

Motor phase V between the controller and the motor is missing.
Turn off the controller and check motor phase V.

ALARM 32, Motor phase W missing

Motor phase W between the controller and the motor is missing.
Turn off the controller and check motor phase W.

ALARM 33, Inrush fault

Too many power-ups have occurred within a short time period. Let the unit cool to operating temperature.

WARNING/ALARM 34, Fieldbus communication fault

The fieldbus on the communication option card is not working.

WARNING/ALARM 35, Out of frequency range:

This warning is active if the output frequency has reached the high limit (set in parameter 4-53) or low limit (set in parameter 4-52). In Process Control, Closed Loop, parameter 1-00 *Configuration Mode* this warning is displayed.

WARNING/ALARM 36, Mains failure

This warning/alarm is only active if the supply voltage to the controller is lost and parameter 14-10 *Mains Failure* is NOT set to OFF. Check the fuses to the controller

ALARM 38, Internal fault

It may be necessary to contact your supplier.

Table 8-1. Warnings and Alarms (continued)

ALARM 39, Heatsink sensor

No feedback from the heatsink temperature sensor.

The signal from the IGBT thermal sensor is not available on the power card. The problem could be on the power card, on the gate drive card, or the ribbon cable between the power card and gate drive card.

WARNING 40, Overload of Digital Output Terminal 27

Check the load connected to terminal 27 or remove the short-circuit connection. Check parameter 5-00 *Digital I/O Mode* and parameter 5-01 *Terminal 27 Mode.*

WARNING 41, Overload of Digital Output Terminal 29

Check the load connected to terminal 29 or remove the short-circuit connection. Check parameter 5-00 *Digital I/O Mode* and parameter 5-02 *Terminal 29 Mode*.

WARNING 42, Overload of Digital Output on X30/6 or Overload of Digital Output on X30/7

For X30/6, check the load connected to X30/6 or remove the short-circuit connection. For X30/7, check the load connected to X30/7 or remove the short-circuit connection.

ALARM 46, Power card supply

The supply on the power card is out of range. There are three power supplies generated by the switch mode power supply (SMPS) on the power card: 24V, 5V, +/- 18V. When powered with three phase mains voltage, all three supplied are monitored.

WARNING 47, 24V supply low

The 24 VDC is measured on the control card. The external 24 VDC backup power supply may be overloaded, otherwise contact your supplier.

WARNING 48, 1.8V supply low

The 1.8 Volt DC supply used on the control card is outside of allowable limits. The power supply is measured on the control card.

WARNING 49, Speed limit

The speed is not within the specified range in parameter 4-11 *Motor Speed Low Limit [RPM]* and parameter 4-13 *Motor Speed High Limit [RPM]*.

ALARM 50, AMA calibration failed

Contact your supplier.

ALARM 51, AMA check U_{nom} and I_{nom}

The setting of motor voltage, motor current, and motor power is presumably wrong. Check the settings.

ALARM 52, AMA low I_{nom}

The motor current is too low. Check the settings.

ALARM 53, AMA motor too big

The motor is too big for the AMA to work.

ALARM 54, AMA motor too small

The motor is too big for the AMA to work.

ALARM 55, AMA parameter out of range

The parameter values found from the motor are outside acceptable range.

ALARM 56, AMA interrupted by user

The AMA has been interrupted by the user.

ALARM 57, AMA time-out

Try to start the AMA again a number of times, until the AMA is carried out. Please note that repeated runs may heat the motor to a level where the resistances R_s and R_r are increased. In most cases, however, this is not critical.

ALARM 58, AMA internal fault

Contact your supplier.

WARNING 59, Current limit

The current is higher than the value in parameter 4-18 *Current Limit*.

WARNING 60, External interlock

External interlock has been activated. To resume normal operation, apply 24 VDC to the terminal programmed for external interlock and reset the controller (via serial communication, digital I/O, or by pressing the reset button on LCP).

WARNING 61, Tracking error

An error has been detected between the calculated motor speed and the speed measurement from the feedback device. The function for Warning/Alarm/Disable is set in parameter 4-30 *Motor Feedback Loss Function*, error setting in parameter 4-31 *Motor Feedback Speed Error,* and the allowed error time in parameter 4-32 *Motor Feedback Loss Timeout*. During a commissioning procedure the function may be effective.

WARNING 62, Output frequency at maximum limit

The output frequency is higher than the value set in parameter 4-19 *Max Output Frequency.*

ALARM 63, Mechanical brake low

The actual motor current has not exceeded the release-brake current within the start-delay time window.

WARNING 64, Voltage limit

The load and speed combination demands a motor voltage higher than the actual DC link voltage.

WARNING/ALARM/TRIP 65, Control card overtemperature

Control card overtemperature. (The cutout temperature of the control card is 80° C.)

Table 8-1. Warnings and Alarms (continued)

WARNING 66, Heatsink temperature low

This warning is based on the temperature sensor in the IGBT module.

Troubleshooting:

The heatsink temperature measured as 0° C could indicate that the temperature sensor is defective, thereby causing the fan speed to increase to the maximum. If the sensor wire between the IGBT and the gate drive card is disconnected, this warning is produced. Also, check the IGBT thermal sensor.

ALARM 67, Option module configuration has changed

One or more options have either been added or removed since the last power-down.

ALARM 68, Safe stop activated

Safe stop has been activated. To resume normal operation, apply 24 VDC to terminal 37, then send a reset signal (via bus, digital I/O, or by pressing the reset key. See parameter 5-19 *Terminal 37 Safe Stop*.

ALARM 69, Power card temperature

The temperature sensor on the power card is either too hot or too cold.

Troubleshooting:

Check the operation of the door fans.

Make sure that the filters for the door fans are not blocked.

Make sure that the gland plate is properly installed on IP21 and IP54 (NEMA 1 and NEMA 12) controllers.

ALARM 70, Illegal FC Configuration

The current control board and power board combination is illegal.

WARNING/ALARM 71, PTC 1 safe stop

Safe Stop has been activated from the MCB 112 PTC thermistor card (motor too warm). Normal operation can be resumed when the MCB 112 applies 24 VDC to T-37 again (when the motor temperature reaches an acceptable level) and when the digital input from the MCB 112 is deactivated. When this happens, a reset signal is sent (via serial communication, digital I/O, or by pressing reset button on LCP). Note that if automatic restart is enabled, the motor may start when the fault is cleared.

ALARM 72, Dangerous failure

Safe stop with trip lock. Unexpected signal levels on the safe stop and digital input from the MCB 112 PTC thermistor card.

Warning 73, Safe stop auto restart

Safe stopped. Note that with automatic restart enabled, the motor may start when the fault is cleared.

ALARM 79, Illegal power section configuration

The scaling card is the incorrect part number or not installed. Also, the MK102 connector on the power card is not installed.

ALARM 80, Drive initialized to default value

Parameter settings are initialized to default settings after a manual reset.

WARNING 81, CSIV corrupt

CSIV file has syntax errors.

WARNING 82, CSIV parameter error

CSIV has failed to record a parameter.

ALARM 91, Analog input 54 wrong settings

Switch S202 must be set in the position OFF (voltage input) when a KTY sensor is connected to analog input terminal 54.

ALARM 92, No flow

A no-load situation has been detected in the system. See parameter group 22-2.

ALARM 93, Dry pump

A no-flow situation and high speed indicate that the pump has run dry. See parameter group 22-2.

ALARM 94, End of curve

Feedback stays lower than the setpoint which may indicate leakage in the pipe system. See parameter group 22-5.

ALARM 95, Broken belt

Torque is below the torque level set for no load, indicating a broken belt. See parameter group 22-6.

ALARM 96, Start delayed

Motor start has been delayed due to short-cycle protection active. See parameter group 22-7.

WARNING 97, Stop delayed

Stopping the motor has been delayed due to short cycle protection is active. See parameter group 22-7.

WARNING 98, Clock fault

Clock Fault. The time is not set or the RTC clock (if mounted) has failed. See parameter group 0-7.

WARNING 220, Bypass Overload Trip

Motor overload has tripped. Indicates excess motor load. Check motor and driven load. To reset press the OFF/Reset key. Then, to restart the system, press the Auto ON or Hand ON key.

WARNING 221, Bypass Interlock

Bypass interlock has opened and caused the motor to stop. Correct the problem. Depending on the setting of parameter 14-20, the system will either automatically reset this alarm or require the OFF/Reset key to be pressed.

Table 8-1. Warnings and Alarms (continued)

WARNING 222, M2 Open Failed
The contactor that connects the drive to the motor failed to open. The motor cannot be operated.

WARNING 223, M2 Close Failed
The contactor that connects the drive to the motor failed to close. The motor cannot be operated.

WARNING 224, M3 Open Failed
The contactor that connects the motor to the power line has failed to open.

WARNING 226, M3 Close Failed
The contactor that connects the motor to the power line has failed to close. The motor cannot be operated.

WARNING 227, Bypass Com Error
Communication between the main control card and the bypass option has been lost. Motor control lost. It will be possible to run the motor using Manual Bypass Override.

WARNING 228, APU Low Voltage
The option panel power supply has failed, or there is a power problem.

WARNING 229, Motor Disconn
Terminal 3 on connector X57 of the ECB control card shows an open. This generally means that neither motor has been selected in contactor motor select. Select a motor.

ALARM 252, LOW_SUCTION_CUT_OUT
Indicates that the pump suction pressure is below the value specified in P39-61 for the time specified in P39-60.

ALARM 253, LOW_SUCTION_CUT_OUT
Indicates that the System Pressure (output pressure) is above the value specified by P39-70 for the time specified in P39-71.

ALARM 254, HIGH_SYSTEM_PRESSURE
Indicates that the System Pressure (output pressure) is below the value specified by P 39-72 for the time specified in P39-73.

ALARM 255, ALL_ZONE_FAILURE
Indicates that all of the feedback sensors are disconnected or have failed. The Drive proceeds to Jog speed after the time specified in P39-45.

ALARM 256, ANALOG_INPUT_53_HIGH
Indicates that the designated Feedback is equal to 20ma and may be shorted. It will no longer be used after the time specified in P39-43

ALARM 257, ANALOG_INPUT_54_HIGH
Indicates that the designated Feedback is equal to 20ma and may be shorted. It will no longer be used after the time specified in P39-43

ALARM 258, ANALOG_INPUT_X30_11_HIGH
Indicates that the designated Feedback is equal to 20ma and may be shorted. It will no longer be used after the time specified in P39-43

ALARM 259, ANALOG_INPUT_X30_12_HIGH
Indicates that the designated Feedback is equal to 20ma and may be shorted. It will no longer be used after the time specified in P39-43

ALARM 260, ANALOG_INPUT_53_LOW
Indicates that the designated Feedback is less than 3ma and may be disconnected. It will no longer be used after the time P39-42.

ALARM 261, ANALOG_INPUT_54_LOW
Indicates that the designated Feedback is less than 3ma and may be disconnected. It will no longer be used after the time P39-42.

ALARM 262, ANALOG_INPUT_X30_11_LOW
Indicates that the designated Feedback is less than 3ma and may be disconnected. It will no longer be used after the time P39-42.

ALARM 263, ANALOG_INPUT_X30_12_LOW
Indicates that the designated Feedback is less than 3ma and may be disconnected. It will no longer be used after the time P39-42.

ALARM 264, VFD_1_FAILED_TO_START
Indicates that the specified Drive has failed or is not responding.

ALARM 265, VFD_2_FAILED_TO_START
Indicates that the specified Drive has failed or is not responding.

ALARM 266, VFD_3_FAILED_TO_START
Indicates that the specified Drive has failed or is not responding.

ALARM 267, VFD_4_FAILED_TO_START
Indicates that the specified Drive has failed or is not responding.

ALARM 268, PUMP_1_FAILED_TO_START
Indicates that the pump suction pressure is above the value specified in P39-63 for the time specified in P39-62.

ALARM 269, PUMP_2_FAILED_TO_START
Indicates that the specified Pump is indicating no difference in pressure between the pump input and output.

ALARM 270, PUMP_3_FAILED_TO_START
Indicates that the specified Pump is indicating no difference in pressure between the pump input and output.

ALARM 271, PUMP_4_FAILED_TO_START
Indicates that the specified Pump is indicating no difference in pressure between the pump input and output.

ALARM 272, HIGH_SUCTION_CUT_OUT
Indicates that the pump suction pressure is above the value specified in P39-63 for the time specified in P39-62.

Section 9 Start Up Troubleshooting

Table 9-1. Fault Table

Symptom	Possible cause	Test	Solution
No function	Missing input power	See startup guide for voltage checks.	Correct voltage at source.
	Missing or open fuses or circuit breaker tripped	See open fuses and tripped circuit breaker in this section for possible causes.	Reset circuit breaker. If fuses, check for opens with power removed from panel.
	Loose connections in panel	Perform pre-startup check for loose connections.	Tighten loose connections in panel.
	Missing customer connections	Missing customer connections can cause the safety circuit or start signal to be open.	See customer connections and make sure all applicable connections are made or jumpers installed especially customer interlock.
	Loose customer connections	Check all customer connections for tightness. Loose customer connections can act like an open circuit.	Tighten loose customer connections.
	Customer wires incorrectly terminated	See customer connection drawing and make sure wires are connected to correct terminals.	Correct any wrong connections. This could potentially case damage to panel.
	Improper voltage applied	See pre-startup check list.	Correct voltage mismatch. This could potentially damage panel caution on applying power recommended.
	Power connections connected wrong	See pre-startup check list to see if motor and power leads were swapped.	Correct any wrong connections. This could potentially case damage to panel.
	Power disconnect open	Verify that disconnect or circuit breaker is closed.	Correct any wrong connections. This could potentially case damage to panel.
	Operator switches off	Verify that operator devices are in operating position per startup procedures.	Set switches to correct position.
	OL tripped	A tripped OL will disable the motor from running. Verify that OL relay is in normal operating position per manual.	Perform pre-startup check list and set OL per instructions.
Open power fuses or circuit breaker trip	Improper voltage applied	See pre-startup check list and correct if wrong.	Correct voltage mismatch. This could potentially damage panel caution on applying power recommended.
	Power connections connected wrong	Motor and line voltage swapped. Make sure the line in and motor out are on the correct terminals. See pre-startup check list.	Correct any wrong connections. This could potentially case damage to panel.
	Power ground fault	Check motor and panel power wires to ground.	Eliminate any ground faults detected.
	Phase to phase short	Motor or panel has a short phase to phase. Check motor and panel phase to phase for shorts.	Eliminate any shorts detected.
	Motor overload	Motor is overloaded for the application.	Perform startup and verify motor current is within specifications. If motor current is exceeding nameplate FLA reduce the load on the motor.
	Drive overload	Drive is overloaded for the application.	Perform startup and verify drive current is within specifications. If not reduce the load on the motor.
	Loose connections	Perform pre-startup check for loose connections.	Tighten loose connections.

Table 9-1. Fault Table (continued)

Symptom	Possible cause	Test	Solution
Repeated fuse or circuit breaker	Application problem	Perform startup procedures. Check panel output motor current at full speed and check for excessive over current.	If current is to high reduce load on motor.
	Panel problem	Perform startup procedures. Check panel input current at full speed and verify it is within acceptable range.	If current is to high reduce load on motor.
	Power problem	Monitor incoming power for surges and sags and overall quality.	Correct any problems found.
	Motor problem	Test motor for correct function.	Repair or replace motor if a problem is found.
Open control fuse	Improper voltage applied	See pre-startup check list.	Correct voltage mismatch. This could potentially damage panel caution on applying power recommended.
	Customer wires incorrectly terminated	See customer connection drawing and make sure wires are connected to correct terminals.	Correct any wrong connections. This could potentially case damage to panel.
	Control ground fault	Check all control wires for a short to ground.	Correct any ground faults found. This could potentially case damage to panel.
	Control short	Check control wires for a short in supply voltage.	Correct any shorts. This could potentially case damage to panel.
Open SMPS fuse	Improper voltage applied	See pre-startup check list.	Correct voltage mismatch. This could potentially damage panel caution on applying power recommended.
	Customer wires incorrectly terminated	See customer connection drawing and make sure wires are connected to correct terminals.	Correct any wrong connections. This could potentially case damage to panel.
	Control ground fault	Check all control wires for a short to ground.	Correct any ground faults found. This could potentially case damage to panel.
	Control short	Check control wires for a short in supply voltage.	Correct any shorts. This could potentially case damage to panel.
Motor rotation incorrect	Rotation incorrect in bypass, drive or both	Motor rotation is backwards in drive mode, bypass mode, or both.	Perform motor rotation procedure in startup section of manual.

Table 9-1. Fault Table (continued)

Symptom	Possible cause	Test	Solution
Overload trips	Motor overloaded	Motor is drawing too much current for the application.	Perform startup and verify motor current is within specifications. If not, reduce the load on the motor.
	Loose connections	Look for signs of overheating on connections to OL.	Perform pre-startup check for loose connections and tighten. Replace any overheated components and wires.
	OL not set correctly	An improperly set OL can cause the OL to trip too soon. See pre-startup procedure for correct setting.	Set correct motor current on OL.
Contactor fails to pull in	Contamination	Remove contactor and check for contamination.	If contamination found, repair or replace.
	Defective coil	Compare coil resistance to functional contactors of the same size. Inspect coil for signs of overheating and damages.	If readings are not the same or visible signs of damage, replace coil or contactor.
	Auxiliary contact binding action	Remove auxiliary contacts and test contactor action.	If contactor operates with auxiliaries removed, replace auxiliary contacts.
Contactor fails to drop out	Contamination	Remove contactor and check for contamination.	If contamination found, repair or replace.
	Defective coil	Compare coil resistance to functional contactors of the same size.	If readings are not the same or visible signs of damage, replace coil or contactor.
	Auxiliary contact binding action	Remove auxiliary contacts and test contactor action.	If contactor operates with auxiliaries removed, replace auxiliary contacts.
Mains current imbalance greater than 3%	Problem with mains power	Rotate incoming power leads into option panel one position; A to B, B to C, and C to A.	If imbalanced leg follows the wire it is a power problem. Causes can vary contact electrician or power expert for solution.
	Problem with option panel	Rotate incoming power leads into option panel one position; A to B, B to C, and C to A.	If imbalance leg stays on same option panel input terminal it is a problem with the option panel. Contact factory for assistance.
Motor current imbalance greater than 3%	Problem with motor or motor wiring	Rotate out going motor leads one position; U to V, V to W, and W to U.	If imbalanced leg follows motor lead the problem is in the motor or wiring to the motor. Causes can vary contact electrician or motor expert for a solution.
	Problem with option panel	Rotate out going motor leads one position; U to V, V to W, and W to U.	If imbalance leg stays on same option panel output terminal it is a problem with the option panel. Contact factory for assistance.

Appendix
Serial Communication Point Maps

Protocols

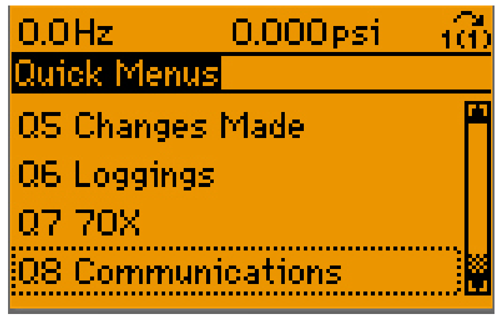
Metasys N2: starts on page 63

Modbus RTU: starts on page 65

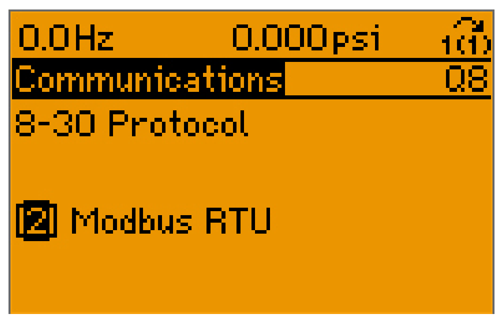
FLN: starts on page 68

Serial Communications Programming

Select the serial communication protocol type in Quick Menu item *Q8, Communications*.



Press the OK key to access the parameter choices and scroll to parameter *8-30, Protocol* to select the protocol in use.



Metasys N2 Point Map

NPT	NPA	POINT DESCRIPTION	RANG/VALUE	UNITS	Size in Bits
BI	162	System Start/Stop	1 = Start 0 = Stop		1
BI	163	Pump Standby Enabled	1 = Enabled 0 = Disabled		1
BI	164	General Alarm Output	1 = Failure 0 = O.K.		1
BI	166	Pump #1 On/Off	1 = On 0 = Off		1
BI	167	Pump #2 On/Off	1 = On 0 = Off		1
BI	168	Pump #3 On/Off	1 = On 0 = Off		1
BI	169	Pump #4 On/Off	1 = On 0 = Off		1
BI	170	Pump #1 Configured	1 = Configured 0 = Disabled		1
BI	171	Pump #2 Configured	1 = Configured 0 = Disabled		1
BI	172	Pump #3 Configured	1 = Configured 0 = Disabled		1
BI	173	Pump #4 Configured	1 = Configured 0 = Disabled		1
BI	174	Pump #1 Running In Bypass Mode	1 = In Bypass 0 = Not In Bypass		1
BI	175	Pump #2 Running In Bypass Mode	1 = In Bypass 0 = Not In Bypass		1
BI	176	Pump #3 Running In Bypass Mode	1 = In Bypass 0 = Not In Bypass		1
BI	177	Pump #4 Running In Bypass Mode	1 = In Bypass 0 = Not In Bypass		1
BI	155	Pump #1 Bypass Overload	1 = Failure 0 = O.K.		1
BI	10	System Reset Required	1 = Yes 0 = No		1
BI	146	All Zone Failure	1 = Failure 0 = O.K.		1
BI	145	Analog Input #1 High Failure	1 = Failure 0 = O.K.		1
BI	144	Analog Input #2 High Failure	1 = Failure 0 = O.K.		1
BI	143	Analog Input #3 High Failure	1 = Failure 0 = O.K.		1
BI	142	Analog Input #4 High Failure	1 = Failure 0 = O.K.		1
BI	141	Analog Input #1 Low Failure	1 = Failure 0 = O.K.		1
BI	140	Analog Input #2 Low Failure	1 = Failure 0 = O.K.		1
BI	139	Analog Input #3 Low Failure	1 = Failure 0 = O.K.		1
BI	138	Analog Input #4 Low Failure	1 = Failure 0 = O.K.		1
BI	178	Pump #1 VFD Failure	1 = Failure 0 = O.K.		1
BI	179	Pump #2 VFD Failure	1 = Failure 0 = O.K.		1
BI	180	Pump #3 VFD Failure	1 = Failure 0 = O.K.		1
BI	181	Pump #4 VFD Failure	1 = Failure 0 = O.K.		1

Metasys N2 Point Map (continued)

BI	182	Pump #1 Pump Failure	1 = Failure 0 = O.K.		1
BI	183	Pump #2 Pump Failure	1 = Failure 0 = O.K.		1
BI	184	Pump #3 Pump Failure or VFD	1 = Failure 0 = O.K.		1
BI	185	Pump #4 Pump Failure or VFD	1 = Failure 0 = O.K.		1
BI	186	High Suction Alarm	1 = Failure 0 = O.K.		1
BI	147	Low Suction Alarm	1 = Failure 0 = O.K.		1
BI	148	High System Alarm	1 = Failure 0 = O.K.		1
BI	149	Low System Alarm	1 = Failure 0 = O.K.		1
BI	187	NFSD Warning	1 = Warning 0 = O.K.		1
BO	6	System Reset Request	1 = Yes 0 = No		1
BO	5	System Start / Stop	1 = Start 0 = Stop		1
ADF	96	Process Variable #1	0 to Span (in Technologic User Setup Menu)		32
ADF	97	Process Variable #2	0 to Span (in Technologic User Setup Menu)		32
ADF	98	Process Variable #3	0 to Span (in Technologic User Setup Menu)		32
ADF	99	Process Variable #4	0 to Span (in Technologic User Setup Menu)		32
ADF	103	Setpoint #1	0 to Span (in Technologic User Setup Menu)		32
ADF	104	Setpoint #2	0 to Span (in Technologic User Setup Menu)		32
ADF	105	Setpoint #3	0 to Span (in Technologic User Setup Menu)		32
ADF	106	Setpoint #4	0 to Span (in Technologic User Setup Menu)		32
ADF	100	System Flow Rate	0 to Span (in Technologic User Setup Menu)	GPM	32
ADF	7	AFD #1 Power	0 to Span (in Technologic User Setup Menu)	KW	32
ADI	127	System Operation Mode	0=Manual,1=Auto, 2=Auto Bypass.		8
ADF	107	Speed %	0 to 100	%	32
AI	4	Frequency Output	0 to 50/60	Hz	16
ADI	128	Lead Pump Number	1 to Pump # (in Technologic User Setup Menu)		16
ADI	129	Active Zone Number	1 to Zone # (in Technologic User Setup Menu)		16
AI	42	Run Time, Tech500 Unit	0-32767 Hours		32
AI	43	Run Time, Pump #2	0-32767 Hours		32
AI	44	Run Time, Pump #3	0-32767 Hours		32
AI	45	Run Time, Pump #4	0-32767 Hours		32

Modbus RTU Point Map (by parameter)

PNU	Name	Size (in bits)	Address(es)	Indexed
16-03	Status Word	16	16030	
16-10	Power (kW)	32	16100,1	
16-13	Frequency	16	16130	
16-15	Frequency (%)	32	16150,1	
16-54	Feedback 1 (Unit)	32	16540,1	
16-55	Feedback 2 (Unit)	32	16550,1	
16-56	Feedback 3 (Unit)	32	16560,1	
16-57	Feedback 4 (Unit)	32	16570,1	
16-91	Alarm Word 2	32	16910,1	
16-93	Warning Word 2	16	16930	
20-21	Setpoint 1	32	20210	
20-22	Setpoint 2	32	20220	
20-23	Setpoint 3	32	20230	
20-24	Setpoint 4	32	20240	
27-01	Pump Status	8	27010	Y
27-03	Current Runtime Hours	32	27030,1	Y
27-93	Cascade Option Status	8	27930	
31-10	Bypass Status Word	16	31100	
39-02	System Status Word	16	39020	
39-03	System Operating Mode	8	39030	
39-29	Measured Flow	32	39290,1	
39-34	Lead Pump Number	16	39340	
39-46	Active Zone Number	16	39460	
39-49	Warning Word 3	32	39490,1	
39-53	No. of Pumps in Duty Standby	16	39530	

Modbus RTU Point Map (by function)

Param Number	Index (Modbus register 0x0009)	Status Word Bit #	Modbus Function Code	Modbus	DESCRIPTION	RANGE/VALUE	SIZE IN BITS
			05	12	Pump Sequence Alternation	1 = Yes 0 = No	
			05	8	System Reset Request	1 = Yes 0 = No	
			05	7	System Start / Stop	1 = Start 0 = Stop	
39-02		# 00	03	39020	System Start/Stop	1 = Start 0 = Stop	16
39-02		# 01	03	39020	Pump Standby Enabled	1 = Enabled 0 = Disabled	16
39-02		# 02	03	39020	General Alarm Output	1 = Failure 0 = O.K.	16
39-02		# 04	03	39020	Pump #1 On/Off	1 = On 0 = Off	16
39-02		# 05	03	39020	Pump #2 On/Off	1 = On 0 = Off	16
39-02		# 06	03	39020	Pump #3 On/Off	1 = On 0 = Off	16
39-02		# 07	03	39020	Pump #4 On/Off	1 = On 0 = Off	16
39-02		# 08	03	39020	Pump #1 Configured	1 = Configured 0 = Disabled	16
39-02		# 09	03	39020	Pump #2 Configured	1 = Configured 0 = Disabled	16
39-02		# 10	03	39020	Pump #3 Configured	1 = Configured 0 = Disabled	16
39-02		# 11	03	39020	Pump #4 Configured	1 = Configured 0 = Disabled	16
39-02		# 12	03	39020	Pump #1 Running In Bypass Mode	1 = In Bypass 0 = VFD	16
39-02		# 13	03	39020	Pump #2 Running In Bypass Mode	1 = In Bypass 0 = VFD	16
39-02		# 14	03	39020	Pump #3 Running In Bypass Mode	1 = In Bypass 0 = VFD	16
39-02		# 15	03	39020	Pump #4 Running In Bypass Mode	1 = In Bypass 0 = VFD	16
16-03		#03	03	16030	System Reset Required	1 = Yes 0 = No	32
16-93		#20	03	16930	All Zone Failure	1 = Failure 0 = O.K.	32
16-93		#21	03	16930	Analog Input #1 High Failure	1 = Failure 0 = O.K.	32
16-93		#22	03	16930	Analog Input #2 High Failure	1 = Failure 0 = O.K.	32
16-93		#23	03	16930	Analog Input #3 High Failure	1 = Failure 0 = O.K.	32
16-93		#24	03	16930	Analog Input #4 High Failure	1 = Failure 0 = O.K.	32
16-93		#25	03	16930	Analog Input #1 Low Failure	1 = Failure 0 = O.K.	32
16-93		#26	03	16930	Analog Input #2 Low Failure	1 = Failure 0 = O.K.	32
16-93		#27	03	16930	Analog Input #3 Low Failure	1 = Failure 0 = O.K.	32
16-93		#28	03	16930	Analog Input #4 Low Failure	1 = Failure 0 = O.K.	32
16-91		#20	03	16910,1	Low System Alarm	1 = Failure 0 = O.K.	32
16-91		#21	03	16910,1	High System Alarm	1 = Failure 0 = O.K.	32
16-91		#22	03	16910,1	Low Suction Alarm	1 = Failure 0 = O.K.	32
16-54			03	16540,1	Process Variable #1	0 to Span (in Technologic User Setup Menu)	32
16-55			03	16550,1	Process Variable #2	0 to Span (in Technologic User Setup Menu)	32
16-56			03	16560,1	Process Variable #3	0 to Span (in Technologic User Setup Menu)	32
16-57			03	16570,1	Process Variable #4	0 to Span (in Technologic User Setup Menu)	32

Modbus RTU Point Map (by function)

20-21			03	20210,1	Setpoint #1	0 to Span (in Technologic User Setup Menu)	32
20-22			03	20220,1	Setpoint #2	0 to Span (in Technologic User Setup Menu)	32
20-23			03	20230,1	Setpoint #3	0 to Span (in Technologic User Setup Menu)	32
20-24			03	20240,1	Setpoint #4	0 to Span (in Technologic User Setup Menu)	32
39-03			03	39030	System Operation Mode	0=Manual,1=Auto, 2=Auto Bypass.	8
39-29			03	39290,1	System Flow Rate (GPM)	0 to Span (in Technologic User Setup Menu)	32
16-10			03	16100,1	AFD #1 Power (kW)	0 to Span (in Technologic User Setup Menu)	32
16-15			03	16150,1	Speed %	0 to 100	32
16-13			03	16130	Frequency Output (Hz)	0 to 50/60	16
39-34			03	39340	Lead Pump Number	1 to Pump # (in Technologic User Setup Menu)	16
39-46			03	39460	Active Zone Number	1 to Zone # (in Technologic User Setup Menu)	16
27-03.01	1		03	27030,1	Run Time, Pump #1	0-32767 Hours	32
27-03.02	2		03	27030,1	Run Time, Pump #2	0-32767 Hours	32
27-03.03	3		03	27030,1	Run Time, Pump #3	0-32767 Hours	32
27-03.04	4		03	27030,1	Run Time, Pump #4	0-32767 Hours	32

Floor Level Network (FLN) Set-up

1. Connect FLN to RS-485 connector on drive.
2. Set parameter *8-30, Protocol* to FLN.
3. Each drive must have a unique address assigned in parameter *8-31, Address*.
4. Check that the baud rate selected in parameter *8-32, Baud Rate* is correct.

The table below lists the parameters associated with FLN functions in the drive. Additional setting are provided to apply customizing of the FLN communication protocol.

FLN Programmable Functions

Parameter	Title	Default Setting	Desired Setting
8-30	Control Timeout	0	
8-04	Control Timeout Function	OFF	
8-30	Protocol	FC	FLN
8-31	Address	1 through 98	
8-32	Baud Rate	9600	4800 or 9600
8-50	Coasting Select	Logic or	
8-52	DC Brake Select	Logic or	
8-53	Start Select	Logic or	
8-54	Reversing Select	Digital Input	
8-55	Set-up Select	Logic or	
8-56	Preset Reference Select	Logic or	

See the FLN Point Map Table on the following pages.

FLN Point Map Table

Point Num.	Descriptor	Factory Default (SI)	Units (SI)	Slope (SI)		On Text	Off Text	Range	Max Value (SI)	Min Value (SI)	Point Type	Class Type	Read Only	Parameter#	Bit
0	SYS CHAR	0		1	0	ON	OFF	255	255	0	2	LDO	No		
1	CTRL ADDRESS	0		1	0			255	255	0	2	LAO	Yes	831	
2	APPLICATION	2760		1	0			16383	16383	0	2	LAO	Yes		
3	FREQ OUTPUT	0	HZ	0.1	0			16383	16383	0	3	LAI	Yes	1613	
4	PCT OUTPUT	0	PCT	0.01	-163.83			32767	16383	-16383	3	LAI	Yes	1615	
5	--Free Point--														
6	CURRENT	0	A	0.1	0			32767	32767	0	3	LAI	Yes	1614	
7	OUTPUT VOLT	0	V	1	0			4095	4095	0	3	LAI	Yes	1612	
8	POWER KW	0	KW	0.1	0			32767	32767	0	3	LAI	Yes	1610	
9	DC BUS VOLT	0	V	1	0			4095	4095	0	3	LAI	Yes	1630	
10	KWH	0	KWH	1	0			1023	1023	0	3	LAI	Yes	1502	
11	RUNTIME PMP1	0	HRS	4	0			32767	131068	0	3	LAI	Yes	2703.01	
12	RUNTIME PMP2	0	HRS	4	0			32767	131068	0	3	LAI	Yes	2703.02	
13	RUNTIME PMP3	0	HRS	4	0			32767	131068	0	3	LAI	Yes	2703.03	
14	RUNTIME PMP4	0	HRS	4	0			32767	131068	0	3	LAI	Yes	2703.04	
15	PUMP SEQ ALT	0		1	0	YES	NO	255	255	0	1	LDO	No	3935	
16	LEAD PUMP	1		1	0			255	255	0	3	LAI	Yes	3934	
17	FEEDBACK 1	0	UNITS	0.01	-163.83			32767	16383	-16383	3	LAI	Yes	1654	
18	FEEDBACK 2	0	UNITS	0.01	-163.83			32767	16383	-16383	3	LAI	Yes	1655	
19	FLOW	0	UNITS	0.01	-163.83			32767	16383	-16383	3	LAI	Yes	3929	
20	OVRD TIME	0	HRS	1	0			255	255	0	2	LAO	No		
21	FEEDBACK 3	0	UNITS	0.01	-163.83			32767	16383	-16383	3	LAI	Yes	1656	
22	FEEDBACK 4	0	UNITS	0.01	-163.83			32767	16383	-16383	3	LAI	Yes	1657	
23	--Free Point--														
29	DAY.NIGHT	0		1	0	NIGHT	DAY	255	255	0	1	LDO	No		
30	CUR LMT PMP1	0	A	0.1	0.1			16383	5000	0	3	LAI	Yes	418	
31	ACCEL TIME 1	0	SEC	1	1			4095	360000	1	1	LAO	No	341	
32	DECEL TIME 1	0	SEC	1	1			4095	360000	1	1	LAO	No	342	

Point Num.	Descriptor	Factory Default (SI)	Units (SI)	Slope (SI)		On Text	Off Text	Range	Max Value (SI)	Min Value (SI)	Point Type	Class Type	Read Only	Parameter#	Bit
33	--Free Point--														
34	HAND.AUTO	0		1	0	HAND	AUTO	255	255	0	3	LDI	Yes	1695	1
35	CMD RUN.STOP	0		1	0	RUN	STOP	255	255	0	1	LDO	No	1685	6
36	PUMP 1 STAT	0		1	0	RUN	STOP	255	255	0	3	LDI	Yes	3902	4
37	PUMP 1 FAIL	0		1	0	FAULT	OK	255	255	0	3	LDI	Yes	3905	0
38	DRIVE 1 STAT	0		1	0	RUN	STOP	255	255	0	3	LDI	Yes		
39	DRIVE 1 FAIL	0		1	0	FAULT	OK	255	255	0	3	LDI	Yes	3904	12
40	PUMP 2 STAT	0		1	0	RUN	STOP	255	255	0	3	LDI	Yes	3902	5
41	PUMP 2 FAIL	0		1	0	FAULT	OK	255	255	0	3	LDI	Yes	3905	1
42	DRIVE 2 STAT	0		1	0	RUN	STOP	255	255	0	3	LDI	Yes		
43	DRIVE 2 FAIL	0		1	0	FAULT	OK	255	255	0	3	LDI	Yes	3904	13
44	PUMP 3 STAT	0		1	0	RUN	STOP	255	255	0	3	LDI	Yes	3902	6
45	PUMP 3 FAIL	0		1	0	FAULT	OK	255	255	0	3	LDI	Yes	3905	2
46	DRIVE 3 STAT	0		1	0	RUN	STOP	255	255	0	3	LDI	Yes		
47	DRIVE 3 FAIL	0		1	0	FAULT	OK	255	255	0	3	LDI	Yes	3904	14
48	DRIVE 4 STAT	0		1	0	RUN	STOP	255	255	0	3	LDI	Yes		
49	DRIVE 4 FAIL	0		1	0	FAULT	OK	255	255	0	3	LDI	Yes	3904	15
50	REF MIN	0	UNIT	0.1	-1638.3			32767	1638.3	-1638.3	3	LAI	No	302	
51	REF MAX	0	UNIT	0.1	-1638.3			32767	1638.3	-1638.3	3	LAI	No	303	
52	REF STAT	0		1	0	ON.REF	OFFREF	255	255	0	1	LDO	Yes	1603	8
53	FREQ MIN	0	HZ	0.1	0			16383	1000	0	1	LAO	Yes	412	
54	FREQ MAX	1000	HZ	0.1	0			16383	1000	0	1	LAO	Yes	414	
55	--Free Point--														
59	ADJUSTD STPT	0	UNIT	0	0			32767	1000000		3	LAI	Yes	1659	
60	--Free Point--														
61	ACTIVE AI	1		1	0			255	0	0	3	LDI	Yes	3946	
62	ACTIVE AI FB	0	UNIT	0.1	-1638.3			32767	1638.3	-1638.3	3	LAI	Yes	1652	
63	PI GAIN	50		0.01	0			1023	1000	0	1	LAO	No	2093	
64	PI I TIME	2000	SEC	0.305	0.01			32767	1000000	1	1	LAO	No	2094	
65	PID D GAIN	50		0.1	0			511	500	10	1	LAO	No	2096	

Point Num.	Descriptor	Factory Default (SI)	Units (SI)	Slope (SI)		On Text	Off Text	Range	Max Value (SI)	Min Value (SI)	Point Type	Class Type	Read Only	Parameter#	Bit
66	PID D TIME	0	SEC	0.01	0			16383	1000	0	1	LAO	No	2095	
67	--Free Point--														
68	FB FUNCTION	7		1	0			255	255	0	1	LDO	No	2020	
69	SETPOINT 1	0	UNIT	0.1	-1638.3			32767	1638300		1	LAO	No	2021	
70	SETPOINT 2	0	UNIT	0.1	-1638.3			32767	1638300		1	LAO	No	2022	
71	SETPOINT 3	0	UNIT	0.1	-1638.3			32767	1638300		1	LAO	No	2023	
72	SETPOINT 4	0	UNIT	0.1	-1638.3			32767	1638300		1	LAO	No	2024	
73	--Free Point--														
75	BUS FBK 1	0	PCT	0.01	-163.83			32767	16383	-16383	1	LAO	No	894	
76	BUS FBK 2	0	PCT	0.01	-163.83			32767	16383	-16383	1	LAO	No	895	
77	BUS FBK 3	0	PCT	0.01	-163.83			32767	16383	-16383	1	LAO	No	896	
78	--Free Point--														
80	DRV ENA PUMP1	0		1	0	ENABLE	DISABL	255	255	0	3	LDI	Yes	1603	2
81	DRV RDY PUMP1	0		1	0	READY	NOTRDY	255	255	0	3	LDI	Yes	1603	1
82	DRV CTL PUMP1	0		1	0	READY	NOTRDY	255	255	0	3	LDI	Yes	1603	0
83	--Free Point--														
88	LOW SUCTION	0		1	0	ALARM	OK	32767	32767	0	3	LDI	Yes	3905	8
89	HI SYS PRESS	0		1	0	ALARM	OK	32767	32767	0	3	LDI	Yes	3905	7
90	OK WARNING	0		1	0	WARN	OK	255	255	0	3	LDI	Yes	1603	7
91	CRNT WARNING	0		1	0			32767	32767	0	3	LAI	Yes		
92	GEN ALARM	0		1	0	FAULT	OK	255	255	0	1	LDO	Yes	3902	2
93	LAST FAULT	0		1	0			255	255	0	3	LAI	Yes	1530	
94	RESET FAULT	0		1	0	YES	OK	255	255	0	1	LDO	No	1685	7
95	ACTIVE SETUP	0		1	0			255	255	0	3	LAI	Yes	10	
96	--Free Point--														
99	ERROR STATUS	0		1	0			255	255	0	3	LAI	Yes		

Quick Start Check List

Confirm job site voltage. Do not apply power or close the disconnect until the following items are completed.

- Check all power wiring connections and secure as required.
- Confirm with the owner/installing contractor if there will be any building automation or remote connections required.
- Inspect and/or install any customer remote terminations required.
- Make note of the design data supplied on the B&G data label (inside of the control panel door)
- Use a volt meter to measure phase to phase voltage on the entering power terminals at the disconnect.
- Compare available voltage to the nameplate data.

Bladder storage tank

- Precharge the bladder storage tank before connecting to the system. The air precharge should be 5 to 10 psi less than the system operating pressure.
- If the storage tank has already been installed and not precharged, disconnect system piping from the tank and equalize to atmospheric pressure, if an isolation valve and drain are provided, use them.
- Apply air pressure to bladder through the air charging valve and pressurize to field conditions (equal to the NFSD restart pressure or 5 to 10 psi below operating pressure).
- Reconnect to the system piping.

Check for available suction water

- Open all supply and discharge valves.
- Close bypass valve if installed in the piping by others.
- Inspect the capillary tubing from the pump discharge to the suction header.
- Open petcocks feeding the tubing.
- Ensure that the plastic tubing is not touching any metal surface. Protect tubing with insulation to prevent abrasion where it may be touching metal.
- Use the pump vent plugs and or the vent cocks on the main PRV to prove available water for suction. Open a faucet to create a demand for water on the system pressure piping.
- Start the package
- Close the disconnect to apply power to the package.
- If the unit starts, press the stop button on the drives to stop the unit.

Enter/Confirm nameplate information

- Go to the Quick Menu and enter motor nameplate information.
- Prove pump rotation for each pump
- Press the Hand Start key to start the pump and then quickly press the Pump Enable key to stop it.
- Observe the spinning shaft for rotation.
- Repeat for each pump.
- Reverse two leads on the pump motors that are incorrect.

If your system has PRVs, set the system operating pressure. Skip next section if system has check valves only.

- Open a faucet or some other demand for water from the discharge of the package. This can be anywhere in the building being served by the package.
- Run one pump manually by pressing Hand Start.
- Adjust the PRV to the desired discharge pressure plus 2 to 5 psi for the building being served. (The PRVs should be set slightly higher than the desired system setpoint.)
- Repeat for each pump in the package, running only one pump at a time.
- All PRVs should be adjusted to the same pressure as seen on the display.

Set system specific parameters

- Press the Quick Menu button.
- Navigate and setup the system parameters.

Testing the package

- Exit the Setup Menu.
- Stop the package.
- Press the Auto Start key to put the system into Auto operation.
- Observe the pressures and temperatures for normal operation.
- Press the Right Arrow key to initiate alternation and observe each pump's operation.
- Close the running water faucet. It should be assumed that no demand for water is required. (No Flow)
- Wait for the no flow shut down sequence to engage. All minimum run timers must elapse for this to occur.
- Demand water from the system again and observe the restart of the package.

No problems? You are done!

Xylem |'zīləm|

1) The tissue in plants that brings water upward from the roots;
2) a leading global water technology company.

We're 12,000 people unified in a common purpose: creating innovative solutions to meet our world's water needs. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. We move, treat, analyze, and return water to the environment, and we help people use water efficiently, in their homes, buildings, factories and farms. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise, backed by a legacy of innovation.

For more information on how Xylem can help you, go to www.xyleminc.com

Let's Solve Water

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