



## H9 ASD Quick Start Guide >>>

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Date: March, 2011

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# Introduction

Congratulations on the purchase of the new **H9 Adjustable Speed Drive!**

The **H9 Adjustable Speed Drive (ASD)** is a solid-state AC drive that features. Toshiba International Corporation's Vector Control Algorithm enables the motor to develop high starting torque and provide compensation for motor slip, which results in smooth, quick starts and highly efficient operation. The H9 ASD uses digitally-controlled pulse width modulation. The programmable functions may be accessed via the easy-to-use menu or via the Direct Access Number. This feature, combined with Toshiba International Corporation's high-performance software, delivers unparalleled motor control and reliability.

The H9 ASD is a very powerful tool, yet surprisingly simple to operate. The user-friendly **Electronic Operator Interface (EOI)** of the H9 ASD has an easy-to-read LCD screen. There is also a read-only LED screen with enhanced visibility that can be read from a greater distance. The EOI provides easy access to the many monitoring and programming features of the H9 ASD.

The motor control software is menu-driven, which allows for easy access to the motor control parameters and quick changes when required.

To maximize the abilities of your new H9 ASD, a working familiarity with this guide will be required. This guide has been prepared for the ASD installer, user, and maintenance personnel. This guide may also be used as a reference guide or for training. With this in mind, use this guide to develop a system familiarity before attempting to install or operate the device.

For a more in-depth description of the many features of the H9 ASD see the ***H9 ASD Installation and Operation Manual*** included on the CD that was received with the device.

## Important Notice

The instructions contained in this guide are not intended to cover all details or variations in equipment types, nor may it provide contingency concerning the installation, operations, or maintenance of this equipment. Should additional information be required contact your Toshiba International Corporation Sales Representative.

The contents of this guide shall not become a part of or modify any prior or existing agreement, commitment, or relationship. The sales contract contains the entire obligation of Toshiba International Corporation. The warranty contained in the contract between the parties is the sole warranty of Toshiba International Corporation and any statements contained herein do not create new warranties or modify the existing warranty.

**Any electrical or mechanical modifications to this equipment without prior written consent of Toshiba International Corporation may void all warranties and may void the UL/CSA listing or other safety certifications. Unauthorized modifications may also result in a safety hazard or equipment damage.**

**Misuse of this equipment could result in injury and equipment damage. In no event will Toshiba Corporation be responsible or liable for direct, indirect, special, or consequential damage or injury that may result from the misuse of this equipment.**

# About This Guide

This guide was written by the TIC Technical Publications Group. This group is tasked with providing technical documentation for the **H9 Adjustable Speed Drive**. Every effort has been made to provide accurate and concise information to you, our customer.

At Toshiba International Corporation we are continuously striving for better ways to meet the constantly changing needs of our customers. E-mail your comments, questions, or concerns about this publication to [Technical-Publications-Dept@tic.toshiba.com](mailto:Technical-Publications-Dept@tic.toshiba.com).

## Guide's Purpose and Scope

This guide provides information on how to safely install, operate, maintain, and dispose of your **H9 Adjustable Speed Drive**. The information provided in this guide is applicable to the **H9 Adjustable Speed Drive** only.

This guide provides information on the various features and functions of this powerful cost-saving device, including

- Installation,
- System operation,
- Configuration and menu options, and
- Mechanical and electrical specifications.

Included is a section on general safety instructions that describe the warning labels and symbols that are used throughout the guide. Read the guide completely before installing, operating, performing maintenance, or disposing of this equipment.

This guide and the accompanying drawings should be considered a permanent part of the equipment and should be readily available for reference and review. Dimensions shown in the guide are in metric and/or the English equivalent.

Because of our commitment to continuous improvement, Toshiba International Corporation reserves the right, without prior notice, to update information, make product changes, or to discontinue any product or service identified in this publication.

**Toshiba International Corporation (TIC) shall not be liable for direct, indirect, special, or consequential damages resulting from the use of the information contained within this manual.**

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# Contacting TIC's Customer Support Center

Toshiba International Corporation's Customer Support Center can be contacted to obtain help in resolving any **Adjustable Speed Drive** system problem that you may experience or to provide application information.

The Support Center is open from 8 a.m. to 5 p.m. (CST), Monday through Friday. The Center's toll free number is US (800) 231-1412/Fax (713) 937-9349 CAN (800) 872-2192 MEX 01 (800) 527-1204. For after-hours support follow the directions in the outgoing message when calling.

You may also contact Toshiba International Corporation by writing to:

Toshiba International Corporation

13131 West Little York Road

Houston, Texas 77041-9990

Attn: ASD Product Manager.

For further information on Toshiba International Corporation's products and services, please visit our website at [www.toshiba.com/ind/](http://www.toshiba.com/ind/).

## TOSHIBA INTERNATIONAL CORPORATION

### H9 Adjustable Speed Drive

Please complete the Warranty Card supplied with the H9 ASD and return it to Toshiba International Corporation by prepaid mail. This will activate the 12 month warranty from the date of installation; but, shall not exceed 18 months from the shipping date.

Complete the following information and retain for your records.

Model Number: \_\_\_\_\_

Serial Number: \_\_\_\_\_

Project Number (if applicable): \_\_\_\_\_

Date of Installation: \_\_\_\_\_

Inspected By: \_\_\_\_\_

Name of Application: \_\_\_\_\_

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# General Safety Information

**DO NOT** attempt to install, operate, maintain, or dispose of this equipment until you have read and understood all of the product safety information and directions that are contained in this manual.

## Safety Alert Symbol

The **Safety Alert Symbol** is comprised of an equilateral triangle enclosing an exclamation mark. This indicates that a potential personal injury hazard exists.



## Signal Words

Listed below are the signal words that are used throughout this manual followed by their descriptions and associated symbols. When the words **DANGER**, **WARNING**, and **CAUTION** are used in this manual they will be followed by important safety information that must be carefully followed.

The word **DANGER** preceded by the safety alert symbol indicates that an imminently hazardous situation exists that, if not avoided or if instructions are not followed precisely, will result in serious injury to personnel or loss of life.



The word **WARNING** preceded by the safety alert symbol indicates that a potentially hazardous situation exists that, if not avoided or if instructions are not followed precisely, could result in serious injury to personnel or loss of life.



The word **CAUTION** preceded by the safety alert symbol indicates that a potentially hazardous situation exists that, if not avoided or if instructions are not followed precisely, may result in minor or moderate injury.



The word **CAUTION** without the safety alert symbol indicates a potentially hazardous situation exists that, if not avoided or if instructions are not followed precisely, may result in equipment and property damage.

## CAUTION



# Special Symbols

To identify special hazards, other symbols may appear in conjunction with the **DANGER**, **WARNING**, and **CAUTION** signal words. These symbols indicate areas that require special and/or strict adherence to the procedures to prevent serious injury to personnel or loss of life.

## Electrical Hazard Symbol

A symbol that is comprised of an equilateral triangle enclosing a lightning bolt indicates a hazard of injury from electrical shock or burn.



## Explosion Hazard Symbol

A symbol that is comprised of an equilateral triangle enclosing an explosion indicates a hazard of injury from exploding parts.



# Equipment Warning Labels

**DO NOT** attempt to install, operate, perform maintenance, or dispose of this equipment until you have read and understood all of the product labels and user directions that are contained in this manual.

Warning labels that are attached to the equipment will include the exclamation mark within a triangle. **DO NOT** remove or cover any of these labels. If the labels are damaged or if additional labels are required, contact your TIC Sales Representative.

Labels attached to the equipment are there to provide useful information or to indicate an imminently hazardous situation that may result in serious injury, severe property and equipment damage, or loss of life if safe procedures or methods are not followed as outlined in this manual.

# Qualified Personnel

Installation, operation, and maintenance shall be performed by **Qualified Personnel Only**. A Qualified Person is one that has the skills and knowledge relating to the construction, installation, operation, and maintenance of the electrical equipment and has received safety training on the hazards involved (Refer to the latest edition of NFPA 70E for additional safety requirements).

**Qualified Personnel** shall:

- Have carefully read the entire manual.
- Be familiar with the construction and function of the ASD, the equipment being driven, and the hazards involved.
- Be able to recognize and properly address hazards associated with the application of motor-driven equipment.
- Be trained and authorized to safely energize, de-energize, ground, lock out/tag out circuits and equipment, and clear faults in accordance with established safety practices.
- Be trained in the proper care and use of protective equipment such as safety shoes, rubber gloves, hard hats, safety glasses, face shields, flash clothing, etc., in accordance with established safety practices.

For further information on workplace safety visit [www.osha.gov](http://www.osha.gov).

# Equipment Inspection

- Upon receipt of the equipment inspect the packaging and equipment for shipping damage.
- Carefully unpack the equipment and check for parts that may have been damaged during shipping, missing parts, or concealed damage. If any discrepancies are discovered, it should be noted with the carrier prior to accepting the shipment, if possible. File a claim with the carrier if necessary and immediately notify your TIC Sales Representative.
- **DO NOT** install the ASD if it is damaged or if it is missing any component(s).
- Ensure that the rated capacity and the model number specified on the nameplate conform to the order specifications.
- Modification of this equipment is dangerous and is to be performed by factory trained personnel. When modifications are required contact your TIC Sales Representative.
- Inspections may be required after moving equipment.
- Contact your TIC Sales Representative to report discrepancies or for assistance if required.

# Handling and Storage

- Use proper lifting techniques when moving the ASD; including properly sizing up the load, getting assistance, and using a forklift if required.
- Store in a well-ventilated location and preferably in the original carton if the equipment will not be used upon receipt.
- Store in a cool, clean, and dry location. Avoid storage locations with extreme temperatures, rapid temperature changes, high humidity, moisture, dust, corrosive gases, or metal particles.
- The storage temperature range of the H9 ASD is -13° to 149° F (-25° to 65° C).
- Do not store the unit in places that are exposed to outside weather conditions (i.e., wind, rain, snow, etc.).
- Store in an upright position.

# Disposal

Never dispose of electrical components via incineration. Contact your state environmental agency for details on disposal of electrical components and packaging in your area.

# Installation Precautions

## Location and Ambient Requirements

- The TIC ASD is intended for permanent installations only.
- Installation should conform to the **National Electrical Code — Article 110** (*Requirements For Electrical Installations*), all regulations of the **Occupational Safety and Health Administration**, and any other applicable national, regional, or industry codes and standards.

**Note:** For all references to the *National Electrical Code (NEC)*, see the latest release of the *National Electrical Code*.

- Select a mounting location that is easily accessible, has adequate personnel working space, and adequate illumination for adjustment, inspection, and maintenance of the equipment (refer to NEC Article 110-13).
- **DO NOT** mount the ASD in a location that would produce catastrophic results if it were to fall from its mounting location (equipment damage or injury).
- **DO NOT** mount the ASD in a location that would allow it to be exposed to flammable chemicals or gases, water, solvents, or other fluids.
- Avoid installation in areas where vibration, heat, humidity, dust, fibers, metal particles, explosive/corrosive mists or gases, or sources of electrical noise are present.
- The installation location shall not be exposed to direct sunlight.
- Allow proper clearance spaces for installation. Do not obstruct the ventilation openings. Refer to the section titled [Mounting the ASD on pg. 11](#) for further information on ventilation requirements.
- The ambient operating temperature range of the H9 ASD is 14° to 104° F (-10 to 40° C).

## Mounting Requirements

- Only **Qualified Personnel** should install this equipment.
- Install the unit in a secure and upright position in a well-ventilated area.
- As a minimum, the installation of the equipment should conform to the **NEC — Article 110**, OSHA, as well as any other applicable national, regional, or industry codes and standards.
- Installation practices should conform to the latest revision of NFPA 70E Electrical Safety Requirements for Employee Workplaces.
- It is the responsibility of the ASD installer/maintenance personnel to ensure that the unit is installed into an enclosure that will protect personnel against electric shock.

# Conductor Routing and Grounding



- Use separate metal conduits for routing the input power, output power, and control circuits.
- A separate ground cable should be run inside the conduit with the input power, output power, and control circuits.
- **DO NOT** connect CC to earth ground.
- Use ICC terminal as the return for the V/I input.
- Always ground the unit to prevent electrical shock and to help reduce electrical noise.
- It is the responsibility of the ASD installer/maintenance personnel to provide proper grounding and branch circuit protection in accordance with the NEC and any applicable local codes.

— The Metal Of Conduit Is Not An Acceptable Ground —

## Grounding Capacitor Switch

The ASD is equipped with noise reduction capacitors which are used to reduce the EMI leakage via the 3-phase power-input circuit and for compliance with the **Electromagnetic Compatibility Directive** (EMC).

The effective value of the capacitor may be increased, reduced, or removed entirely via the **Selector Switch**, **Switching Bar**, or the **Switching Screw** — the type used is typeform-specific.

The **Grounding Capacitor Switch** allows the user to quickly change the value of the capacitance of the 3-phase input circuit without the use of tools.

See the section titled [System Grounding on pg. 14](#) for more on the [Grounding Capacitor](#).

See figures [4](#), [5](#), [6](#), and [7 on pg. 15](#) for an electrical depiction of the leakage-reduction functionality of the [Grounding Capacitor](#) and the methods used to set the capacitance value.

# Power Connections



**Contact With Energized Wiring Will Cause Severe Injury Or Loss Of Life.**

- Turn off, lock out, and tag out all power sources before proceeding to connect the power wiring to the equipment.
- After ensuring that all power sources are turned off and isolated in accordance with established lock out/tag out procedures, connect the 3-phase power source wiring of the correct voltage to the correct input terminals and connect the output terminals to a motor of the correct voltage and type for the application (refer to the NEC Article 300 – Wiring Methods and Article 310 – Conductors For General Wiring). Size the branch circuit conductors in accordance with the NEC Table 310.16.
- Ensure that the 3-phase input power is **NOT** connected to the output of the ASD. This will damage the ASD and may cause injury to personnel.
- **DO NOT** connect resistors across terminals PA – PC or PO – PC. This may cause a fire.
- Ensure the correct phase sequence and the desired direction of motor rotation in the **Bypass** mode (if applicable).

## Protection

- Ensure that primary protection exists for the input wiring to the equipment. This protection must be able to interrupt the available fault current from the power line. The equipment may or may not be equipped with an input disconnect (option).
- All cable entry openings must be sealed to reduce the risk of entry by vermin and to allow for maximum cooling efficiency.
- External dynamic braking resistors must be thermally protected.
- It is the responsibility of the ASD installer/maintenance personnel to setup the **Emergency Off** braking system of the ASD. The function of the **Emergency Off** braking function is to remove output power from the drive in the event of an emergency. A supplemental braking system may also be engaged in the event of an emergency. For further information on braking systems, see parameters **F250** and **F304**.

***Note:** A supplemental emergency stopping system should be used with the ASD. Emergency stopping should not be a task of the ASD alone.*

- Follow all warnings and precautions and do not exceed equipment ratings.

# System Integration Precautions

The following precautions are provided as general guidelines for the setup of the ASD within the system.

- The TIC ASD is a general-purpose product. It is a system component only and the system design should take this into consideration. Please contact your TIC Sales Representative for application-specific information or for training support.
- The TIC ASD is part of a larger system and the safe operation of the ASD will depend upon observing certain precautions and performing proper system integration.
- Improperly designed or improperly installed system interlocks may render the motor unable to start or stop on command.
- The failure of external or ancillary components may cause intermittent system operation (i.e., the system may start the motor without warning).
- A detailed system analysis and job safety analysis should be performed by the systems designer and/or systems integrator before the installation of the ASD component. Contact your TIC Sales Representative for options availability and for application-specific system integration information if required.

## Personnel Protection

- Installation, operation, and maintenance shall be performed by **Qualified Personnel Only**.
- A thorough understanding of the ASD will be required before the installation, operation, or maintenance of the ASD.



- Rotating machinery and live conductors can be hazardous and shall not come into contact with personnel. Personnel should be protected from all rotating machinery and electrical hazards at all times.
- Insulators, machine guards, and electrical safeguards may fail or be defeated by the purposeful or inadvertent actions of workers. Insulators, machine guards, and electrical safeguards are to be inspected (and tested where possible) at installation and periodically after installation for potential hazardous conditions.
- **DO NOT** allow personnel near rotating machinery. Warning signs to this effect shall be posted at or near the machinery.
- **DO NOT** allow personnel near electrical conductors. Contact with electrical conductors can be fatal. Warning signs to this effect shall be posted at or near the hazard.
- Personal protection equipment shall be provided and used to protect employees from any hazards inherent to system operation.

# System Setup Requirements

- When using the ASD as an integral part of a larger system, it is the responsibility of the ASD installer/maintenance personnel to ensure that there is a fail-safe in place (i.e., an arrangement designed to switch the system to a safe condition if there is a fault or failure).
- Power factor improvement capacitors or surge absorbers **MUST NOT** be installed on the output of the ASD.
- Use of the built-in system protective features is highly recommended (i.e., E-Off, Overload Protection, etc.).
- The operating controls and system status indicators should be clearly readable and positioned where the operator can see them without obstruction.
- Additional warnings and notifications shall be posted at the equipment installation location as deemed required by [Qualified Personnel](#).



## CAUTION

- System safety features should be employed and designed into the integrated system in a manner such that system operation, even in the event of system failure, will not cause harm or result in system damage or injury to personnel (i.e., E-Off, Auto-Restart settings, System Interlocks, etc.).
- The programming setup and system configuration of the ASD may allow it to start the motor unexpectedly. A familiarity with the **Auto-Restart** (F301) settings are a requirement to use this product.
- There may be thermal or physical properties, or ancillary devices integrated into the overall system that may allow for the ASD to start the motor without warning. Signs to this effect must be posted at the equipment installation location.
- If a secondary magnetic contactor (MC) or an ASD output disconnect is used between the ASD and the load, it should be interlocked to halt the ASD before the secondary contact opens. If the output contactor is used for bypass operation, it must be interlocked such that commercial power is never applied to the ASD output terminals (U, V, or W).
- When using an ASD output disconnect, the ASD and the motor must be stopped before the disconnect is either opened or closed. Closing the output disconnect while the 3-phase output of the ASD is active may result in equipment damage or injury to personnel.

# Operational and Maintenance Precautions



- Turn off, lock out, and tag out the main power, the control power, and instrumentation connections before inspecting or servicing the drive, opening the door of the enclosure, or connecting/disconnecting the power wiring to the equipment.
- The capacitors of the ASD maintain a residual charge for a period of time after turning the ASD off. The required time for each ASD typeform is indicated with a cabinet label and a **Charge LED** (shown for smaller ASDs in [Figure 2 on pg. 12](#); LED is located on the front panel of larger ASDs). Wait at least the minimum time indicated on the enclosure-mounted label and ensure that the **Charge LED** has gone out before opening the door of the ASD once the ASD power has been turned off.
- Turn the power on only after attaching (or closing) the front cover and **DO NOT** remove or open the front cover of the ASD when the power is on.
- **DO NOT** attempt to disassemble, modify, or repair the ASD. Call your TIC Sales Representative for repair information.
- **DO NOT** place any objects inside of the ASD.
- If the ASD should emit smoke, or an unusual odor or sound, turn the power off immediately.
- The heat sink and other components may become extremely hot to the touch. Allow the unit to cool before coming in contact with these items.
- The **Auto-Restart** (F301) programmable functions of the ASD may allow for the system to start or stop unexpectedly. Signs to this effect are to be clearly posted at the installation location.
- Remove power from the ASD during extended periods of non-use.
- The system should be inspected periodically for damaged or improperly functioning parts, cleanliness, and to ensure that the connectors are tightened securely.



# Installation and Connections

The **H9 Adjustable Speed Drive** may be set up initially by performing a few simple configuration settings. To operate properly, the ASD must be securely mounted and connected to a power source (3-phase AC input at the R/L1, S/L2, and T/L3 terminals). The control terminals of the H9 ASD may be used by connecting the terminals of the **Terminal Board** to the proper sensors or signal input sources (see the section titled [I/O and Control on pg. 17](#) and [Figure 9 on pg. 20](#)).

System performance may be further enhanced by assigning a function to the output terminals of the **Terminal Board** and connecting the terminals to the proper indicators or actuators (LEDs, relays, contactors, etc.).

***Note:** The optional H9 ASD interface boards may be used to expand the I/O functionality of the H9 ASD.*

## Installation Notes



### CAUTION

When a brake-equipped motor is connected to the H9 ASD, it is possible that the brake may not release at startup because of insufficient voltage. To avoid this, **DO NOT** connect the brake or the brake contactor to the output of the H9 ASD.

If an output contactor is used for bypass operation, it must be interlocked such that commercial power is never applied to the output terminals of the H9 ASD (U/T1, V/T2, and W/T3).

**DO NOT** apply commercial power to the H9 ASD output terminals **U/T1, V/T2, and W/T3**.

If a secondary magnetic contactor (MC) is used between the output of the ASD and the motor, it should be interlocked such that the **ST – CC** connection is disconnected before the output contactor is opened.

**DO NOT** open and then close a secondary magnetic contactor between the ASD and the motor unless the ASD is off and the motor is not rotating.

***Note:** Re-application of power via a secondary contact while the ASD is on or while the motor is still turning may cause ASD damage.*

The ASD input voltage should remain within 10% of the specified input voltage range. Input voltages approaching the lower or upper-limit settings may require that the over-voltage and under-voltage stall protection level parameters be adjusted. Voltages outside of the permissible tolerance should be avoided.

The frequency of the input power should be  $\pm 2$  Hz of the specified input frequency.

**DO NOT** use an ASD with a motor that has a current rating higher than the rated current of the ASD.

The H9 ASD is designed to operate NEMA B motors. Consult with your Toshiba International Corporation Sales Representative before using the ASD for special applications such as with an explosion-proof motor or applications with a piston load.

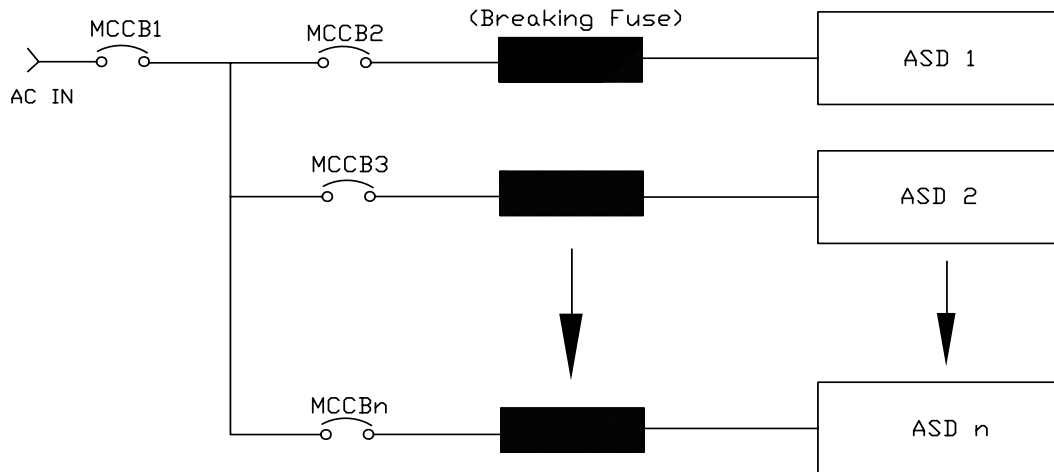
Disconnect the H9 ASD from the motor before megging or applying a bypass voltage to the motor.

Interface problems may occur when an ASD is used in conjunction with some types of process controllers. Signal isolation may be required to prevent controller and/or ASD malfunction (contact your Toshiba International Corporation Sales Representative or the process controller manufacturer for additional information about compatibility and signal isolation).

Use caution when setting the output frequency. Over speeding a motor decreases its ability to deliver torque and may result in damage to the motor and/or the driven equipment.

Not all H9 ASDs are equipped with internal primary power input fuses (HP dependent). When connecting two or more drives that have no internal fuse to the same power line as shown in [Figure 1](#), select a circuit-breaking configuration that will ensure that if a short circuit occurs in ASD 1, only MCCB2 trips, not MCCB1. If it is not feasible to use this configuration, insert a fuse between MCCB2 and ASD 1.

Figure 1. Circuit Breaker Configuration.



## Mounting the ASD

# CAUTION

— The following thermal specifications apply to the 230-volt and 460-volt ASDs ONLY —

Install the unit securely in a well ventilated area that is out of direct sunlight.

The process of converting AC to DC, and then back to AC produces heat. During normal ASD operation, up to 5% of the input energy to the ASD may be dissipated as heat. If installing the ASD in a cabinet, ensure that there is adequate ventilation.

**DO NOT** operate the ASD with the enclosure door open.

The ambient operating temperature rating of the H9 ASD is 14° to 104° F (-10° to 40° C).

When installing adjacent ASDs horizontally TIC recommends at least 5 cm of space between adjacent units. However, horizontally mounted ASDs may be installed side-by-side with no space in between the adjacent units — side-by-side installations require that the top cover be removed from each ASD.

For 150 HP and above ASDs, a minimum of 50 cm of space is required above and below adjacent units and any obstruction. This space is the recommended minimum space requirement for the H9 ASD and ensures that adequate ventilation is provided for each unit. More space will provide a better environment for cooling (see the section titled [Enclosure and Conduit Plate Dimensions on pg. 74](#) for additional information on mounting space requirements).

**Note:** Ensure that the ventilation openings are not obstructed.

# Connecting the ASD



Refer to the section titled [Installation Precautions on pg. 4](#) and the section titled [Lead Length Specifications on pg. 16](#) before attempting to connect the ASD and the motor to electrical power.

## Power Connections



**Contact With 3-Phase Input/Output Terminals May Cause An Electrical Shock Resulting In Injury Or Loss Of Life.**

See [Figure 20 on pg. 22](#) for a system I/O connectivity schematic.

An inductor (DCL) may be connected across the **PO** and **PA/+** terminals to provide additional filtering. When not used, a jumper must be connected across these terminals (see [Figure 20 on pg. 22](#)).

**PA/+** and **PB** are used for the DBR connection if using a braking resistor.

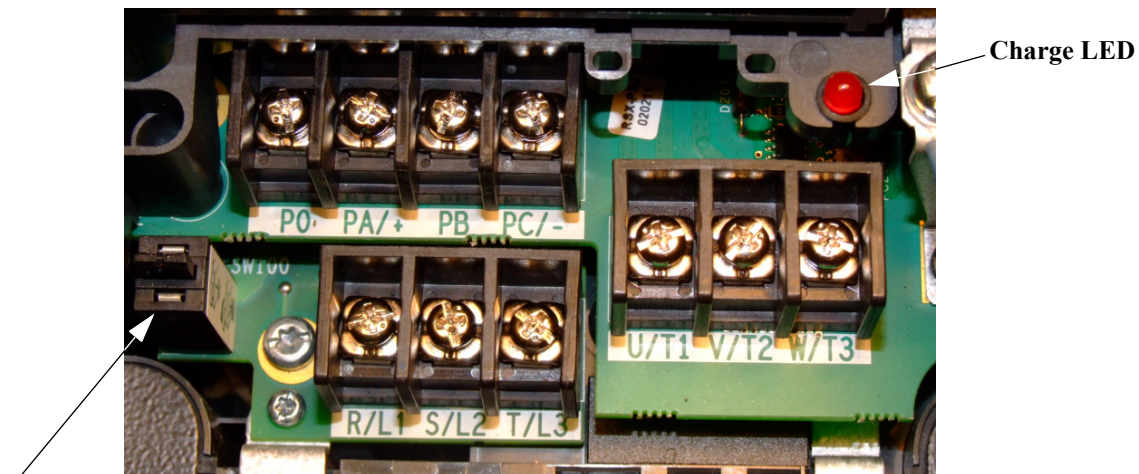
**PC/-** is the negative terminal of the DC bus.

**R/L1**, **S/L2**, and **T/L3** are the 3-phase input supply terminals for the H9 ASD.

**U/T1**, **V/T2**, and **W/T3** are the output terminals of the ASD that connect to the motor.

The location of the **Charge LED** for the smaller typeform ASD is provided in [Figure 2](#). The **Charge LED** is located on the front door of the enclosure of the larger ASDs.

Figure 2. Typical H9 ASD Input/output Terminals and the [Grounding Capacitor Switch](#).



**Grounding Capacitor Switch** — Pull for **Small** capacitance/push for **Large** capacitance.

## Power Connection Requirements

Connect the 3-phase input power to the input terminals of the H9 ASD at **R/L1**, **S/L2**, and **T/L3** (see [Figure 3](#) for the typical electrical connection scheme). Connect the output of the ASD to the motor from the ASD terminals **U/T1**, **V/T2**, and **W/T3**. The input and output conductors and terminal lugs used shall be in accordance with the requirements listed in the section titled [Current/Voltage Specifications](#) on pg. 82.

If multiple conductors are used in parallel for the input or output power and it is necessary to use separate conduits, each parallel set shall have its own conduit and not share its conduit with other parallel sets (i.e., place U1, V1, and W1 in one conduit and U2, V2, and W2 in another; refer to NEC Article 300.20 and Article 310.4). National and local electrical codes should be referenced if three or more power conductors are run in the same conduit (refer to 2008 NEC Article 310 adjustment factors).

**Note:** *National and local codes should be referenced when running more than three conductors in the same conduit.*

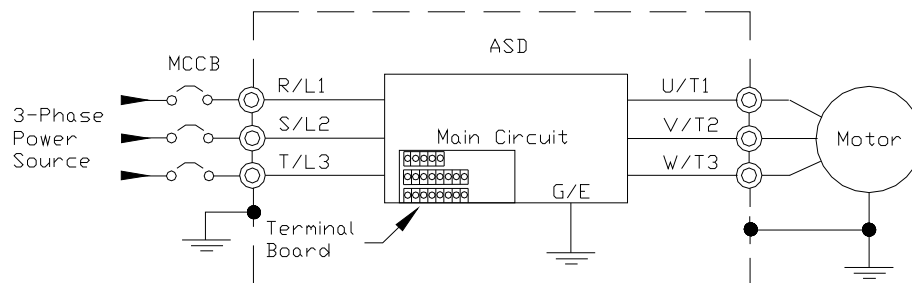
Install a molded case circuit breaker (MCCB) or fuse between the 3-phase power source and the H9 ASD in accordance with the fault current setting of the ASD and **2008 NEC Article 430**.

The H9 ASD is designed and tested to comply with UL Standard 508C. Modifications to the ASD system or failure to comply with the short circuit protection requirements outlined in this manual may disqualify the UL rating. See [Table 13](#) on pg. 86 for typeform-specific short circuit protection recommendations.

As a minimum, the installation of the H9 ASD shall conform to **2008 NEC Article 110**, the **Occupational Safety and Health Administration** requirements, and to any other local and regional industry codes and standards.

**Note:** *In the event that the motor rotates in the wrong direction when powered up, reverse any two of the three H9 ASD output power leads (U, V, or W) connected to the motor.*

Figure 3. H9 ASD/Motor Typical Connection Diagram.



# System Grounding

Proper grounding helps to prevent electrical shock and to reduce electrical noise. The H9 ASD is designed to be grounded in accordance with **Article 250** of the **2008 NEC** or **Section 10/Part One** of the **Canadian Electrical Code (CEC)**.

The grounding conductor shall be sized in accordance with **Article 250-122** of the **NEC** or **Part One-Table 6** of the **CEC**.

## — The Metal Of Conduit Is Not An Acceptable Ground —

The input, output, and control lines of the system shall be run in separate metal conduits and each shall have its own ground conductor.

ASDs produce high-frequency noise — take steps to avoid the negative effects of noise. Listed below are some examples of measures that will help to combat noise problems during installation.

- **DO NOT** install the input power and output power wires in the same duct or in parallel with each other, and do not bind them together.
- **DO NOT** install the input/output power wires and the wires of the control circuit in the same duct or in parallel with each other, and do not bind them together.
- Use shielded wires or twisted wires for the control circuits.
- Ensure that the grounding terminals (G/E) of the H9 ASD are securely connected to ground.
- Connect a surge suppressor to every electromagnetic contactor and every relay installed near the ASD.
- Install noise filters as required.

# Grounding Capacitor

The **Grounding Capacitor** plays a role in minimizing the effects of leakage current through the ASD system and through ground paths to other systems. Leakage current may cause the improper operation of earth-leakage current breakers, leakage-current relays, ground relays, fire alarms, and other sensors — and it may cause superimposed noise on CRT screens.

The [Grounding Capacitor Switch](#) allows the user to quickly change the value of the leakage-reduction capacitance of the 3-phase input circuit. See figures [4](#), [5](#), [6](#), and [7 on pg. 15](#) for an electrical depiction of the leakage-reduction functionality and the methods used to change the capacitance value. The method used is typeform-specific.

If using a 460-volt 5 HP ASD or a 460-volt ASD that is in the range of 7.5 HP to 25 HP, and the **U/T1**, **V/T2**, and **W/T3** connections to the motor are 100 meters or more in length, the ASD **Carrier Frequency** must be set to 4 kHz or less when activating or deactivating the [Grounding Capacitor Switch](#). ASD overheating may occur if the **Carrier Frequency** is set above 4 kHz when activating or deactivating the [Grounding Capacitor Switch](#).

See [pg. 5](#) for more information on the [Grounding Capacitor Switch](#) and [pg. 12](#) for the location.

Figure 4. The **Grounding Capacitor**

**Switch** is used on typeforms **230-volt** 0.75 HP to 10 HP and the 25 and 30 HP/**460-volt** 1.0 HP to 25 HP. The value may be set to **Maximum** (default setting) or to **Zero** by pushing or pulling the switch actuator, respectively.

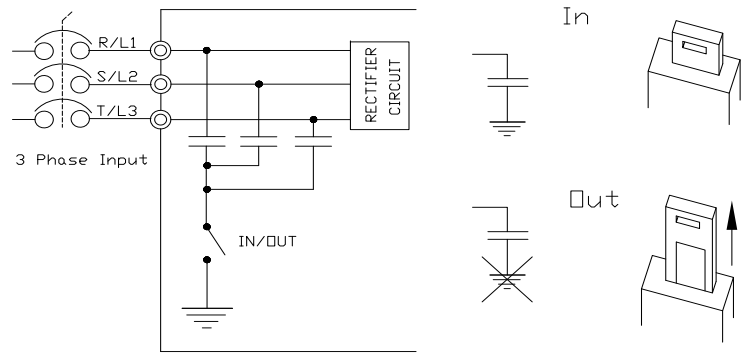


Figure 5. The **Grounding Capacitor**

**Switch** is used on typeforms **230-volt** 15 HP to 20 HP and the 40 HP to 60 HP/**460-volt** 30 HP to 100 HP. The value may be set to **Large** (default setting) or **Small** by pushing or pulling the switch actuator, respectively.

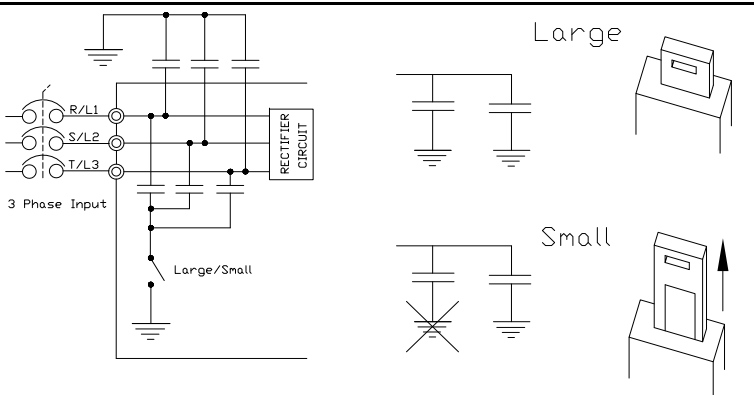


Figure 6. The **Grounding Capacitor**

**Bar** is used on typeforms **230-volt** 75 HP and the 100 HP/**460-volt** 125 HP and the 150 HP. The value may be set to **Large** or **Small** (default setting) by connecting or disconnecting the switching bar, respectively.

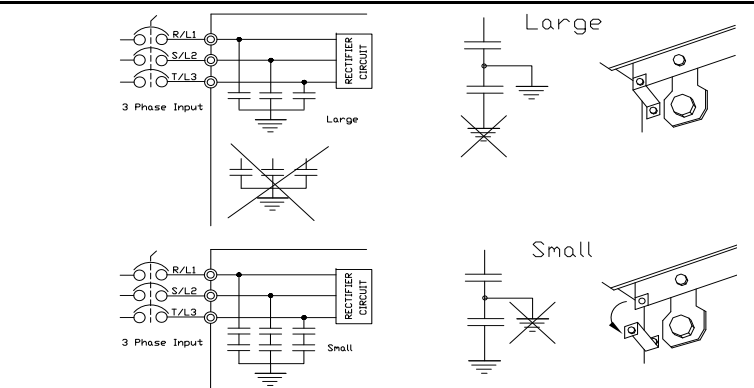
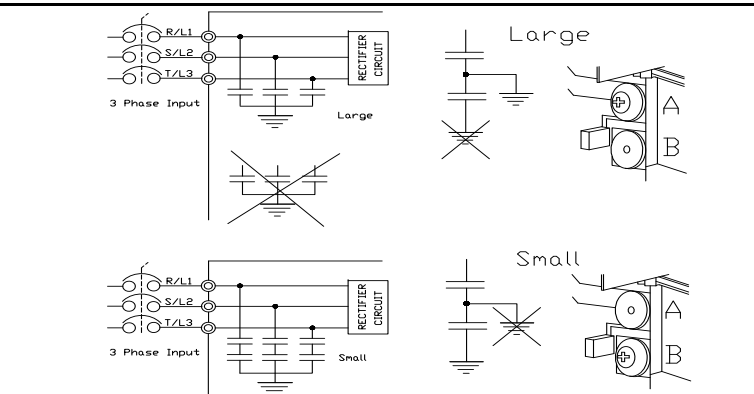


Figure 7. The **Grounding Capacitor**

**Screw** is used on typeforms **460-volt** 200 HP and above. The value may be set to **Large** or **Small** (default setting) by placing the screw in the **A** position or by placing the screw in the **B** position, respectively.



# Lead Length Specifications

Adhere to the NEC and any local codes during the installation of ASD/motor systems. Excessive lead lengths may adversely effect the performance of the motor. Special cables are not required.

Lead lengths from the ASD to the motor in excess of those listed in [Table 1](#) may require filters to be added to the output of the ASD. [Table 1](#) lists the suggested maximum lead lengths for the listed motor voltages.

Table 1. Lead Length Recommendations.

| Model    | PWM Carrier Frequency | NEMA MG1 Part 31 Compliant Motors | NEMA MG1 Part 30 Compliant Motors |
|----------|-----------------------|-----------------------------------|-----------------------------------|
| 230-Volt | All                   | 1000 feet                         | 450 feet                          |
| 460-Volt | < 5 kHz               | 600 feet                          | 200 feet                          |
|          | ≥ 5 kHz               | 300 feet                          | 100 feet                          |

**Note:** *Contact the Toshiba International Corporation Customer Support Center for application assistance when using lead lengths in excess of those listed.*

*Exceeding the peak voltage rating or the allowable thermal rise time of the motor insulation will reduce the life expectancy of the motor.*

*When operating in the **Vector Control** mode the carrier frequency should be set to 2.2 kHz or above.*

# I/O and Control

The H9 ASD can be controlled by several input types and combinations thereof, as well as operate within a wide range of output frequency and voltage levels. This section discusses the H9 ASD control methods and supported I/O functions.

The **Terminal Board** supports discrete and analog I/O functions and is shown in [Figure 9 on pg. 20](#). [Table 2](#) lists the names, functions, and default settings (of programmable terminals) of the input and output terminals of the **Terminal Board**.

**Note:** To use the input lines of the **Terminal Board** to provide **Run** commands the **Command Mode** setting must be set to **Terminal Block**.

[Figure 20 on pg. 22](#) shows the basic connection diagram for the H9 ASD system.

Table 2. Terminal Board Default Assignment Terminal Names and Functions.

| Term. Name                       | Input/Output                                                 | Function (Default Setting If Programmable)<br>(See <a href="#">Terminal Descriptions on pg. 18</a> )                                                                                                    | Circuit Config.                                             |
|----------------------------------|--------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|
| ST                               | Discrete Input<br><br>Connect to CC to activate (Sink mode). | <b>Standby</b> — Multifunctional programmable discrete input. Activation required for normal ASD operation (see <a href="#">Installation Notes on pg. 10</a> for further information on this terminal). | <a href="#">Figure 10 on pg. 21.</a>                        |
| RES                              |                                                              | <b>Reset</b> — Multifunctional programmable discrete input. Resets ASD.                                                                                                                                 |                                                             |
| F                                |                                                              | <b>Forward</b> — Multifunctional programmable discrete input.                                                                                                                                           |                                                             |
| R                                |                                                              | <b>Reverse</b> — Multifunctional programmable discrete input.                                                                                                                                           |                                                             |
| S1                               |                                                              | <b>Preset Speed 1</b> — Multifunctional programmable discrete input.                                                                                                                                    |                                                             |
| S2                               |                                                              | <b>Preset Speed 2</b> — Multifunctional programmable discrete input.                                                                                                                                    |                                                             |
| S3                               |                                                              | <b>Preset Speed 3</b> — Multifunctional programmable discrete input.                                                                                                                                    |                                                             |
| S4                               |                                                              | <b>Preset Speed 4</b> — Multifunctional programmable discrete input.                                                                                                                                    |                                                             |
| O1A/B (OUT1)                     | Switched Output                                              | <b>Low Speed</b> — Multifunctional programmable discrete output.                                                                                                                                        | <a href="#">Figure 16 on pg. 21.</a>                        |
| O2A/B (OUT2)                     |                                                              | <b>Reach Frequency</b> — Multifunctional programmable discrete output.                                                                                                                                  |                                                             |
| FLA                              |                                                              | Fault relay (N.O.).                                                                                                                                                                                     | <a href="#">Figure 19 on pg. 21.</a>                        |
| FLB                              |                                                              | Fault relay (N.C.).                                                                                                                                                                                     |                                                             |
| FLC                              |                                                              | Fault relay (Common).                                                                                                                                                                                   |                                                             |
| RR                               | Analog Input                                                 | <b>Frequency Mode 1</b> — Multifunction programmable analog input. (0.0 to 10 volt input — 0 Hz to Maximum Frequency).                                                                                  | <a href="#">Figure 11 on pg. 21.</a>                        |
| RX                               |                                                              | Multifunctional programmable analog input (-10 to +10 VDC input).                                                                                                                                       | <a href="#">Figure 12 on pg. 21.</a>                        |
| V/I<br>(Select V or I via SW301) |                                                              | <b>Unassigned</b> — <b>V</b> — Multifunctional programmable isolated analog voltage input (0 to 10 VDC input).                                                                                          | <a href="#">Figure 13 on pg. 21.</a>                        |
|                                  |                                                              | <b>Frequency Mode 2</b> (default SW301 setting) — <b>I</b> — Multifunctional programmable isolated analog current input (4 [0] to 20 mADC input — 0 Hz to Maximum Frequency).                           |                                                             |
| AM                               | Analog Output                                                | <b>Output Current</b> — Current output that is proportional to the output current of the ASD or to the magnitude of the function assigned to this terminal.                                             | <a href="#">Figure 18 on pg. 21</a>                         |
| FM                               |                                                              | <b>Output Frequency</b> — <u>Current</u> or <u>Voltage</u> output that is proportional to the output frequency of the ASD or to the magnitude of the function assigned to this terminal.                |                                                             |
| SU+                              | DC Input                                                     | Externally-supplied 24 VDC backup control power (1.1 A min.).                                                                                                                                           |                                                             |
| P24                              | DC Output                                                    | 24 VDC output (200 mA max.).                                                                                                                                                                            | <a href="#">Figure 14 on pg. 21.</a>                        |
| PP                               |                                                              | 10.0 VDC/10 mA voltage source for an external potentiometer.                                                                                                                                            | <a href="#">Figure 15 on pg. 21.</a>                        |
| FP                               | Pulsed Output                                                | <b>Frequency Pulse</b> — Multifunctional programmable output pulse train of a frequency based on the output frequency of the ASD.                                                                       | <a href="#">Figure 17 on pg. 21.</a>                        |
| IICC                             | —                                                            | Return for the <b>V/I</b> input terminal.                                                                                                                                                               | <b>Do Not</b> connect to <b>Earth Gnd</b> or to each other. |
| CCA                              | —                                                            | Return for the <b>RR</b> , <b>RX</b> , <b>P24</b> , and the <b>PP</b> terminals.                                                                                                                        |                                                             |
| CC                               | —                                                            | Return for the <b>AM</b> , <b>FM</b> , <b>SU+</b> , and the discrete input terminals.                                                                                                                   |                                                             |



# Terminal Descriptions

**Note:** The programmable terminal assignments may be accessed and changed from the default settings as mapped on [pg. 34](#) or via the **Direct Access** method: Program  $\Rightarrow$  Direct Access  $\Rightarrow$  **Applicable Parameter Number**. See the section titled [Program Mode Menu Navigation on pg. 34](#) for the applicable **Direct Access** parameter numbers.

For further information on terminal assignments and default setting changes, see the sections titled [Terminal on pg. 35](#) and [Default Setting Changes on pg. 62](#).

**Note:** See the section titled [Cable/Terminal/Torque Specifications on pg. 84](#) for the H9 ASD conductor and terminal electrical specifications.

**ST** — The default setting for this terminal is the **Standby** mode controller. As the default setting, this terminal must be activated for normal system operation. The **ST** terminal is activated by connecting **CC** to this terminal (Sink mode). When deactivated, **OFF** is flashed on the LED screen and the **Not-Ready-to-Run** indicator is displayed on the LCD screen [Figure 22 on pg. 28](#). This input terminal may be programmed to any of the functions listed in the *H9 ASD Installation and Operation Manual* (see F113).

**RES** — The default setting for this terminal is **Reset**. The **RES** terminal is activated by connecting **CC** to this terminal (Sink mode). A momentary connection to **CC** resets the ASD and any fault indications from the display. **Reset** is effective when faulted only. This input terminal may be programmed to any of the functions listed in the *H9 ASD Installation and Operation Manual* (see F114).

**F** — The default setting for this terminal is **Forward** run command. The **F** terminal is activated by connecting **CC** to this terminal (Sink mode). This input terminal may be programmed to any of the functions listed in the *H9 ASD Installation and Operation Manual* (see F111).

**R** — The default setting for this terminal is **Reverse** run command. The **R** terminal is activated by connecting **CC** to this terminal (Sink mode). This input terminal may be programmed to any of the functions listed in the *H9 ASD Installation and Operation Manual* (see F112).

**S1** — The default setting for this terminal is the **Preset Speed 1**. The **S1** terminal is activated by connecting **CC** to this terminal (Sink mode). This input terminal may be programmed to any of the functions listed in the *H9 ASD Installation and Operation Manual* (see F115).

**S2** — The default setting for this terminal is the **Preset Speed 2**. The **S2** terminal is activated by connecting **CC** to this terminal (Sink mode). This input terminal may be programmed to any of the functions listed in the *H9 ASD Installation and Operation Manual* (see F116).

**S3** — The default setting for this terminal is the **Preset Speed 3**. The **S3** terminal is activated by connecting **CC** to this terminal (Sink mode). This input terminal may be programmed to any of the functions listed in the *H9 ASD Installation and Operation Manual* (see F117).

**S4** — The default setting for this terminal is the **Preset Speed 4**. The **S4** terminal is activated by connecting **CC** to this terminal (Sink mode). This input terminal may be programmed to any of the functions listed in the *H9 ASD Installation and Operation Manual* (see F118).

**RR** — The default function assigned to this terminal is **Frequency Mode 1**. The **RR** terminal accepts a 0 – 10 VDC input signal that is used to control the function assigned to this terminal. This input terminal may be programmed to control the speed or torque of the motor via an amplitude setting or to regulate by setting a limit. The gain and bias of this terminal may be adjusted for application-specific suitability (see F210 – F215). See [Figure 20 on pg. 22](#) for an electrical depiction of the **RR** terminal.

**RX** — The default function assigned to this terminal is **Torque Command**. The **RX** terminal accepts a  $\pm 10$  VDC input signal that is used to control the function assigned to this terminal. This input terminal may be programmed to control the speed or torque of the motor via an amplitude setting or regulate by

setting a limit. The gain and bias of this terminal may be adjusted for application-specific suitability (see F216 – F221). See [Figure 20 on pg. 22](#) for an electrical depiction of the **RX** terminal.

**V/I** — The V/I terminal has the dual function of being able to receive an input voltage or current. The function as a voltage input is to receive a 0 – 10 VDC input signal. The function as a current input is to receive a 0 – 20 mA input signal. Using either input type, the function is to control the 0.0 – Maximum Frequency output or the 0.0 to 250% torque output of the ASD. This is an isolated input terminal. This terminal may be programmed to control the speed or torque of the motor and cannot process both input types simultaneously. SW301 must be set to V or I to receive a voltage or current, respectively (see [Figure 9 on pg. 20](#)). Terminal scaling and the selection of speed or torque control is accomplished via parameters **F201 – F206**. The gain and bias of this terminal may be adjusted for application-specific suitability (see **F470** and **F471**).

**SU+** — **Control Power Supply Backup** input terminal. This terminal accepts the user-supplied 24 VDC backup power to the control circuits (only). Backup power is used in the event of an open MCCB or during a momentary loss of the 3-phase input power. Parameter settings, real-time clock information, display unit power, and trip history information are also retained/supported by the **SU+** backup power. See the section titled [Battery Backup on pg. 24](#) for more information on system backup features.

**P24** — +24 VDC at 200 mA power supply for customer use.

**PP** — The function of output **PP** is to provide a 10 VDC/10 mADC (max.) output that may be divided using a potentiometer. The tapped voltage is applied to the **RR** input to provide manual control of the **RR** programmed function.

**01A/B** (OUT1A/B) — The default function assigned to this terminal is **Output Low Speed**. This output may be programmed to provide an indication (open or closed) that any of the functions listed in the ***H9 ASD Installation and Operation Manual*** has occurred or is active. This function may be used to signal external equipment (e.g., activate the brake) (see F130). The **OUT1** terminal is rated at 2 A/120 VAC and 2 A/30 VDC.

**02A/B** (OUT2A/B) — The default function assigned to this terminal is **ACC/DEC Complete**. This output may be programmed to provide an indication (open or closed) that any of the functions listed in the ***H9 ASD Installation and Operation Manual*** has occurred or is active. This function may be used to signal external equipment (e.g., activate the brake) (see F131). The **OUT2** terminal is rated at 2 A/120 VAC and 2 A/30 VDC.

**FP** — The default function of this output terminal is to output a series of pulses at a rate that is a function of the ASD output frequency (50 mA max. at 1.0 kHz to 43.3 kHz). As the output frequency of the ASD goes up so does the **FP** output pulse rate. This terminal may be programmed to provide an output pulse rate that is proportional to the magnitude of the user-selected item listed in the ***H9 ASD Installation and Operation Manual***.

**AM** — This output terminal produces an output current that is proportional to the output current of the ASD or of the magnitude of the function assigned to this terminal. The available assignments for this output terminal are listed in the ***H9 ASD Installation and Operation Manual***.

**FM** — This output terminal produces an output current or voltage that is proportional to the output frequency of the ASD or of magnitude of the function assigned to this terminal. The available assignments for this output terminal are listed in the ***H9 ASD Installation and Operation Manual***. The Voltage/Current output selection is performed at **F681**.

**FLA** — One of two normally open contacts that, under user-defined conditions, connect to **FLC**.

**FLB** — One of two normally closed contacts that, under user-defined conditions, connect to **FLC**.

**FLC** — **FLC** is the common leg of a single-pole double-throw form C relay. The **FL** relay is the **Fault Relay** by default, but may be programmed to any of the selections listed in the ***H9 ASD Installation and Operation Manual***. For further information on this terminal see **F132** and [Figure 8](#).

**Note:** The **FLA**, **FLB**, and **FLC** contacts are rated at 2A/120 VAC and 2A/30 VDC.

Figure 8. FLA, FLB, and FLC Switching Contacts Shown in the Normal Operating Condition.

**Note:** The relay is shown in the normal operating condition. During a **faulted** condition the relay connection is **FLC-to-FLA**.

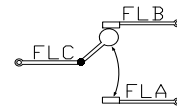
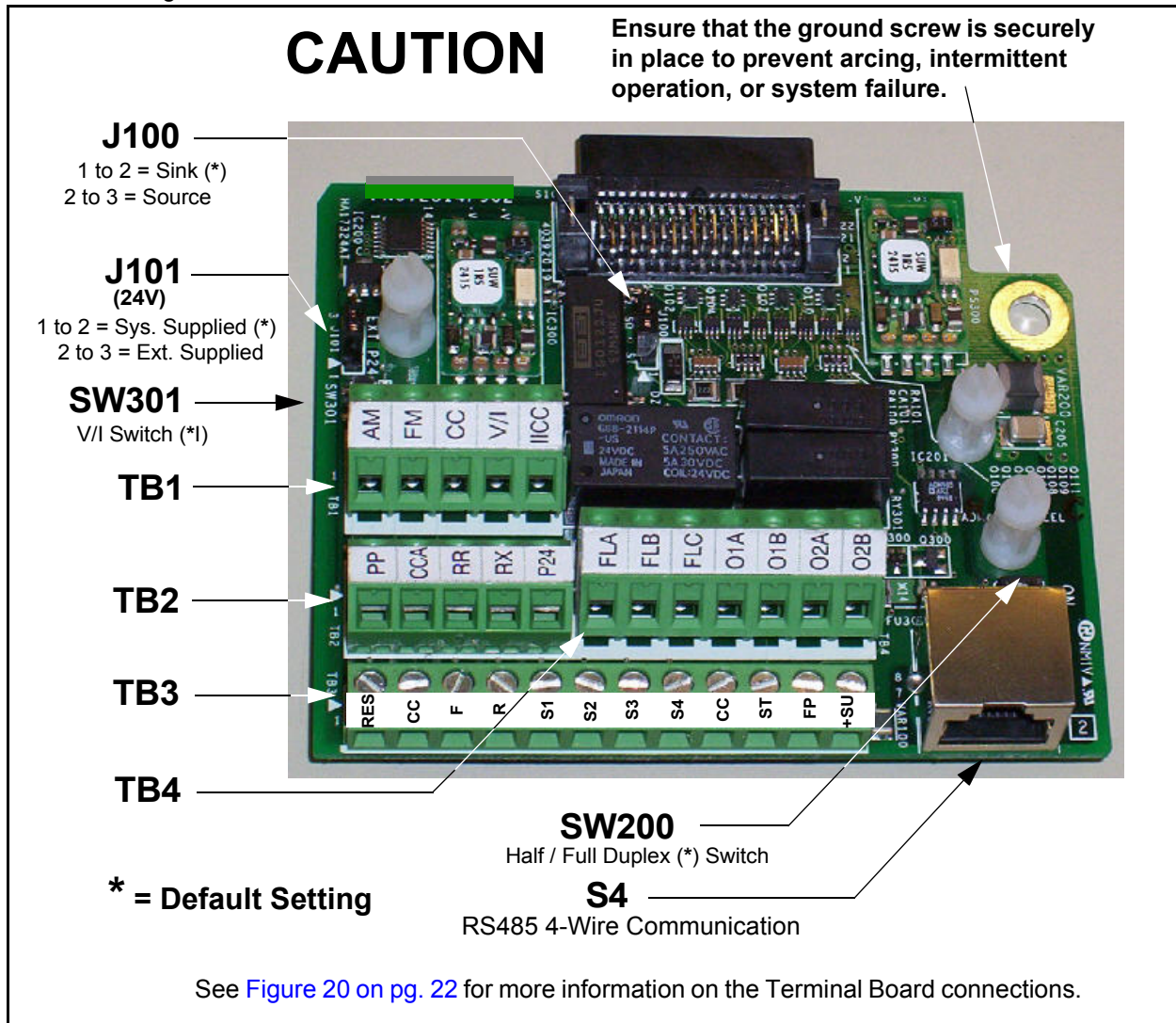


Figure 9. Terminal Board.



See the section titled [Terminal Descriptions on pg. 18](#) for terminal descriptions.

See the section titled [Cable/Terminal/Torque Specifications on pg. 84](#) for information on the proper cable/terminal sizes and torque specifications when making **Terminal Board** connections.

# I/O Circuit Configurations

Figure 10. Discrete Input.

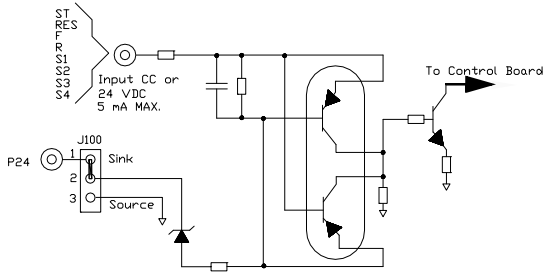


Figure 11. RR Input.

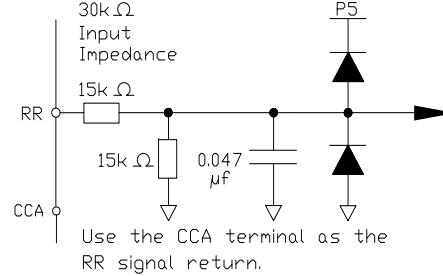


Figure 12. RX Input.

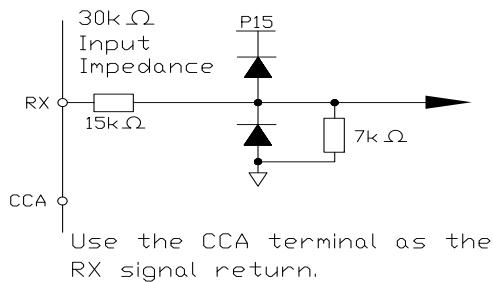


Figure 13. V/I Isolated Input.

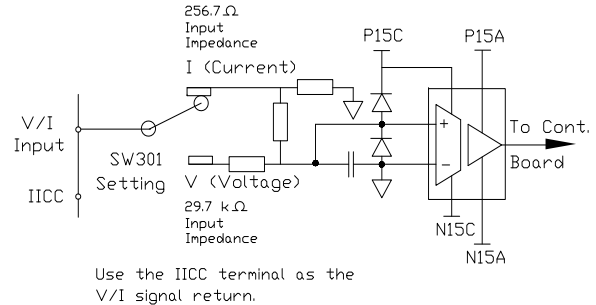


Figure 14. P24 Output.

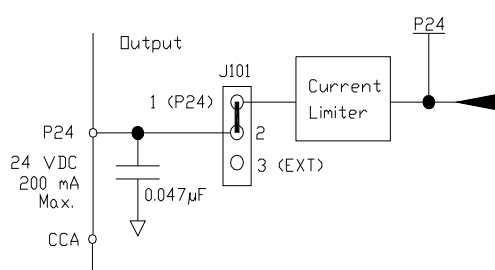


Figure 15. PP Output.

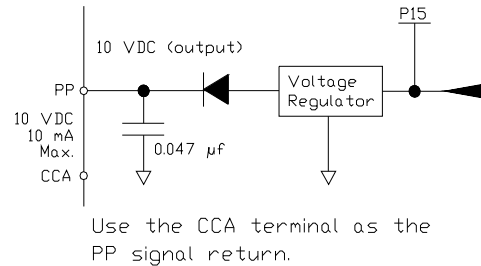


Figure 16. OUT1/OUT2 Output.

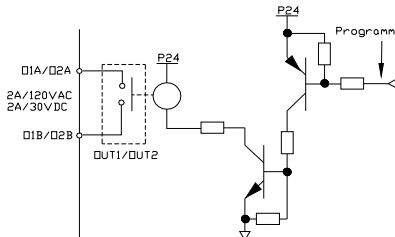


Figure 17. FP Output.

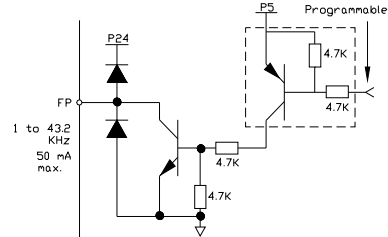


Figure 18. AM/FM Output.

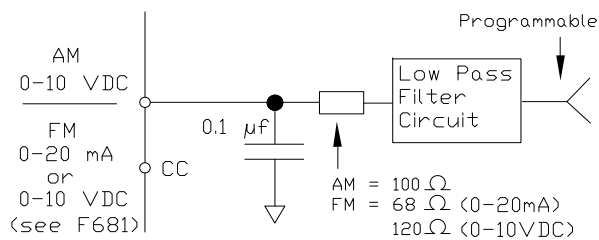
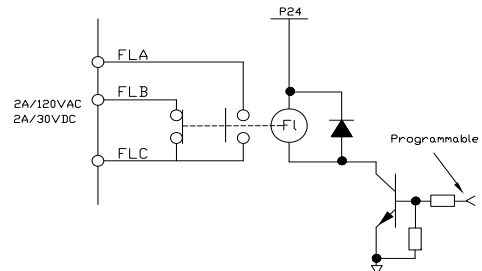


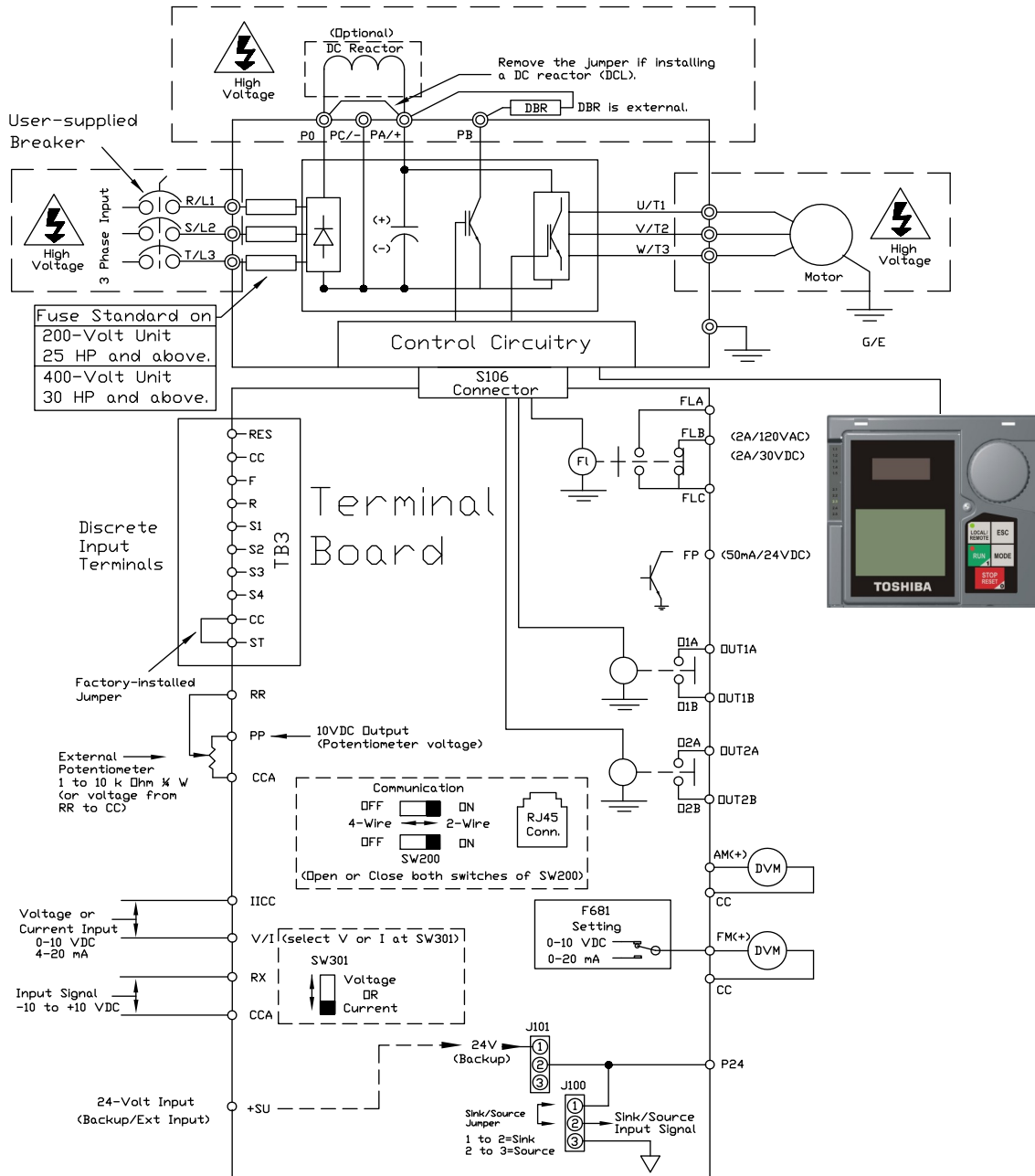
Figure 19. Fault Relay (shown not faulted).



# Typical Connection Diagram

Figure 20. The H9 ASD Typical Connection Diagram.

**Note:** When connecting multiple wires to the PA, PB, PC, or PO terminals, do not connect a solid wire and a stranded wire to the same terminal.



**Note:** The AM, FM, and the +SU analog terminals are referenced to CC.

The PP, RR, RX, and the P24 analog terminals are referenced to CCA.

The isolated V/I analog terminal references IICC.

## Startup and Test



Before turning on the ASD ensure that:

- **R/L1, S/L2, and T/L3** are connected to the 3-phase input power.
- **U/T1, V/T2, and W/T3** are connected to the motor.
- The 3-phase input voltage is within the specified tolerance.
- There are no shorts and all grounds are secured.
- All personnel are at a safe distance from the motor and the motor-driven equipment.

# Electronic Operator Interface

The H9 ASD **Electronic Operator Interface** (EOI) is comprised of an LED screen, an LCD screen, two LEDs, a rotary encoder, and five keys. These items are shown and described on [pg. 26](#).

## EOI Operation

The **EOI** is the primary input/output device for the user. The **EOI** may be used to monitor system functions, input data into the system, perform diagnostics, and view performance data (e.g., motor frequency, bus voltage, torque, etc.).

The software used with the H9 ASD is menu driven; thus, making it a select and click environment. The operating parameters of a motor may be selected and viewed or changed using the **EOI** (or via communications).

## Battery Backup

The EOI is equipped with a battery backup system. The function of the backup system is to retain the EOI SRAM programming in the event of a power outage, or if an EOI removal and installation from one system to another is required without the loss of programming.

Listed below are the items retained by the battery backup system:

- Trip History,
- EOI Contrast,
- Real-time Clock Information,
- Monitor Items,
- Password/Lockout Information,
- Alarm Information,
- Main Monitor Items,
- Prohibited Items, and
- the Save User Settings Information (Parameter settings if saved by the user).

The battery backup system must be activated by the installer or maintenance personnel to use the backup function.

To activate the battery backup system, remove the Phillips screw from the front of the LED/LCD display unit. Remove the LED/LCD display unit from the ASD. From the circuit side of the display unit, remove the jumper at **J1**, pins **2** and **3**. Place the jumper at **J1**, pins **1** and **2**.

The expected battery life cycle is four and a half years.

**Note:** *The Battery backup system does not supply power to the LED/LCD display.*

## LED/LCD Screen Installation Note

When installing the LED/LCD display unit of the **EOI**, ensure that the left side of the display is inserted first with the top and bottom catches (see Phillips screws at underside of display) securely in place. This ensures the proper alignment and electrical connection of the CNX connector of the LED/LCD display unit PCB. Gently hold the display in place while securing the Phillips mounting screw.

If improperly seated, the periphery of the LED/LCD display unit will not be flush with the EOI surface and the unit will not function properly.

# EOI Remote Mounting

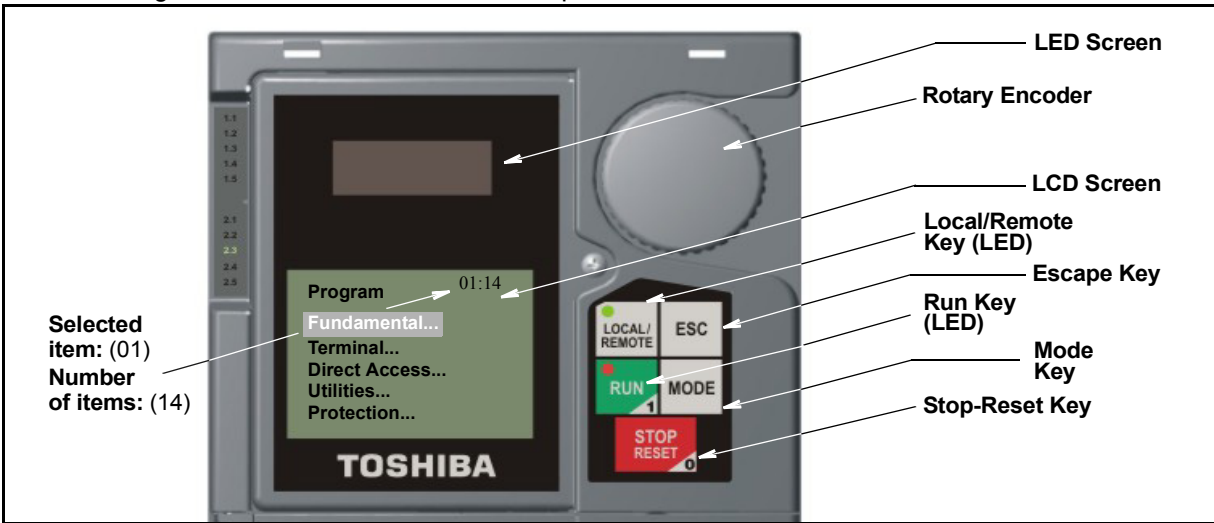
The EOI may be mounted remotely using the optional **ASD-MTG-KIT9**. The kit contains all of the hardware required to mount the EOI of the 9-Series ASD remotely.

System operation and EOI operation while using the remotely-mounted EOI are the same as with the ASD-mounted configuration.



# EOI Features

Figure 21. The H9 ASD Electronic Operator Interface Features.



**LED Screen** — Displays the running frequency, active **Fault**, or active **Alarm** information.

**Rotary Encoder** — Used to access the H9 ASD menu selections, change the value of a displayed parameter, and performs the **Enter** key function. Turn the **Rotary Encoder** either clockwise or counterclockwise to perform the **Up** or **Down** functions of the displayed menu selection. Press the **Rotary Encoder** to perform the **Enter** (select) function.

**LCD Screen** — Displays configuration information, performance data (e.g., output frequency, bus voltage, torque, etc.), diagnostic information, and **LED** screen information in expanded normal text.

**Local/Remote Key** — Toggles the system to and from the **Local** and **Remote** modes. The **Local/Remote Key** is disabled while the **Fault** screen is displayed. The LED is on when the system is in the **Local Command** mode. The **Local** mode allows the **Command** and **Frequency** control functions to be carried out via the **EOI**.

The **Remote** mode enables the **Command** and **Frequency** control functions to be carried out via the **Terminal Board**, **RS485**, **Communication Card**, **Pulse Input**, or the settings of **F003/F004**. The (F003/F004) selections may be made via Program ⇒ Fundamental ⇒ Standard Mode Settings ⇒ [Command Mode](#) and [Frequency Mode 1](#), respectively.

The availability of **Local** mode control (**Command** and **Frequency** control) may be disabled via Program ⇒ Utilities ⇒ Prohibition ⇒ [Local/Remote Key Command Override](#) and [Local/Remote Key Frequency Override](#). The availability of the **Local** mode of operation may be reinstated by changing this setting or performing a **Reset** (see F007).

**ESC Key** — Returns the system to the previous level of the menu tree, toggles between the **EOI Command** screen and the **Frequency Command** screen, or cancels changes made to a field if pressed while still in the reverse video mode (dark background/light text). The three functions are menu-specific.

**Run Key** — Issues the **Run** command while in the **Local** mode. The **Run** key LED illuminates green while stopped or red while running to alert personnel.

**Mode Key** — Provides a means to access the three root menus. Pressing the **Mode Key** key repeatedly loops the system through the three root menus (see [Figure 25 on pg. 29](#)). While looping through the root menus, the **Program** menu will display the root menu screen or the **Program** sub-menu item being accessed prior to pressing the **Mode** key.

**Stop-Reset Key** — This key has three functions.

1. Issues the **Off** command (decelerates to **Stop** at the programmed rate) if pressed once while in the **Local** mode in accordance with the setting of **F721**.
2. Initiates an **Emergency Off Fault** if pressed twice quickly from the **Local** or **Remote** modes. The **Emergency Off** function terminates the H9 ASD output and stops the motor in accordance with the setting of **F603**.
3. Resets active **Faults** and/or active **Alarms** if pressed twice quickly. The source of the **Faults** or **Alarms** must be determined and corrected before normal ASD operation can resume.

## LED/LCD Screen

The LED screen is used to display the output frequency, active alarms and/or active faults.

If there are no active alarms or faults, the output frequency is displayed.

During an active alarm, the display toggles to and from the running frequency and the active alarm.

During an active fault, the fault is displayed.

Loss of the **ST-to-CC** connection flashes **OFF**.

### LED Character/Font Information

Characters displayed on the LED screen will be of the seven-segment format. Not all alpha-numeric characters are available or used with the LED screen.

Listed are the seven-segment characters used on the LED screen along with the same characters as they are displayed on the LCD screen.

### LCD Character/Font Information

All alpha-numeric characters are available.

| LED/LCD Screen Information |     |     |     |
|----------------------------|-----|-----|-----|
| LED                        | LCD | LED | LCD |
| A                          | A   | 1   | 1   |
| b                          | b   | 2   | 2   |
| C                          | C   | 3   | 3   |
| d                          | d   | 4   | 4   |
| E                          | E   | 5   | 5   |
| F                          | F   | 6   | 6   |
| G                          | G   | 7   | 7   |
| H                          | H   | 8   | 8   |
| I                          | I   | 9   | 9   |
| J                          | J   | 0   | 0   |
| L                          | L   |     |     |
| M                          | M   |     |     |
| n                          | n   |     |     |
| O                          | O   |     |     |
| P                          | P   |     |     |
| q                          | q   |     |     |
| r                          | r   |     |     |
| S                          | S   |     |     |
| t                          | t   |     |     |
| U                          | U   |     |     |
| v                          | v   |     |     |
| y                          | y   |     |     |
| -                          | -   |     |     |

# LCD Screen

The LCD screen is the primary user input/output information center. Parameter settings may be viewed or changed using the LCD screen module of the **EOI**. To view or change a parameter setting using the LCD screen, press the **Mode** key until the **Program** menu is displayed. Turn the **Rotary Encoder** until the **Primary Menu** item (see [pg. 34](#)) is within the cursor block. Press the **Rotary Encoder** to select the item from the **Primary Menu** (repeat the press-to-select for submenu items).

See the section titled [Default Setting Changes on pg. 62](#) for more information on changing parameter settings.

Upon reaching the desired parameter selection the current setting may be viewed, or selected and changed by pressing the **Rotary Encoder** and the setting will take on the reverse video format (dark background/light text). Turn the **Rotary Encoder** to change the parameter setting. Press the **ESC** key while the new parameter setting is in the reverse video mode to exit the selection without saving the change or press the **Rotary Encoder** while the parameter setting is in the reverse video mode to accept the change.

Repeated **ESC** key entries at any time takes the menu back one level each time the **ESC** key is pressed until the **Frequency Command** screen is reached. Further **ESC** entries will toggle the system to and from the **Frequency Command** screen and the **EOI Command** menu.

**Note:** Changes carried out from the **EOI Command** screen will be effective for EOI-controlled ASD operation only. See the section titled [EOI Command Mode on pg. 30](#) for further information on [EOI Command Mode](#) operations.

## Primary Menus of the LCD Screen

The three primary screens of the LCD screen are displayed while accessing the associated operating mode: the **Frequency Command**, **Monitor**, and the **Program Menu** screens.

Figure 22. **Frequency Command** Screen.

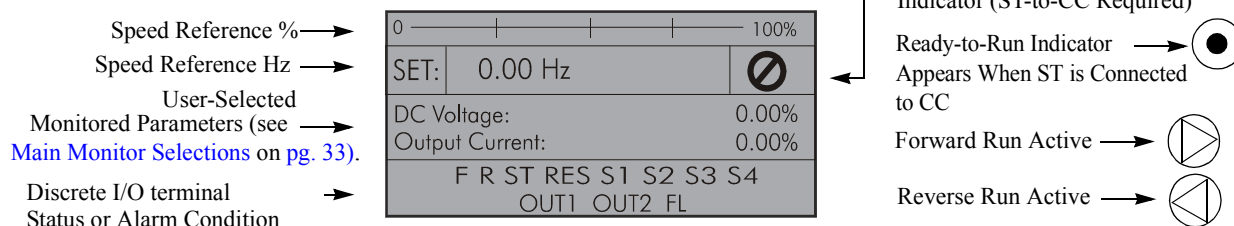


Figure 23. **Monitor** Screen (see [pg. 31](#) for more on the Monitor screen items).

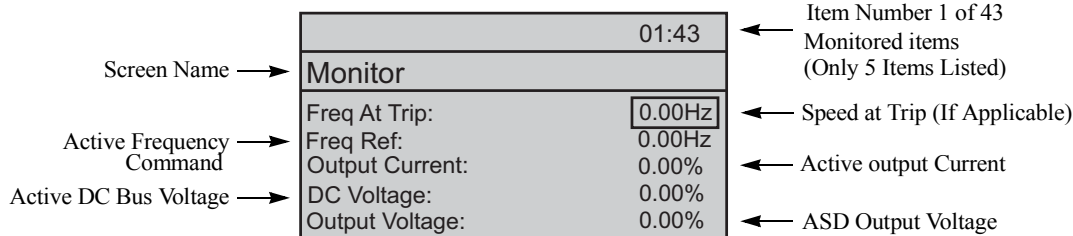
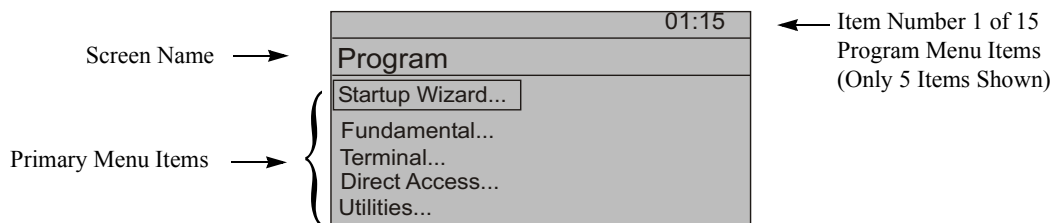


Figure 24. **Program Menu** Screen (see [pg. 34](#) for more on the Program Menu screen).



# System Configuration and Menu Options

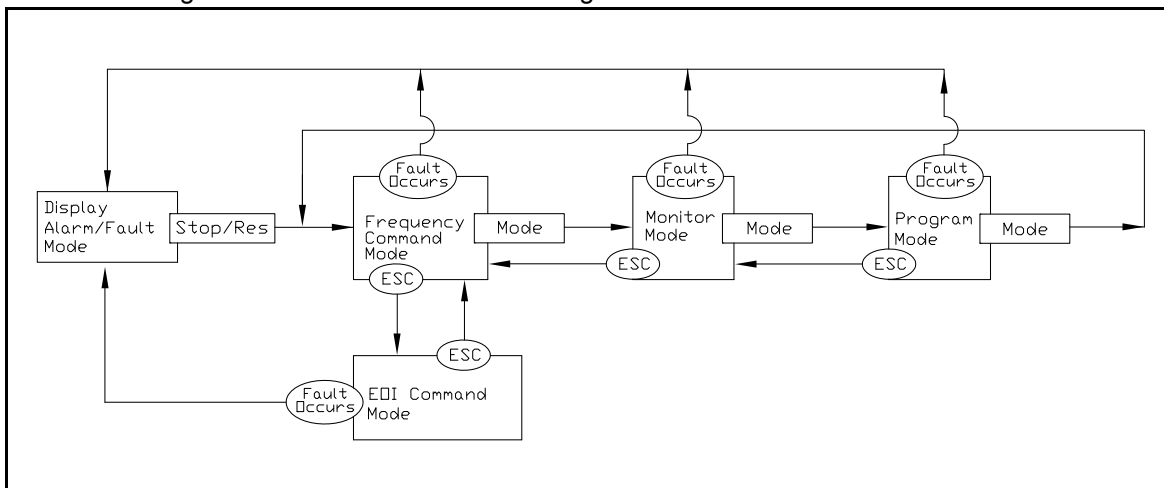
## Root Menus

The **Mode** key accesses the three primary modes of the H9 ASD: the **Frequency Command** mode, the **Monitor** mode, and the **Program** mode. From either mode, press the **Mode** key to loop through to the other two modes (see [Figure 25](#)). While in the **Frequency Command** mode, pressing the **ESC** key toggles the menu to and from the **EOI Command** mode and the **Frequency Command** mode.

The **Alarm** or **Fault** information will be displayed in the event of an active **Alarm** or **Fault**. **Alarm** text will be displayed on the **Frequency Command** screen and on the LED screen when active. **Fault** information will be displayed via the **Fault** screen. See the *H9 ASD Installation and Operation Manual* for more information on **Alarms** and **Trips**.

*Note: EOI Command mode changes are effective for EOI control operation Only.*

Figure 25. H9 ASD Root Menu Navigation.



## Frequency Command Mode

### Frequency Setting

While operating in the **Local** mode (Local LED is illuminated on the front panel), the running frequency of the motor may be set from the **Frequency Command** screen. Using the **Rotary Encoder**, enter the **Frequency Command** value, connect **ST** to **CC**, and provide a **Run** command (F and/or R) and then press the **Run** key. The motor will run at the **Frequency Command** speed and may be changed while running. See [Figure 22 on pg. 28](#) and [Operation \(Local\) on pg. 61](#) for more information on the **Frequency Command** mode.

## EOI Command Mode

The **EOI Command** mode is accessed by pressing the **ESC** key from the **Frequency Command** screen.

The control settings of the **EOI Command** menu are effective for **LCD EOI** control only.

The **EOI Command** mode provides quick access to the following menu parameters:

**Direction** — **Forward** or **Reverse**.

**Stop Pattern** — The **Decel Stop** or **Coast Stop** settings determines the method used to stop the motor when using the **Stop-Reset** key of the **EOI**. The **Decel Stop** setting enables the **Dynamic Braking** system setup at **F304** or the **DC Injection Braking** system setup at **F250**, **F251**, and **F252**. The **Coast Stop** setting allows the motor to stop at the rate allowed by the inertia of the load.

*Note:* The **Stop Pattern** setting has no effect on the **Emergency Off** settings of **F603**.

**V/f Group** — One of 4 **V/f** profiles may be selected and run. Each **V/f** profile is comprised of 4 user settings: **Base Frequency**, **Base Frequency Voltage**, **Manual Torque Boost**, and **Electronic Thermal Protection**. Expanded descriptions of these parameters may be found in the section titled Direct Access Parameter Information in the *H9 ASD Installation and Operation Manual*.

**Accel/Decel Group** — One of 4 **Accel/Decel** profiles may be selected and run. Each of the **Accel/Decel** profiles is comprised of three user settings: **Acceleration**, **Deceleration**, and **Pattern**. Expanded descriptions of these parameters may be found in the section titled Direct Access Parameter Information in the *H9 ASD Installation and Operation Manual*.

**Feedback in Panel Mode** — This feature enables or disables the **PID** feedback function.

**Torque Limit Group** — This parameter is used to select 1 of 4 preset positive torque limits to apply to the active motor (of a multiple motor configuration). The settings of profiles 1 – 4 may be setup at **F441**, **F444**, **F446**, and **F448**, respectively.

# Monitor Mode

The **Monitor** mode allows the user to monitor motor performance variables, control settings, and configuration data during motor operation. The items that are viewable from this mode are listed and described below.

**Note:** The **Monitor** mode is a read-only mode. The settings cannot be changed from the **Monitor** mode. For information on how to change the values, see the section titled [Default Setting Changes on pg. 62](#).

**Note:** Any two of the Underlined monitored items may be selected for display on the **Frequency Command** screen while running via Program  $\Rightarrow$  Utilities  $\Rightarrow$  [Main Monitor Selections](#) (see [pg. 33](#) for information on using the [Main Monitor Selections](#) feature).

**Note:** The **F701** setting will determine if the Current and Voltage values displayed appear as **A (Amps)** and **V (Voltage)**, or if the value is shown as a % (percentage) of the ASD rating.

**Frequency at Trip** — Display the at-trip frequency.

**Frequency Reference** — Displays the **Frequency Setpoint**.

**Output Current** — Displays the **Output Current** as a percentage of the rated capacity of the H9 ASD.

**DC Bus Voltage** — Displays the **Bus Voltage** as a percentage of the rated capacity of the H9 ASD.

**Output Voltage** — Displays the **Output Voltage** as a percentage of the rated capacity of the H9 ASD.

**AM Output** — Displays the **AM** output terminal value for the function assigned to the **AM** terminal.

**FM Output** — Displays the **FM** output terminal value for the function assigned to the **FM** terminal.

**Motor OL (Overload) Real** — Displays the real-time **Motor Overload** value as a percentage of the rated capacity of the motor.

**Motor OL (Overload) Trip** — Displays the **Motor Overload Trip** value as a percentage of the rated capacity of the motor.

**Motor Load** — Displays the real-time **Motor Load** as a percentage of the rated capacity of the motor.

**ASD OL (Overload) Real** — Displays the real-time **ASD Overload** as a percentage of the rated capacity of the H9 ASD.

**ASD OL (Overload) Trip** — Displays the **ASD Overload Trip** value as a percentage of the rated capacity of the ASD.

**ASD Load** — Displays the **ASD Load** as a percentage of the rated capacity of the H9 ASD.

**Run Time** — Displays the **Cumulative Run Time** in hours.

**Compensation Frequency** — Displays the **Output Frequency** after the application of the slip compensation correction value (Post Compensation Frequency).

**DBR OL (Overload) Real** — Displays the real-time **DBR Overload** value as a percentage of the **Dynamic Braking Resistor** capacity.

**DBR OL (Overload) Trip** — Displays the **DBR Overload Trip** value as a percentage of the **Dynamic Braking Resistor** capacity.

**DBR Load** — Displays the **DBR Load** as a percentage of the **Dynamic Braking Resistor** capacity.

**Feedback (inst)** — Provides a status of the **Real Time Feedback** in Hz.

**Feedback (1 second)** — Provides a status of the **1-Second Averaging** feedback in Hz.

**Torque** — Displays the **Output Torque** as a percentage of the rated capacity of the H9 ASD.

**Torque Reference** — Displays the **Torque Reference** as a percentage.

**Torque Current** — Displays the torque-producing current value.

**Excitation Current** — Displays the current value required to produce the excitation field.

**PID Feedback** — Provides a status of the **PID Real Time Feedback** in Hz.

**Input Power** — Displays the **Input Power** in Kilowatts (kW).

**Output Power** — Displays the **Output Power** in Kilowatts (kW).

**Pattern Group Number** — Displays the active **Pattern Run Group Number**.

**Pattern Group Cycle** — Displays the cycle number of the active **Pattern Run Group**.

**Pattern Group Preset** — Displays the active **Preset Speed** being run of the active **Pattern Run Group**.

**Pattern Time** — Displays the remaining time for the active **Pattern Run Group**.

**RR** — Displays the **RR** input value as a percentage of the full range of the **RR** value (potentiometer input).

**V/I** — Displays the **V/I** input setting as a percentage of the full range of the **V/I** value.

***Note:** The isolated **V/I** input terminal may receive **Current** or **Voltage** to control the output speed or the output torque. The input signal type must be selected at **SW301** on the **Terminal Board**.*

*The **V** input setting of **SW301** is used for the 0 – 10 VDC analog input signal and the **I** input setting of **SW301** is used for the 0 – 20 mA analog input signal. Either may be used as a frequency or torque command source. See parameter **F201** for more information on the setup of this terminal.*

**RX** — Displays the **RX** input setting as a percentage of the full range of the **RX** value (-10 to +10 VDC input).

**RX2 Option (AI1)** — Displays the **RX2** input setting as a percentage of the full range of the **RX2** value.

***Note:** The **RX2** function is available on the **Expansion IO Card Option 1** option board (P/N ETB003Z) only.*

**Trip Code** — Displays **None** if there are no errors, or displays one of the associated **Fault Codes** listed in the **H9 ASD Installation and Operation Manual** if there is an active **Fault** (e.g., **E** = **Emergency Off**).

**Past Trip 1** — This function records and displays the last trip incurred. Subsequent trips will replace **Past Trip 1**. As trip records are replaced they are shifted to the next level of the **Past Trip** locations until being deleted (i.e., Past Trip 1 is moved to Past Trip 2 and then to 3 until being shifted out of 4). Once shifted out of **Past Trip 4** the record is deleted. If no trips have occurred since the last reset, **None** is displayed for each trip record.

**Past Trip 2** — Past Trip information or **None**.

**Past Trip 3** — Past Trip information or **None**.

**Past Trip 4** — Past Trip information or **None**.

***Note:** An improper H9 ASD setup may cause some trips — reset the H9 ASD to the **Factory Default** settings before pursuing a systemic malfunction (Program ⇒ Utilities ⇒ Type Reset ⇒ **Reset to Factory Settings**).*

**Direction** — Displays the **Direction** command (forward/reverse).

**Discrete Input Terminals** — Displays the status (Activated = reverse video) of the discrete input terminals of the **Terminal Board**.

**Discrete Output Terminals** — Displays the status (Activated = reverse video) of the discrete output lines of the **Terminal Board**.

## Main Monitor Selections

Two (2) **Monitor Mode** items may be selected from the **Main Monitor Selections** screen to be displayed on the **Frequency Command** screen while the H9 ASD is running.

The selected items, along with their real-time values, are displayed on the **Frequency Command** screen while running. Not all **Monitor Mode** items are available for display on the **Frequency Command** screen. The available items are underlined on [pg. 31](#) and [pg. 32](#).

Any two of the underlined items may be selected from the listing at Program ⇒ Utilities ⇒ **Main Monitor Selections**. Select an item from the **Monitor 1** listing and another item from the **Monitor 2** listing to be displayed as shown in [Figure 22 on pg. 28](#) (DC Voltage and Output Current shown).



## Program Mode Menu Navigation

The following table lists the menu items of the **Program** mode and maps the flow of the menu selections. The **Parameter Numbers** for the listed functions are provided where applicable.

The functions listed may be viewed, or selected and changed as mapped below or via the **Direct Access** method: Program ⇒ Direct Access ⇒ *Applicable Parameter Number*.

| Program Mode Menu Navigation |                                                                                                 |                                                |                  |
|------------------------------|-------------------------------------------------------------------------------------------------|------------------------------------------------|------------------|
| Primary Menu                 | Sub Menu                                                                                        | Parameter Name                                 | Parameter Number |
| <b>STARTUP WIZARD</b>        | See the section titled <a href="#">Initial Setup on pg. 58</a> for Startup Wizard Requirements. |                                                |                  |
| <b>FUNDAMENTAL</b>           | <b>Accel/Decel 1 Settings</b>                                                                   | Automatic Acceleration/Deceleration            | F000             |
|                              |                                                                                                 | Acceleration Time 1                            | F009             |
|                              |                                                                                                 | Deceleration Time 1                            | F010             |
|                              |                                                                                                 | Acceleration/Deceleration Suspended Function   | F349             |
|                              |                                                                                                 | Acceleration Suspend Frequency                 | F350             |
|                              |                                                                                                 | Acceleration Suspend Time                      | F351             |
|                              |                                                                                                 | Deceleration Suspend Frequency                 | F352             |
|                              |                                                                                                 | Deceleration Suspend Time                      | F353             |
|                              | <b>Frequency Settings</b>                                                                       | Maximum Frequency                              | F011             |
|                              |                                                                                                 | Upper-Limit Frequency                          | F012             |
|                              |                                                                                                 | Lower-Limit Frequency                          | F013             |
|                              |                                                                                                 | V/f Pattern                                    | F015             |
|                              |                                                                                                 | Time Limit for Lower-Limit Frequency Operation | F256             |
|                              | <b>Motor Set 1</b>                                                                              | Automatic Torque Boost                         | F001             |
|                              |                                                                                                 | Base Frequency 1                               | F014             |
|                              |                                                                                                 | Manual Torque Boost 1                          | F016             |
|                              |                                                                                                 | Motor Overload Protection Level 1              | F600             |
|                              | <b>Standard Mode Selection</b>                                                                  | Command Mode                                   | F003             |
|                              |                                                                                                 | Frequency Mode 1                               | F004             |
|                              |                                                                                                 | Forward/Reverse Run                            | F008             |
|                              |                                                                                                 | Frequency Priority                             | F200             |
|                              |                                                                                                 | Frequency Mode 2                               | F207             |
|                              |                                                                                                 | Frequency Mode Priority Switching Frequency    | F208             |
| <b>TERMINAL</b>              | <b>Analog Output Terminals</b>                                                                  | FM Output Terminal Function                    | F005             |
|                              |                                                                                                 | FM Output Terminal Adjustment                  | F006             |

| Program Mode Menu Navigation |                                |                                                      |                  |
|------------------------------|--------------------------------|------------------------------------------------------|------------------|
| Primary Menu                 | Sub Menu                       | Parameter Name                                       | Parameter Number |
| <b>TERMINAL</b>              | <b>Analog Output Terminals</b> | FM Output Gradient Characteristic                    | F682             |
|                              |                                | FM Bias Adjustment                                   | F683             |
|                              |                                | FM Voltage/Current Output Switching                  | F681             |
|                              |                                | AM Output Terminal Function                          | F670             |
|                              |                                | AM Output Terminal Adjustment                        | F671             |
|                              |                                | AM Output Gradient Characteristic                    | F685             |
|                              |                                | AM Bias Adjustment                                   | F686             |
|                              |                                | MON 1 Terminal Meter Selection                       | F672             |
|                              |                                | MON 1 Terminal Meter Adjustment                      | F673             |
|                              |                                | MON 1 Output Gradient Characteristic                 | F689             |
|                              |                                | MON 1 Bias Adjustment                                | F690             |
|                              |                                | MON 1 Voltage/Current Output Switching               | F688             |
|                              |                                | MON 2 Terminal Meter Selection                       | F674             |
|                              |                                | MON 2 Terminal Meter Adjustment                      | F675             |
|                              |                                | MON 2 Output Gradient Characteristic                 | F692             |
|                              |                                | MON 2 Bias Adjustment                                | F693             |
|                              |                                | MON 2 Voltage/Current Output Switching               | F691             |
|                              |                                | Pulse Output Function                                | F676             |
|                              |                                | Pulse Output Frequency                               | F677             |
|                              | <b>Input Special Functions</b> | Forward/Reverse Run Priority When Both Are Activated | F105             |
|                              |                                | Input Terminal Priority                              | F106             |
|                              |                                | 16-Bit Binary/BCD Input                              | F107             |
|                              |                                | V/I Analog Input Broken Wire Detection Level         | F633             |
|                              | <b>Input Terminal Delays</b>   | Input Terminal 1 (F) Response Time                   | F140             |
|                              |                                | Input Terminal 2 (R) Response Time                   | F141             |
|                              |                                | Input Terminal 3 (ST) Response Time                  | F142             |
|                              |                                | Input Terminal 4 (RES) Response Time                 | F143             |
|                              |                                | Input Terminal 5–12 Response Time                    | F144             |
|                              |                                | Input Terminal 13–20 Response Time                   | F145             |

| Program Mode Menu Navigation |                             |                                                |                  |
|------------------------------|-----------------------------|------------------------------------------------|------------------|
| Primary Menu                 | Sub Menu                    | Parameter Name                                 | Parameter Number |
| <b>TERMINAL</b>              | <b>Input Terminals</b>      | Always ON Terminal Function                    | F110             |
|                              |                             | Input Terminal 1 (F) Function                  | F111             |
|                              |                             | Input Terminal 2 (R) Function                  | F112             |
|                              |                             | Input Terminal 3 (ST) Function                 | F113             |
|                              |                             | Input Terminal 4 (RES) Function                | F114             |
|                              |                             | Input Terminal 5 (S1) Function                 | F115             |
|                              |                             | Input Terminal 6 (S2) Function                 | F116             |
|                              |                             | Input Terminal 7 (S3) Function                 | F117             |
|                              |                             | Input Terminal 8 (S4) Function                 | F118             |
|                              |                             | Input Terminal 9 (LI1) Function                | F119             |
|                              |                             | Input Terminal 10 (LI2) Function               | F120             |
|                              |                             | Input Terminal 11 (LI3) Function               | F121             |
|                              |                             | Input Terminal 12 (LI4) Function               | F122             |
|                              |                             | Input Terminal 13 (LI5) Function               | F123             |
|                              |                             | Input Terminal 14 (LI6) Function               | F124             |
|                              |                             | Input Terminal 15 (LI7) Function               | F125             |
|                              |                             | Input Terminal 16 (LI8) Function               | F126             |
|                              |                             | Input Terminal 17 (B12) Function               | F164             |
|                              |                             | Input Terminal 18 (B13) Function               | F165             |
|                              |                             | Input Terminal 19 (B14) Function               | F166             |
|                              |                             | Input Terminal 20 (BI5) Function               | F167             |
|                              |                             | Virtual Input Terminal Selection 1             | F973             |
|                              |                             | Virtual Input Terminal Selection 2             | F974             |
|                              |                             | Virtual Input Terminal Selection 3             | F975             |
|                              |                             | Virtual Input Terminal Selection 4             | F976             |
|                              | <b>Line Power Switching</b> | Commercial Power/ASD Switching Output          | F354             |
|                              |                             | Commercial Power/ASD Switching Frequency       | F355             |
|                              |                             | ASD Side Switching Delay Time                  | F356             |
|                              |                             | Commercial Power-Side Switching Delay Time     | F357             |
|                              |                             | Commercial Power Switching Frequency Hold Time | F358             |

| Program Mode Menu Navigation |                    |                                           |                  |
|------------------------------|--------------------|-------------------------------------------|------------------|
| Primary Menu                 | Sub Menu           | Parameter Name                            | Parameter Number |
| TERMINAL                     | Output Terminals   | Output Terminal 1 (OUT1) Function         | F130             |
|                              |                    | Output Terminal 2 (OUT2) Function         | F131             |
|                              |                    | Output Terminal 3 (FL) Function           | F132             |
|                              |                    | Output Terminal 4 (OUT3) Function         | F133             |
|                              |                    | Output Terminal 5 (OUT4) Function         | F134             |
|                              |                    | Output Terminal 6 (R1) Function           | F135             |
|                              |                    | Output Terminal 7 (OUT5) Function         | F136             |
|                              |                    | Output Terminal 8 (OUT6) Function         | F137             |
|                              |                    | Output Terminal 9 (R2) Function           | F138             |
|                              |                    | Output Terminal 10 (R3) Function          | F168             |
|                              |                    | Output Terminal 11 (R4) Function          | F169             |
|                              | Reach Settings     | Low Speed Signal Output Frequency         | F100             |
|                              |                    | Speed Reach Frequency                     | F101             |
|                              |                    | Speed Reach Detection Band                | F102             |
| DIRECT ACCESS                |                    | Parameter Number Input                    | N/A              |
|                              |                    | Unknown Numbers Accepted                  |                  |
| UTILITIES                    | Display Parameters | Automatic Function Selection              | F040             |
|                              |                    | Voltage/Current Display Units             | F701             |
|                              |                    | Free Unit Multiplication Factor           | F702             |
|                              |                    | Free Unit                                 | F703             |
|                              |                    | Free Unit Display Gradient Characteristic | F705             |
|                              |                    | Free Unit Display Bias                    | F706             |
|                              |                    | Change Step Selection 1                   | F707             |
|                              |                    | Change Step Selection 2                   | F708             |
|                              | Prohibition        | Write Parameter Lockout                   | F700             |
|                              |                    | Command Mode/Frequency Mode Lockout       | F736             |
|                              |                    | Lockout All Keys                          | F737             |
|                              |                    | Local/Remote Key Command Override         | N/A              |
|                              |                    | Local/Remote Key Frequency Override       |                  |
|                              | Trace              | Trace Selection                           | F740             |

| Program Mode Menu Navigation |                                                                                                  |                                          |                  |
|------------------------------|--------------------------------------------------------------------------------------------------|------------------------------------------|------------------|
| Primary Menu                 | Sub Menu                                                                                         | Parameter Name                           | Parameter Number |
| UTILITIES                    | Trace                                                                                            | Trace Cycle                              | F741             |
|                              |                                                                                                  | Trace Data 1                             | F742             |
|                              |                                                                                                  | Trace Data 2                             | F743             |
|                              |                                                                                                  | Trace Data 3                             | F744             |
|                              |                                                                                                  | Trace Data 4                             | F745             |
|                              | <b>Alarm Prohibition</b><br>(prohibits an EOI alarm display <b>ONLY</b> — alarm still activated) | Over-Current Alarm                       | N/A              |
|                              |                                                                                                  | ASD Overload Alarm                       |                  |
|                              |                                                                                                  | Motor Overload Alarm                     |                  |
|                              |                                                                                                  | Over-Heat Alarm                          |                  |
|                              |                                                                                                  | Over-Voltage Alarm                       |                  |
|                              |                                                                                                  | Main Power Under-Voltage Alarm           |                  |
|                              |                                                                                                  | Reserved (POFF) Alarm                    |                  |
|                              |                                                                                                  | Under-Current Alarm                      |                  |
|                              |                                                                                                  | Over-Torque Alarm                        |                  |
|                              |                                                                                                  | Braking Resistor Overload Alarm          |                  |
|                              |                                                                                                  | Cumulative Run Timer Alarm               |                  |
|                              |                                                                                                  | DeviceNet/Profibus/CC-Link Alarm         |                  |
|                              |                                                                                                  | RS485 Communication                      |                  |
|                              |                                                                                                  | Main Power Under-Voltage Alarm           |                  |
|                              |                                                                                                  | Stop After Instantaneous Power-off Alarm |                  |
|                              |                                                                                                  | Stop After Lower-Limit Continuous Time   |                  |
|                              |                                                                                                  | Light-Load Alarm                         |                  |
|                              |                                                                                                  | Heavy-Load Alarm                         |                  |
|                              |                                                                                                  | Maintenance Timer Alarm                  |                  |
|                              |                                                                                                  | Over-Torque Alarm                        |                  |
|                              |                                                                                                  | Soft Stall Alarm                         |                  |
|                              | Type Reset                                                                                       | Reset                                    | F007             |
|                              | Real-Time Clock Setup                                                                            | Set Real-Time Clock                      | N/A              |
|                              | Trip History (read-only)                                                                         | Trip Number                              | N/A              |
|                              |                                                                                                  | Trip Type                                |                  |

| Program Mode Menu Navigation |                             |                             |                  |
|------------------------------|-----------------------------|-----------------------------|------------------|
| Primary Menu                 | Sub Menu                    | Parameter Name              | Parameter Number |
| UTILITIES                    | Trip History<br>(read-only) | Frequency at Trip           | N/A              |
|                              |                             | Output Current              |                  |
|                              |                             | Output Voltage              |                  |
|                              |                             | Direction                   |                  |
|                              |                             | Frequency Reference         |                  |
|                              |                             | DC Voltage                  |                  |
|                              |                             | Discrete Input Terminals    |                  |
|                              |                             | Discrete Output Terminals   |                  |
|                              |                             | Run Timer                   |                  |
|                              |                             | Post Compensation Frequency |                  |
|                              |                             | Speed Feedback (Real-Time)  |                  |
|                              |                             | Speed Feedback (1 Second)   |                  |
|                              |                             | Torque Feedback             |                  |
|                              |                             | Torque Reference            |                  |
|                              |                             | Torque Current              |                  |
|                              |                             | Excitation Current          |                  |
|                              |                             | PID Feedback                |                  |
|                              |                             | Motor Overload Ratio        |                  |
|                              |                             | ASD Overload Ratio          |                  |
|                              |                             | DBR Overload Ratio          |                  |
|                              |                             | Motor Load                  |                  |
|                              |                             | ASD Load                    |                  |
|                              |                             | DBR Load                    |                  |
|                              |                             | Input Power                 |                  |
|                              |                             | Output Power                |                  |
|                              | Changed From Default        | Changed Parameters          | N/A              |
|                              | Contrast                    | Contrast Adjustment         | N/A              |
|                              | Version (read-only)         | H9 EOI (Ver:DB)             | N/A              |
|                              |                             | ASD Type                    |                  |
|                              |                             | CPU Code Version            |                  |

| Program Mode Menu Navigation |                         |                                                     |                  |
|------------------------------|-------------------------|-----------------------------------------------------|------------------|
| Primary Menu                 | Sub Menu                | Parameter Name                                      | Parameter Number |
| UTILITIES                    | Version (read-only)     | CPU Code Revision                                   | N/A              |
|                              |                         | MC Version                                          |                  |
|                              |                         | MC Revision                                         |                  |
|                              |                         | Main Board EEPROM Version                           |                  |
|                              | Main Monitor Selections | Monitor 1                                           |                  |
|                              |                         | Monitor 2                                           |                  |
|                              | View Trace Data         | View Trace Data                                     |                  |
| PROTECTION                   | Abnormal Speed Settings | Abnormal Speed Detection Time                       | F622             |
|                              |                         | Over-Speed Detection Frequency Upper Band           | F623             |
|                              |                         | Over-Speed Detection Frequency Lower Band           | F624             |
|                              | Base Frequency Voltage  | Supply Voltage Correction                           | F307             |
|                              | DC Injection Braking    | DC Injection Braking Start Frequency                | F250             |
|                              |                         | DC Injection Braking Current                        | F251             |
|                              |                         | DC Injection Braking Time                           | F252             |
|                              |                         | Forward/Reverse DC Injection Braking Priority       | F253             |
|                              |                         | Motor Shaft Stationary Control                      | F254             |
|                              | Dynamic Braking         | Dynamic Braking Enable                              | F304             |
|                              |                         | Dynamic Braking Resistance                          | F308             |
|                              |                         | Continuous Dynamic Braking Capacity                 | F309             |
|                              |                         | Braking Resistance Overload Time (10x Rated Torque) | F639             |
|                              | Emergency Off Settings  | Emergency Off                                       | F603             |
|                              |                         | Emergency DC Injection Braking Control Time         | F604             |
|                              | Low-Current Settings    | Low-Current Trip                                    | F610             |
|                              |                         | Low-Current Detection Current                       | F611             |
|                              |                         | Low-Current Detection Time                          | F612             |
|                              |                         | Low-Current Detection Hysteresis Width              | F609             |
|                              | Overload                | Motor Overload Protection Configuration             | F017             |
|                              |                         | Overload Reduction Start Frequency                  | F606             |

| Program Mode Menu Navigation |                                      |                                                         |                  |
|------------------------------|--------------------------------------|---------------------------------------------------------|------------------|
| Primary Menu                 | Sub Menu                             | Parameter Name                                          | Parameter Number |
| <b>PROTECTION</b>            | <b>Overload</b>                      | Motor 150% Overload Time Limit                          | F607             |
|                              |                                      | ASD Overload                                            | F631             |
|                              | <b>Over-Torque Parameters</b>        | Over-Torque Trip                                        | F615             |
|                              |                                      | Over-Torque Detection Level During Power Running        | F616             |
|                              |                                      | Over-Torque Detection Level During Regenerative Braking | F617             |
|                              |                                      | Over-Torque Detection Time                              | F618             |
|                              |                                      | Over-Torque Detection Hysteresis                        | F619             |
|                              | <b>Phase Loss</b>                    | ASD Output Phase Loss Detection                         | F605             |
|                              |                                      | ASD Input Phase Loss Detection                          | F608             |
|                              | <b>Retry/Restart</b>                 | Auto Restart Enable                                     | F301             |
|                              |                                      | Number of Times to Retry                                | F303             |
|                              |                                      | Ridethrough Time                                        | F310             |
|                              |                                      | Random Mode                                             | F312             |
|                              | <b>Stall</b>                         | Over-Voltage Limit Operation                            | F305             |
|                              |                                      | Stall Prevention Factor 1                               | F416             |
|                              |                                      | Power Running Stall Continuous Trip Detection Time      | F452             |
|                              |                                      | Stall Prevention During Regeneration                    | F453             |
|                              |                                      | Stall Prevention Level                                  | F601             |
|                              |                                      | Over-Voltage Limit Operation Level                      | F626             |
|                              | <b>Trip Settings</b>                 | Retain Trip Record at Power Down                        | F602             |
|                              | <b>Under-Voltage/ Ridethrough</b>    | Regenerative Power Ridethrough Mode                     | F302             |
|                              |                                      | Synchronized Deceleration Time                          | F317             |
|                              |                                      | Synchronized Acceleration Time                          | F318             |
|                              |                                      | Under-Voltage Trip                                      | F627             |
|                              |                                      | Under-Voltage (Trip Alarm) Detection Time               | F628             |
|                              |                                      | Regenerative Power Ridethrough Control Level            | F629             |
|                              | <b>Special Protection Parameters</b> | Short Circuit Detection at Start                        | F613             |
|                              |                                      | Cooling Fan Control                                     | F620             |
|                              |                                      | Cumulative Operation Time Alarm Setting                 | F621             |
|                              |                                      | Brake Answer Wait Time                                  | F630             |



| Program Mode Menu Navigation |                             |                                                                        |                  |
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| Primary Menu                 | Sub Menu                    | Parameter Name                                                         | Parameter Number |
| FREQUENCY                    | Analog Filter               | Analog Input Filter                                                    | F209             |
|                              | Forward/Reverse Disable     | Forward/Reverse Disable                                                | F311             |
|                              | Jog Settings                | Jog Frequency                                                          | F260             |
|                              |                             | Jog Stop Pattern                                                       | F261             |
|                              |                             | Panel Operation Jog Mode                                               | F262             |
|                              | UP/DOWN Frequency Functions | UP/DOWN Up Response Time                                               | F264             |
|                              |                             | UP/DOWN Up Frequency Step                                              | F265             |
|                              |                             | UP/DOWN Down Response Time                                             | F266             |
|                              |                             | UP/DOWN Down Frequency Step                                            | F267             |
|                              |                             | Initial UP/DOWN Frequency                                              | F268             |
|                              |                             | Initial UP/DOWN Frequency Rewriting                                    | F269             |
|                              | V/I Settings                | Option V/I Terminal Voltage/Current Selection (AI2 option board input) | F109             |
|                              | Preset Speeds               | Preset Speed 1                                                         | F018             |
|                              |                             | Preset Speed 2                                                         | F019             |
|                              |                             | Preset Speed 3                                                         | F020             |
|                              |                             | Preset Speed 4                                                         | F021             |
|                              |                             | Preset Speed 5                                                         | F022             |
|                              |                             | Preset Speed 6                                                         | F023             |
|                              |                             | Preset Speed 7                                                         | F024             |
|                              |                             | Preset Speed 8                                                         | F287             |
|                              |                             | Preset Speed 9                                                         | F288             |
|                              |                             | Preset Speed 10                                                        | F289             |
|                              |                             | Preset Speed 11                                                        | F290             |
|                              |                             | Preset Speed 12                                                        | F291             |
|                              |                             | Preset Speed 13                                                        | F292             |
|                              |                             | Preset Speed 14                                                        | F293             |
|                              |                             | Preset Speed 15                                                        | F294             |

| Program Mode Menu Navigation |                           |                                          |                  |
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| Primary Menu                 | Sub Menu                  | Parameter Name                           | Parameter Number |
| FREQUENCY                    | Speed Reference Setpoints | V/I Input Point 1 Setting                | F201             |
|                              |                           | V/I Input Point 1 Frequency              | F202             |
|                              |                           | V/I Input Point 2 Setting                | F203             |
|                              |                           | V/I Input Point 2 Frequency              | F204             |
|                              |                           | RR Input Point 1 Setting                 | F210             |
|                              |                           | RR Input Point 1 Frequency               | F211             |
|                              |                           | RR Input Point 2 Setting                 | F212             |
|                              |                           | RR Input Point 2 Frequency               | F213             |
|                              |                           | RX Input Point 1 Setting                 | F216             |
|                              |                           | RX Input Point 1 Frequency               | F217             |
|                              |                           | RX Input Point 2 Setting                 | F218             |
|                              |                           | RX Input Point 2 Frequency               | F219             |
|                              |                           | RX2 Option (AI1) Input Point 1 Setting   | F222             |
|                              |                           | RX2 Option (AI1) Input Point 1 Frequency | F223             |
|                              |                           | RX2 Option (AI1) Input Point 2 Setting   | F224             |
|                              |                           | RX2 Option (AI1) Input Point 2 Frequency | F225             |
|                              |                           | BIN Input Point 1 Setting                | F228             |
|                              |                           | BIN Input Point 1 Frequency              | F229             |
|                              |                           | BIN Input Point 2 Setting                | F230             |
|                              |                           | BIN Input Point 2 Frequency              | F231             |
|                              |                           | PG Input Point 1 Setting                 | F234             |
|                              |                           | PG Input Point 1 Frequency               | F235             |
|                              |                           | PG Input Point 2 Setting                 | F236             |
|                              |                           | PG Input Point 2 Frequency               | F237             |
|                              |                           | V/I Input Bias                           | F470             |
|                              |                           | V/I Input Gain                           | F471             |
|                              |                           | RR Input Bias                            | F472             |
|                              |                           | RR Input Gain                            | F473             |
|                              |                           | RX Input Bias                            | F474             |
|                              |                           | RX Input Gain                            | F475             |

| Program Mode Menu Navigation |                                  |                                                                 |                  |
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| Primary Menu                 | Sub Menu                         | Parameter Name                                                  | Parameter Number |
| <b>FREQUENCY</b>             | <b>Speed Reference Setpoints</b> | RX2 Option (AI1) Input Bias                                     | F476             |
|                              |                                  | RX2 Option (AI1) Input Gain                                     | F477             |
|                              |                                  | V/I Input Bias (AI2 Option Board Input)                         | F478             |
|                              |                                  | V/I Input Gain (AI2 Option Board Input)                         | F479             |
| <b>SPECIAL</b>               | <b>Acc/Dec 1 – 4 Settings</b>    | Acceleration Time 2                                             | F500             |
|                              |                                  | Deceleration Time 2                                             | F501             |
|                              |                                  | Acc/Dec Pattern 1                                               | F502             |
|                              |                                  | Acc/Dec Pattern 2                                               | F503             |
|                              |                                  | Acceleration Time 3                                             | F510             |
|                              |                                  | Deceleration Time 3                                             | F511             |
|                              |                                  | Acc/Dec Pattern 3                                               | F512             |
|                              |                                  | Acceleration Time 4                                             | F514             |
|                              |                                  | Deceleration Time 4                                             | F515             |
|                              |                                  | Acc/Dec Pattern 4                                               | F516             |
|                              | <b>Acc/Dec Special</b>           | Acc/Dec Pattern 1 – 4                                           | F504             |
|                              |                                  | Acc/Dec Switching Frequency 1                                   | F505             |
|                              |                                  | S-Pattern Acceleration Lower-Limit Adjustment                   | F506             |
|                              |                                  | S-Pattern Acceleration Upper-Limit Adjustment                   | F507             |
|                              |                                  | S-Pattern Deceleration Lower-Limit Adjustment                   | F508             |
|                              |                                  | S-Pattern Deceleration Upper-Limit Adjustment                   | F509             |
|                              |                                  | Acc/Dec Switching Frequency 2                                   | F513             |
|                              |                                  | Acc/Dec Switching Frequency 3                                   | F517             |
|                              | <b>Carrier Frequency</b>         | PWM Carrier Frequency                                           | F300             |
|                              |                                  | Carrier Frequency Control Mode                                  | F316             |
|                              | <b>Crane/Hoist Settings</b>      | Light-Load/High-Speed Operation                                 | F328             |
|                              |                                  | Light-Load/High-Speed Learning Function                         | F329             |
|                              |                                  | Light-Load/High-Speed Operation Frequency                       | F330             |
|                              |                                  | Light-Load/High-Speed Operation Switching Lower-Limit Frequency | F331             |
|                              |                                  | Light-Load/High-Speed Operation Load Wait Time                  | F332             |
|                              |                                  | Light-Load/High-Speed Operation Detection Time                  | F333             |

| Program Mode Menu Navigation |                             |                                                   |                  |
|------------------------------|-----------------------------|---------------------------------------------------|------------------|
| Primary Menu                 | Sub Menu                    | Parameter Name                                    | Parameter Number |
| <b>SPECIAL</b>               | <b>Crane/Hoist Settings</b> | Light-Load/High-Speed Heavy-Load Detection Time   | F334             |
|                              |                             | Switching Load Torque During Power Running        | F335             |
|                              |                             | Heavy-Load Torque During Power Running            | F336             |
|                              |                             | Heavy-Load Torque During Constant Power Running   | F337             |
|                              |                             | Switching Load Torque During Regeneration Braking | F338             |
|                              | <b>V/f 5-Point Setting</b>  | V/f 5-Point Setting Frequency 1                   | F190             |
|                              |                             | V/f 5-Point Setting Voltage 1                     | F191             |
|                              |                             | V/f 5-Point Setting Frequency 2                   | F192             |
|                              |                             | V/f 5-Point Setting Voltage 2                     | F193             |
|                              |                             | V/f 5-Point Setting Frequency 3                   | F194             |
|                              |                             | V/f 5-Point Setting Voltage 3                     | F195             |
|                              |                             | V/f 5-Point Setting Frequency 4                   | F196             |
|                              |                             | V/f 5-Point Setting Voltage 4                     | F197             |
|                              |                             | V/f 5-Point Setting Frequency 5                   | F198             |
|                              |                             | V/f 5-Point Setting Voltage 5                     | F199             |
|                              | <b>Frequency Control</b>    | Start Frequency                                   | F240             |
|                              |                             | Run Frequency                                     | F241             |
|                              |                             | Run Frequency Hysteresis                          | F242             |
|                              |                             | End Frequency                                     | F243             |
|                              | <b>Special Parameters</b>   | 0 Hz Dead Band Signal                             | F244             |
|                              |                             | 0 Hz Command Output                               | F255             |
|                              |                             | Exciting Strengthening Coefficient                | F415             |
|                              |                             | Annual Average Ambient Temperature                | F634             |
|                              |                             | Rush Current Suppression Relay Activation Time    | F635             |
|                              |                             | PTC 1 Thermal Selection                           | F637             |
|                              |                             | PTC 2 Thermal Selection                           | F638             |
|                              | <b>Jump Frequencies</b>     | Jump Frequency 1                                  | F270             |
|                              |                             | Jump Frequency 1 Bandwidth                        | F271             |
|                              |                             | Jump Frequency 2                                  | F272             |
|                              |                             | Jump Frequency 2 Bandwidth                        | F273             |

| Program Mode Menu Navigation |                                   |                                                             |                  |
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| Primary Menu                 | Sub Menu                          | Parameter Name                                              | Parameter Number |
| <b>SPECIAL</b>               | <b>Jump Frequencies</b>           | Jump Frequency 3                                            | F274             |
|                              |                                   | Jump Frequency 3 Bandwidth                                  | F275             |
|                              | <b>Operation Panel Parameters</b> | Operation Command Clear Selection With Standby Terminal Off | F719             |
|                              |                                   | Panel Stop Pattern                                          | F721             |
|                              |                                   | Panel Torque Command                                        | F725             |
|                              |                                   | Panel Tension Torque Bias                                   | F727             |
|                              |                                   | Panel Load Sharing Gain                                     | F728             |
|                              |                                   | Panel Override Multiplication Gain                          | F729             |
|                              |                                   | Panel Frequency Lockout                                     | F730             |
|                              |                                   | Panel Emergency Off Lockout                                 | F734             |
|                              |                                   | Panel Reset Lockout                                         | F735             |
|                              | <b>Traverse</b>                   | Traverse Selection                                          | F980             |
|                              |                                   | Traverse Acceleration Time                                  | F981             |
|                              |                                   | Traverse Deceleration Time                                  | F982             |
|                              |                                   | Traverse Step                                               | F983             |
|                              |                                   | Traverse Jump Step                                          | F984             |
| <b>MOTOR</b>                 | <b>Motor Set 2</b>                | Motor Set 2 Base Frequency                                  | F170             |
|                              |                                   | Motor Set 2 Base Frequency Voltage                          | F171             |
|                              |                                   | Motor Set 2 Manual Torque Boost                             | F172             |
|                              |                                   | Motor Set 2 Overload Protection Level                       | F173             |
|                              | <b>Motor Set 3</b>                | Motor Set 3 Base Frequency                                  | F174             |
|                              |                                   | Motor Set 3 Base Frequency Voltage                          | F175             |
|                              |                                   | Motor Set 3 Manual Torque Boost                             | F176             |
|                              |                                   | Motor Set 3 Overload Protection Level                       | F177             |
|                              | <b>Motor Set 4</b>                | Motor Set 4 Base Frequency                                  | F178             |
|                              |                                   | Motor Set 4 Base Frequency Voltage                          | F179             |
|                              |                                   | Motor Set #4 Manual Torque Boost                            | F180             |
|                              |                                   | Motor Set #4 Overload Protection Level                      | F181             |
|                              | <b>PM Motor</b>                   | PM Motor Constant 1 (D-Axis Inductance)                     | F498             |
|                              |                                   | PM Motor Constant 2 (Q-Axis Inductance)                     | F499             |

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| Primary Menu                 | Sub Menu                            | Parameter Name                                   | Parameter Number |
| <b>MOTOR</b>                 | <b>PM Motor</b>                     | Step-Out Detection-Current Level (For PM Motors) | F640             |
|                              |                                     | Step-Out Detection-Current Time (For PM Motors)  | F641             |
|                              | <b>Vector Motor Model</b>           | Autotune 1                                       | F400             |
|                              |                                     | Slip Frequency Gain                              | F401             |
|                              |                                     | Autotune 2                                       | F402             |
|                              |                                     | Motor Rated Capacity (Nameplate)                 | F405             |
|                              |                                     | Motor Rated Current (Nameplate)                  | F406             |
|                              |                                     | Motor Rated RPM (Nameplate)                      | F407             |
|                              |                                     | Base Frequency Voltage 1                         | F409             |
|                              |                                     | Motor Constant 1 (Torque Boost)                  | F410             |
|                              |                                     | Motor Constant 2 (No Load Current)               | F411             |
|                              |                                     | Motor Constant 3 (Leak Inductance)               | F412             |
|                              |                                     | Motor Constant 4 (Rated Slip)                    | F413             |
| <b>TORQUE</b>                | <b>Manual Torque Limit Settings</b> | Power Running Torque Limit 2 Level               | F444             |
|                              |                                     | Regenerative Braking Torque Limit 2 Level        | F445             |
|                              |                                     | Power Running Torque Limit 3 Level               | F446             |
|                              |                                     | Regenerative Braking Torque Limit 3 Level        | F447             |
|                              |                                     | Power Running Torque Limit 4 Level               | F448             |
|                              |                                     | Regenerative Braking Torque Limit 4 Level        | F449             |
|                              | <b>Setpoints</b>                    | V/I Input Point 1 Rate                           | F205             |
|                              |                                     | V/I Input Point 2 Rate                           | F206             |
|                              |                                     | RR Input Point 1 Rate                            | F214             |
|                              |                                     | RR Input Point 2 Rate                            | F215             |
|                              |                                     | RX Input Point 1 Rate                            | F220             |
|                              |                                     | RX Input Point 2 Rate                            | F221             |
|                              |                                     | RX2 Option (AI1) Input Point 1 Rate              | F226             |
|                              |                                     | RX2 Option (AI1) Input Point 2 Rate              | F227             |
|                              | <b>Torque Control</b>               | Braking Mode                                     | F341             |
|                              |                                     | Torque Bias Input                                | F342             |
|                              |                                     | Panel Torque Bias                                | F343             |
|                              |                                     | Panel Torque Gain                                | F344             |

| Program Mode Menu Navigation |                       |                                                        |                  |
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| Primary Menu                 | Sub Menu              | Parameter Name                                         | Parameter Number |
| TORQUE                       | Torque Control        | Release Time                                           | F345             |
|                              |                       | Creeping Frequency                                     | F346             |
|                              |                       | Creeping Time                                          | F347             |
|                              |                       | Braking Time Learning Function                         | F348             |
|                              |                       | Torque Command                                         | F420             |
|                              |                       | Tension Torque Bias Input (Torque Control)             | F423             |
|                              |                       | Load Sharing Gain Input                                | F424             |
|                              |                       | Forward Speed Limit Input                              | F425             |
|                              |                       | Forward Speed Limit Input Level                        | F426             |
|                              |                       | Reverse Speed Limit Input                              | F427             |
|                              |                       | Reverse Speed Limit Input Level                        | F428             |
|                              | Torque Limit Settings | Power Running Torque Limit 1                           | F440             |
|                              |                       | Power Running Torque Limit 1 Level                     | F441             |
|                              |                       | Regenerative Braking Torque Limit 1                    | F442             |
|                              |                       | Regenerative Braking Torque Limit 1 Level              | F443             |
|                              |                       | Acceleration/Deceleration Operation After Torque Limit | F451             |
|                              | Torque Speed Limiting | Speed Limit (Torque = 0) Center Value Reference        | F430             |
|                              |                       | Speed Limit (Torque = 0) Center Value                  | F431             |
|                              |                       | Speed Limit (Torque = 0) Band                          | F432             |
|                              |                       | Allow Specified Direction ONLY                         | F435             |
| FEEDBACK                     | Drooping Control      | Drooping Gain                                          | F320             |
|                              |                       | Speed at 0% Drooping Gain                              | F321             |
|                              |                       | Speed at F320 Drooping Gain                            | F322             |
|                              |                       | Drooping Insensitive Torque                            | F323             |
|                              |                       | Drooping Output Filter                                 | F324             |
|                              | Feedback Settings     | PID Control Switching                                  | F359             |
|                              |                       | PID Feedback Signal                                    | F360             |
|                              |                       | PID Feedback Delay Filter                              | F361             |
|                              |                       | PID Feedback Proportional Gain                         | F362             |
|                              |                       | PID Feedback Integral Gain                             | F363             |

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| Primary Menu                 | Sub Menu                     | Parameter Name                              | Parameter Number |
| <b>FEEDBACK</b>              | <b>Feedback Settings</b>     | PID Deviation Upper-Limit                   | F364             |
|                              |                              | PID Deviation Lower-Limit                   | F365             |
|                              |                              | PID Feedback Differential Gain              | F366             |
|                              |                              | Process Upper-Limit                         | F367             |
|                              |                              | Process Lower-Limit                         | F368             |
|                              |                              | PID Control Wait Time                       | F369             |
|                              |                              | PID Output Upper-Limit                      | F370             |
|                              |                              | PID Output Lower-Limit                      | F371             |
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|                              |                              | PG Disconnection Detection                  | F377             |
|                              |                              | Simple Positioning Completion Range         | F381             |
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|                              |                              | Load Moment of Inertia 2                    | F465             |
| <b>MY FUNCTION</b>           | <b>My Function Selection</b> | My Function Operating Mode                  | F977             |
|                              | <b>My Function Unit 1</b>    | Input Function Target 1                     | F900             |
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|                              |                              | Input Function Target 2                     | F902             |
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|                              |                              | Input Function Target 3                     | F904             |
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| Program Mode Menu Navigation |                           |                          |                  |
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|                              |                           | Input Function Command 1 | F907             |
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|                              |                           | Input Function Command 2 | F909             |
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|                              |                           | Output Function Assigned | F911             |
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|                              |                           | Input Function Command 1 | F913             |
|                              |                           | Input Function Target 2  | F914             |
|                              |                           | Input Function Command 2 | F915             |
|                              |                           | Input Function Target 3  | F916             |
|                              |                           | Output Function Assigned | F917             |
|                              | <b>My Function Unit 4</b> | Input Function Target 1  | F935             |
|                              |                           | Input Function Command 1 | F936             |
|                              |                           | Input Function Target 2  | F937             |
|                              |                           | Input Function Command 2 | F938             |
|                              |                           | Input Function Target 3  | F939             |
|                              |                           | Output Function Assigned | F940             |
|                              | <b>My Function Unit 5</b> | Input Function Target 1  | F941             |
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|                              |                           | Input Function Command 2 | F944             |
|                              |                           | Input Function Target 3  | F945             |
|                              |                           | Output Function Assigned | F946             |
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|                              |                           | Input Function Command 1 | F948             |
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|                              |                           | Input Function Target 3  | F951             |
|                              |                           | Output Function Assigned | F952             |

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| Primary Menu                 | Sub Menu                   | Parameter Name                     | Parameter Number |
| <b>MY FUNCTION</b>           | <b>My Function Unit 7</b>  | Input Function Target 1            | F953             |
|                              |                            | Input Function Command 1           | F954             |
|                              |                            | Input Function Target 2            | F955             |
|                              |                            | Input Function Command 2           | F956             |
|                              |                            | Input Function Target 3            | F957             |
|                              |                            | Output Function Assigned           | F958             |
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|                              |                            | My Function Percent Data 3         | F920             |
|                              |                            | My Function Percent Data 4         | F921             |
|                              |                            | My Function Percent Data 5         | F922             |
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|                              |                            | My Function Time Data 1            | F928             |
|                              |                            | My Function Time Data 2            | F929             |
|                              |                            | My Function Time Data 3            | F930             |
|                              |                            | My Function Time Data 4            | F931             |
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|                              |                            | Analog Function Assigned Object 21 | F964             |
|                              | <b>My Function Monitor</b> | Monitor Output Function 11         | F965             |
|                              |                            | Monitor Output Function Command 11 | F966             |

| Program Mode Menu Navigation |                                  |                                                        |                  |
|------------------------------|----------------------------------|--------------------------------------------------------|------------------|
| Primary Menu                 | Sub Menu                         | Parameter Name                                         | Parameter Number |
| <b>MY FUNCTION</b>           | <b>My Function Monitor</b>       | Monitor Output Function 21                             | F967             |
|                              |                                  | Monitor Output Function Command 21                     | F968             |
|                              |                                  | Monitor Output Function 31                             | F969             |
|                              |                                  | Monitor Output Function Command 31                     | F970             |
|                              |                                  | Monitor Output Function 41                             | F971             |
|                              |                                  | Monitor Output Function Command 41                     | F972             |
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|                              |                                  | Point 1 Setting                                        | F811             |
|                              |                                  | Point 1 Frequency                                      | F812             |
|                              |                                  | Point 2 Setting                                        | F813             |
|                              |                                  | Point 2 Frequency                                      | F814             |
|                              | <b>Communication Settings</b>    | RS485 2-Wire Baud Rate                                 | F800             |
|                              |                                  | RS485 2-Wire and 4-Wire Parity                         | F801             |
|                              |                                  | ASD Number                                             | F802             |
|                              |                                  | RS485 2-Wire and 4-Wire Communications Time-Out        | F803             |
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|                              |                                  | RS485 2-Wire ASD-to-ASD Communication                  | F806             |
|                              |                                  | RS485 2-Wire Protocol                                  | F807             |
|                              |                                  | RS485 4-Wire Baud Rate                                 | F820             |
|                              |                                  | RS485 Send Wait Time                                   | F825             |
|                              |                                  | RS485 4-Wire ASD-to-ASD Communication                  | F826             |
|                              |                                  | RS485 4-Wire Protocol (TSB/MODBUS)                     | F829             |
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|                              |                                  | Communication Option (DeviceNet/Profibus) Setting 3    | F832             |
|                              |                                  | Communication Option (DeviceNet/Profibus) Setting 4    | F833             |
|                              |                                  | Communication Option (DeviceNet/Profibus) Setting 5    | F834             |
|                              |                                  | Communication Option (DeviceNet/Profibus) Setting 6    | F835             |
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| Program Mode Menu Navigation |                        |                                                             |                  |
|------------------------------|------------------------|-------------------------------------------------------------|------------------|
| Primary Menu                 | Sub Menu               | Parameter Name                                              | Parameter Number |
| COMMUNICATIONS               | Communication Settings | Communication Option (DeviceNet/Profibus) Setting 8         | F841             |
|                              |                        | Communication Option (DeviceNet/Profibus) Setting 9         | F842             |
|                              |                        | Communication Option (DeviceNet/Profibus) Setting 10        | F843             |
|                              |                        | Communication Option (DeviceNet/Profibus) Setting 11        | F844             |
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|                              |                        | Disconnection Detection Extended Time                       | F850             |
|                              |                        | ASD Operation at Disconnection                              | F851             |
|                              |                        | Preset Speed Operation                                      | F852             |
|                              |                        | Communication Option Station Address Monitor                | F853             |
|                              |                        | Communication Option Speed Switch Monitor DeviceNet/CC-Link | F854             |
|                              |                        | Block Write Data 1                                          | F870             |
|                              |                        | Block Write Data 2                                          | F871             |
|                              |                        | Block Read Data 1                                           | F875             |
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|                              |                        | Block Read Data 3                                           | F877             |
|                              |                        | Block Read Data 4                                           | F878             |
|                              |                        | Block Read Data 5                                           | F879             |
|                              |                        | Free Notes                                                  | F880             |
|                              |                        | Network Option Reset Setting                                | F899             |
|                              | Ethernet Settings      | IP                                                          | N/A              |
|                              |                        | Sub Net                                                     |                  |
|                              |                        | Gateway                                                     |                  |
|                              |                        | DHCP Mode                                                   |                  |
|                              |                        | MAC ID                                                      |                  |
| PATTERN RUN                  | Operation Mode         | Preset Speed Operation Mode                                 | F560             |
|                              |                        | Preset Speed 1                                              | F561             |
|                              |                        | Direction                                                   |                  |
|                              |                        | Acc/Dec Group                                               |                  |

| Program Mode Menu Navigation |                |                       |                  |
|------------------------------|----------------|-----------------------|------------------|
| Primary Menu                 | Sub Menu       | Parameter Name        | Parameter Number |
| PATTERN RUN                  | Operation Mode | V/f Group             | F561             |
|                              |                | Torque Limit Group    |                  |
|                              |                | <b>Preset Speed 2</b> | F562             |
|                              |                | Direction             |                  |
|                              |                | Acc/Dec Group         |                  |
|                              |                | V/f Group             |                  |
|                              |                | Torque Limit Group    |                  |
|                              |                | <b>Preset Speed 3</b> | F563             |
|                              |                | Direction             |                  |
|                              |                | Acc/Dec Group         |                  |
|                              |                | V/f Group             |                  |
|                              |                | Torque Limit Group    |                  |
|                              |                | <b>Preset Speed 4</b> | F564             |
|                              |                | Direction             |                  |
|                              |                | Acc/Dec Group         |                  |
|                              |                | V/f Group             |                  |
|                              |                | Torque Limit Group    |                  |
|                              |                | <b>Preset Speed 5</b> | F565             |
|                              |                | Direction             |                  |
|                              |                | Acc/Dec Group         |                  |
|                              |                | V/f Group             |                  |
|                              |                | Torque Limit Group    |                  |
|                              |                | <b>Preset Speed 6</b> | F566             |
|                              |                | Direction             |                  |
|                              |                | Acc/Dec Group         |                  |
|                              |                | V/f Group             |                  |
|                              |                | Torque Limit Group    |                  |
|                              |                | <b>Preset Speed 7</b> | F567             |
|                              |                | Direction             |                  |
|                              |                | Acc/Dec Group         |                  |

| Program Mode Menu Navigation |                |                        |                  |
|------------------------------|----------------|------------------------|------------------|
| Primary Menu                 | Sub Menu       | Parameter Name         | Parameter Number |
| PATTERN RUN                  | Operation Mode | V/f Group              | F567             |
|                              |                | Torque Limit Group     |                  |
|                              |                | <b>Preset Speed 8</b>  | F568             |
|                              |                | Direction              |                  |
|                              |                | Acc/Dec Group          |                  |
|                              |                | V/f Group              |                  |
|                              |                | Torque Limit Group     | F569             |
|                              |                | <b>Preset Speed 9</b>  |                  |
|                              |                | Direction              |                  |
|                              |                | Acc/Dec Group          |                  |
|                              |                | V/f Group              | F570             |
|                              |                | Torque Limit Group     |                  |
|                              |                | <b>Preset Speed 10</b> |                  |
|                              |                | Direction              |                  |
|                              |                | Acc/Dec Group          | F571             |
|                              |                | V/f Group              |                  |
|                              |                | Torque Limit Group     |                  |
|                              |                | <b>Preset Speed 11</b> |                  |
|                              |                | Direction              | F572             |
|                              |                | Acc/Dec Group          |                  |
|                              |                | V/f Group              |                  |
|                              |                | Torque Limit Group     |                  |
|                              |                | <b>Preset Speed 12</b> | F573             |
|                              |                | Direction              |                  |
|                              |                | Acc/Dec Group          |                  |
|                              |                | V/f Group              |                  |
|                              |                | Torque Limit Group     | F573             |
|                              |                | <b>Preset Speed 13</b> |                  |
|                              |                | Direction              | F573             |
|                              |                | Acc/Dec Group          |                  |

| Program Mode Menu Navigation |                       |                         |                  |
|------------------------------|-----------------------|-------------------------|------------------|
| Primary Menu                 | Sub Menu              | Parameter Name          | Parameter Number |
| <b>PATTERN RUN</b>           | <b>Operation Mode</b> | V/f Group               | F573             |
|                              |                       | Torque Limit Group      |                  |
|                              |                       | <b>Preset Speed 14</b>  | F574             |
|                              |                       | Direction               |                  |
|                              |                       | Acc/Dec Group           |                  |
|                              |                       | V/f Group               |                  |
|                              |                       | Torque Limit Group      | F575             |
|                              |                       | <b>Preset Speed 15</b>  |                  |
|                              |                       | Direction               |                  |
|                              |                       | Acc/Dec Group           |                  |
|                              |                       | V/f Group               |                  |
|                              |                       | Torque Limit Group      |                  |
|                              | <b>Operation Time</b> | Speed 1 Operation Time  | F540             |
|                              |                       | Speed 2 Operation Time  | F541             |
|                              |                       | Speed 3 Operation Time  | F542             |
|                              |                       | Speed 4 Operation Time  | F543             |
|                              |                       | Speed 5 Operation Time  | F544             |
|                              |                       | Speed 6 Operation Time  | F545             |
|                              |                       | Speed 7 Operation Time  | F546             |
|                              |                       | Speed 8 Operation Time  | F547             |
|                              |                       | Speed 9 Operation Time  | F548             |
|                              |                       | Speed 10 Operation Time | F549             |
|                              |                       | Speed 11 Operation Time | F550             |
|                              |                       | Speed 12 Operation Time | F551             |
|                              |                       | Speed 13 Operation Time | F552             |
|                              |                       | Speed 14 Operation Time | F553             |
|                              |                       | Speed 15 Operation Time | F554             |
|                              | <b>Pattern Run</b>    | Pattern Operation       | F520             |
|                              |                       | Pattern Operation Mode  | F521             |
|                              |                       | Pattern 1 Repeat        | F522             |

| Program Mode Menu Navigation |                        |                             |                  |
|------------------------------|------------------------|-----------------------------|------------------|
| Primary Menu                 | Sub Menu               | Parameter Name              | Parameter Number |
| <b>PATTERN RUN</b>           | <b>Pattern Run</b>     | Pattern 2 Repeat            | F531             |
|                              | <b>Speeds</b>          | Pattern Group 1 Selection 1 | F523             |
|                              |                        | Pattern Group 1 Selection 2 | F524             |
|                              |                        | Pattern Group 1 Selection 3 | F525             |
|                              |                        | Pattern Group 1 Selection 4 | F526             |
|                              |                        | Pattern Group 1 Selection 5 | F527             |
|                              |                        | Pattern Group 1 Selection 6 | F528             |
|                              |                        | Pattern Group 1 Selection 7 | F529             |
|                              |                        | Pattern Group 1 Selection 8 | F530             |
|                              |                        | Pattern Group 2 Selection 1 | F532             |
|                              |                        | Pattern Group 2 Selection 2 | F533             |
|                              |                        | Pattern Group 2 Selection 3 | F534             |
|                              |                        | Pattern Group 2 Selection 4 | F535             |
|                              |                        | Pattern Group 2 Selection 5 | F536             |
|                              |                        | Pattern Group 2 Selection 6 | F537             |
|                              |                        | Pattern Group 2 Selection 7 | F538             |
|                              |                        | Pattern Group 2 Selection 8 | F539             |
| <b>PASSWORD AND LOCKOUT</b>  | <b>Enter Password</b>  |                             | N/A              |
|                              | <b>Change Password</b> | Enter New Password          | N/A              |
|                              | <b>Lockouts</b>        | Reset From Trip             | N/A              |
|                              |                        | Local/Remote                |                  |
|                              |                        | Run/Stop from EOI           |                  |
|                              |                        | Frequency Change From EOI   |                  |
|                              |                        | Monitor Screen              |                  |
|                              |                        | Parameter Access            |                  |
|                              |                        | Parameter Write             |                  |



# System Operation

## Initial Setup

Upon initial system power up, the **Startup Wizard** starts automatically. The **Startup Wizard** assists the user with the initial configuration of the input power settings and the output parameters of the **H9 ASD**.

The **Startup Wizard** may also be selected and run from the [Program](#) menu after the initial startup, if required.

The **Startup Wizard** queries the user to select one of the following items:

**Run Now?** ⇒ Continue on to item [1](#) below.

**Run Next Time?** ⇒ Go to [Program Mode](#).

**Manually Configure?** ⇒ Go to **Finish** screen and click **Finish**.

## Startup Wizard Parameters

Startup Wizard parameter settings may be viewed or changed. Change the parameter setting and click **Next**. Or click **Next** without making any changes to go to the next startup parameter.

See the section titled [Startup Wizard Parameter Requirements on pg. 59](#) for further information on the **Startup Wizard** parameters.

Click **Finish** to close the **Startup Wizard** when finished.

Startup Wizard parameters are listed below.

1. The [Voltage and Frequency Rating of the Motor](#) (Must make a selection to continue or click Finish).
2. The [Upper-Limit Frequency](#).
3. The [Lower-Limit Frequency](#).
4. The [Automatic Acceleration/Deceleration Setting](#).
5. The [Acceleration Time](#).
6. The [Deceleration Time](#).
7. The [Volts per Hertz Setting](#).
8. The [Motor Current Rating](#).
9. The [Motor RPM](#).
10. The [Command Source](#).
11. The [Frequency Reference Source](#).
12. The [Display Unit](#).
13. [Wizard: Finish](#).

# Startup Wizard Parameter Requirements

The **Startup Wizard** queries the user for information on the I/O signal parameters, control, and the EOI display settings of the ASD. The ASD may also be setup by directly accessing each of the startup settings via the [Program](#) menu or the associated **Direct Access Numbers** (see the *H9 ASD Installation and Operation Manual*).

Upon initial system power up, the **Startup Wizard** starts automatically. It may also be run from the [Program](#) menu after startup, if required. The user is queried to either **(1) Run Now**, **(2) Run Next Time**, or **(3) Manually Configure** the ASD.

Select **Run Now** to start the **Startup Wizard**. The wizard will assist the user with the configuration of the **H9 Adjustable Speed Drive** using the user-input screens below starting with the [Voltage and Frequency Rating of the Motor](#).

Select **Run Next Time** to return to the [Program](#) menu. The system will default to the **Startup Wizard** on the next power up.

Select **Manually Configure** to go to the **Finish** box. Click **Finish** to return the system to the **Frequency Command** screen.

## Voltage and Frequency Rating of the Motor

Motors are designed and manufactured to be operated within a specific voltage and frequency range. The voltage and frequency specifications for a given motor may be found on the nameplate of the motor. Highlight and click on the voltage and frequency of the motor being used.

## Upper-Limit Frequency

This parameter sets the highest frequency that the H9 will accept as a frequency command or frequency setpoint. The H9 may output frequencies higher than the **Upper-Limit Frequency** (but, lower than the **Maximum Frequency**) when operating in the **PID Control** mode, **Torque Control** mode, or the **Vector Control** modes (sensorless or feedback).

## Lower-Limit Frequency

This parameter sets the lowest frequency that the H9 will accept as a frequency command or frequency setpoint. The H9 will output frequencies lower than the **Lower-Limit Frequency** when accelerating to the lower-limit or decelerating to a stop. Frequencies below the **Lower-Limit** may be output when operating in the **PID Control** mode, **Torque Control** mode, or the **Vector Control** modes (sensorless or feedback).

## Automatic Acceleration/Deceleration

When **Automatic ACC/DEC** is chosen, the H9 adjusts the acceleration and deceleration rates according to the applied load. The minimum accel/decel time may be set using **F508**. The motor and the load must be connected prior to selecting **Automatic Accel/Decel**.

Select **Manual** to allow the settings of **F009** and **F010** to control the accel/decel, respectively. The acceleration and deceleration times range from 12.5% to 800% of the programmed values for the active acceleration time.

Select **Automatic ACC Only** to allow for the acceleration rate to be controlled automatically only.

## Acceleration Time

This parameter specifies the time in seconds for the output of the ASD to go from 0.0 Hz to the **Maximum Frequency** for the **1 Acceleration** profile. The **Accel/Decel Pattern** may be set using **F502**.

## Deceleration Time

This parameter specifies the time in seconds for the output of the ASD to go from the **Maximum Frequency** to 0.0 Hz for the **1 Deceleration** profile. The **Accel/Decel Pattern** may be set using **F502**.

## Volts per Hertz Setting

This function establishes the relationship between the output frequency and the output voltage of the ASD.

Settings:

- Constant Torque
- Voltage Decrease Curve
- Automatic Torque Boost
- Sensorless Vector Control (Speed)
- Sensorless Vector Control (Speed/Torque Switching)
- V/f 5-point Curve (Go to F190 to Configure the V/f 5-Point Settings)
- PM Drive (Permanent Magnet)
- PG Feedback Vector Control (Speed)
- PG Feedback Vector Control (Speed/Torque Switching)

## Motor Current Rating

This parameter allows the user to input the full-load amperage (FLA) of the motor. This value is found on the nameplate of the motor and is used by the ASD to determine the **Thermal Overload Protection** setting for the motor.

## Motor RPM

This parameter is used to input the (nameplated) rated speed of the motor.

## Command Source

This selection allows the user to establish the source of the **Run** commands. Run commands are **Run**, **Stop**, **Jog**, etc.

Settings:

- Use Terminal Block
- Use EOI Keypad
- Use RS485
- Use Communication Option Board

## Frequency Reference Source

This selection allows the user to establish the source of the **Frequency** command.

Settings:

Use V/I  
Use RR  
Use RX  
EOI Keypad  
RS485  
Communication Option Board  
RX2 Option (AI1)  
Option V/I  
UP/DOWN Frequency  
Pulse Input (Option)  
Pulse Input (Motor CPU)  
Binary/BCD Input (Option)

## Display Unit

This parameter sets the unit of measurement for current and voltage values displayed on the EOI.

## Wizard: Finish

This is the final screen of the **Startup Wizard**. The basic parameters of the ASD have been set. Click **Finish** to return to the **Program** mode. Additional application-specific programming may be required.

# Operation (Local)

**Note:** See the section titled *EOI Features on pg. 26* for information on **Remote** operation.

To turn the motor on perform the following:

1. Connect the **CC** terminal to the **ST** terminal.
2. Press the **Mode** key until the **Frequency Command** screen is displayed. Press the **Local/Remote** key to enter the **Local** mode (green **Local** LED illuminates).
3. Turn the **Rotary Encoder** clockwise until the desired **Frequency Command** value is displayed in the **SET** field of the LCD screen.
4. Press the **Run** key and the motor runs at the **Frequency Command** value.

Frequency Command Screen

|                        |         |                                                                                       |
|------------------------|---------|---------------------------------------------------------------------------------------|
| 0 ————— 100%           |         |                                                                                       |
| SET:                   | 0.00 Hz |  |
| DC Voltage:            |         | 0.00%                                                                                 |
| Output Current:        |         | 0.00%                                                                                 |
| F R ST RES S1 S2 S3 S4 |         |                                                                                       |
| OUT1 OUT2 FL           |         |                                                                                       |

**Note:** The speed of the motor may be changed while the motor is running by using the **Rotary Encoder** to change the **Frequency Command** value.

5. Press the **Stop-Reset** key to stop the motor.

# Default Setting Changes

To change a default parameter setting, go to the root level of the **Program** menu. Turn the **Rotary Encoder** until the desired parameter group is within the cursor block. Press the **Rotary Encoder** to select an item or to access a subgroup (repeat if required until reaching the parameter to be changed).

Press the **Rotary Encoder** to enter the **Edit** mode and the value/setting takes on the reverse video format (dark background/light text). Turn the **Rotary Encoder** to change the parameter value/setting.

Press the **Rotary Encoder** while the parameter setting is in the reverse video mode to accept the new setting or press the **ESC** key while the new parameter setting is in the reverse video mode to exit the menu without saving the change.

For a complete listing of the **Program** mode menu selections, see the section titled **Program Mode Menu Navigation on pg. 34**. **Program** menu items are listed and mapped for convenience. The **Direct Access Numbers** are listed where applicable.

The default settings may also be changed by entering the **Parameter Number** of the setting to be changed at the **Direct Access** menu (Program ⇒ Direct Access ⇒ *Applicable Parameter Number*). A listing of the **Direct Access Numbers** and a description of the associated parameter may be found in the *H9 Adjustable Speed Drive Installation and Operation Manual*.

A listing of all parameters that have been changed from the default setting may be viewed sequentially by accessing the **Changed From Default** screen (Program ⇒ Utilities ⇒ **Changed From Default**).

The **Changed From Default** feature allows the user to quickly access the parameters that are different from the factory default settings or the post-reset settings. Once the **Changed From Default** screen is displayed, the system scrolls through all of the system parameters automatically and halts once reaching a changed parameter.

Once stopped at a changed parameter, the **Rotary Encoder** may be clicked once clockwise to continue scrolling forward or clicked once counterclockwise to begin scrolling in reverse. With each click of the **Rotary Encoder** from a stop, the system scrolls through the parameters and stops at the next parameter that has been changed.

Press the **Rotary Encoder** while stopped at a changed parameter to display the settings of the changed parameter. Press the **Rotary Encoder** to enter the **Edit** mode — the parameter value/setting takes on the reverse video format (dark background/light text). Turn the **Rotary Encoder** to change the parameter setting.

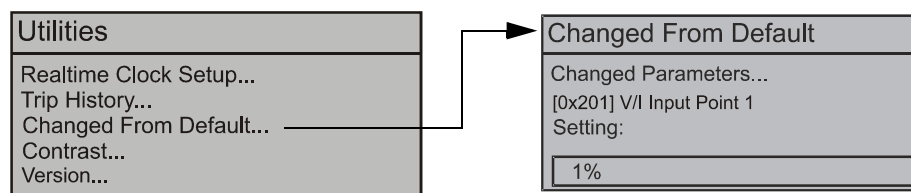
Press the **ESC** key while the setting is in the reverse video format to exit the **Edit** mode without saving the change and to resume the **Changed From Default** search. Or press the **Rotary Encoder** while the setting is in the reverse video format to save the change. Press **ESC** to return to the **Changed From Default** search.

Pressing **ESC** while the system is performing a **Changed From Default** search terminates the search. Pressing **ESC** when finished searching (or halted at a changed parameter) takes the menu back one level.

**Note:** *Communications setting changes will require that the power be removed and then re-applied for the changes to take affect.*

**Note:** *Parameter F201 was changed to create the example shown in Figure 26.*

Figure 26. Changed From Default Screen.



# Save User Settings

A profile of an existing setup may be saved and re-applied when required by using the **Save User Setup** feature. This function is carried out via Program ⇒ Utilities ⇒ Type Reset ⇒ **Save User Settings**.

With the initial setup saved, troubleshooting and diagnostics may be performed and the starting setup may be re-applied when finished via Program ⇒ Utilities ⇒ Type Reset ⇒ **Restore User Settings**.

**Note:** *EOI settings are not stored or restored using the **Save User Settings** or **Restore User Settings**, respectively (i.e., contrast setting, voltage/current units, display gradient characteristics, etc.). See the section titled [Battery Backup on pg. 24](#) for more information on stored EOI settings.*

# Alarms, Trips, and Troubleshooting

## Alarms and Trips

This section lists the available user-notification codes of the EOI display and provides information that assists the user in the event that a **Fault** is incurred. The **User Notification** codes are displayed as an indication that a system function or system condition is active (i.e., ATN, DB, and DBON). The code is displayed on the EOI for the duration of the activation.

If a user setting or an H9 ASD parameter has been exceeded, or if a data transfer function produces an unexpected result, a condition that is referred to as a **Fault** is incurred.

An **Alarm** is an indication that a **Fault** is imminent if existing operating conditions continue unchanged. An **Alarm** may be associated with an output terminal to notify the operator of the condition remotely, close a contact, or engage a brake. At the least, an **Alarm** will cause an alarm code to appear on the EOI display. [Table 4](#) lists the **Alarm** codes that may be displayed during operation of the H9 ASD.

In the event that the condition that caused the **Alarm** does not return to its normal operating level within a specified time, the ASD **Faults** and a **Trip** is incurred (**Fault** and **Trip** are sometimes used interchangeably).

A **Trip** is a safety feature (the result of a **Fault**) that disables the H9 ASD system and removes the 3-phase power to the motor in the event that a subsystem of the ASD is malfunctioning, or one or more of the variables listed below exceeds its normal range (time and/or magnitude).

- Current,
- Voltage,
- Speed,
- Temperature,
- Torque, or
- Load.

See [Table 5 on pg. 68](#) for a listing of the potential **Trips** and the associated probable causes.

The operating conditions at the time of the trip may be used to help determine the cause of the trip. Listed below are operating conditions that may be used to assist the operator in correcting the problem or that the H9 ASD operator should be prepared to discuss when contacting the TIC Customer Support Center for assistance.

- What trip information is displayed?
- Is this a new installation?
- Has the system ever worked properly and what are the recent modifications (if any)?
- What is the ASD and Motor size?
- What is the CPU version and revision level?
- What is the EOI version?
- Does the ASD trip when accelerating, running, decelerating, or when not running?
- Does the ASD reach the commanded frequency?
- Does the ASD trip without the motor attached?
- Does ASD trip with an unloaded motor?

# User Notification Codes

The **User Notification** codes appear in the top right corner of the **Frequency Command** screen while the associated function is active.

**User Notification** codes notify the user of active functions that are usually only momentary under normal conditions and are active for the duration of activation only. User notification events are not error conditions and only convey active system functions to the user.

Table 3. User Notification Codes.

| LED         | Function        | Description                                                                                                                                                                                         |
|-------------|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Atn</b>  | Autotune active | <b>Atn</b> indicates that the <b>Autotune</b> function is active.                                                                                                                                   |
| <b>dbOn</b> | DC Braking      | This code conveys the <b>DC Injection</b> function being carried out. The display shows <b>db</b> when braking and shows <b>dbOn</b> when the motor shaft stationary function is being carried out. |



# Alarms

[Table 4](#) lists the alarm codes that may be displayed during operation of the H9 ASD. Each alarm code listed is accompanied by a description and a possible cause. In the event that the source of the malfunction cannot be determined, contact your TIC Sales Representative for further information on the condition and for an appropriate course of action.

The **Alarms** are listed in the top-down order that they are checked for activation. Only the first to be detected will be displayed on the **Frequency Command** screen.

Table 4. H9 ASD Alarms.

| LED Screen                 | LCD Screen         | Description                                                                           | Possible Cause/Troubleshooting                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------------------|--------------------|---------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CM1</b>                 | Comm1 Error        | Internal communications error.                                                        | <ul style="list-style-type: none"> <li>Improperly programmed ASD.</li> <li>Improper communications settings.</li> <li>Improperly connected cables.</li> </ul>                                                                                                                                                                                                                                                                                                                                                           |
| <b>CM2</b>                 | Comm2 Error        | External communications error.                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>E</b>                   | Emergency Off      | Output signal from the ASD is terminated and a brake may be applied if so configured. | <ul style="list-style-type: none"> <li>Stop/Reset pressed twice at the EOI.</li> <li>EOFF command received remotely.</li> <li>ASD reset required.</li> </ul>                                                                                                                                                                                                                                                                                                                                                            |
| <b>MOFF</b>                | Main Under-Voltage | Under-voltage condition at the 3-phase AC input to the ASD.                           | <ul style="list-style-type: none"> <li>Low 3-phase commercial voltage.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>OC</b>                  | Over-Current       | ASD output current greater than <b>F601</b> setting.                                  | <ul style="list-style-type: none"> <li>Defective IGBT (U, V, or W).</li> <li>ASD output to the motor is connected incorrectly.</li> <li>ASD output phase-to-phase short.</li> <li>The ASD is starting into a spinning motor.</li> <li>Motor/machine jammed.</li> <li>Mechanical brake engaged while the ASD is starting or while running.</li> <li>Accel/Decel time is too short.</li> <li>Voltage Boost setting is too high.</li> <li>Load fluctuations.</li> <li>ASD operating at an elevated temperature.</li> </ul> |
| <b>*OH</b>                 | Overheat           | ASD ambient temperature excessive.                                                    | <ul style="list-style-type: none"> <li>ASD is operating at an elevated temperature.</li> <li>ASD is too close to heat-generating equipment.</li> <li>Cooling fan vent is obstructed (see <a href="#">Mounting the ASD on pg. 11</a>).</li> <li>Cooling fan is inoperative.</li> <li>Internal thermistor is disconnected.</li> </ul>                                                                                                                                                                                     |
| <b>OJ</b>                  | Timer              | Run-time counter exceeded.                                                            | <ul style="list-style-type: none"> <li><b>Type Reset</b> required; select <b>Clear run timer</b>.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                            |
| * Reset ignored if active. |                    |                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

| LED Screen                 | LCD Screen            | Description                                                                                                                                                                                              | Possible Cause/Troubleshooting                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|----------------------------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>*OLI</b>                | ASD Overload          | Load requirement in excess of the capability of the ASD.                                                                                                                                                 | <ul style="list-style-type: none"> <li>The carrier frequency is too high.</li> <li>An excessive load.</li> <li>Acceleration time is too short.</li> <li>DC damping rate is set too high.</li> <li>The motor is starting into a spinning load after a momentary power failure.</li> <li>The ASD is improperly matched to the application.</li> </ul>                                                                                                                                                                                                                              |
| <b>OLM</b>                 | Motor Overload        | Load requirement in excess of the capability of the motor.                                                                                                                                               | <ul style="list-style-type: none"> <li>V/f parameter improperly set.</li> <li>Motor is locked.</li> <li>Continuous operation at low speed.</li> <li>The load is in excess of what the motor can deliver.</li> </ul>                                                                                                                                                                                                                                                                                                                                                              |
| <b>*OLR</b>                | Resistor Overload     | Excessive current at the <b>Dynamic Braking Resistor</b> .                                                                                                                                               | <ul style="list-style-type: none"> <li>Deceleration time is too short.</li> <li>DBR configuration improperly set.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>*OP</b>                 | Over-Voltage          | DC bus voltage exceeds specifications.                                                                                                                                                                   | <ul style="list-style-type: none"> <li>ASD attempting to start into a spinning motor after a momentary power loss.</li> <li>Incoming commercial power is above the specified range.</li> <li>Decel time is too short.</li> <li>Voltage spikes at the 3-phase input; install inductive filter.</li> <li>DBR required.</li> <li>DBR resistance value is too high.</li> <li>DBR function is turned off.</li> <li>Over-Voltage Stall feature is turned off.</li> <li>System is regenerating.</li> <li>Load instability.</li> <li>Disable the Ridethrough function (F302).</li> </ul> |
| <b>OT</b>                  | Over-Torque           | Torque requirement is in excess of the setting of <b>F616</b> or <b>F617</b> for a time longer than the setting of <b>F618</b> .                                                                         | <ul style="list-style-type: none"> <li>ASD is not correctly matched to the application.</li> <li><b>F616</b> or <b>F617</b> setting is too low.</li> <li>Obstructed load.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>*POFF</b>               | Control Under-Voltage | Under-voltage condition at the 5, 15, or the 24 VDC supply.                                                                                                                                              | <ul style="list-style-type: none"> <li>Defective Control board.</li> <li>Excessive load on power supply.</li> <li>Low input voltage.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>PtSt</b>                | Reference Point       | Two speed-reference frequency setpoint values are too close to each other.                                                                                                                               | <ul style="list-style-type: none"> <li>Two speed reference frequency setpoints are too close to each other (increase the difference).</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>UC</b>                  | Under-Current         | With the <b>Low-Current Trip (F610)</b> parameter enabled, the output current of the ASD is below the level defined at <b>F611</b> and remains there for a time longer than the setting of <b>F612</b> . | <ul style="list-style-type: none"> <li>Output current too low.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| * Reset ignored if active. |                       |                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

# Trips/Faults

A **Trip** is an H9 ASD response to a **Fault** (though **Fault** and **Trip** are sometimes used interchangeably). A **Trip** is a safety feature that disables the ASD system in the event that a subsystem of the ASD is malfunctioning or a parameter setting has been exceeded.

Listed in [Table 5](#) are the **Faults** that may result in a **Trip** and the possible causes. When a **Trip** is incurred the system displays the **Fault** screen. The **Fault** screen identifies the active **Fault**.

Table 5. H9 ASD Fault Listing.

| LED Screen  | LCD Screen                                      | Possible Causes                                                                                                                                                                                                                                                                                                                          |
|-------------|-------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>E</b>    | Emergency Off                                   | <ul style="list-style-type: none"> <li>Emergency Off command received via EOI or remotely.</li> </ul>                                                                                                                                                                                                                                    |
| <b>E-10</b> | Sink/Source Setting Error                       | <ul style="list-style-type: none"> <li>Improperly positioned <b>Sink/Source</b> jumper on the Terminal board or on an option device (see J100 at the Terminal PCB of the ASD).</li> <li><b>Sink/Source</b> configuration is incorrect.</li> </ul>                                                                                        |
| <b>E-11</b> | Brake Sequence Response Error                   | <ul style="list-style-type: none"> <li><b>F630</b> is set to a non-zero value.</li> <li>Braking sequence discrete input and output terminals are not setup properly.</li> </ul>                                                                                                                                                          |
| <b>E-12</b> | Encoder Signal-Loss Error                       | <ul style="list-style-type: none"> <li>ASD is configured to receive a signal from a shaft-mounted encoder and no signal is being received while running.</li> <li>Disconnection at the Encoder circuit.</li> <li>Motor is stopped and is generating torque via torque limit control.</li> <li>ASD is not configured properly.</li> </ul> |
| <b>E-13</b> | Speed Error                                     | <ul style="list-style-type: none"> <li>Result of a motor speed that is greater than the commanded speed when using an encoder for speed control.</li> <li>Improper encoder connection or setup information.</li> <li>Defective encoder.</li> </ul>                                                                                       |
| <b>E-17</b> | Key Failure                                     | <ul style="list-style-type: none"> <li>Same key input for 20 seconds or more.</li> </ul>                                                                                                                                                                                                                                                 |
| <b>E-18</b> | Analog (Terminal) Input Loss                    | <ul style="list-style-type: none"> <li>V/I signal loss.</li> <li>Terminal Board failure.</li> <li>P24 over-current condition.</li> <li><b>F633</b> setting is too high.</li> </ul>                                                                                                                                                       |
| <b>E-19</b> | CPU Communication Error                         | <ul style="list-style-type: none"> <li>CPU data Transmit/Receive error.</li> </ul>                                                                                                                                                                                                                                                       |
| <b>E-20</b> | V/f Control Error                               | <ul style="list-style-type: none"> <li>Torque processing error.</li> <li>Make service call.</li> </ul>                                                                                                                                                                                                                                   |
| <b>E-21</b> | CPU Processing Error                            | <ul style="list-style-type: none"> <li>Software processed incorrectly.</li> <li>Make service call.</li> </ul>                                                                                                                                                                                                                            |
| <b>E-22</b> | Logic Input Voltage Error                       | <ul style="list-style-type: none"> <li>Incorrect voltage applied to the discrete input terminals.</li> </ul>                                                                                                                                                                                                                             |
| <b>E-23</b> | Optional Expansion Input Terminal Board 1 Error | <ul style="list-style-type: none"> <li>Optional Expansion Input Terminal Board 1 is defective.</li> </ul>                                                                                                                                                                                                                                |
| <b>E-24</b> | Optional Expansion Input Terminal Board 2 Error | <ul style="list-style-type: none"> <li>Optional Expansion Input Terminal Board 2 is defective.</li> </ul>                                                                                                                                                                                                                                |

| LED Screen       | LCD Screen                       | Possible Causes                                                                                                                                                                                                                                       |
|------------------|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>E-25</b>      | Stop Positioning Retention Error | <ul style="list-style-type: none"> <li>• Load movement while stopped.</li> <li>• <b>F381</b> setting is too low.</li> <li>• Encoder malfunction.</li> <li>• Creep speed is too high.</li> </ul>                                                       |
| <b>E-26</b>      | CPU2 Fault                       | <ul style="list-style-type: none"> <li>• CPU malfunction.</li> <li>• Control board malfunction.</li> </ul>                                                                                                                                            |
| <b>E-50/E-51</b> | Sink/Source Setting Error        | <ul style="list-style-type: none"> <li>• Improperly positioned <b>Sink/Source</b> jumper on the Terminal board or on an option device (see J100 at the Terminal PCB of the ASD).</li> <li>• <b>Sink/Source</b> configuration is incorrect.</li> </ul> |
| <b>EEP1</b>      | EEPROM Fault                     | <ul style="list-style-type: none"> <li>• EEPROM write malfunction.</li> <li>• Make a service call.</li> </ul>                                                                                                                                         |
| <b>EEP2/EEP3</b> | EEPROM Read Error                | <ul style="list-style-type: none"> <li>• EEPROM read malfunction.</li> <li>• Make a service call.</li> </ul>                                                                                                                                          |
| <b>EF1/EF2</b>   | (Earth) Ground Fault             | <ul style="list-style-type: none"> <li>• Ground fault at the motor.</li> <li>• Ground fault at the output of the ASD.</li> <li>• Current leakage to <b>Earth Ground</b>.</li> </ul>                                                                   |
| <b>EPHI</b>      | Input Phase Failure              | <ul style="list-style-type: none"> <li>• 3-phase input to the ASD is low or missing at the R, S, or T input terminals.</li> </ul>                                                                                                                     |
| <b>EPHO</b>      | Output Phase Failure             | <ul style="list-style-type: none"> <li>• 3-phase output from the ASD is low or missing at the U, V, or W output terminals or at the input to the motor.</li> </ul>                                                                                    |
| <b>ERR2</b>      | RAM Fault                        | <ul style="list-style-type: none"> <li>• Internal RAM malfunction.</li> <li>• Make a service call.</li> </ul>                                                                                                                                         |
| <b>ERR3</b>      | ROM Fault                        | <ul style="list-style-type: none"> <li>• Internal ROM malfunction.</li> <li>• Make a service call.</li> </ul>                                                                                                                                         |
| <b>ERR4</b>      | CPU Fault                        | <ul style="list-style-type: none"> <li>• CPU malfunction.</li> <li>• Control board malfunction.</li> <li>• Make a service call.</li> </ul>                                                                                                            |
| <b>ERR5</b>      | Communication Error              | <ul style="list-style-type: none"> <li>• Communication time out error.</li> <li>• Communication malfunction.</li> <li>• Improper or loose connection.</li> <li>• Improper system settings.</li> </ul>                                                 |
| <b>ERR6</b>      | Gate Array Fault                 | <ul style="list-style-type: none"> <li>• Main Gate Array is defective.</li> </ul>                                                                                                                                                                     |
| <b>ERR7</b>      | Low -Current                     | <ul style="list-style-type: none"> <li>• Improper Low- Current detection level settings at <b>F609 – F612</b>.</li> </ul>                                                                                                                             |
| <b>ERR8</b>      | Option Device Fault              | <ul style="list-style-type: none"> <li>• Check installation, connections, and option device manual.</li> </ul>                                                                                                                                        |
| <b>ERR9</b>      | Flash Memory Fault               | <ul style="list-style-type: none"> <li>• Flash memory malfunction.</li> <li>• Make a service call.</li> </ul>                                                                                                                                         |

| LED Screen  | LCD Screen                       | Possible Causes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>ETN</b>  | Autotune Error                   | <ul style="list-style-type: none"> <li>• <b>Autotune</b> readings that are significantly inconsistent with the configuration information.</li> <li>• A non-3-phase motor is being used.</li> <li>• Incorrect settings at <b>F400</b> or <b>F413</b>.</li> <li>• Using a motor that has a significantly smaller rating than the ASD.</li> <li>• ASD output cabling is too small, too long, or is being housed in a cable tray with other cables that are producing an interfering EMF.</li> <li>• Motor is running during the <b>Autotune</b> function.</li> </ul>                                                                                                                                                                     |
| <b>ETN1</b> |                                  | <ul style="list-style-type: none"> <li>• <b>F402</b> adjustment required (Motor temperature is too high).</li> <li>• <b>F410</b> adjustment required (Motor Constant 1 improperly set).</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>ETN2</b> |                                  | <ul style="list-style-type: none"> <li>• <b>F412</b> adjustment required (Motor Constant 3 improperly set).</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>ETN3</b> |                                  | <ul style="list-style-type: none"> <li>• Autotune setting <b>F400</b> is set to Auto Calculation and there is a problem with the Motor Constant readings.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>ETYP</b> | Typeform Error                   | <ul style="list-style-type: none"> <li>• Firmware information (typeform) loaded into the <b>Gate Driver</b> board is inconsistent with the device in which the firmware is being used.</li> <li>• The <b>Gate Driver</b> board has been replaced.</li> <li>• The <b>Gate Driver</b> board is defective.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>None</b> | No Errors                        | <ul style="list-style-type: none"> <li>• No active faults.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>OC1</b>  | Over-Current During Acceleration | <ul style="list-style-type: none"> <li>• Improper V/f setting.</li> <li>• Restart from a momentary power outage.</li> <li>• The ASD is starting into a rotating motor.</li> <li>• ASD/Motor not properly matched.</li> <li>• Phase-to-phase short (<b>U</b>, <b>V</b>, or <b>W</b>).</li> <li>• <b>Accel</b> time too short.</li> <li>• <b>Voltage Boost</b> setting is too high.</li> <li>• Motor/machine jammed.</li> <li>• Mechanical brake engaged while the ASD is running.</li> <li>• ASD current exceeds 340% of the rated FLA on ASDs that are 100 HP or less during acceleration. On ASDs that are greater than 100 HP, this fault occurs when the ASD current exceeds 320% of the rated FLA during acceleration.</li> </ul> |
| <b>OC1P</b> | Overheat During Acceleration     | <ul style="list-style-type: none"> <li>• Cooling fan inoperative.</li> <li>• Ventilation openings are obstructed.</li> <li>• Internal thermistor is disconnected.</li> <li>• Acceleration time is too short.</li> <li>• Improper V/f setting.</li> <li>• ASD or the motor is improperly matched to the application.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                        |

| LED Screen         | LCD Screen                            | Possible Causes                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------|---------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>OC2</b>         | Over-Current During Deceleration      | <ul style="list-style-type: none"> <li>• Phase-to-phase short (U, V, or W).</li> <li>• Deceleration time is too short.</li> <li>• Motor/machine jammed.</li> <li>• Mechanical brake engaged while the ASD is running.</li> <li>• ASD current exceeds 340% of the rated FLA on ASDs that are 100 HP or less during deceleration. On ASDs that are greater than 100 HP, it occurs when the ASD current exceeds 320% of the rated FLA during deceleration.</li> </ul> |
| <b>OC2P</b>        | Overheat During Deceleration          | <ul style="list-style-type: none"> <li>• Cooling fan inoperative.</li> <li>• Ventilation openings are obstructed.</li> <li>• Internal thermistor is disconnected.</li> <li>• Deceleration time is too short.</li> <li>• DC Injection current is too high.</li> <li>• ASD or the motor is improperly matched to the application.</li> </ul>                                                                                                                         |
| <b>OC3</b>         | Over-Current During Run               | <ul style="list-style-type: none"> <li>• Load fluctuations.</li> <li>• ASD is operating at an elevated temperature.</li> <li>• ASD current exceeds 340% of the rated FLA on ASDs that are 100 HP or less during a fixed-speed run or if during a fixed-speed run the ASD overheats. On ASDs that are greater than 100 HP, it occurs when the ASD current exceeds 320% of the rated FLA on a fixed-speed run.</li> </ul>                                            |
| <b>OC3P</b>        | Overheat During Run                   | <ul style="list-style-type: none"> <li>• Cooling fan inoperative.</li> <li>• Ventilation openings are obstructed.</li> <li>• Internal thermistor is disconnected.</li> <li>• Improper V/f setting.</li> <li>• ASD or the motor is improperly matched to the application.</li> </ul>                                                                                                                                                                                |
| <b>OCA1 or OCL</b> | U-Phase Over-Current                  | <ul style="list-style-type: none"> <li>• Low impedance at the U lead of the ASD output.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                 |
| <b>OCA2 or OCL</b> | V-Phase Over-Current                  | <ul style="list-style-type: none"> <li>• Low impedance at the V lead of the ASD output.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                 |
| <b>OCA3 or OCL</b> | W-Phase Over-Current                  | <ul style="list-style-type: none"> <li>• Low impedance at the W lead of the ASD output.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                 |
| <b>OCR</b>         | Dynamic Braking Resistor Over-Current | <ul style="list-style-type: none"> <li>• ASD inability to discharge the bus voltage during regeneration.</li> <li>• No dynamic braking resistor (DBR) installed.</li> <li>• Deceleration time is too short.</li> <li>• Improper DBR setup information.</li> <li>• Defective IGBT7 (or IGBT7 ckt.).</li> <li>• 3-phase input voltage is above specification.</li> </ul>                                                                                             |
| <b>OH</b>          | Overheat                              | <ul style="list-style-type: none"> <li>• Cooling fan inoperative.</li> <li>• Ventilation openings are obstructed.</li> <li>• Internal thermistor is disconnected.</li> </ul>                                                                                                                                                                                                                                                                                       |
| <b>OH2</b>         | External Overheat                     | <ul style="list-style-type: none"> <li>• Excessive-heat signature received at the <b>TB3 – TH1(+)</b> and <b>TH1(-)</b> terminals. See <b>F637</b> for setup information.</li> </ul>                                                                                                                                                                                                                                                                               |

| LED Screen  | LCD Screen                        | Possible Causes                                                                                                                                                                                                                                                                                 |
|-------------|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>OL1</b>  | ASD Overload                      | <ul style="list-style-type: none"> <li>Acceleration time is too short.</li> <li>DC Injection current is too high.</li> <li>Improper V/f setting.</li> <li>Motor running during restart.</li> <li>ASD or the motor is improperly matched to the application.</li> </ul>                          |
| <b>OL2</b>  | Motor Overload                    | <ul style="list-style-type: none"> <li>Improper V/f setting.</li> <li>Motor is locked.</li> <li>Continuous operation at low speed.</li> <li>Load requirement exceeds ability of the motor.</li> <li>Startup frequency setting adjustment required.</li> </ul>                                   |
| <b>OLR</b>  | Dynamic Braking Resistor Overload | <ul style="list-style-type: none"> <li>Deceleration time is too short.</li> <li>DBR setting adjustment required.</li> <li>Over-Voltage Stall setting adjustment required.</li> </ul>                                                                                                            |
| <b>OP1</b>  | Over-Voltage During Acceleration  | <ul style="list-style-type: none"> <li>Motor running during restart.</li> </ul>                                                                                                                                                                                                                 |
| <b>OP2</b>  | Over-Voltage During Deceleration  | <ul style="list-style-type: none"> <li>Deceleration time is too short.</li> <li>DBR value is too high.</li> <li>DBR required (DBR setup required).</li> <li>Stall protection is disabled.</li> <li>3-phase input voltage is out of specification.</li> <li>Input reactance required.</li> </ul> |
| <b>OP3</b>  | Over-Voltage During Run           | <ul style="list-style-type: none"> <li>Load fluctuations.</li> <li>3-Phase input voltage out of specification.</li> <li>DBR required (DBR setup required).</li> </ul>                                                                                                                           |
| <b>OT</b>   | Over-Torque                       | <ul style="list-style-type: none"> <li>A torque requirement by the load in excess of the setting of <b>F616</b> or <b>F617</b> for a time longer than the setting of <b>F618</b>.</li> <li>The ASD is improperly matched to the application.</li> <li>The load is obstructed.</li> </ul>        |
| <b>SOUT</b> | Step-Out<br>(for PM Motor Only)   | <ul style="list-style-type: none"> <li>Motor shaft is locked.</li> <li>Output phase is open.</li> <li>Operating a reciprocating load.</li> </ul>                                                                                                                                                |
| <b>UP1</b>  | Main Power Under-Voltage          | <ul style="list-style-type: none"> <li>Input 3-phase voltage is too low.</li> <li>Momentary power failure longer than the time setting of <b>F628</b>.</li> </ul>                                                                                                                               |
| <b>UP2</b>  | Control Power Under-Voltage       | <ul style="list-style-type: none"> <li>This fault is caused by an under-voltage condition at the 5, 15, or the 24 VDC supply.</li> <li>3-phase input voltage low.</li> </ul>                                                                                                                    |

# Viewing Trip Information

In the event that the condition causing an **Alarm** does not return to the normal operating level within a specified time, the H9 ASD **Faults** and a **Trip** is incurred.

When a trip occurs, the resultant error information may be viewed either from the LED screen, LCD **Fault** screen (Table 5 on pg. 68), **Monitor** screen, or the **Trip History** screen (Program ⇒ Utilities ⇒ **Trip History**).

## Trip Record at Monitor Screen

The at-trip condition of the last 4 incurred trips may be viewed at the **Monitor** screen. The **Monitor** screen displays the records of up to four trips and catalogs each trip as **Past Trip 1** through **Past Trip 4** (see pg. 31). Once reset (**Type Reset**), the trip records are erased. If no trips have occurred since being powered up or since the last reset, **None** is displayed for each trip record.

The **Monitor** screen at-trip record is erased when the H9 ASD is reset.

**Note:** *An improper H9 ASD setup may cause some trips — reset the ASD to the **Factory Default** settings before pursuing a systemic malfunction (Program ⇒ Utilities ⇒ Type Reset ⇒ **Reset to Factory Settings**).*

## Trip History

The **Trip History** screen records the system parameters for up to 20 trips. The recorded trips are numbered from zero to 19. Once the **Trip History** record reaches trip number 19, the oldest recorded trip will be deleted with each new record stored (first-in first-out). The **Trip #** field may be selected and scrolled through to view the recorded trip information for a given trip number. The monitored parameters are listed in Table 6 as **At-trip Recorded Parameters** (parameter readings at the time that the trip occurred).

In the event of a power loss or if the keypad has been removed from the ASD, the trip records and the real-time clock information are retained within the keypad for up to four years via battery backup.

Table 6. Trip History Record Parameters.

| At-trip Recorded Parameters                                               |                                 |                        |                  |
|---------------------------------------------------------------------------|---------------------------------|------------------------|------------------|
| 1) Trip Number                                                            | 8) Frequency Reference          | 15) Feedback (1 sec.)  | 22) ASD Overload |
| 2) Trip Type                                                              | 9) Bus Voltage                  | 16) Torque             | 23) DBR Overload |
| 3) Time and Date                                                          | 10) Discrete Input Status       | 17) Torque Reference   | 24) Motor Load   |
| 4) Frequency at Trip                                                      | 11) OUT1/OUT2/FL Status         | 18) Torque Current     | 25) ASD Load     |
| 5) Output Current                                                         | 12) Timer                       | 19) Excitation Current | 26) DBR Load     |
| 6) Output Voltage                                                         | 13) Post Compensation Frequency | 20) PID Value          | 27) Input Power  |
| 7) Direction                                                              | 14) Feedback (inst.)            | 21) Motor Overload     | 28) Output Power |
| Trip records are comprised of the full list of monitored parameters (28). |                                 |                        |                  |

## Clearing a Trip

Once the cause of the trip has been corrected, performing a **Reset** re-enables the H9 ASD for normal operation.

The record of a trip may also be cleared using either of the following methods:

- Cycling power (trip info may be saved via **F602** if desired),
- Pressing the **Stop-Reset** key twice,
- Remotely via the communications channel,
- Momentarily connecting terminal **RES** to **CC** of the **Terminal Board**, or
- Via Program ⇒ Utilities ⇒ Type Reset ⇒ **Clear Past Trip** (clears Monitor screen records only).

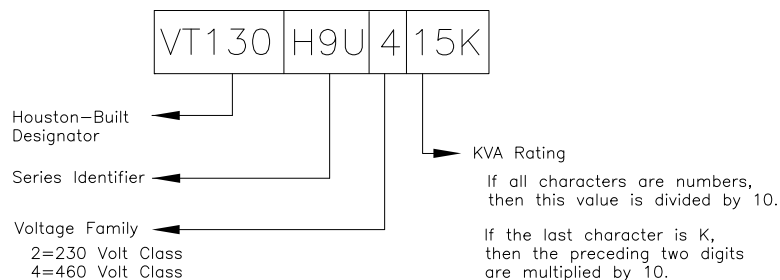


# Enclosure and Conduit Plate Dimensions

The H9 ASD part numbering convention is shown below.

The enclosure dimensions for the available models (typeforms) are listed in [Tables 7 and 8](#). The conduit plates referenced are shown in [Figures 30, 31, and 32](#).

## H9 Part Numbering Convention.



**Note:** The Type I enclosed versions of these drives meet or exceed the specification **UL 50-1995, the Standard for Heating and Cooling Equipment**, and complies with the applicable requirements for installation in a compartment handling conditioned air.

## Enclosure Dimensions

Table 7. 230-Volt H9 ASD Systems.

| Frame | Model Number<br>VT130H9U | Enclosure<br>Figure<br>Number | A<br>Width<br>(in/mm) | B<br>Height<br>(in/mm) | C<br>Depth<br>(in/mm) | Mounting Hole Dimensions<br>(in/mm) |           |           |           | Conduit<br>Plate |
|-------|--------------------------|-------------------------------|-----------------------|------------------------|-----------------------|-------------------------------------|-----------|-----------|-----------|------------------|
|       |                          |                               |                       |                        |                       | D                                   | E         | R1        | R2        |                  |
| 2     | 2010                     | Figure 27                     | 5.2/132               | 11.2/285               | 6.1/155               | 8.7/220                             | 4.5/114   | 0.098/2.5 | 0.217/5.5 | Figure 30-A      |
|       | 2015                     |                               |                       |                        |                       |                                     |           |           |           |                  |
|       | 2025                     |                               |                       |                        |                       |                                     |           |           |           |                  |
| 3     | 2035                     |                               | 6.1/155               | 12.4/315               | 6.6/168               | 9.8/249                             | 5.4/138   |           | 0.236/6.0 | Figure 30-B      |
|       | 2055                     |                               |                       |                        |                       |                                     |           |           |           |                  |
| 4     | 2080                     |                               | 6.9/175               | 15.0/381               | 7.6/193               | 11.1/283                            | 6.2/158   | 0.118/3.0 | 0.276/7.0 | Figure 30-D      |
|       | 2110                     |                               |                       |                        |                       |                                     |           |           |           |                  |
| 5B    | 2160                     |                               | 9.1/231               | 19.3/490               | 15.2/386              | 8.3/210                             | 0.188/4.8 | 0.375/9.5 | 0.670/17  | Figure 30-E      |
|       | 2220                     |                               |                       |                        |                       |                                     |           |           |           |                  |
|       | 2270                     |                               |                       |                        |                       |                                     |           |           |           |                  |
| 6     | 2330                     | Figure 28                     | 11.1/283              | 25.9/658               | 13.2/335              | 25.0/635                            | 8.0/203   | 0.188/4.8 | 0.375/9.5 | Figure 31-G      |
| 7B    | 2400                     |                               | 14.3/363              | 33.1/841               | 15.0/381              | 32.3/820                            |           |           |           |                  |
|       | 2500                     |                               |                       |                        |                       |                                     |           |           |           |                  |
|       | 2600                     |                               |                       |                        |                       |                                     |           |           |           |                  |
|       | 2750                     |                               |                       |                        |                       |                                     |           |           |           |                  |
| 9     | 210K                     | Figure 29                     | 14.6/371              | 51.7/1313              | 17.6/447              | 50.2/1275                           | 9.2/234   | 0.344/8.7 | 0.670/17  | Figure 31-I      |
| 10    | 212K                     |                               | 15.7/399              | 53.1/1349              |                       | 51.7/1313                           | 9.9/252   |           |           | Figure 31-J      |

Table 8. 460-Volt H9 ASD Systems.

| Frame | Model Number<br>VT130H9U | Enclosure<br>Figure<br>Number | A<br>Width<br>(in/mm) | B<br>Height<br>(in/mm) | C<br>Depth<br>(in/mm) | Mounting Hole Dimensions<br>(in/mm) |          |             |           | Conduit<br>Plate |             |             |             |
|-------|--------------------------|-------------------------------|-----------------------|------------------------|-----------------------|-------------------------------------|----------|-------------|-----------|------------------|-------------|-------------|-------------|
|       |                          |                               |                       |                        |                       | D                                   | E        | R1          | R2        |                  |             |             |             |
| 2     | 4015                     | Figure 27                     | 5.2/132               | 11.2/285               | 6.1/155               | 8.7/220                             | 4.5/114  | 0.098/2.5   | 0.217/5.5 | Figure 30-A      |             |             |             |
|       | 4025                     |                               |                       |                        |                       |                                     |          |             |           |                  |             |             |             |
|       | 4035                     |                               |                       |                        |                       |                                     |          |             |           |                  |             |             |             |
| 3     | 4055                     |                               | 6.1/155               | 12.4/315               | 6.6/168               | 9.8/249                             | 5.4/138  |             |           |                  | 0.236/6.0   | Figure 30-B |             |
|       | 4080                     |                               |                       |                        |                       |                                     |          |             |           |                  |             |             |             |
| 4     | 4110                     |                               | 6.9/175               | 15.0/381               |                       | 11.1/283                            | 6.2/158  |             | 0.118/3.0 | 0.276/7.0        |             |             | Figure 30-C |
| 5A    | 4160                     |                               | 8.3/211               | 15.1/384               | 7.6/193               |                                     | 7.5/190  | Figure 30-D |           |                  |             |             |             |
|       | 4220                     |                               |                       |                        |                       |                                     |          |             |           |                  |             |             |             |
| 5B    | 4270                     |                               | 9.1/231               | 19.3/490               |                       | 15.2/386                            | 8.3/210  |             |           |                  | Figure 30-E |             |             |
|       | 4330                     |                               |                       |                        |                       |                                     |          |             |           |                  |             |             |             |
| 6     | 4400                     | Figure 28                     | 11.1/283              | 25.9/658               | 13.2/335              | 25.0/635                            | 8.0/203  |             | 0.188/4.8 | 0.375/9.5        |             | Figure 30-F |             |
| 7A    | 4500                     |                               |                       | 30.8/782               | 14.3/363              |                                     |          | 29.7/754    |           |                  |             |             | Figure 31-H |
|       | 4600                     |                               |                       |                        |                       |                                     |          |             |           |                  |             |             |             |
| 8     | 4750                     |                               | 14.3/363              | 36.1/917               | 15.3/389              | 35.3/897                            |          | Figure 31-I |           |                  |             |             |             |
|       | 410K                     |                               |                       |                        |                       |                                     |          |             |           |                  |             |             |             |
|       | 412K                     |                               |                       |                        |                       |                                     |          |             |           |                  |             |             |             |
| 9     | 415K                     | Figure 29                     | 14.6/371              | 51.7/1313              | 17.6/447              | 50.2/1275                           | 9.2/234  |             | 0.344/8.7 | 0.670/17         | Figure 31-J |             |             |
| 10    | 420K                     |                               | 15.7/399              | 53.1/1349              |                       | 51.7/1313                           | 9.9/252  |             |           |                  |             | Figure 32-L |             |
| 11    | 425K                     |                               | 15.0/381              | 63.1/1603              |                       | 61.6/1565                           |          |             |           |                  |             |             | 13.8/351    |
| 12    | 430K                     |                               | 18.9/480              | 68.5/1740              |                       | 67.0/1701                           | 21.3/541 |             |           |                  |             |             |             |
|       | 435K                     |                               |                       |                        |                       |                                     |          |             |           |                  |             |             |             |
| 13    | 440K                     |                               | 25.6/650              | 70.0/1778              |                       | 68.5/1740                           | 21.3/541 |             |           |                  |             |             |             |

Figure 27. See [Tables 7](#) and [8](#) for Actual Dimensions.

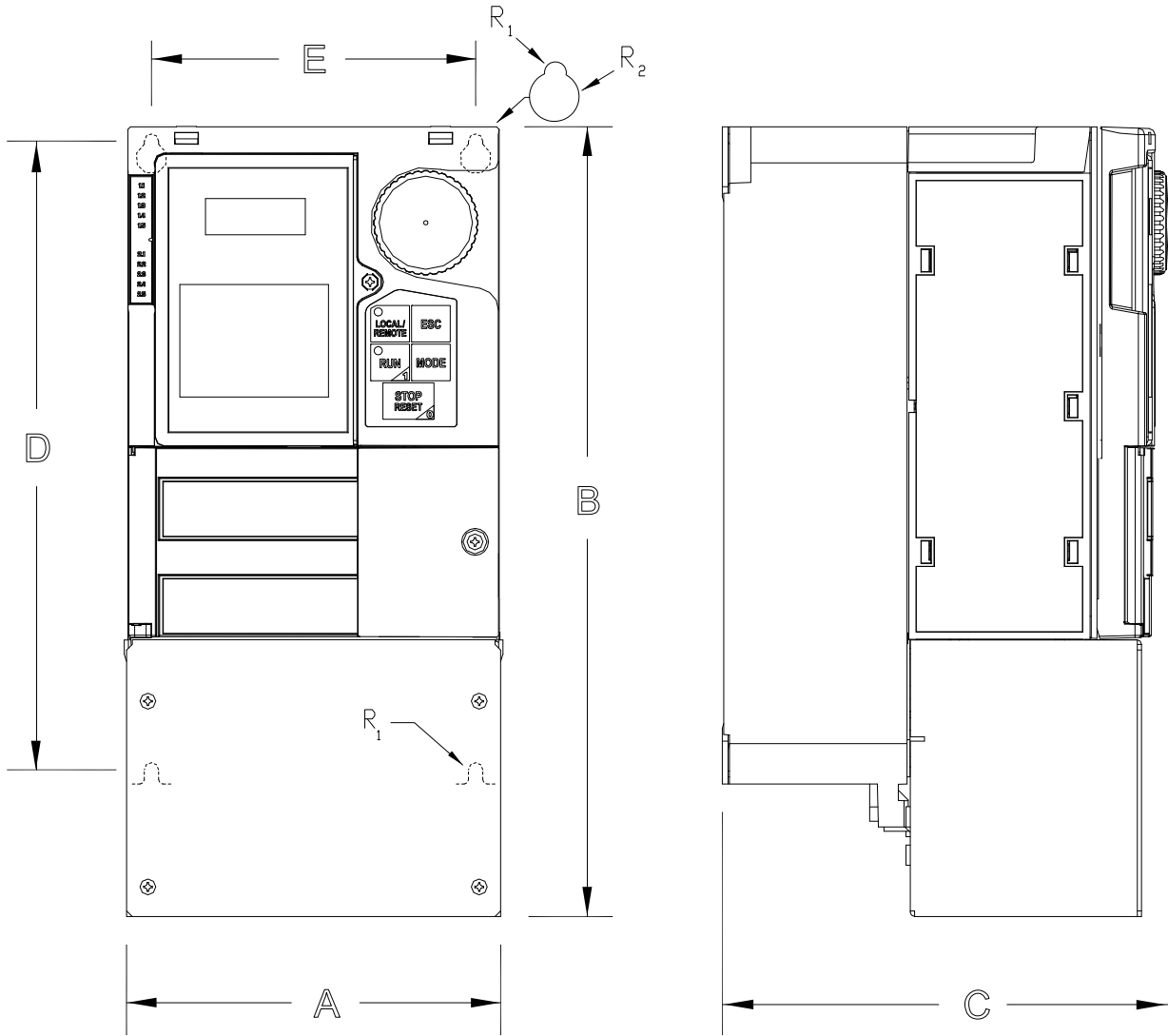


Figure 28. See [Tables 7](#) and [8](#) for Actual Dimensions.

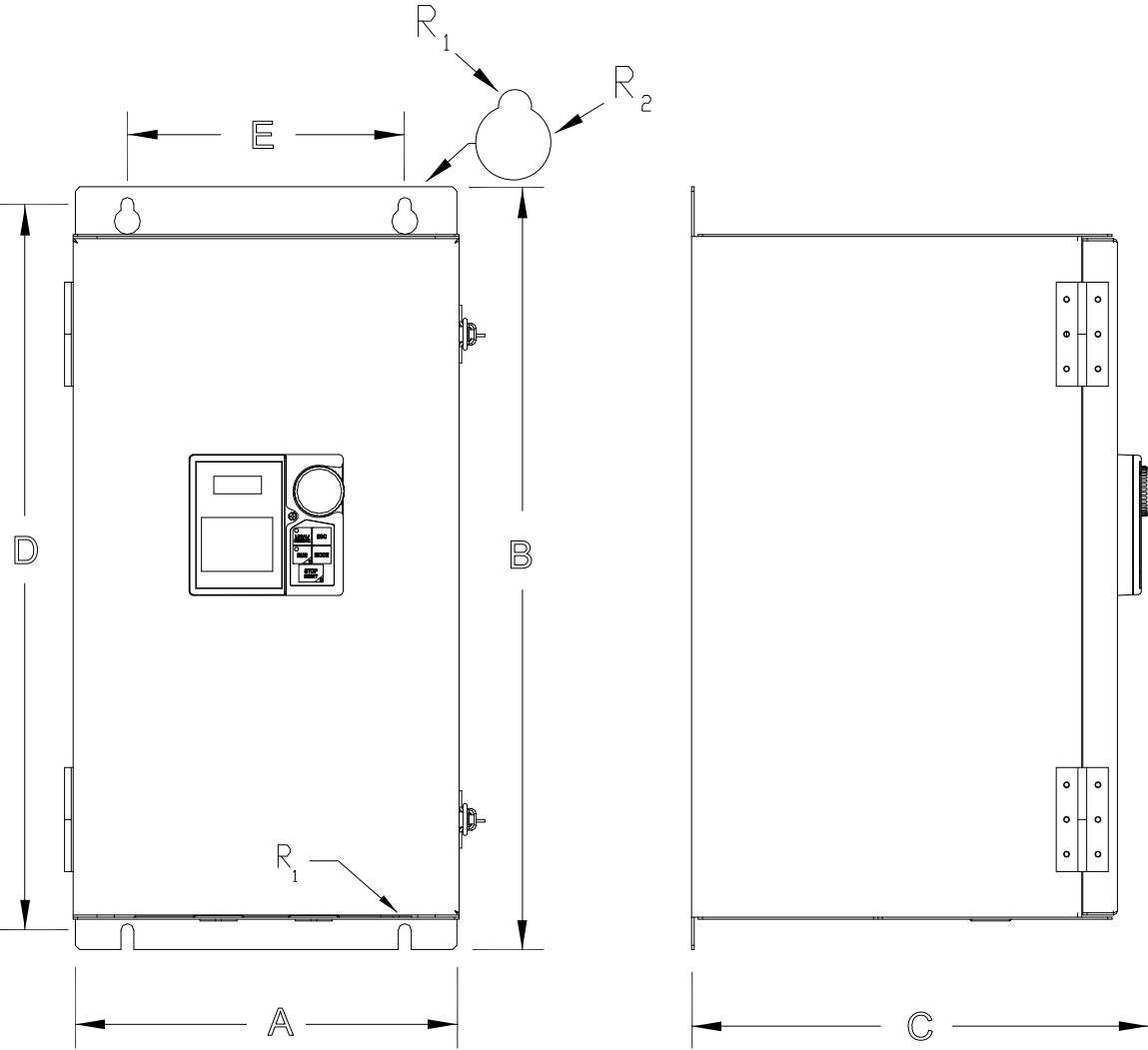
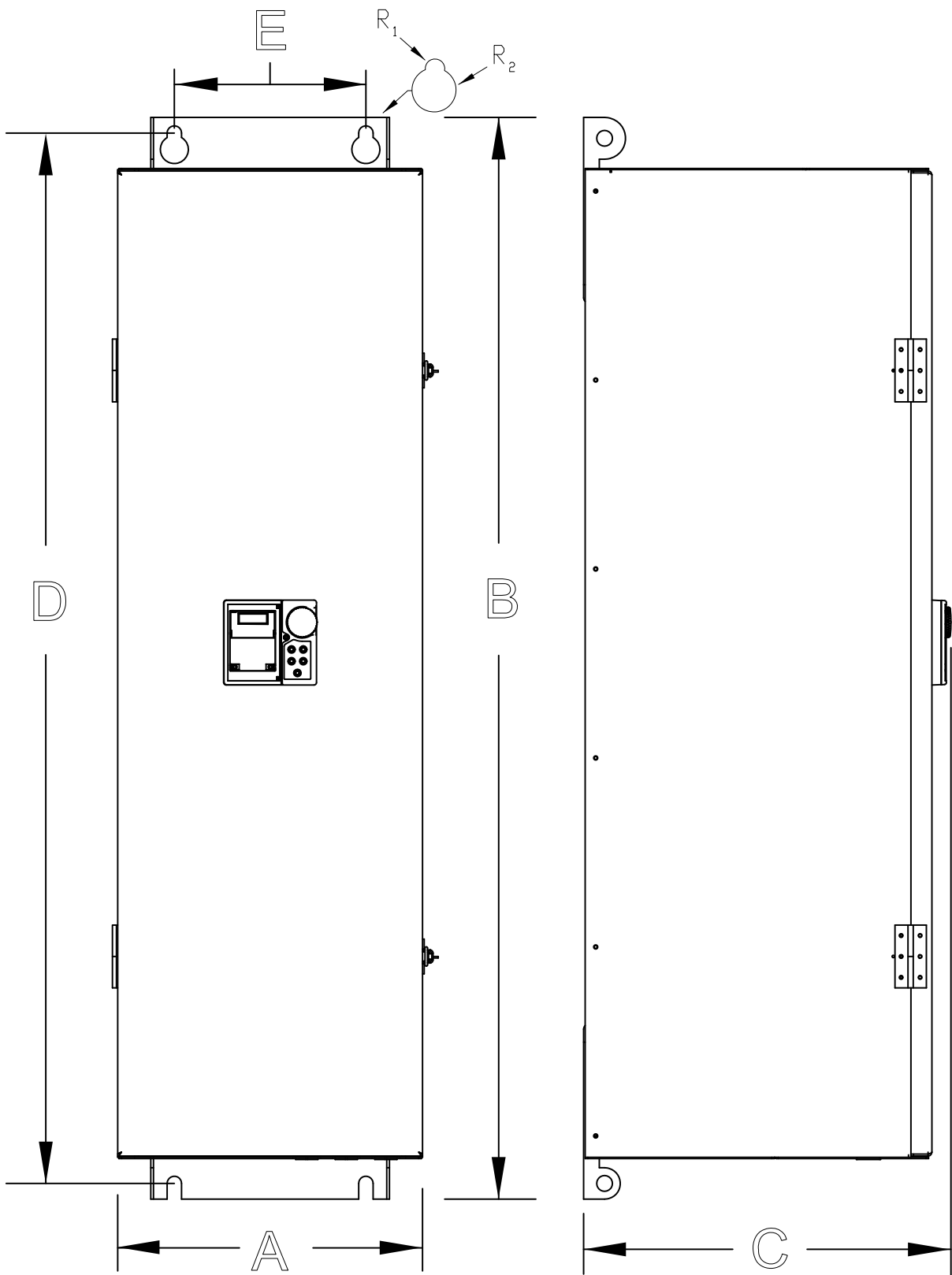


Figure 29. See [Tables 7](#) and [8](#) for Actual Dimensions.



# Conduit Plate Dimensions

Figure 30. See [Tables 7](#) and [8](#) for the associated device. Dimensions are in in/cm.

ØX = Concentric Knockouts for Diameter Sizes 0.5", 0.75", and 1.0" Conduit.

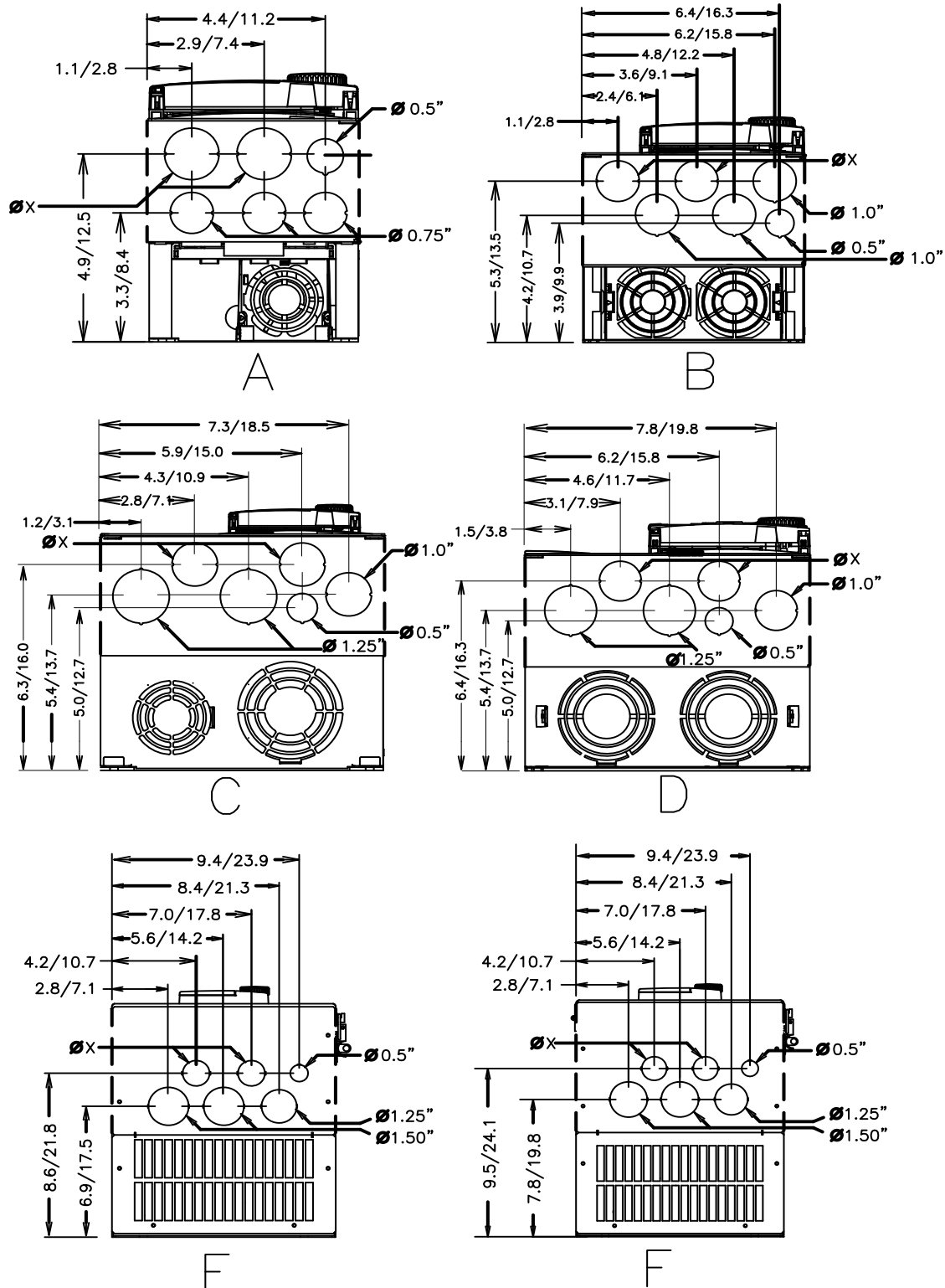
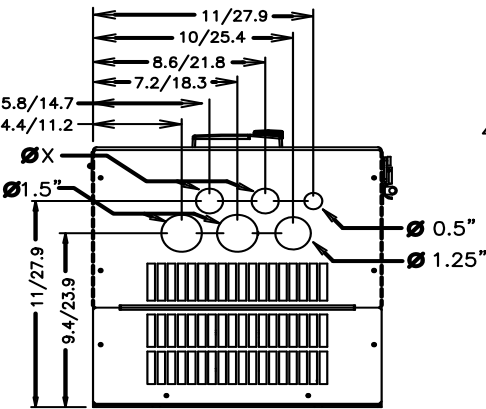
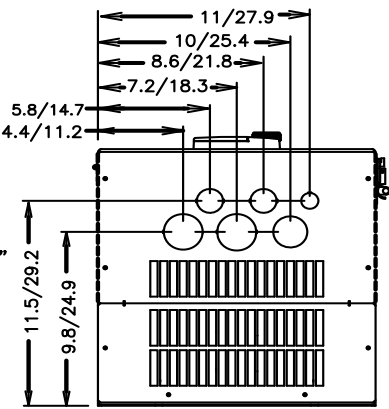


Figure 31. See [Tables 7](#) and [8](#) for the associated device. Dimensions are in in/cm.

ØX = Concentric Knockouts for Diameter Sizes 0.5", 0.75", and 1.0" Conduit.

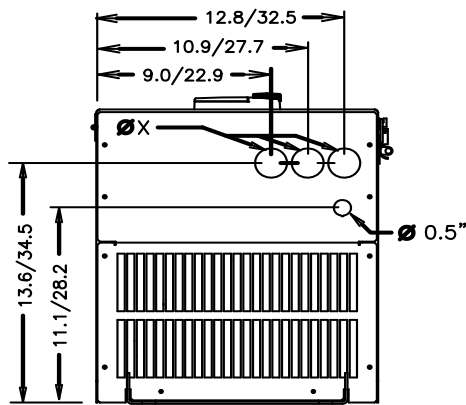


G

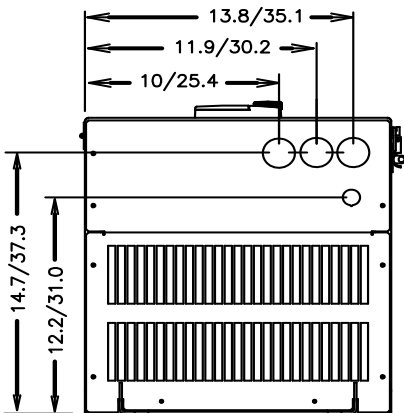


Conduit Ø = Same as G

H

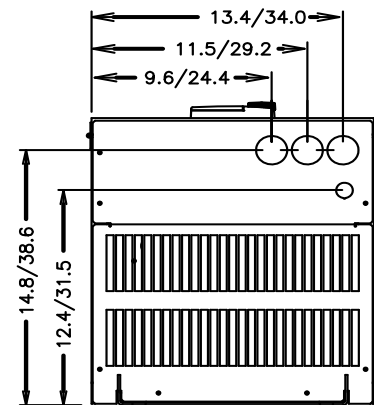


I



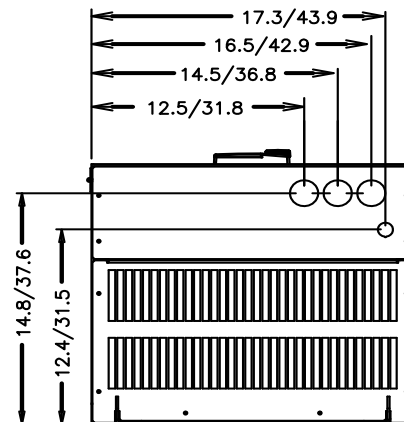
Conduit Ø = Same as I

J



Conduit Ø = Same as I

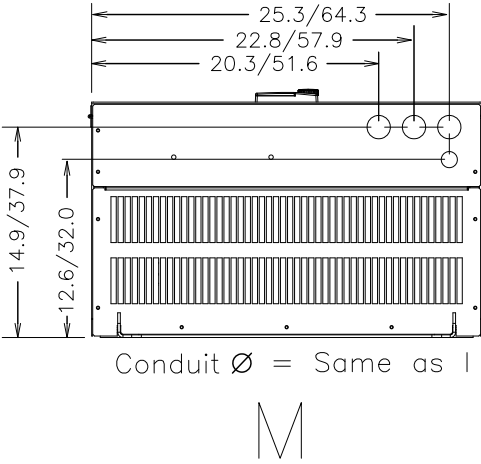
K



Conduit Ø = Same as I

L

Figure 32. See [Table 8](#) for the associated device. Dimensions are in in/cm.





# Current/Voltage Specifications

Table 9. 230-Volt Chassis Standard Ratings Table.

| Model Number<br>VT130H9U | Typical Motor HP | 100% Output Current Continuous | Overload Current 120% for 60 Seconds | Input Voltage 3-Ph 50/60 $\pm 2$ Hz | Output Voltage 3-Ph Variable Frequency |
|--------------------------|------------------|--------------------------------|--------------------------------------|-------------------------------------|----------------------------------------|
| 2010                     | 0.75             | 3.2 A                          | 3.84 A                               | 200–240 VAC ( $\pm 10\%$ )          | Input Voltage Level (Max.)             |
| 2015                     | 1.0              | 4.2 A                          | 5.04 A                               |                                     |                                        |
| 2025                     | 2.0              | 6.8 A                          | 8.16 A                               |                                     |                                        |
| 2035                     | 3.0              | 9.6 A                          | 11.5 A                               |                                     |                                        |
| 2055                     | 5.0              | 15.2 A                         | 18.2 A                               |                                     |                                        |
| 2080                     | 7.5              | 22.0 A                         | 26.0 A                               |                                     |                                        |
| 2110                     | 10               | 28.0 A                         | 34.0 A                               |                                     |                                        |
| 2160                     | 15               | 42.0 A                         | 50.0 A                               |                                     |                                        |
| 2220                     | 20               | 54.0 A                         | 65.0 A                               |                                     |                                        |
| 2270                     | 25               | 68.0 A                         | 82.0 A                               |                                     |                                        |
| 2330                     | 30               | 80.0 A                         | 96.0 A                               |                                     |                                        |
| 2400                     | 40               | 104 A                          | 125 A                                |                                     |                                        |
| 2500                     | 50               | 130 A                          | 156 A                                |                                     |                                        |
| 2600                     | 60               | 154 A                          | 185 A                                |                                     |                                        |
| 2750                     | 75               | 192 A                          | 230 A                                |                                     |                                        |
| 210K                     | 100              | 248 A                          | 298 A                                |                                     |                                        |
| 212K                     | 125              | 312 A                          | 374 A                                |                                     |                                        |

Table 10. 460-Volt Chassis Standard Ratings Table.

| Model Number<br>VT130H9U | Typical Motor HP | 100% Output Current Continuous | Overload Current 120% for 60 Seconds | Input Voltage 3-Ph 50/60 $\pm 2$ Hz | Output Voltage 3-Ph Variable Frequency |
|--------------------------|------------------|--------------------------------|--------------------------------------|-------------------------------------|----------------------------------------|
| 4015                     | 1.0              | 2.1 A                          | 2.52 A                               | 380 – 480 VAC<br>( $\pm 10\%$ )     | Input Voltage Level (Max.)             |
| 4025                     | 2.0              | 3.4 A                          | 4.08 A                               |                                     |                                        |
| 4035                     | 3.0              | 4.8 A                          | 5.76 A                               |                                     |                                        |
| 4055                     | 5.0              | 7.6 A                          | 9.00 A                               |                                     |                                        |
| 4080                     | 7.5              | 11.0 A                         | 13.0 A                               |                                     |                                        |
| 4110                     | 10               | 14.0 A                         | 17.0 A                               |                                     |                                        |
| 4160                     | 15               | 21.0 A                         | 25.0 A                               |                                     |                                        |
| 4220                     | 20               | 27.0 A                         | 32.0 A                               |                                     |                                        |
| 4270                     | 25               | 34.0 A                         | 41.0 A                               |                                     |                                        |
| 4330                     | 30               | 40.0 A                         | 48.0 A                               |                                     |                                        |
| 4400                     | 40               | 52.0 A                         | 62.0 A                               |                                     |                                        |
| 4500                     | 50               | 65.0 A                         | 78.0 A                               |                                     |                                        |
| 4600                     | 60               | 77.0 A                         | 92.0 A                               |                                     |                                        |
| 4750                     | 75               | 96.0 A                         | 115 A                                |                                     |                                        |
| 410K                     | 100              | 124 A                          | 149 A                                |                                     |                                        |
| 412K                     | 125              | 156 A                          | 187 A                                |                                     |                                        |
| 415K                     | 150              | 180 A                          | 216 A                                |                                     |                                        |
| 420K                     | 200              | 240 A                          | 288 A                                |                                     |                                        |
| 425K                     | 250              | 302 A                          | 362 A                                |                                     |                                        |
| 430K                     | 300              | 361 A                          | 433 A                                |                                     |                                        |
| 435K                     | 350              | 414 A                          | 497 A                                |                                     |                                        |
| 440K                     | 400              | 477 A                          | 572 A                                |                                     |                                        |

# Cable/Terminal/Torque Specifications

Installation should conform to the NEC Article 110 (Requirements for Electrical Installations), all regulations of the Occupational Safety and Health Administration, and any other applicable national, regional, or industry codes and standards.

**Note:** The following ratings are guidelines and shall not be the sole determining factor of the lug or wire size used with the H9 ASD. Application-specific applicables, wire insulation type, conductor material, and local and regional regulations are but a few of the considerations when selecting the actual lug and wire type to be used with the H9 ASD.

**Note:** Cable/Terminal specifications are based on the rated current of the H9 ASD and **Do Not** include the 10% Service Factor.

**Note:** Use only 75° C copper wire/cable for motor and power connections.

For further installation information see the section titled [Installation and Connections on pg. 14](#).

Table 11. 230-Volt H9 ASD Cable/Terminal/Torque Specifications.

| Model Number<br>VT130H9U | MCP Rating<br>(Amps) | Wire/Cable Size    |         | Lug Size Range                                |           | Terminal Board                                 | Torque             |           |
|--------------------------|----------------------|--------------------|---------|-----------------------------------------------|-----------|------------------------------------------------|--------------------|-----------|
|                          |                      | AWG or kcmil       |         |                                               |           |                                                |                    |           |
|                          |                      | Input/Output Power |         | Wire-Size/Lug-Capacity for Input/Output Power |           | TB1 – 4 Terminals                              | 3Ø-Input           | 3Ø-Output |
|                          |                      | Recommended        | Maximum | 3Ø-Input                                      | 3Ø-Output | In-Lbs./Nm                                     |                    |           |
| 2010                     | 15                   | 14                 | 10      | 14 to 8                                       |           | 20<br>(3-core shield)<br><br>Torque to 5.3/0.6 | 11.5/1.3           |           |
| 2015                     |                      |                    |         |                                               |           |                                                |                    |           |
| 2025                     |                      |                    |         |                                               |           |                                                |                    |           |
| 2035                     | 30                   | 10                 | 12 to 8 |                                               | 17.7/2.0  |                                                |                    |           |
| 2055                     |                      |                    |         |                                               |           |                                                |                    |           |
| 2080                     | 50                   | 8                  | 8       | 8 to 3                                        |           |                                                | 21/2.4             |           |
| 2110                     |                      |                    |         |                                               |           |                                                |                    |           |
| 2160                     | 75                   | 6                  | 3       | 12 to 1/0      4 to 1/0                       |           |                                                |                    |           |
| 2220                     | 100                  | 4                  |         |                                               |           |                                                |                    |           |
| 2270                     | 125                  | 3                  |         |                                               |           |                                                |                    |           |
| 2330                     | 150                  | 2                  | 2       | 6 to 250      2 to 300                        |           |                                                | 275/31      168/19 |           |
| 2400                     | 175                  | 1/0                | 4/0     |                                               |           |                                                |                    |           |
| 2500                     | 200                  | 2/0                |         |                                               |           |                                                |                    |           |
| 2600                     | 250                  | 3/0                |         |                                               |           |                                                |                    |           |
| 2750                     | 300                  | 4/0                |         |                                               |           |                                                |                    |           |
| 210K                     | 400                  | *3/0               | *1/0    | 6 to 250                                      |           |                                                | 275/31             |           |
| 212K                     | 500                  | *250               | *250    |                                               |           |                                                |                    |           |

**Note:** (\*) Indicates that the item is one of a set of two parallel cables.

Table 12. 460-Volt H9 ASD Cable/Terminal/Torque Specifications.

| Model Number<br>VT130H9U | MCP Rating<br>(Amps) | Wire/Cable Size    |         | Lug Size Range                                   |           | Terminal Board                                 | Torque             |           |                    |  |
|--------------------------|----------------------|--------------------|---------|--------------------------------------------------|-----------|------------------------------------------------|--------------------|-----------|--------------------|--|
|                          |                      | AWG or kcmil       |         |                                                  |           |                                                |                    |           |                    |  |
|                          |                      | Input/Output Power |         | Wire-Size/Lug-Capacity<br>for Input/Output Power |           | TB1 – 4<br>Terminals                           | 3Ø-Input           | 3Ø-Output |                    |  |
|                          |                      | Recommended        | Maximum | 3Ø-Input                                         | 3Ø-Output | In-Lbs./Nm                                     |                    |           |                    |  |
| 4015                     | 15                   | 14                 | 10      | 14 to 8                                          |           | 20<br>(3-core shield)<br><br>Torque to 5.3/0.6 | 11.5/1.3           |           |                    |  |
| 4025                     |                      |                    |         |                                                  |           |                                                |                    |           |                    |  |
| 4035                     |                      |                    |         |                                                  |           |                                                |                    |           |                    |  |
| 4055                     |                      |                    |         |                                                  |           |                                                |                    |           |                    |  |
| 4080                     | 20                   | 12                 | 8       | 12 to 8                                          |           |                                                | 17.7/2.0           |           |                    |  |
| 4110                     | 30                   | 10                 |         |                                                  |           |                                                |                    |           |                    |  |
| 4160                     |                      | 50                 |         | 8                                                | 10 to 4   |                                                |                    |           | 21/2.4             |  |
| 4220                     |                      |                    |         |                                                  |           |                                                |                    |           |                    |  |
| 4270                     | 75                   | 4                  | 3       | 8 to 3                                           |           |                                                | 50/5.7      53/6.0 |           |                    |  |
| 4330                     |                      |                    |         |                                                  |           |                                                |                    |           |                    |  |
| 4400                     | 100                  |                    | 2       | 12 to 1/0                                        | 4 to 1/0  |                                                |                    |           | 275/31      168/19 |  |
| 4500                     |                      |                    |         |                                                  |           |                                                |                    |           |                    |  |
| 4600                     | 125                  | 2                  |         |                                                  |           |                                                |                    |           |                    |  |
| 4750                     | 175                  | 1/0                |         |                                                  |           |                                                | 4/0                | 6 to 250  |                    |  |
| 410K                     | 200                  | 2/0                |         |                                                  |           |                                                |                    |           |                    |  |
| 412K                     | 250                  | 4/0                |         |                                                  |           |                                                |                    |           |                    |  |
| 415K                     | 300                  | *1/0               | *4/0    | 6 to 250                                         |           |                                                |                    |           | 275/31             |  |
| 420K                     | 400                  | *3/0               | *250    |                                                  |           |                                                |                    |           |                    |  |
| 425K                     | 500                  | *250               |         |                                                  |           |                                                |                    |           |                    |  |
| 430K                     | 600                  | *300               | *350    | 4 to 350                                         |           |                                                | 375/42.4           |           |                    |  |
| 435K                     | 700                  | *350               |         |                                                  |           |                                                |                    |           |                    |  |
| 440K                     | 800                  | **250              | **350   | 0 to 500                                         | 6 to 350  |                                                |                    |           |                    |  |

**Note:** (\*) Indicates that the item is one of a set of two parallel cables.

**Note:** (\*\*) Indicates that the item is one of a set of three parallel cables.

# Short Circuit Protection Recommendations

Table 13. 230/240 and 400/480-Volt ASD Recommended Circuit Breaker Selection.

| Model Number<br>VT130H9U | HP   | Continuous Output Current<br>(Amps) | Circuit Breaker Part Number |
|--------------------------|------|-------------------------------------|-----------------------------|
| 2010                     | 0.75 | 3.2                                 | HLL36015                    |
| 2015                     | 1.0  | 4.2                                 |                             |
| 2025                     | 2.0  | 6.8                                 |                             |
| 2035                     | 3.0  | 9.6                                 | HLL36025                    |
| 2055                     | 5.0  | 15.2                                |                             |
| 2080                     | 7.5  | 22.0                                | HLL36040                    |
| 2110                     | 10   | 28.0                                | HLL36050                    |
| 2160                     | 15   | 42.0                                | HLL36070                    |
| 2220                     | 20   | 54.0                                | HLL36090                    |
| 2270                     | 25   | 68.0                                | HLL36100                    |
| 2330                     | 30   | 80.0                                |                             |
| 2400                     | 40   | 104                                 | HLL36125                    |
| 2500                     | 50   | 130                                 | HLL36150                    |
| 2600                     | 60   | 154                                 | JLL36200                    |
| 2750                     | 75   | 192                                 |                             |
| 210K                     | 100  | 248                                 | JLL36250                    |
| 212K                     | 125  | 312                                 | LIL36300                    |
| 4015                     | 1.0  | 2.1                                 | HLL36015                    |
| 4025                     | 2.0  | 3.4                                 |                             |
| 4035                     | 3.0  | 4.8                                 |                             |
| 4055                     | 5    | 7.6                                 | HLL36025                    |
| 4080                     | 7.5  | 11.0                                |                             |
| 4110                     | 10   | 14.0                                | HLL36040                    |
| 4160                     | 15   | 21.0                                | HLL36070                    |
| 4220                     | 20   | 27.0                                |                             |
| 4270                     | 25   | 34.0                                | HLL36090                    |
| 4330                     | 30   | 40.0                                | HLL36100                    |
| 4400                     | 40   | 52.0                                | HLL36125                    |
| 4500                     | 50   | 65.0                                | HLL36150                    |
| 4600                     | 60   | 77.0                                | JLL36200                    |
| 4750                     | 75   | 96.0                                | JLL36225                    |
| 410K                     | 100  | 124                                 | JLL36250                    |
| 412K                     | 125  | 156                                 | LIL36300                    |
| 415K                     | 150  | 180                                 |                             |
| 420K                     | 200  | 240                                 | LIL36400                    |
| 425K                     | 250  | 302                                 |                             |
| 430K                     | 300  | 361                                 | LIL36450                    |
| 435K                     | 350  | 414                                 | LIL36500                    |
| 440K                     | 400  | 477                                 | Consult NEC                 |

# Dynamic Braking Resistor Wire/Cable Specifications

Thermal protection for the DBR circuit (see [Figure 33. on pg. 88](#)) or an input contactor that will open the input 3-phase power circuit (see [Figure 34. on pg. 88](#)) to the H9 ASD in the event that a DBR over-temperature condition occurs is a requirement. If a DBR failure occurs or should a power source over-voltage condition occur the DBR thermal protection circuitry will prevent hazardous DBR temperatures.

To use the **Dynamic Braking** function the following requirements must be met:

- **Enable** the DBR function,
- Selected a **Resistance Value**, and
- Set the **Continuous Braking Wattage** value at **F304**, **F308**, and **F309**, respectively.

Set the **Braking Resistance Overload Time** at parameter **F639** to establish how long the braking resistor is allowed to sustain the overload condition before a trip is incurred (the factory default setting is 5 seconds).

Light-duty and heavy-duty resistors vary from a few ohms to several hundred ohms. The appropriate resistance size will be typeform- and application-specific. Contact your Toshiba International Corporation Sales Representative or the Toshiba International Corporation Customer Service Department for more information on your specific DBR requirements.

Heavy duty DBRs should be wired using the same gauge wire as the motor leads. Light duty DBRs may use one wire size smaller (AWG or kcmil) than the motor leads.

Because the heat generated by the DBR will affect the cooling capacity of the heat sink, the resistor pack should be mounted above or to the side of the ASD — **Never below the ASD**. Maintain a minimum of six inches between the resistor pack and the ASD unit.

The total wire length from the ASD to the DBR should not exceed ten feet.

The wiring from the ASD to the DBR should be twisted approximately two twists per foot throughout the length of the wire.

If EMI/RFI noise is of concern, the DBR wiring should be three-core screened cable. The screen should connect to the ASD enclosure and the resistor enclosure.

## CAUTION

Though the in-line DBR fuse and the thermal relay are designed into the system to prevent a catastrophic DBR over-current condition, they are both intended to be used as backup protection **ONLY**.

A proper typeform-specific and application-specific system setup that includes using the appropriate **Dynamic Braking Resistor and Overload** settings will be required.

Figure 33. Braking Resistor Circuit with a Thermal Fuse.

The diagram illustrates a braking resistor circuit with a thermal fuse. The main circuit is a 3-phase system with terminals R/L1, S/L2, and T/L3. A 3-phase Main Circuit Power Supply is connected to these terminals. An MCCB (Molded Case Circuit Breaker) is shown in the main circuit. The braking resistor (DBR) is connected to the main circuit through a thermal fuse assembly, which is labeled (Thermal) and contains a DBR and a Fuse. The thermal fuse assembly is connected to the main circuit through terminals PA/+ and PB. The motor is connected to the main circuit through terminals U/T1, V/T2, and W/T3. The motor is labeled Motor. The circuit is grounded at the bottom through a ground symbol.

Figure 34. Shown below is the connection diagram using an MCCB with a Trip Coil (TC) in lieu of an input contactor. A control transformer is required for 400-volt models only. The primary MC is opened in the event of a DBR over-current detection. With no power supplied to the ASD the failure will not be displayed on the EOI; see the Trip History for failure information once restarted.

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