EATON | Cutler-Hammer

HVX9000 AF Drives

User Manual

November 2003
Supersedes April 2003

November 2003

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Cover Photo: Cutler-Hammer HVX IntelliPass Drive

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Safety

Definitions and Symbols

⚠ WARNING

This symbol indicates high voltage. It calls your attention to items or operations that could be dangerous to you and other persons operating this equipment. Read the message and follow the instructions carefully.

⚠

This symbol is the "Safety Alert Symbol." It occurs with either of two signal words: WARNING or CAUTION as described below.

⚠ WARNING

Indicates a potentially hazardous situation which, if not avoided, can result in serious injury or death.

⚠ CAUTION

Indicates a potentially hazardous situation which, if not avoided, can result in minor to moderate injury, or serious damage to the equipment. The situation described in the CAUTION may, if not avoided, lead to serious results. Important safety measures are described in CAUTION (as well as WARNING).

Hazardous High Voltage

⚠ WARNING

Motor control equipment and electronic controllers are connected to hazardous line voltages. When servicing drives and electronic controllers, there may be exposed components with housings or protrusions at or above line potential. Extreme care should be taken to protect against shock.

- Stand on an insulating pad and make it a habit to use only one hand when checking components.
- Always work with another person in case an emergency occurs.
- Disconnect power before checking controllers or performing maintenance.
- Be sure equipment is properly grounded.
- Wear safety glasses whenever working on electronic controllers or rotating machinery.

Warnings, Cautions and Notices

Read this manual thoroughly and make sure you understand the procedures before you attempt to install, set up, or operate this Cutler-Hammer® HVX9000 Adjustable Frequency Drive from Eaton Electrical®.

Warnings

⚠ WARNING

Be sure to ground the unit following the instructions in this manual. Ungrounded units may cause electric shock and/or fire.

⚠ WARNING

This equipment should be installed, adjusted, and serviced by qualified electrical maintenance personnel familiar with the construction and operation of this type of equipment and the hazards involved. Failure to observe this precaution could result in death or severe injury.

⚠ WARNING

Components within the HVX9000 power unit are live when the drive is connected to power. Contact with this voltage is extremely dangerous and may cause death or severe injury.

⚠ WARNING

Line terminals (L1, L2, L3), motor terminals (U, V, W) and the DC-link/brake resistor terminals (-/+) are live when the drive is connected to power, even if the motor is not running. Contact with this voltage is extremely dangerous and may cause death or severe injury.

⚠ WARNING

Even though the control I/O-terminals are isolated from line voltage, the relay outputs and other I/O-terminals may have dangerous voltage present even when the drive is disconnected from power. Contact with this voltage is extremely dangerous and may cause death or severe injury.

⚠ WARNING

The HVX9000 drive has a large capacitive leakage current during operation, which can cause enclosure parts to be above ground potential. Proper grounding, as described in this manual, is required. Failure to observe this precaution could result in death or severe injury.

⚠ WARNING

Before applying power to the HVX9000 drive, make sure that the front and cable covers are closed and fastened to prevent exposure to potential electrical fault conditions. Failure to observe this precaution could result in death or severe injury.

⚠ WARNING

An upstream disconnect/protective device must be provided as required by the National Electric Code (NEC). Failure to follow this precaution may result in death or severe injury.

⚠ WARNING

Before opening the HVX9000 drive covers:

- Disconnect all power to the HVX9000 drive.
- Wait a minimum of 5 (five) minutes after all the lights on the keypad are off. This allows time for the DC bus capacitors to discharge.
- A hazardous voltage may still remain in the DC bus capacitors even if the power has been turned off. Confirm that the capacitors have fully discharged by measuring their voltage using a multimeter set to measure DC voltage.

Failure to follow the above precautions may cause death or severe injury.

Cautions

⚠ CAUTION

Do not perform any meggar or voltage withstand tests on any part of the HVX9000 drive or its components. Improper testing may result in damage.

⚠ CAUTION

Prior to any tests or measurements of the motor or the motor cable, disconnect the motor cable at the HVX9000 output terminals (U, V, W) to avoid damaging the HVX9000 during the motor or cable testing.

⚠ CAUTION

Do not touch any components on the circuit boards. Static voltage discharge may damage the components.

⚠ CAUTION

Any electrical or mechanical modification to this equipment without prior written consent of Eaton's Cutler-Hammer business unit will void all warranties and may result in a safety hazard in addition and voiding of the UL listing.

⚠ CAUTION

Install the HVX9000 drive on flame-resistant material such as a steel plate to reduce the risk of fire.

⚠ CAUTION

Install the HVX9000 drive on a perpendicular surface that is able to support the weight of the drive and is not subject to vibration, to lessen the risk of the drive falling and being damaged and/or causing personal injury.

⚠ CAUTION

Prevent foreign material such as wire clippings or metal shavings from entering the drive enclosure, as this may cause arcing damage and fire.

⚠ CAUTION

Install the HXV9000 drive in a well-ventilated room that is not subject to temperature extremes, high humidity, or condensation, and avoid locations that are directly exposed to sunlight, or have high concentrations of dust, corrosive gas, explosive gas, inflammable gas, grinding fluid mist, etc. Improper installation may result in a fire hazard.

Motor and Equipment Safety

⚠ CAUTION

Before starting the motor, check that the motor is mounted properly and aligned with the driven equipment. Ensure that starting the motor will not cause personal injury or damage equipment connected to the motor.

⚠ CAUTION

Set the maximum motor speed (frequency) in the HXV9000 drive according to the requirements of the motor and the equipment connected to it. Incorrect maximum frequency settings can cause motor or equipment damage and the potential for personal injury.

⚠ CAUTION

Before reversing the motor rotation, ensure that this will not cause personal injury or equipment damage.

⚠ CAUTION

Make sure that no power factor correction capacitors are connected to the HVX9000 output or the motor terminals to prevent HVX9000 malfunction and potential damage.

⚠ CAUTION

Make sure that the HVX9000 output terminals (U, V, W) are not connected to the utility line power as severe damage to the HVX9000 drive and personal injury may occur.

Chapter 1 — Overview

This chapter describes the purpose and contents of this manual, the receiving inspection recommendations and the Cutler-Hammer® HVX9000 catalog numbering system.

How to Use This Manual

The purpose of this manual is to provide you with information necessary to install, set and customize parameters, start-up, troubleshoot and maintain the Cutler-Hammer HVX9000 drive from Eaton Electrical®. To provide for safe installation and operation of the equipment, read the safety guidelines at the beginning of this manual and follow the procedures outlined in the following chapters before connecting power to the HVX9000 drive. Keep this operating manual handy and distribute to all users, technicians and maintenance personnel for reference.

Chapter 1 – Overview

Chapter 2 – Mounting

Chapter 3 – Power Wiring

Chapter 4 – Control Wiring

Chapter 5 – IntelliPass Bypass Option

Chapter 6 – Menu Information

Chapter 7 – Start-Up

Chapter 8 – Application Information

Appendix A – Technical Data

Appendix B – Parameter Tables

Appendix C – Fault and Warning Codes

Receiving and Inspection

The HVX9000 AC drive has met a stringent series of factory quality requirements before shipment. It is possible that packaging or equipment damage may have occurred during shipment. After receiving your HVX9000 drive, please check for the following:

- Check to make sure that the package(s) includes the HVX9000 drive, the User Manual, rubber conduit covers, screws, conduit plate and ground straps.
- Inspect the unit to ensure it was not damaged during shipment.
- Make sure that the part number indicated on the nameplate corresponds with the Catalog Number on your order.

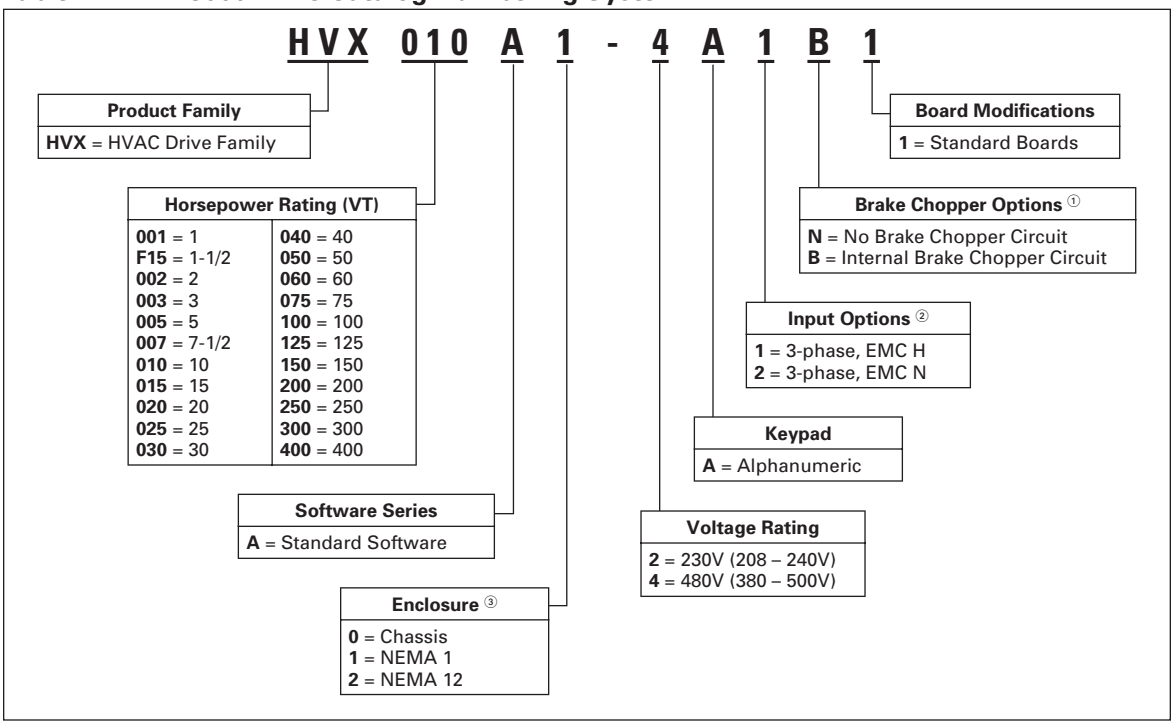
If shipping damage has occurred, please contact and file a claim with the carrier involved immediately.

If the delivery does not correspond to your order, please contact your Eaton Electrical Cutler-Hammer representative.

Note: Do not destroy the packing. The template printed on the protective cardboard can be used for marking the mounting points of the HVX9000 on the wall or cabinet.

Catalog Numbering System

Table 1-1: HVX9000 Drive Catalog Numbering System



① 480V Drives up to 40 hp (VT) are only available with Brake Chopper Option **B**.
480V Drives 50 hp (VT) or larger are only available with Brake Chopper Option **N**.
230V Drives up to 20 hp (VT) are only available with Brake Chopper Option **B**.
230V Drives 25 hp (VT) or larger are only available with Brake Chopper Option **N**.

② All 230V Drives and 480V Drives up to 250 hp (VT) are only available with Input Option **1**.
480V Drives 300 hp (VT) or larger are only available with Input Option **2**.

③ 300 and 400 hp (VT), 480V Drives are only available with Enclosure Style **0** (Chassis).

Note: Availability —
480V: 1-1/2 – 400 hp, 230V: 1 – 40 hp.

Chapter 2 — Mounting

HVX9000 drives may be mounted side-by-side or stacked vertically, as outlined in the following section.

Space Requirements

To ensure proper air circulation and cooling, follow the guidelines below.

Table 2-1: Space Requirements for Mounting an HVX9000 Drive

Drive Type	Approximate Dimensions in Inches (mm)①				
	A	A_2	B	C	D
230V, 1 – 3 hp 480V, 1-1/2 – 7-1/2 hp	0.8 (20)		0.8 (20)	3.9 (100)	2.0 (50)
230V, 5 – 10 hp 480V, 10 – 20 hp	0.8 (20)		0.8 (20)	4.7 (120)	2.4 (60)
230V, 15 – 20 hp 480V, 25 – 40 hp	1.2 (30)		0.8 (20)	6.3 (160)	3.1 (80)
230V, 25 – 30 hp 480V, 50 – 75 hp	3.1 (80)		3.1 (80)	11.8 (300)	3.9 (100)
480V, 100 – 150 hp	3.1 (80)	5.9 (150)	3.1 (80)	11.8 (300)	7.9 (200)
480V, 200 – 250 hp	2.0 (50)		3.1 (80)	15.7 (400)	9.8 (250) 13.8② (350)

① Dimensions represent the minimum clearance needed when mounting a drive. See **Figure 2-1** below.
A = clearance around the HVX9000.
A_2 = clearance needed to change the fan without disconnecting the motor cables.
B = distance between adjacent HVX9000s or between the HVX9000 and an enclosure wall.
C = clearance above the HVX9000.
D = clearance below the HVX9000.

② Minimum clearance below the HVX9000 needed to change the fan.

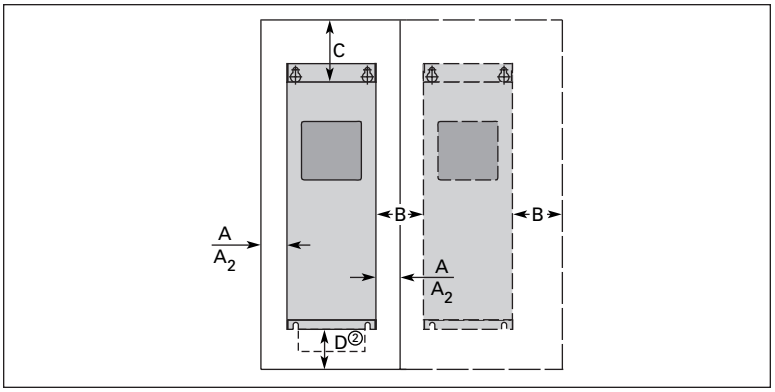


Figure 2-1: Mounting Space Requirements

If several units are mounted above each other, the clearance between the drives should equal C + D (see **Table 2-1** and **Figure 2-1** above). In addition, the outlet air used for cooling the lower unit must be directed away from the inlet air used by the upper unit.

Environmental Requirements

Ensure that the environment meets the requirements listed in **Table A-1** of **Appendix A** for any storage or operating situation.

The following table specifies the minimum airflow required in the area where the drive will be mounted.

Table 2-2: Cooling Airflow Requirements

Drive Type	Cooling Air Required
230V, 1 – 3 hp 480V, 1-1/2 – 7-1/2 hp	41 cfm (70 m^3/h)
230V, 5 – 10 hp 480V, 10 – 20 hp	112 cfm (190 m^3/h)
230V, 15 – 20 hp 480V, 25 – 40 hp	250 cfm (425 m^3/h)
230V, 25 – 30 hp 480V, 50 – 75 hp	250 cfm (425 m^3/h)
480V, 100 – 150 hp	383 cfm (650 m^3/h)
480V, 200 – 250 hp	765 cfm (1300 m^3/h)

Standard Mounting Instructions

1. Measure the mounting space to ensure that it allows for the minimum space surrounding the HVX9000 drive. Drive dimensions are in **Appendix A**.
2. Make sure the mounting surface is flat and strong enough to support the drive, is not flammable, and is not subject to excessive motion or vibration.
3. Ensure that the minimum airflow requirements for your drive are met at the mounting location.
4. Mark the location of the mounting holes on the mounting surface, using the template provided on the cover of the cardboard shipping package.
5. Using fasteners appropriate to your drive and mounting surface, securely attach the drive to the mounting surface using all 4 screws or bolts.

Chapter 3 — Power Wiring

Guidelines

To ensure proper wiring, use the following guidelines:

- Use heat-resistant copper cables only, +75°C or higher.
- The input line cable and line fuses must be sized in accordance with the rated input current of the unit. See **Tables 3-2** and **3-4**.
- Consistent with UL listing requirements, for maximum protection of the HVX9000 drive, UL recognized fuses type RK should be used.
- If motor temperature sensing is used for overload protection, the output wire size may be selected based on the motor specifications.
- If three or more shielded cables are used in parallel for the output on the larger units, every cable must have its own overload protection.
- Avoid placing the motor cables in long parallel lines with other cables.
- If the motor cables run in parallel with other cables, note the minimum distances between the motor cables and other cables given in **Table 3-1** below:

Table 3-1: Cable Spacings

Minimum Distance Between Cables in Feet (m)	Shielded Cable Length in Feet (m)
1 (0.3)	≤164 (50)
3.3 (1.0)	≤656 (200)

- The spacings of **Table 3-1** also apply between the motor cables and signal cables of other systems.
- Maximum length of the motor cables is as follows:
  - 1 – 2 hp 230V units, 328 ft. (100m)
  - All other hp units, 984 ft. (300m)
- The motor cables should cross other cables at an angle of 90 degrees.
- If conduit is being used for wiring, use separate conduits for the input power wiring, the output power wiring, the signal wiring, and the control wiring.

UL Compatible Cable Selection and Installation

Use only copper wire with temperature rating of at least 167°F (75°C).

Table 3-2: Cable and Fuse Sizes – 230V Ratings

hp	Frame Size	NEC I_l (A)	I_l (A)	Fuse (A) ①	Wire Size		Terminal Size	
					Power	Ground	Power	Ground
1	FR4	4.2	4.8	10	14	14	16 – 12	16 – 14
1-1/2	FR4	6	6.6	10	14	14	16 – 12	16 – 14
2	FR4	6.8	7.8	10	14	14	16 – 12	16 – 14
3	FR4	9.6	11	15	12	14	16 – 12	16 – 14
5	FR5	15.2	17.5	20	10	12	16 – 8	16 – 8
7-1/2	FR5	22	25	30	10	10	16 – 8	16 – 8
10	FR5	28	31	40	8	10	16 – 8	16 – 8
15	FR6	42	48	60	4	8	14 – 0	10 – 2
20	FR6	54	61	80	2	8	14 – 0	10 – 2
25	FR7	68	72	100	2	8	14 – 0	10 – 00
30	FR7	80	87	110	1	6	14 – 0	10 – 00

① UL recognized type RK5.

Table 3-3: Cable and Fuse Sizes – 480V Ratings

hp	Frame Size	NEC I_l (A)	I_l (A)	Fuse (A) ①	Wire Size		Terminal Size	
					Power	Ground	Power	Ground
1-1/2	FR4	3	3.3	10	14	14	16 – 12	16 – 14
2	FR4	3.4	4.3	10	14	14	16 – 12	16 – 14
3	FR4	4.8	5.6	10	14	14	16 – 12	16 – 14
5	FR4	7.6	7.6	10	14	14	16 – 12	16 – 14
7-1/2	FR4	11	12	15	12	14	16 – 12	16 – 14
10	FR5	14	16	20	10	12	16 – 8	16 – 8
15	FR5	21	23	30	10	10	16 – 8	16 – 8
20	FR5	27	31	35	8	10	16 – 8	16 – 8
25	FR6	34	38	50	6	10	14 – 0	10 – 2
30	FR6	40	46	60	4	8	14 – 0	10 – 2
40	FR6	52	61	80	2	8	14 – 0	10 – 2
50	FR7	65	72	100	2	8	14 – 0	10 – 00
60	FR7	77	87	110	1	6	14 – 0	10 – 00
75	FR7	96	105	125	1/0	6	14 – 0	10 – 00
100	FR8	124	140	175	3/0	2	4– 3/0	4 – 000
125	FR8	156	170	200	4/0	2	000 – 350 MCM	4 – 000
150	FR8	180	205	250	350	2	000 – 350 MCM	4 – 000
200	FR9	240	261	350	2 X 250	1/0	2*000 – 350 MCM	4 – 000
250	FR9	302	300	400	2 X 300	1/0	2*000 – 350 MCM	4 – 000

① UL recognized type RK5.

Table 3-4: Maximum Symmetrical Supply Current

Product	Voltage	Maximum RMS Symmetrical Amperes on Supply Circuit
1 – 30 hp	230	100,000A
1-1/2 – 250 hp	480	100,000A

Table 3-5: Power Connection Tightening Torque

Rating	Frame Size	Tightening Torque (in-lbs)	Tightening Torque (Nm)
230V, 1 – 3 hp 480V, 1-1/2 – 5 hp	FR4	5	0.6
480V, 7.5 hp	FR4	13	1.5
230V, 5 – 7-1/2 hp 480V, 10 – 15 hp	FR5	13	1.5
480V, 20 hp	FR5	35	4
230V, 10 – 15 hp 480V, 25 – 30 hp	FR6	35	4
230V, 20 hp 480V, 40 hp	FR6	85	10
230V, 25 – 30 hp 480V, 50 – 60 hp	FR7	85	10
480V, 75 hp	FR7	170/76 ①	20/9 ①
480V, 100 hp	FR8	170/80 ①	20/9 ①
480V, 125 – 150 hp	FR8	354/195 ①	40/22 ①
480V, 200 – 250 hp	FR9	354/195 ①	40/22 ①
480V, 300 – 400 hp	FR10	620/340	70/40 ①

① The isolation standoff of the bus bar will not withstand the listed tightening torque. Use a wrench to apply a counter torque when tightening.

Installation Instructions

1. Strip the motor and power cables as shown in **Figure 3-1** and **Table 3-6**.

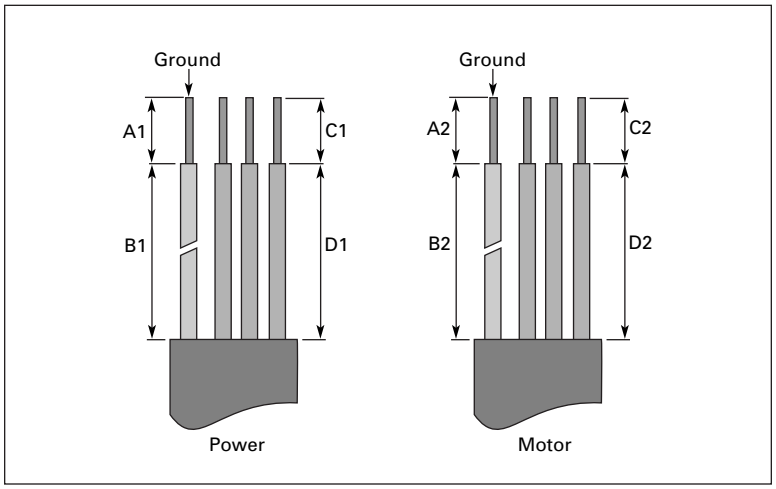


Figure 3-1: Input Power and Motor Cable Stripping and Wire Lengths

Table 3-6: Power and Motor Cable Stripping Lengths

Product		Frame Size	Power Wiring in Inches (mm)				Motor Wiring in Inches (mm)			
Horsepower	Voltage		A1	B1	C1	D1	A2	B2	C2	D2
1 – 3 1-1/2 – 5	230 480	FR4	0.59 (15)	1.38 (35)	0.39 (10)	0.79 (20)	0.28 (7)	1.97 (50)	0.28 (7)	1.38 (35)
7-1/2	480	FR4	0.79 (20)	1.57 (40)	0.39 (10)	1.18 (30)	0.79 (20)	2.36 (60)	0.39 (10)	1.57 (40)
5 – 7-1/2 10 – 15	230 480	FR5	0.79 (20)	1.57 (40)	0.39 (10)	1.18 (30)	0.79 (20)	2.36 (60)	0.39 (10)	1.57 (40)
20	480	FR5	0.79 (20)	3.54 (90)	0.59 (15)	2.36 (60)	0.79 (20)	3.54 (90)	0.59 (15)	2.36 (60)
10 – 15 25 – 30	230 480	FR6	0.79 (20)	3.54 (90)	0.59 (15)	2.36 (60)	0.79 (20)	3.54 (90)	0.59 (15)	2.36 (60)
20 40	230 480	FR6	0.98 (25)	4.72 (120)	0.98 (25)	4.72 (120)	0.98 (25)	4.72 (120)	0.98 (25)	4.72 (120)
25 – 30 50 – 60	230 480	FR7	0.98 (25)	4.72 (120)	0.98 (25)	4.72 (120)	0.98 (25)	4.72 (120)	0.98 (25)	4.72 (120)
75	480	FR8	0.91 (23)	9.45 (240)	0.91 (23)	9.45 (240)	0.91 (23)	9.45 (240)	0.91 (23)	9.45 (240)
100 – 125	480	FR8	1.1 (28)	9.45 (240)	1.1 (28)	9.45 (240)	1.1 (28)	9.45 (240)	1.1 (28)	9.45 (240)
150 – 250	480	FR9	1.1 (28)	11.61 (295)	1.1 (28)	11.61 (295)	1.1 (28)	11.61 (295)	1.1 (28)	11.61 (295)

2. Locate the plastic bag shipped with the drive containing the wiring plate.

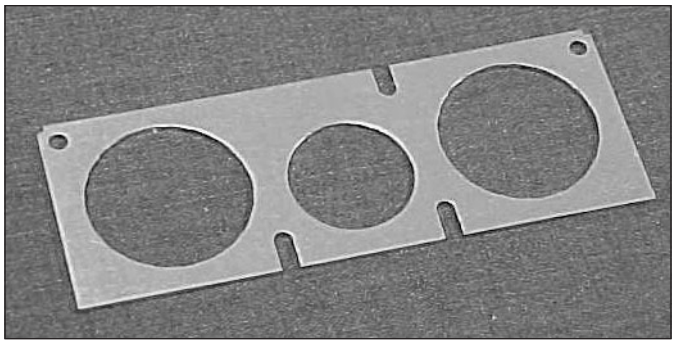


Figure 3-2: Wiring Plate

3. If conduit is being used, attach the wiring plate to it.
4. Pass the motor and input power wires/cables through the holes of the wiring plate.
5. Connect the input power and motor wires to their respective terminals according to the wiring diagrams in the following section marked “Standard Wiring Diagrams and Terminal Locations” on **Page 3-6**.
6. If an optional external brake resistor is used, connect its cable to the appropriate terminals. See “Standard Wiring Diagrams and Terminal Locations”.

7. If shielded cable is used, connect the shields of the input line power cable and the motor cable to the ground terminals of the HVX9000 drive, the motor and the line power supply.

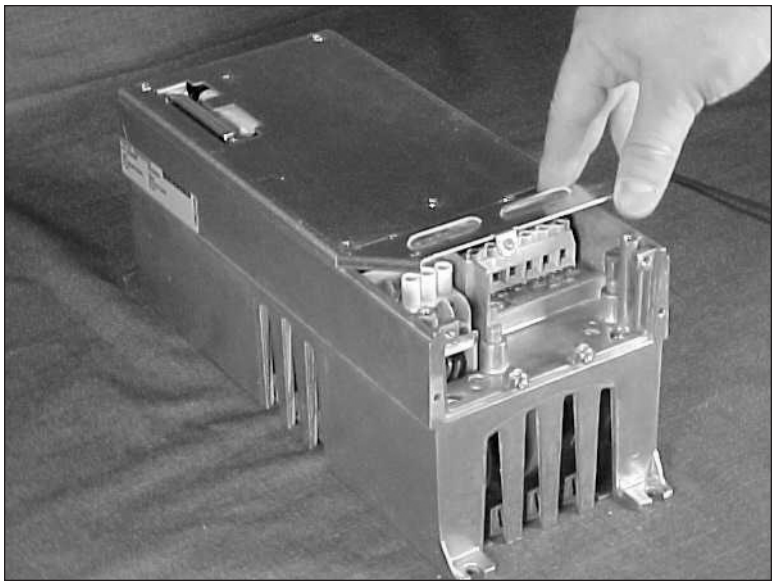


Figure 3-3: Ground Terminal Locations

8. If shielded cable is not used, check the connection of the ground cable to the motor, the HVX9000 drive and the input line power terminals marked with ⏚ .
9. Attach the wiring plate with the screws provided. Ensure that no wires are trapped between the frame and the wiring plate.
10. Insert the rubber grommets into the wiring plate holes that have not been used as illustrated in **Figure 3-4**.

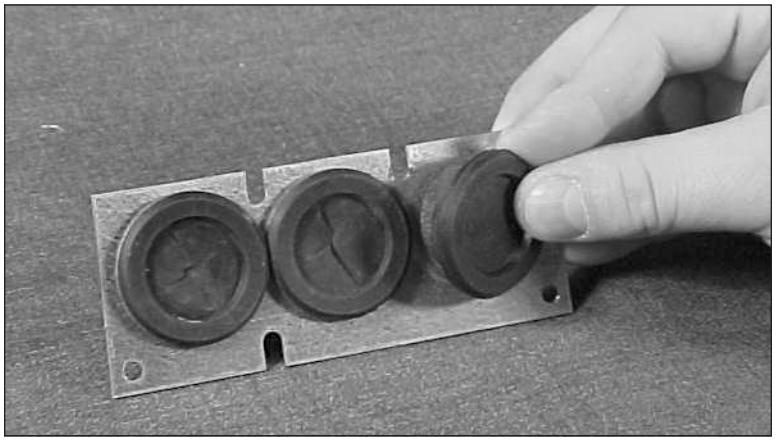


Figure 3-4: Cable Protection Plate

Standard Wiring Diagrams and Terminal Locations

Power and Motor Wiring Terminal Schematic for HVX9000 Drives

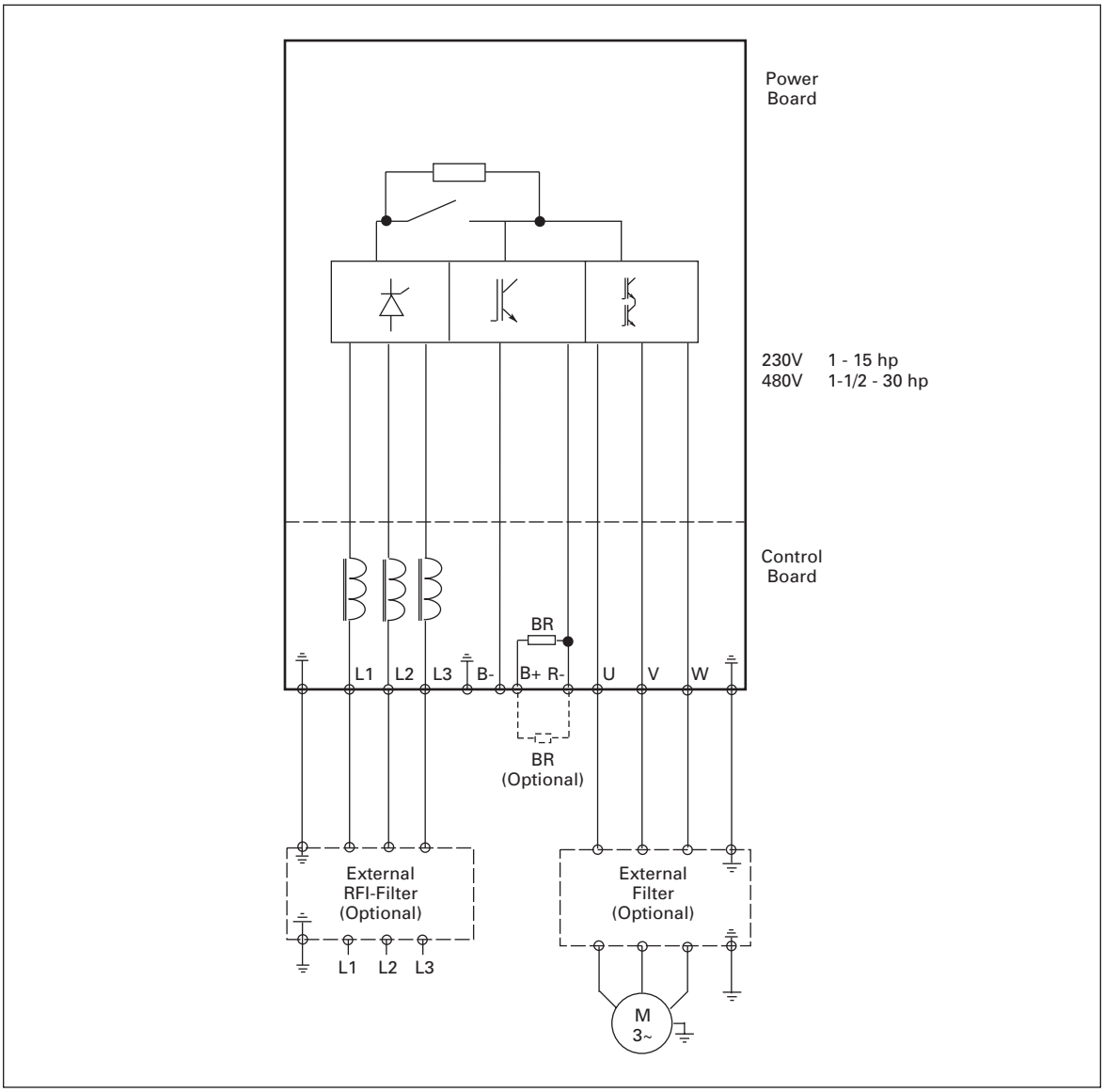


Figure 3-5: HVX9000 Power and Motor Wiring for Small Horsepower Drives

Note: When using a 1-phase supply, for units rated for such, connect the input power to terminals L1 and L2. Refer to **Tables A-2** and **A-3** in **Appendix A**.

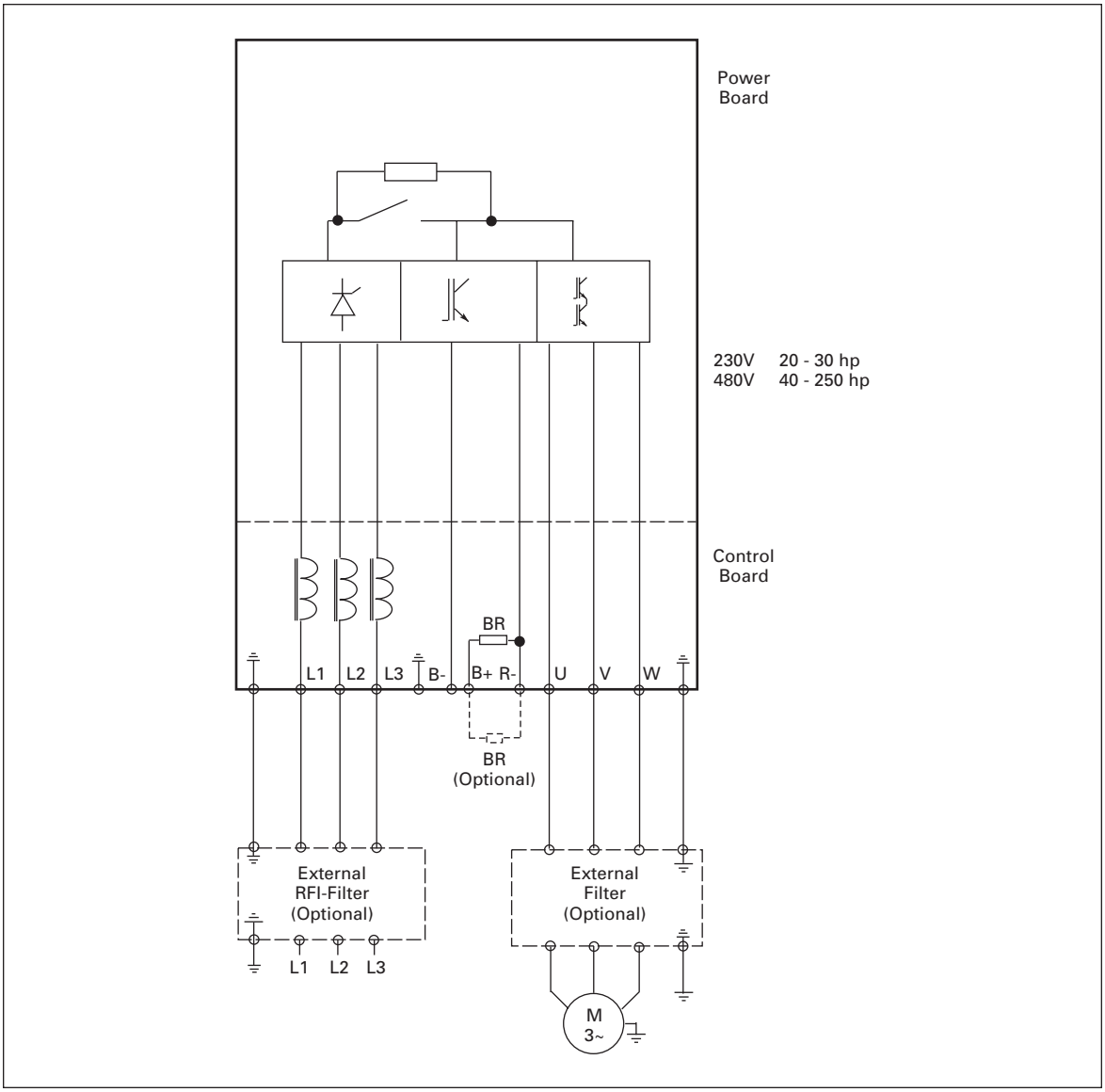


Figure 3-6: HVX9000 Power and Motor Wiring for Large Horsepower Drives

Note: When using a 1-phase supply, for units rated for such, connect the input power to terminals L1 and L2. Refer to **Tables A-2** and **A-3** in **Appendix A**.

Power and Motor Wiring Terminal Photos

230V, 1 – 3 hp
480V, 1-1/2 – 7-1/2 hp

Frame Size: FR4

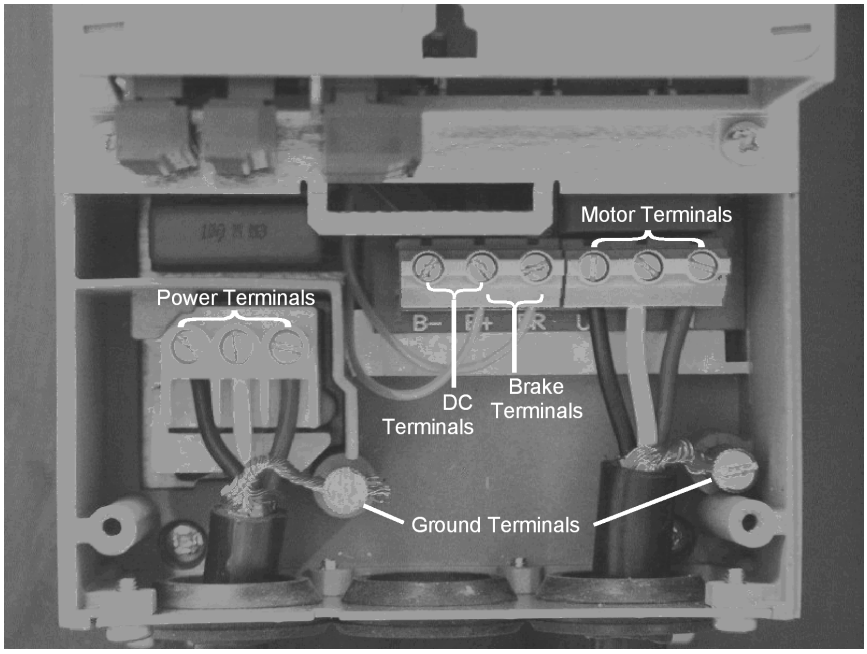


Figure 3-7: FR4 Power and Motor Wiring Terminals

230V, 5 – 10 hp
480V, 10 – 20 hp

Frame Size: FR5

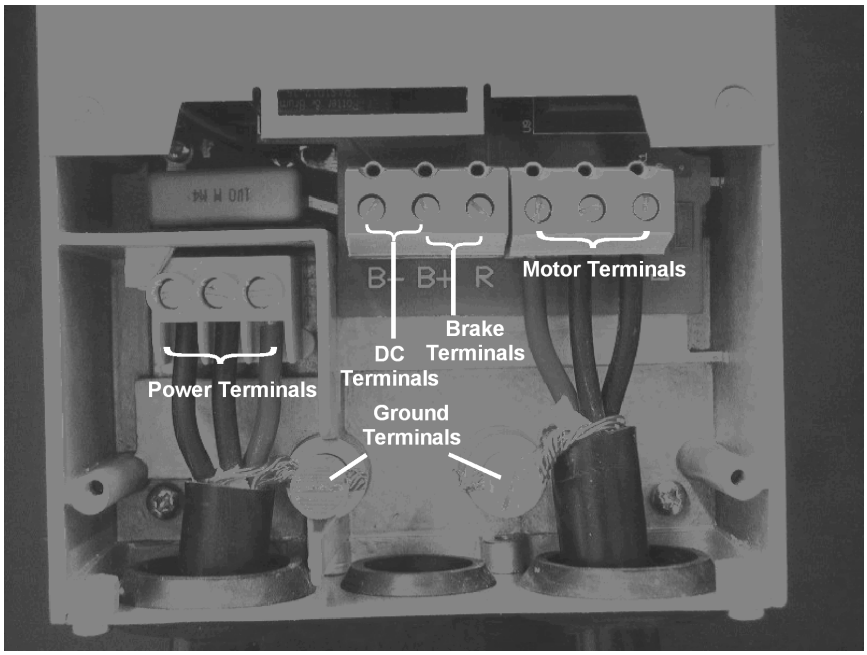


Figure 3-8: FR5 Power and Motor Wiring Terminals

230V, 15 – 20 hp
480V, 25 – 40 hp
525 – 690V

Frame Size: FR6

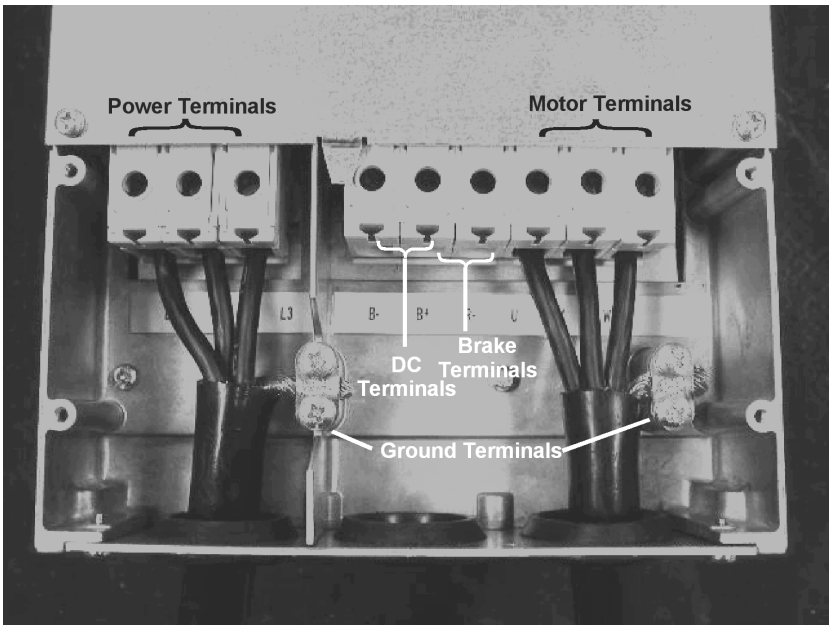


Figure 3-9: FR6 Power and Motor Wiring Terminals

230V, 25 – 30 hp
480V, 50 – 75 hp

Frame Size: FR7

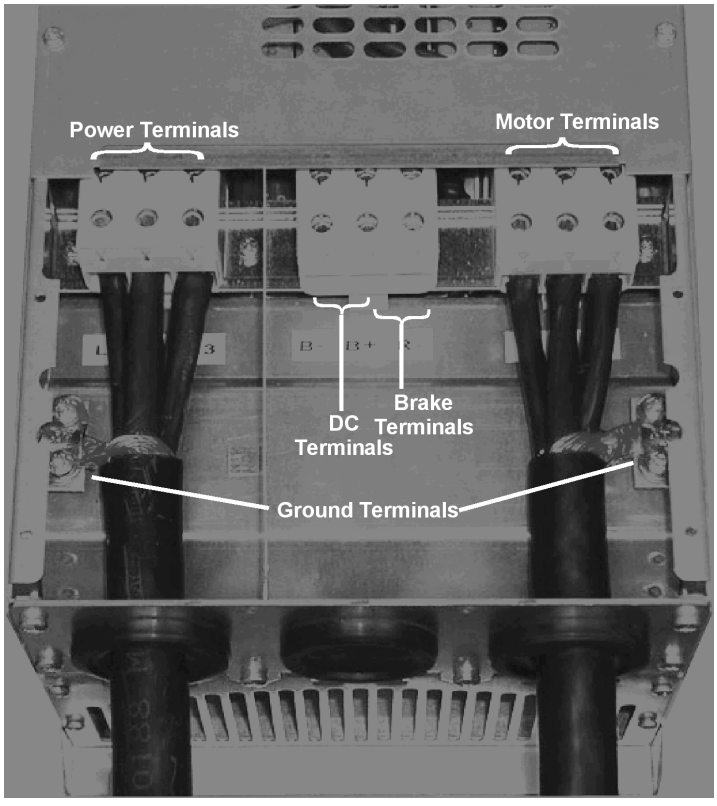
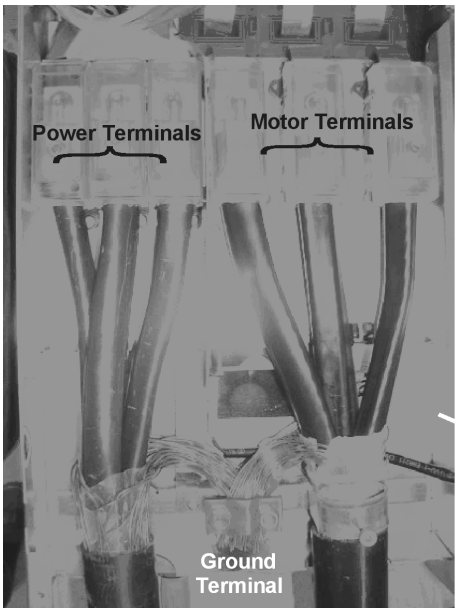


Figure 3-10: FR7 Power and Motor Wiring Terminals

480V, 100 – 150 hp

Frame Size: FR8



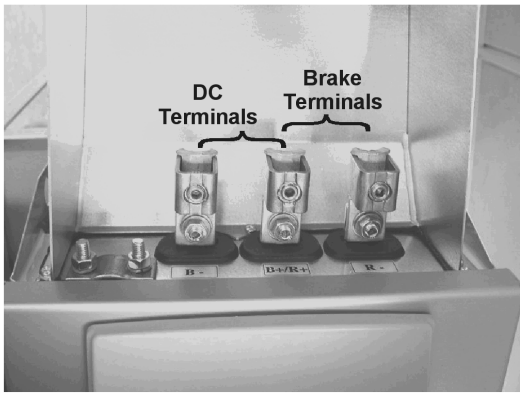


Figure 3-11: FR8 Power and Motor Wiring Terminals

480V, 200 – 250 hp

Frame Size: FR9

Figure 3-12: FR9 Power and Motor Wiring Terminals

Checking the Cable and Motor Insulation

1. Check the motor cable insulation as follows:
   - Disconnect the motor cable from terminals U, V and W of the HVX900 and from the motor.
   - Measure the insulation resistance of the motor cable between each phase conductor as well as between each phase conductor and the protective ground conductor.
   - The insulation resistance must be >1MΩ.
2. Check the input power cable insulation as follows:
   - Disconnect the input power cable from terminals L1, L2 and L3 of the HVX9000 and from the utility line feeder.
   - Measure the insulation resistance of the input power cable between each phase conductor as well as between each phase conductor and the protective ground conductor.
   - The insulation resistance must be >1MΩ.
3. Check the motor insulation as follows:
   - Disconnect the motor cable from the motor and open any bridging connections in the motor connection box.
   - Measure the insulation resistance of each motor winding. The measurement voltage must equal at least the motor nominal voltage but not exceed 1000V.
   - The insulation resistance must be >1MΩ.

Chapter 4 — Control Wiring

General Information

The control unit of the HVX9000 drive consists of the control board and various option boards that plug into the five slot connectors (A to E) of the control board.

Galvanic isolation of the control terminals is provided as follows:

- Control connections are isolated from power, and the GND terminals are permanently connected to ground.
- Digital inputs are galvanically isolated from the I/O ground.
- Relay outputs are double-isolated from each other at 300V AC.

Option Board General Information

The HVX9000 Series drives can accommodate a wide selection of *expander* and *adapter boards* to customize the drive for your application needs.

The drive's control unit is designed to accept a total of five option boards. Option boards are available for normal analog and digital inputs and outputs, for communication and for additional application-specific hardware.

The HVX9000 factory installed standard option board configuration includes an A9 I/O board and an A2 relay output board, which are installed in slots A and B. For information on additional option boards, see the 9000X Series Drives Option Board Manual.

Note: If your HVX9000 has been shipped with a factory installed IntelliPass bypass, the B5 option board is installed in slot C.

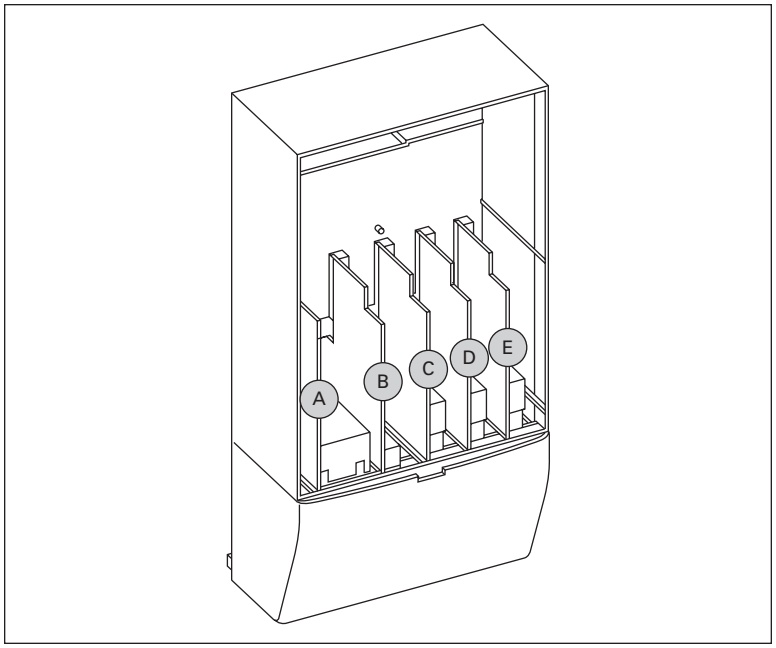


Figure 4-1: Option Board Slots

Control Wiring Guidelines

Wire the control terminals using the following guidelines:

- The control wires shall be at least AWG 20 (0.5 mm^2) shielded cables.
- The maximum wire size is AWG 14 (2.5 mm^2) for the relay terminals and AWG 16 (1.5 mm^2) for all other terminals.
- The tightening torques for the option board terminals are listed in **Table 4-1**.

Table 4-1: Tightening Torques of Terminals

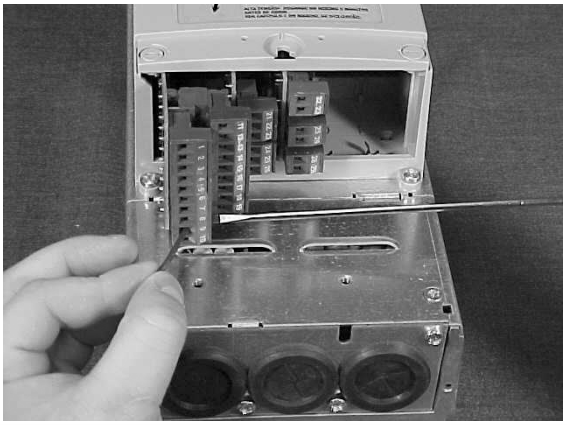
Terminal Screw	Tightening Torque	
	lb-in	Nm
Relay and thermistor terminals (M3 screw)	4.5	0.5
Other terminals (M2.6 screw)	2.2	0.25

Control Wiring Instructions

Table 4-2: Control Wiring Instructions

1. Unlock the bottom cover by turning the locking screw 90 degrees counterclockwise.	
2. Remove the bottom cover by rotating the cover towards you on the base hinges, then lifting the cover away from the base.	

Table 4-2: Control Wiring Instructions (Continued)

3. Wire the control terminals following the details for the specific option boards shown on the following pages. **Note:** For ease of access, the option board terminal blocks can be unplugged for wiring.	

Control Wiring Details

Wiring Option Board A9

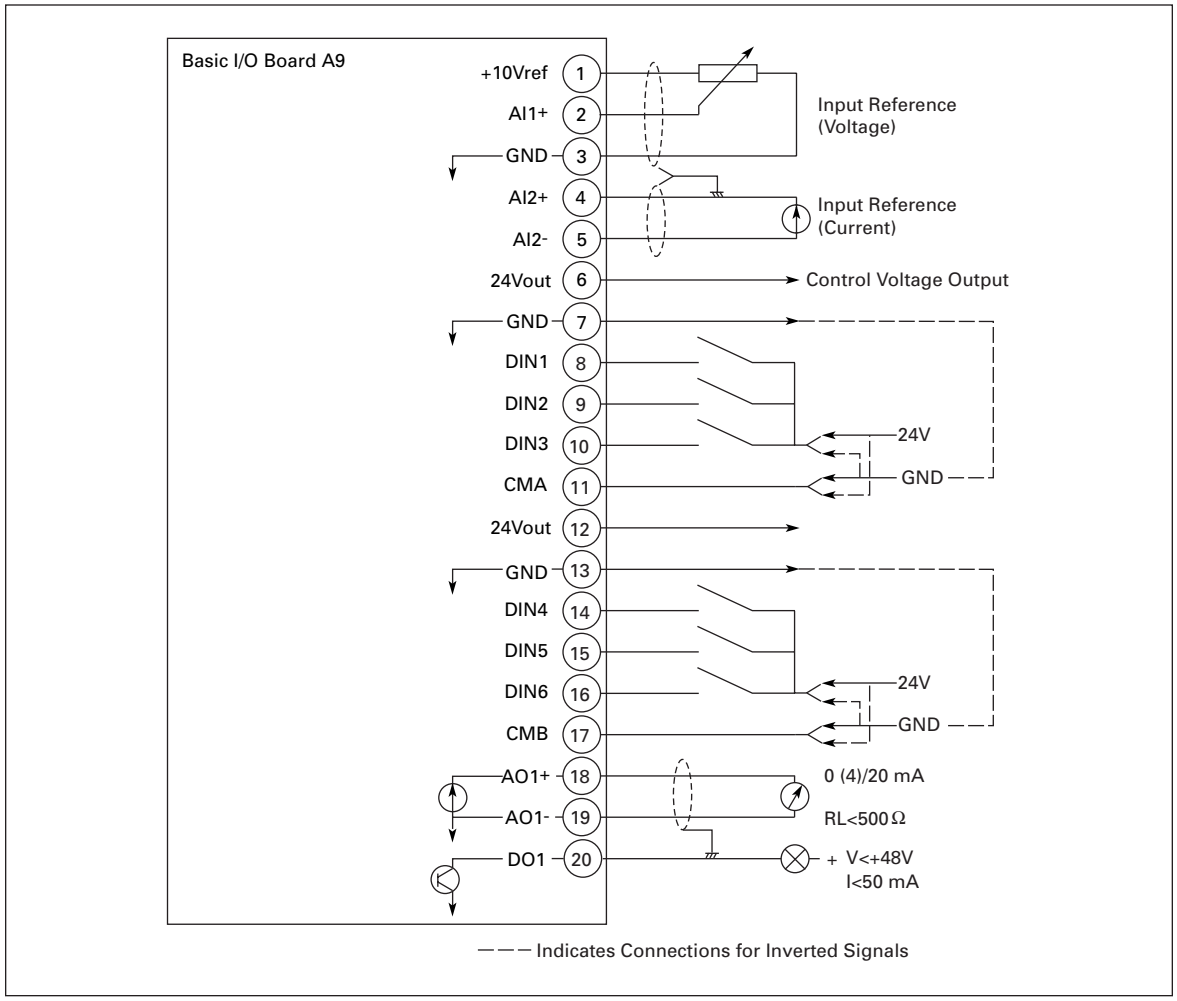


Figure 4-2: Option Board A9 Wiring Diagram

Table 4-3: Option Board A9 Terminal Descriptions

Terminal		Signal		Description and Parameter Reference
1	+10 V_{ref}	Reference voltage		Maximum current 10 mA
2	AI1+	Analog input, voltage		Default: 0 – +10V (R_i = 200 kΩ; -10V to +10V joystick control) 0 – 20 mA (R_i = 250 Ω) *Select V or mA with jumper block X1 (**Figure 4-3**)* Differential input if not connected to ground; allows ±20V differential mode voltage to GND
3	GND	Analog input common		
4	AI2+	Analog input		Default: 0 – 20 mA (R_i = 250 Ω) 0 – +10V (R_i = 200 kΩ; -10V to +10V joystick control) *Select V or mA with jumper block X2 (**Figure 4-3**)* Differential input if not connected to ground; allows ±20V differential mode voltage to GND
5	GND/ AI2-	Analog input common		
6	24 V_{out}	24V control voltage (bi-directional)		±15%, 250 mA (all boards total); 150 mA (max. current from single board); Can be used as external power backup for the control (and fieldbus); Galvanically connected to terminal #12
7	GND	I/O ground		Ground for reference and controls; Galvanically connected to terminals #13, 19
8	DIN1	Digital input 1	Start	R_i = min. 5 kΩ
9	DIN2	Digital input 2	Ext Fault Closed	
10	DIN3	Digital input 3	Fault Reset	
11	CMA	Digital input common A for DIN1, DIN2 and DIN3		Must be connected to GND or 24V of I/O terminal or to external 24V or GND. Selection with jumper block X3. (**Figure 4-3**)
12	24 V_{out}	24V control voltage (bi-directional)		Same as terminal #6; Galvanically connected to terminal #6
13	GND	I/O ground		Same as terminal #7; Galvanically connected to terminals #7 & 19
14	DIN4	Digital input 4	Accel/Decel Select	R_i = min. 5 kΩ
15	DIN5	Digital input 5	PM Setback	
16	DIN6	Digital input 6	Speed Select 3	
17	CMB	Digital input common B for DIN4, DIN5 and DIN6		Must be connected to GND or 24V of I/O terminal or to external 24V or GND. Select with jumper block X3. (**Figure 4-3**)
18	A01+	Analog signal (+output)		Output signal range: 0 – 10V default Current: 0(4) – 20 mA, RL max 500 Ω or Voltage: 0 – 10V, RL >1 kΩ: default Selection with jumper block X6. (**Figure 4-3**)
19	A01-	Analog output common		Maximum V_{in} = 48V DC; Galvanically connected to terminals #7, 13
20	DO1	Digital output1	Ready	Open collector, Maximum current = 50 mA

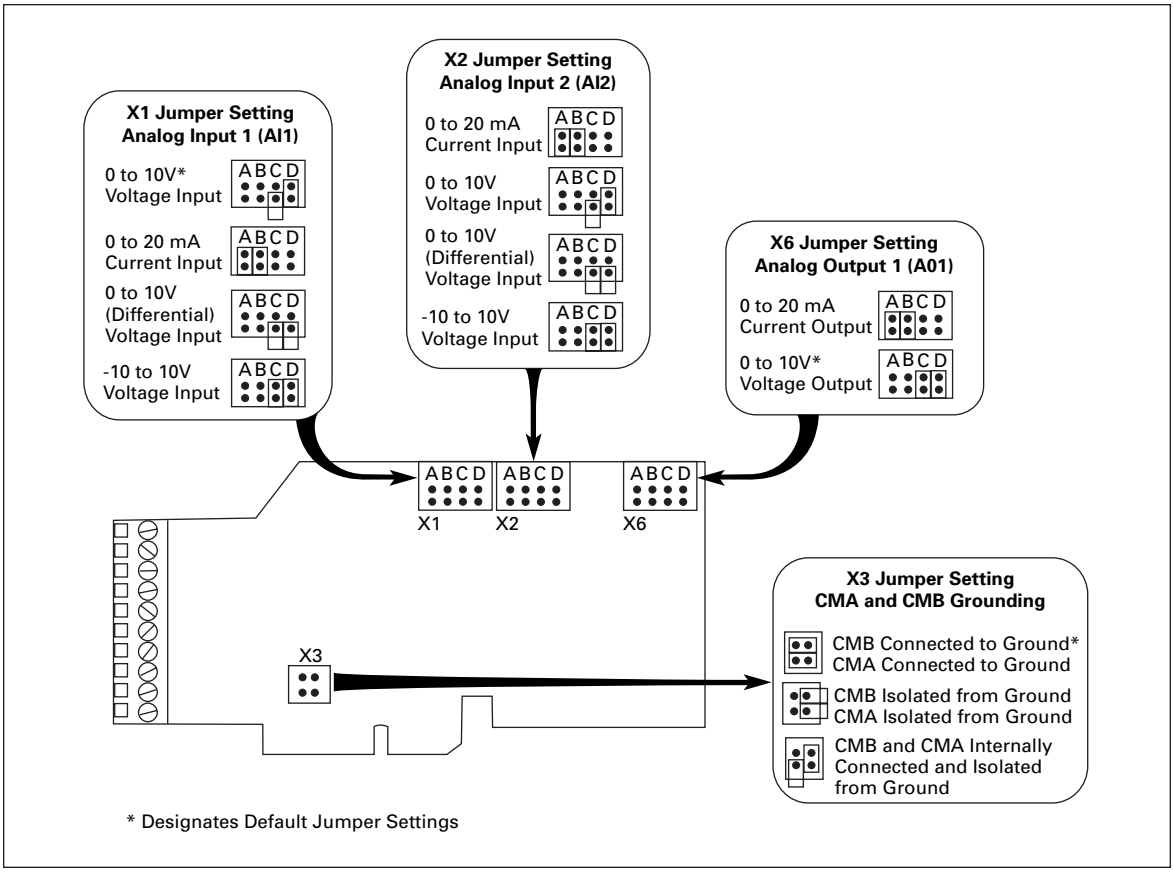


Figure 4-3: Option Board A9 Jumper Location and Settings

Wiring Option Board A2

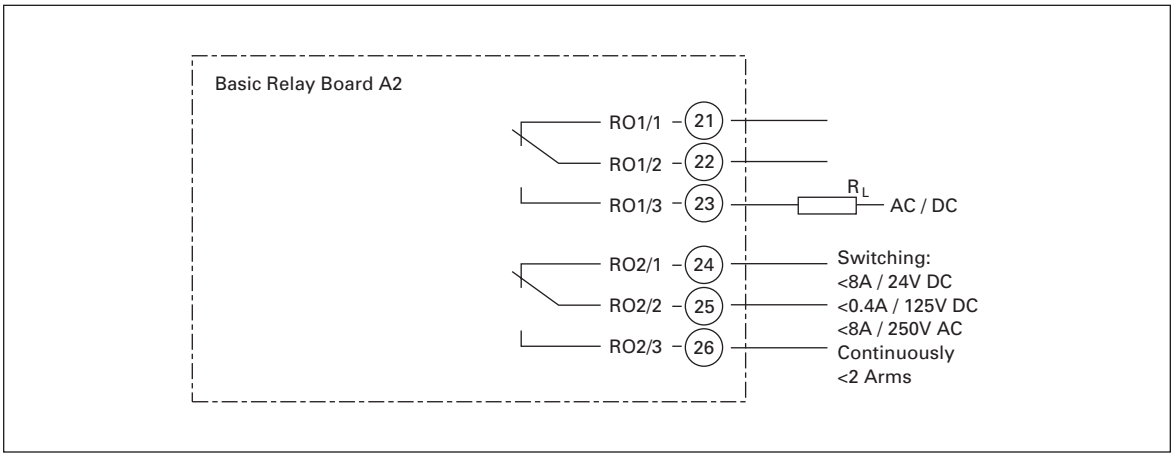


Figure 4-4: Option Board A2 Wiring Diagram

Table 4-4: Option Board A2 Terminal Descriptions

Terminal		Signal	Description and Parameter Reference	
21	RO1/1	Normally Closed (NC)	Run	Switching Capacity: 24V DC / 8A 250V AC / 8A 125V DC / 0.4Az Min switching load: 5V/10 mA Continuous Capacity: <2 Arms
22	RO1/2	Common		
23	RO1/3	Normally Open (NO)		
24	RO2/1	Normally Closed (NC)	Fault	Switching Capacity: 24V DC / 8A 250V AC / 8A 125V DC / 0.4A Min switching load: 5V/10 mA Continuous Capacity: <2 Arms
25	RO2/2	Common		
26	RO2/3	Normally Open (NO)		

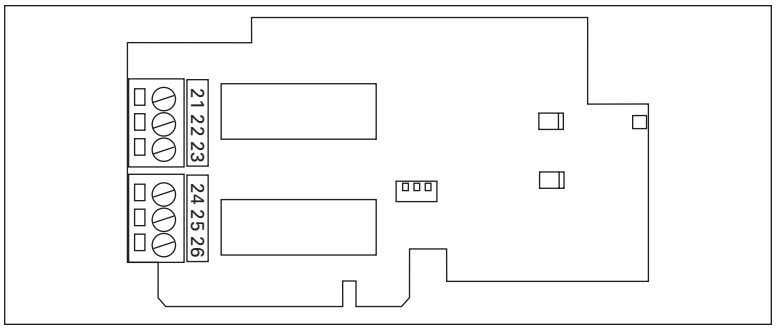


Figure 4-5: Option Board A2 Terminal Locations

Inverting the Digital Input Signal

The active signal level depends on which potential the common inputs CMA and CMB (terminals 11 and 17) are connected to. The alternatives are either +24V or ground (0V). See **Figure 4-6**.

The 24-volt control voltage and the ground for the digital inputs and the common inputs (CMA, CMB) can be either the internal 24V supply or an external supply.

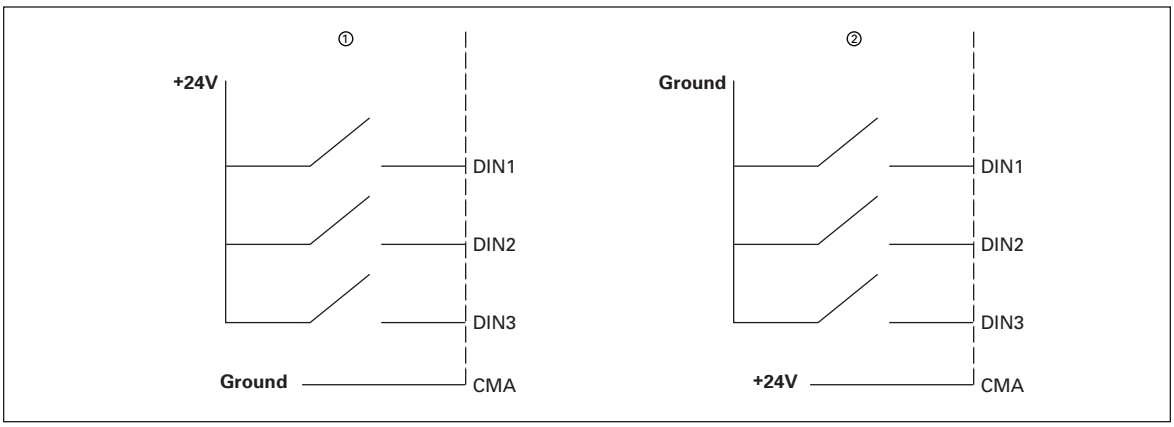


Figure 4-6: Positive/Negative Logic

① Positive logic (+24V is the active signal) = the input is active when the switch is closed.
② Negative logic (0V is the active signal) = the input is active when the switch is closed.

Chapter 5 — IntelliPass Bypass Option

Product Description

The Cutler-Hammer IntelliPass Drive continues Eaton Electrical's tradition of providing a premier intelligent drive integrated with a reliable bypass configuration, by taking advantage of the Cutler-Hammer Intelligent Technologies (***IT.***), enclosed control and circuit breaker expertise.

The IntelliPass bypass is a two- or three-contactor design utilizing the Cutler-Hammer 24V DC ***IT.*** series of contactors and power supplies. The ***IT.*** features, function and form allow the drive and bypass to become an integrated design, enabling Eaton Electrical to manufacture the world's smallest drive and bypass package. The IntelliPass comes standard with a Cutler-Hammer protective disconnect integrated into the drive and bypass design.

Dimensions

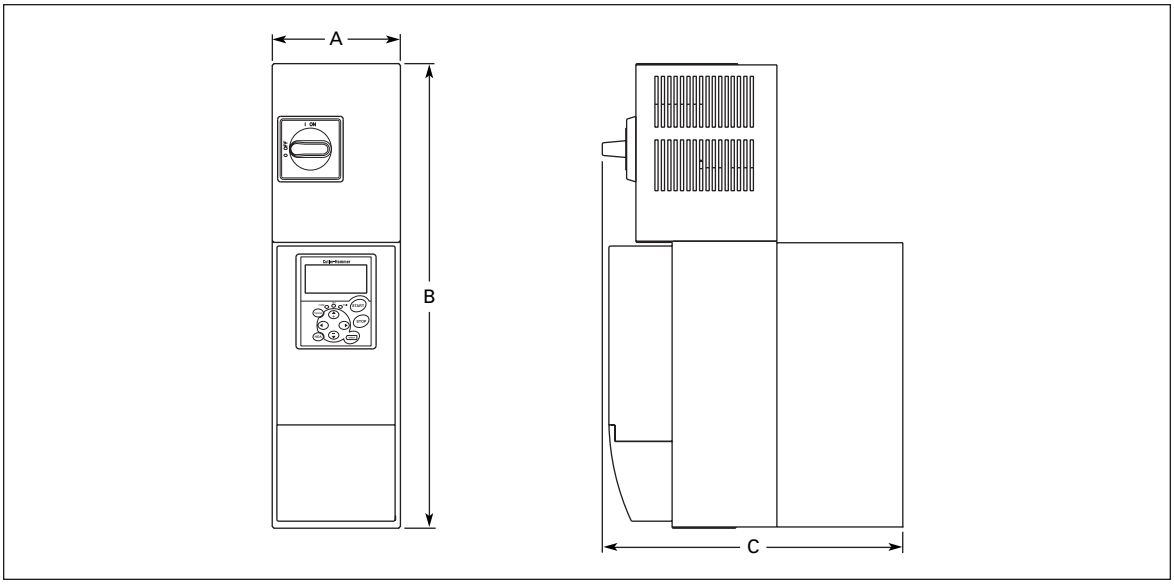


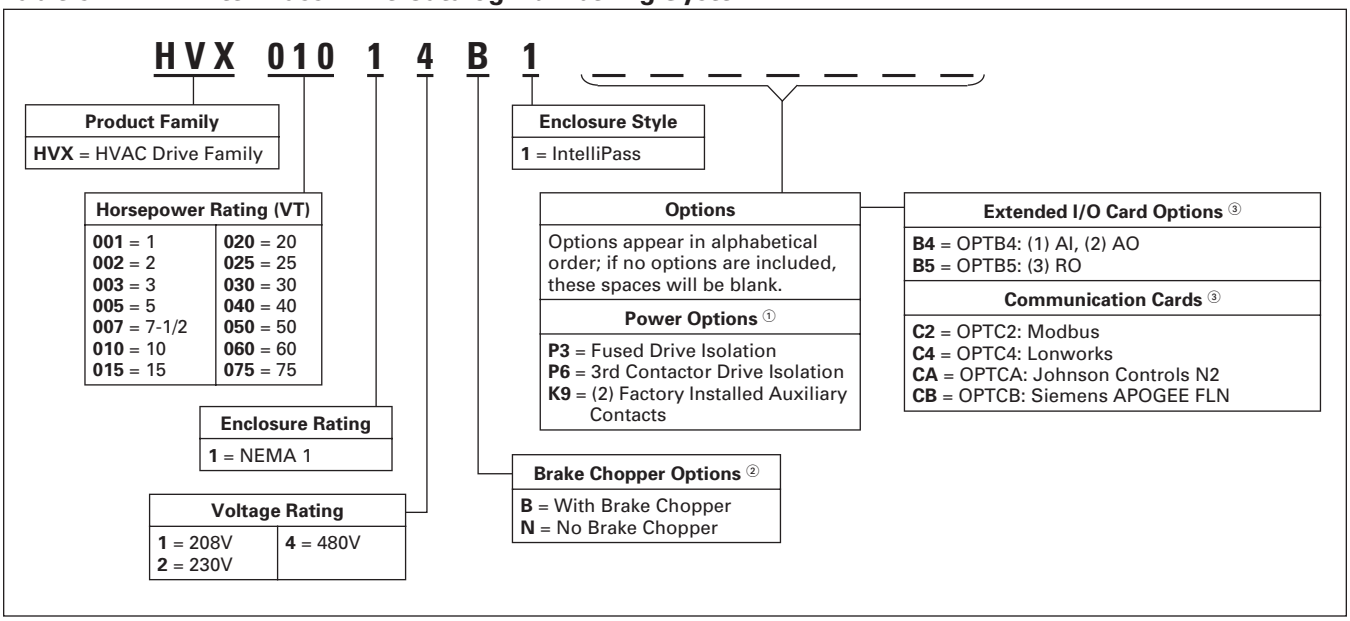
Figure 5-1: HVX IntelliPass Dimensions

Table 5-1: 480V NEMA 1 IntelliPass Drive Dimensions

Drive Horsepower (VT)	Frame Size	Approximate Dimensions in Inches (mm)			Weight in Lbs. (kg)
		A	B	C	
230V, 1 – 3 hp 480V, 1 – 7-1/2 hp	FR4	5.04 (128)	18.25 (464)	12.13 (308)	21 (9.5)
230V, 5 – 7-1/2 hp 480V, 10 – 20 hp	FR5	5.50 (140)	23.25 (591)	15.00 (381)	35 (15.9)
230V, 10 – 20 hp 430V, 25 – 40 hp	FR6	7.50 (191)	29.38 (746)	15.25 (387)	67 (30.4)
230V, 25 – 30 hp 480V, 50 – 75 hp	FR7	9.10 (231)	37.53 (953)	16.00 (419)	108 (49.0)

Catalog Number Selection

Table 5-2: HVX IntelliPass Drive Catalog Numbering System



① Power Options **P3** and **P6** cannot be ordered together in the same drive.

② 480V Drives, 50 – 75 hp are only available with Brake Chopper Option **N**. 208/230V Drives, 1 – 20 hp are only available with Brake Chopper Option **N**. 208/230V Drives, 25 hp and 30 hp are only available with Brake Chopper Option **N**.

③ Two slots (D, E) available for expansion cards.

Converting the HVX9000 Drive to an IntelliPass Drive

Installing the IntelliPass Bypass Kit

Table 5-3: IntelliPass Bypass Kit Installation Instructions

1. To unlock the bottom cover, turn the locking screw 90 degrees counterclockwise.	
2. Remove the bottom cover by rotating the cover towards you on the base hinges, then lifting the cover away from the base.	
3. Remove the keypad by squeezing the two side tabs and lifting the keypad away from the drive.	

Table 5-3: IntelliPass Bypass Kit Installation Instructions, continued

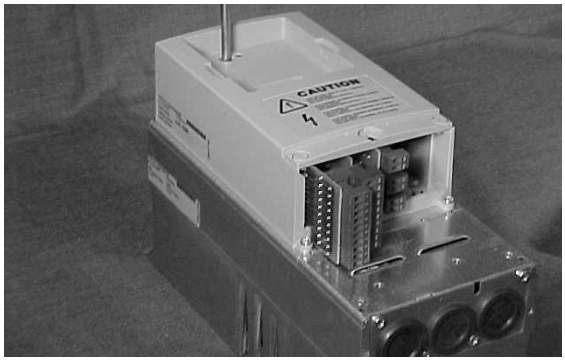
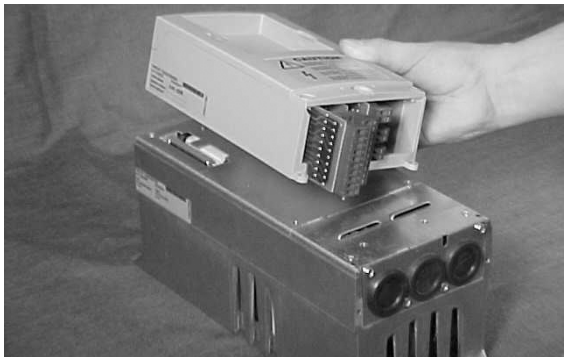
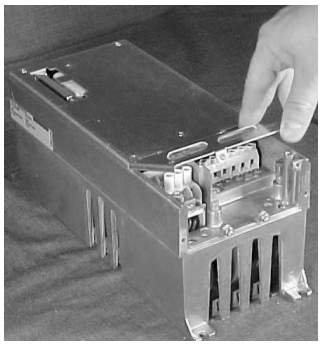
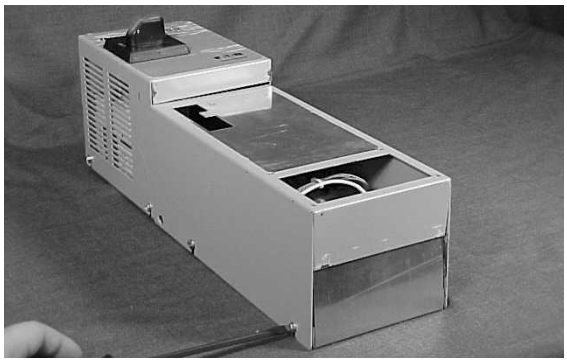
4. Loosen the three control module mounting screws.	
5. Remove the control module.	
6. Remove the motor and line lead cover plate from the power module by unscrewing the two flathead screws and lifting the plate.	 
7. Loosen the four bypass cover screws.	

Table 5-3: IntelliPass Bypass Kit Installation Instructions, continued

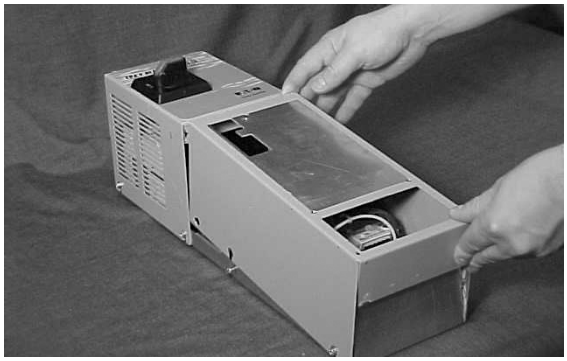
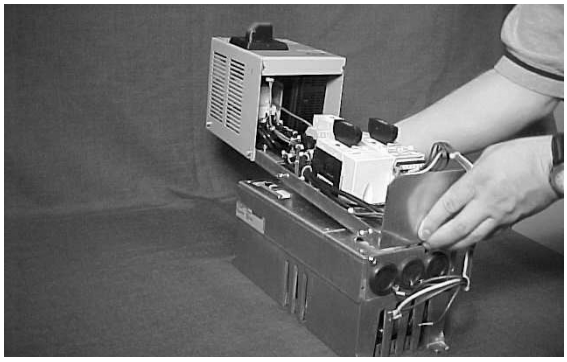
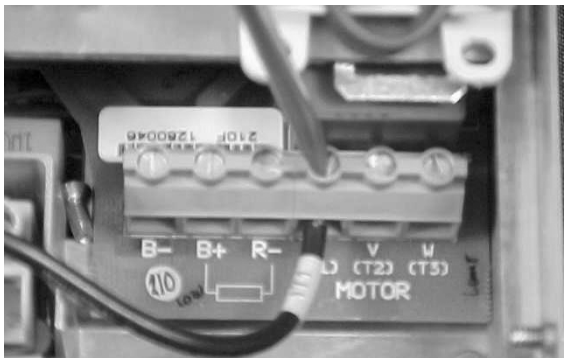
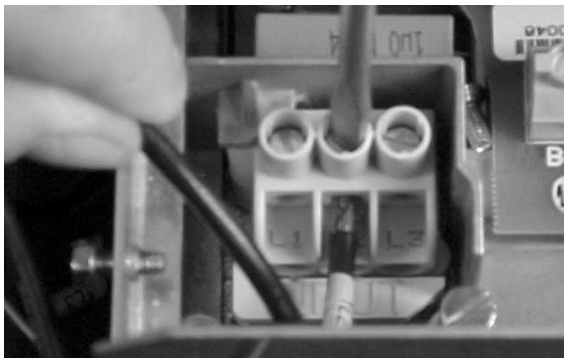
8. Remove the cover from the bypass.	
9. Set the bypass on the drive's power module.	
10. Wire 1T1, 1T2 and 1T3 wires from bypass to power module terminals U(T1), V(T2) and W(T3).	
11. Wire 1L1, 1L2 and 1L3 wires from bypass to power module terminals L1, L2 and L3 respectively.	

Table 5-3: IntelliPass Bypass Kit Installation Instructions, continued

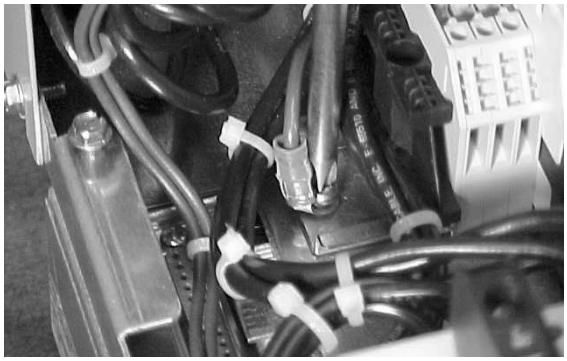
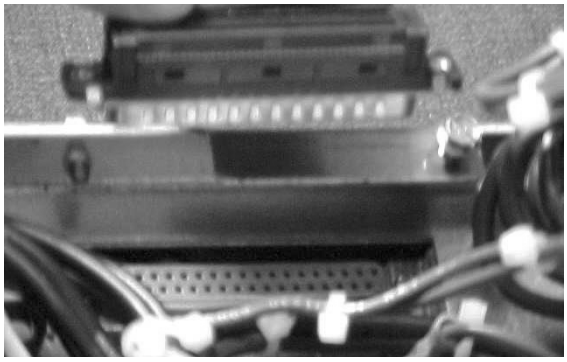
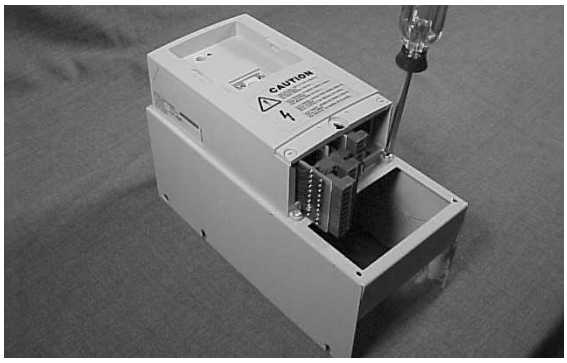
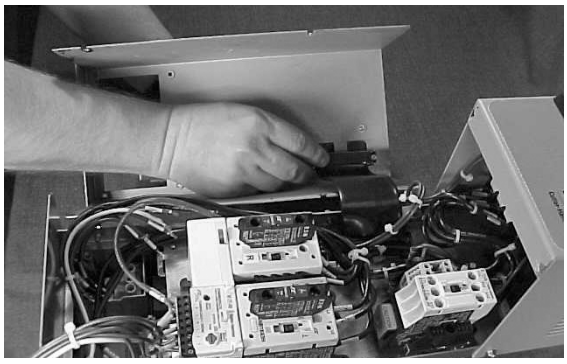
12. Attach the bypass to the power module using the three mounting screws. **Note:** Be sure to ground the green wire using the mounting screw marked "1" in the picture.	
13. Plug in the control cable.	
14. Place the control module on the top of the bypass cover and fasten the mounting screws.	
15. Plug the control cable into the drive control.	

Table 5-3: IntelliPass Bypass Kit Installation Instructions, continued

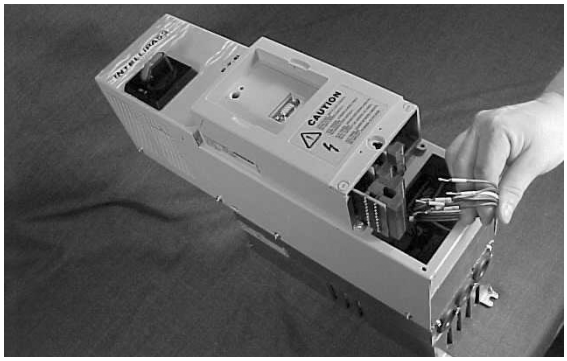
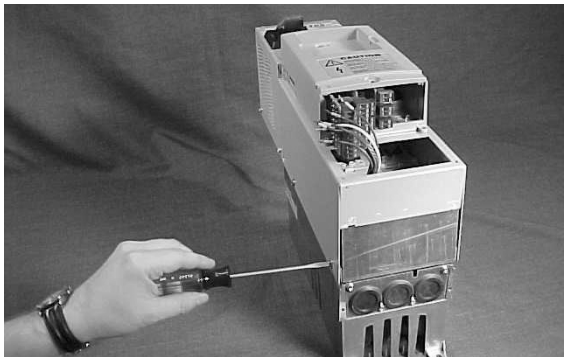
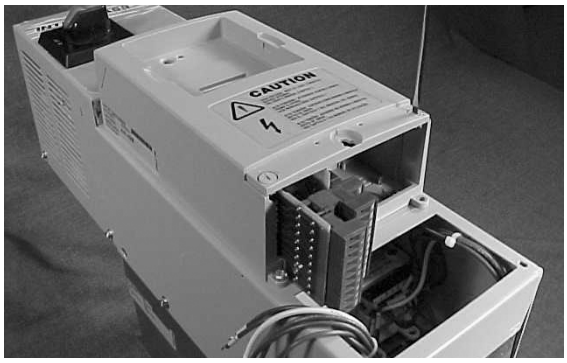
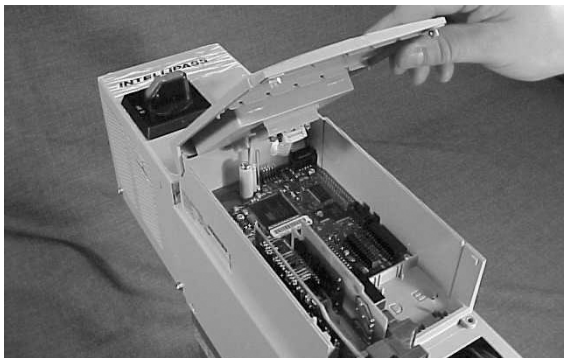
16. Thread the control wiring through the bypass cover and place the cover on the bypass.	
17. Tighten the bypass cover screws.	
18. Loosen the control cover by turning the two lock screws 1/4 turn.	
19. Lift the control cover.	

Table 5-3: IntelliPass Bypass Kit Installation Instructions, continued

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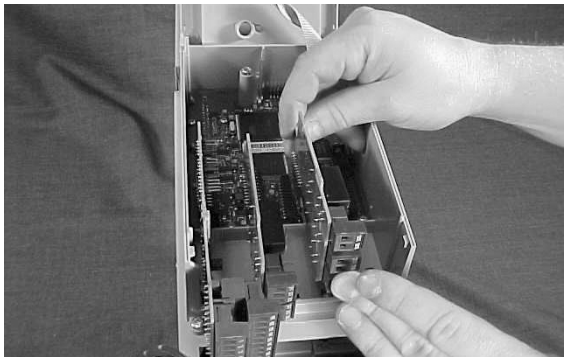
<td>20. Insert the B5 option board into slot C.</td>
<td>  </td>
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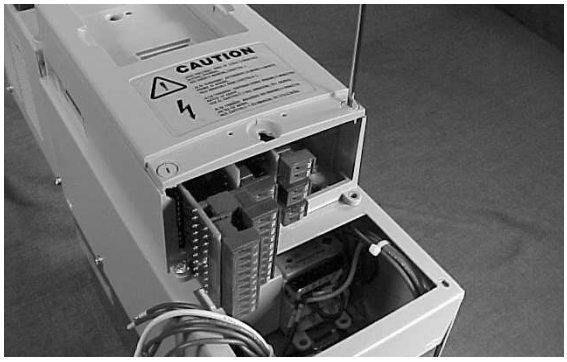
<tr>
<td>21. Close and lock the control cover.</td>
<td> 
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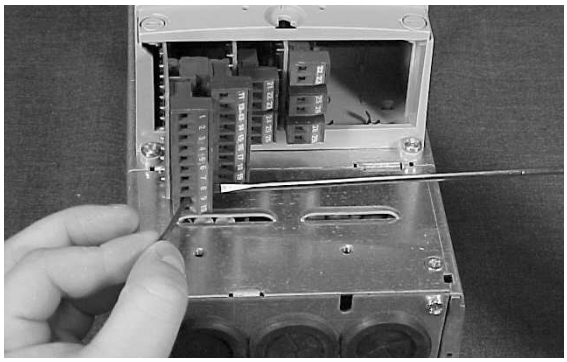
<tr>
<td>22. Wire the bypass control wires to the drive control boards.</td>
<td> 
<table>
<tr><th>Wire Number</th><th>Control Board</th><th>Terminal Number</th></tr>
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<tr><td>2</td><td>A9</td><td>6</td></tr>
<tr><td>3</td><td>B5</td><td>23</td></tr>
<tr><td>4</td><td>B5</td><td>26</td></tr>
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<tr><td>6</td><td>A9</td><td>11</td></tr>
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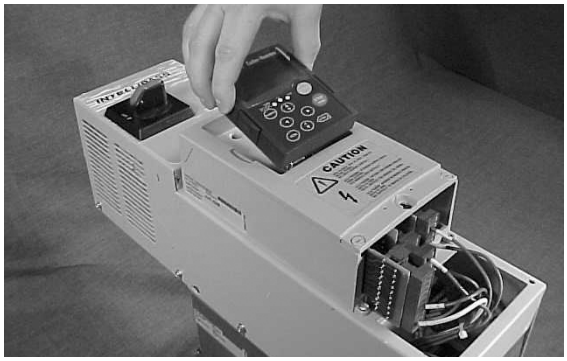
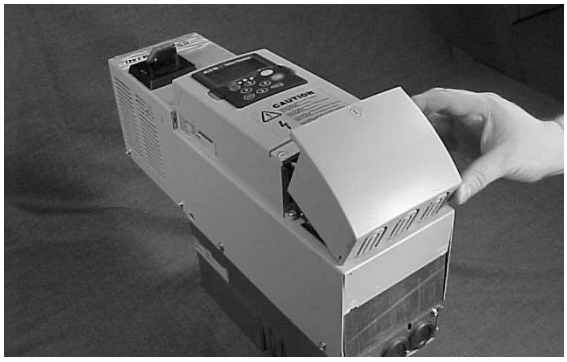
Table 5-3: IntelliPass Bypass Kit Installation Instructions, continued

23. Replace the keypad.	
24. Replace the control module's bottom cover and lock it.	

25. Proceed to the power and control wiring sections for the IntelliPass.

IntelliPass Power Wiring Instructions

Table 5-4: IntelliPass Power Wiring Instructions

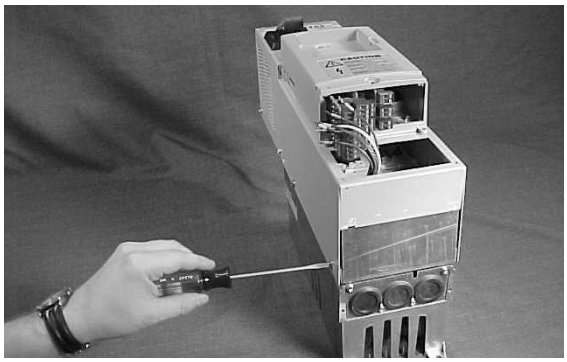
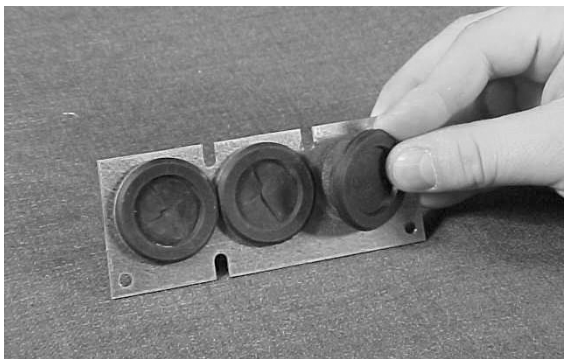
1. Loosen the four screws on the side of the bottom bypass cover. 2. Lift the bypass cover off of the base.	
3. Hook the cover on the hanger screw on the upper left side of the unit using the keyhole in the side of the bypass cover.	
4. If using conduit, remove the base plate and attach the conduit connector to the plate. Thread the power and motor wires through separate holes in the conduit plate.	

Table 5-4: IntelliPass Power Wiring Instructions, continued

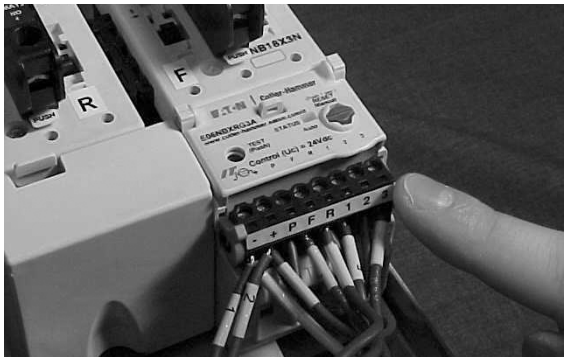
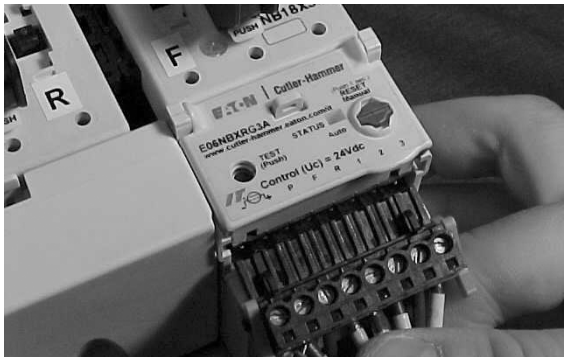
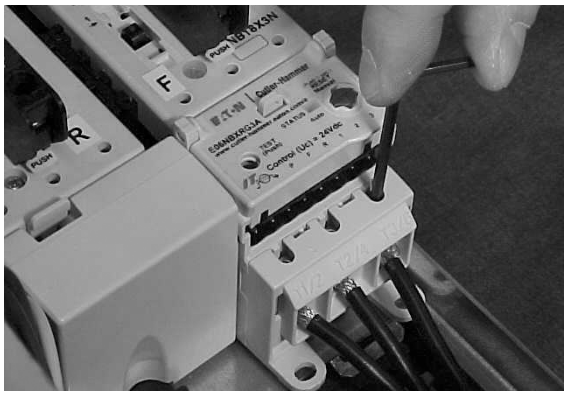
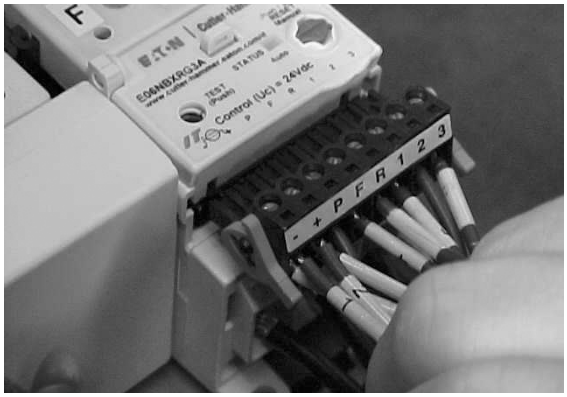
5. Remove the contactor control wiring terminal by the orange locking tabs on either side of the terminal block, ...	
6. ... then pull the terminal away from the contactor.	
7. Attach the motor wiring to terminals U(T1/2), V(T2/4) and W(T3/5) ...	
8. ... and plug the contactor control terminal back into the terminal block.	

Table 5-4: IntelliPass Power Wiring Instructions, continued

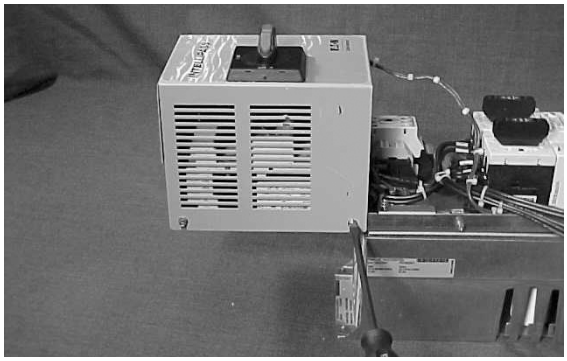
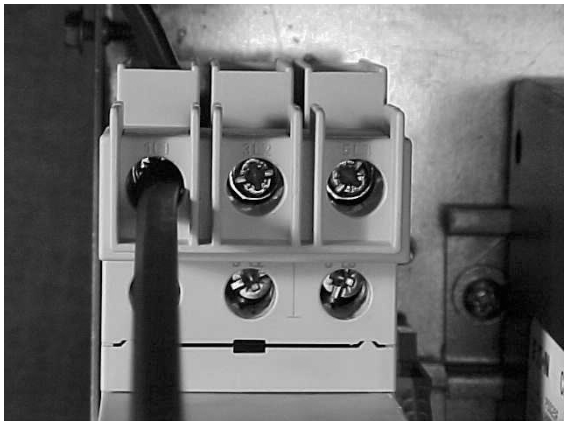
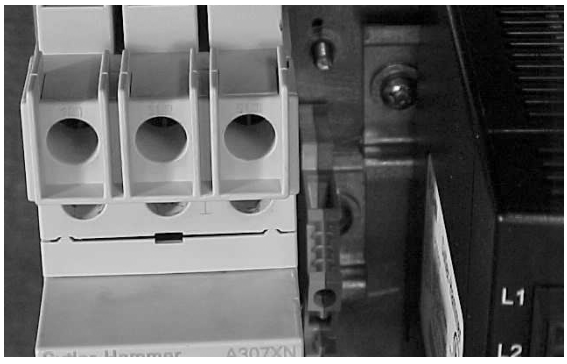
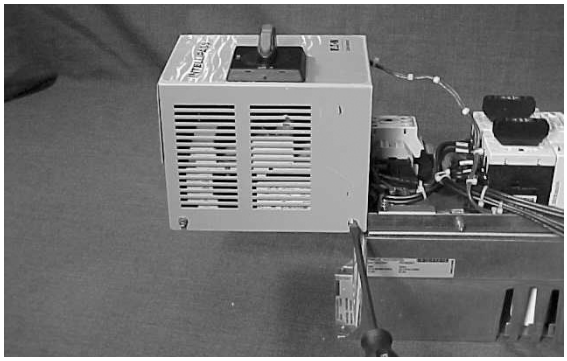
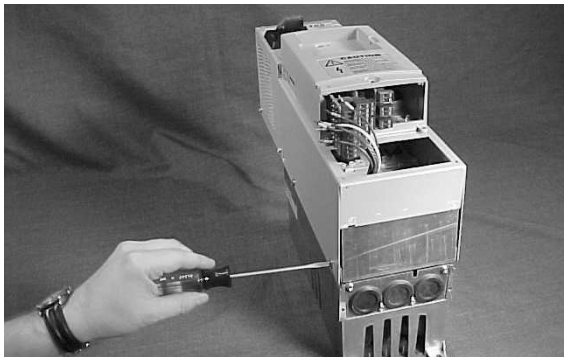
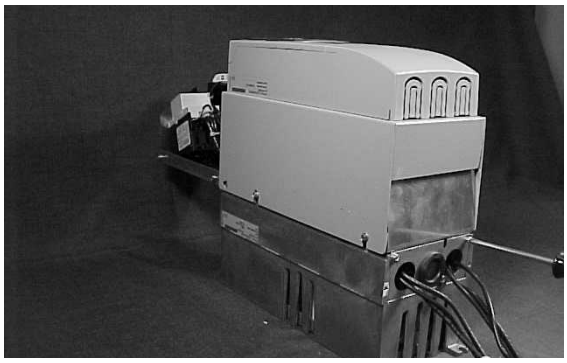
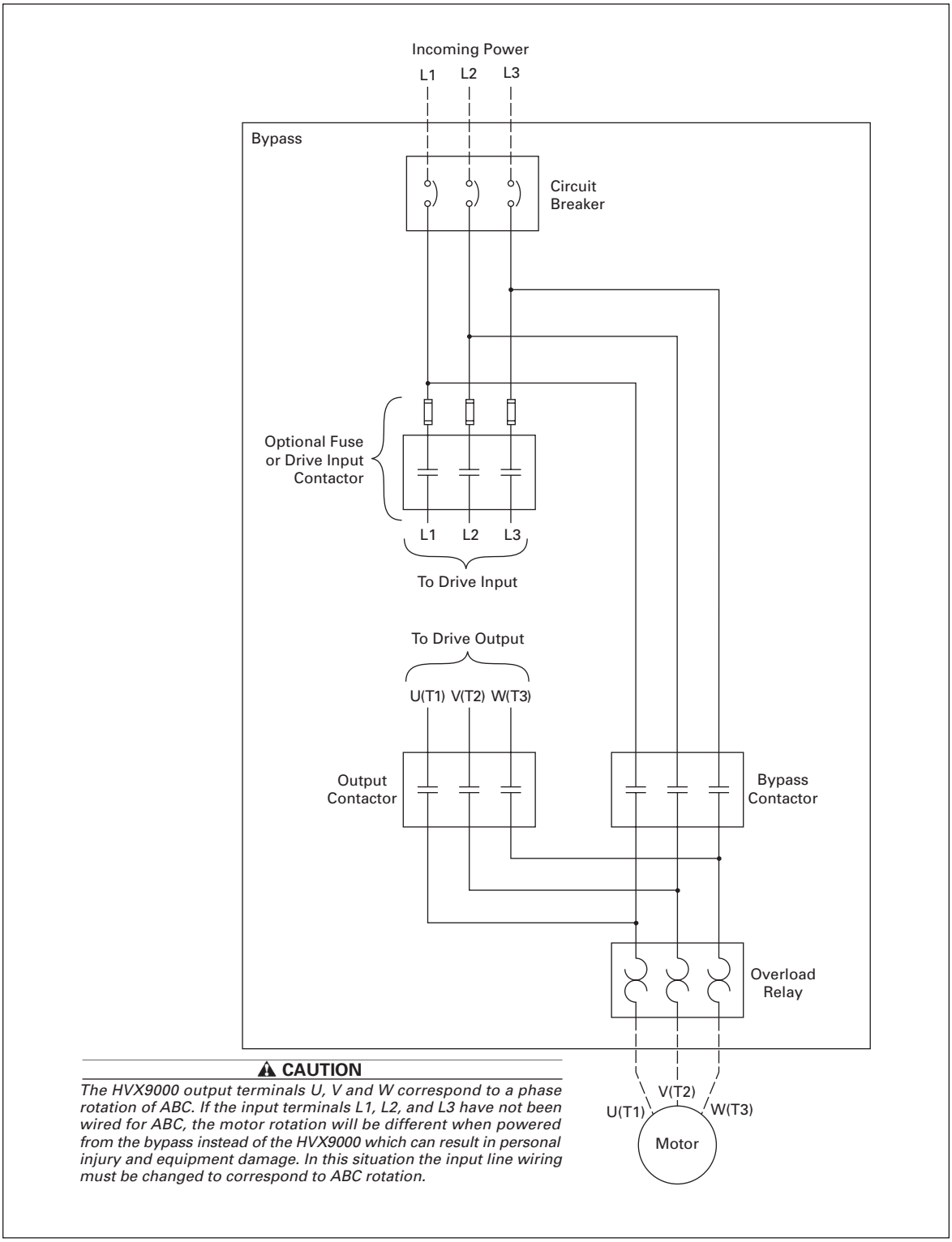
9. Remove the top bypass cover by loosening the four screws on the side of the cover and lifting the cover away from the bypass.	
10. Thread the line power wires through a second hole and pull the wires to the top of the unit and to terminals 1L1, 3L2 and 5L3. **Note:** The HVX9000 output terminals U, V and W correspond to a phase rotation of ABC. If the input terminals L1, L2 and L3 have not been wired for ABC, the motor rotation will be different when powered from the bypass instead of the HVX9000 which can result in personal injury and equipment damage. In this situation the input line wiring must be changed to correspond to ABC rotation.	
11. Remove the grounding nuts from the package and use them to secure both the motor and input power ground wires to their respective ground posts.	

Table 5-4: IntelliPass Power Wiring Instructions, continued

12. Replace the bypass covers.	
13. Tighten the screws on the sides of the cover(s).	
14. Replace the base plate. Install rubber grommets in any of the wiring plate holes that will not be used.	

Power and Motor Wiring Schematic



⚠ CAUTION

The HVX9000 output terminals U, V and W correspond to a phase rotation of ABC. If the input terminals L1, L2, and L3 have not been wired for ABC, the motor rotation will be different when powered from the bypass instead of the HVX9000 which can result in personal injury and equipment damage. In this situation the input line wiring must be changed to correspond to ABC rotation.

Figure 5-2: IntelliPass Power and Motor Terminal Wiring Example

IntelliPass Control Wiring Instructions

Use the instructions and diagrams in Chapter 4 “Control Wiring” for wiring standard option boards A9 and A2.

In addition to these two boards, the IntelliPass Bypass includes option board B5, which is described in the following section.

Wiring Option Board B5

- This board is to be mounted in slot C.

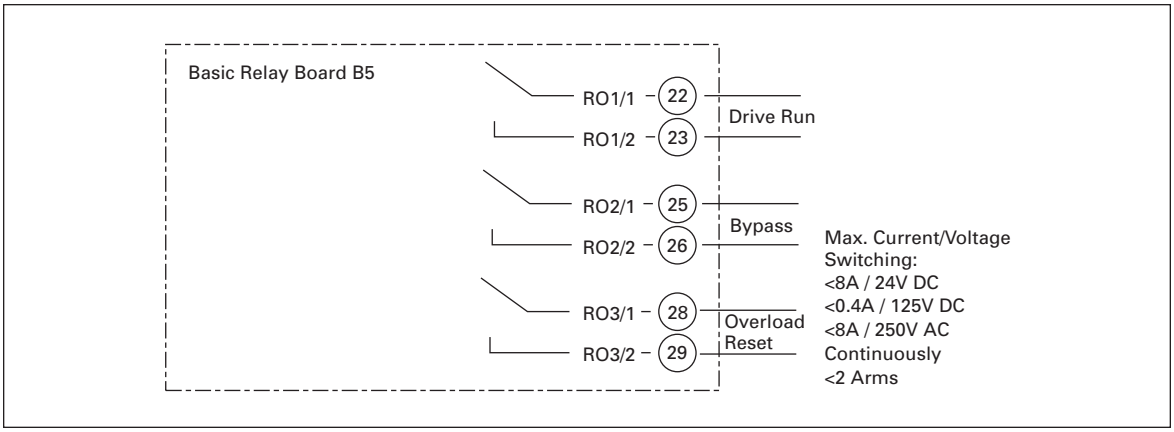


Figure 5-3: Option Board B5 Wiring Diagram

Table 5-5: Option Board B5 Terminal Descriptions

Terminal		Signal	Description and Parameter Reference	
22	RO1/1	Common	Drive Run	Switching Capacity: 24V DC / 8A 250V AC / 8A 125V DC / 0.4A Min Switching Load: 5V/10 mA Continuously: <2 Arms
23	RO1/2	Normally Open		
25	RO2/1	Common	Bypass	Switching Capacity: 24V DC / 8A 250V AC / 8A 125V DC / 0.4A
26	RO2/2	Normally Open		
28	RO3/1	Common	Overload Reset	Switching Capacity: 24V DC / 8A 250V AC / 8A 125V DC / 0.4A
29	RO3/2	Normally Open		

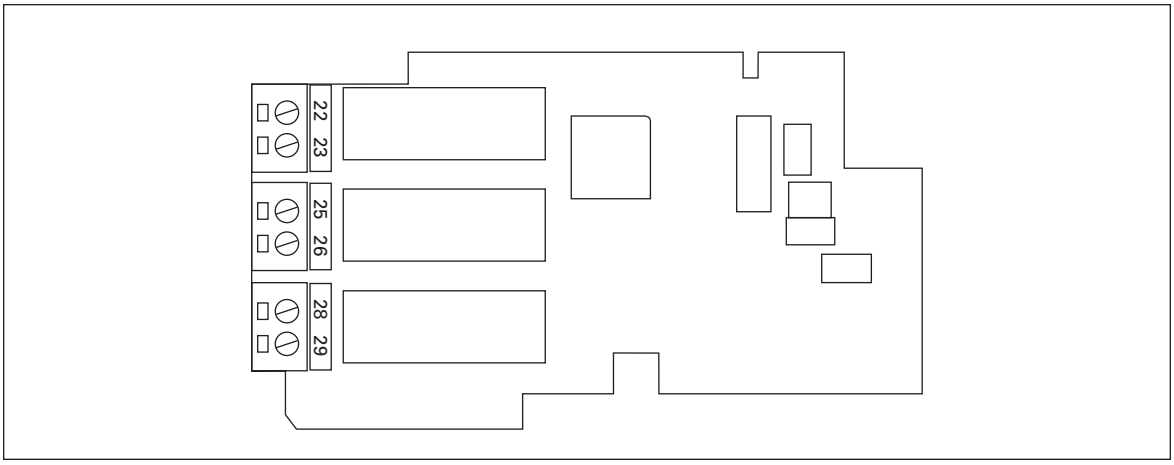


Figure 5-4: Option Board B5 Terminal Location

Start-Up Wizard

Upon initial power up, the **Start-Up Wizard** guides the commissioner through the basic SVX9000 setup. The **Start-Up Wizard** may be set to function upon an application change by setting parameter P5.5.3.

Upon power up, the display will read:
"Startup Wizard"
"Press enter"

Upon pressing ENTER, the choice for the language to be used followed by the application desired are presented. Change selection by using the up and down arrow buttons. A selection is confirmed by pressing ENTER. After the application selection, the following text appears:
"Setup starts"
"Press enter"

When ENTER is pressed the setup parameter list is presented. The parameter value will be blinking allowing setting by the up and down arrow buttons. The value is confirmed using the ENTER button, after which the next parameter in the list will be displayed.

After the last setup parameter is presented, the following text is displayed:
"Repeat setup?"
"Press ←"

If the left arrow is pressed the Start-Up Wizard restarts. If the ENTER button is pressed the following is displayed:
"Setup done"

After this, the display returns to the default page, normally the Operate Menu.

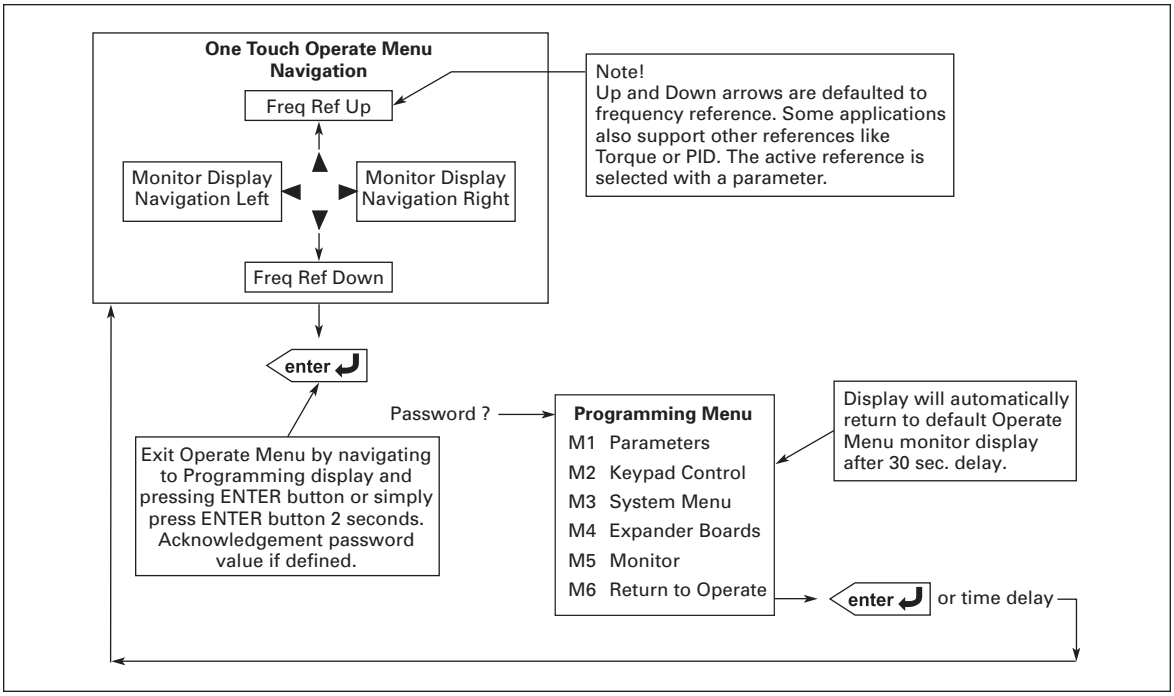


Figure 5-5: Operate Menu Navigation

The Operate Menu provides an easy to use method of viewing key numerical Monitoring Menu items. Some applications also support the setting of reference values in this menu. The items displayed vary by application. **Table 5-6** is an example for the Standard application.

Table 5-6: Operate Menu Items — IntelliPass Application Example

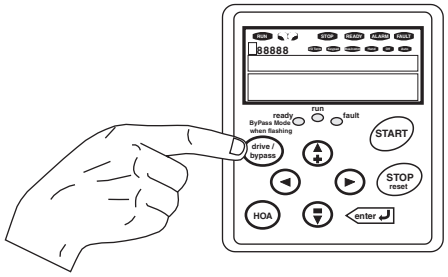
Code	Signal Name	Unit	Description
O.1	Motor Speed	rpm	Calculated motor speed
O.2	Motor Nomspeed	%	Motor nominal speed
O.3	Freq Reference	Hz	Frequency Reference
O.4	Output Frequency	Hz	Output Frequency
O.5	Motor Current	A	Measured Motor Current
O.6	Motor Torque	%	Calculated torque based on nominal motor torque
O.7	Motor Power	%	Calculated motor voltage
O.8	DC-Bus Voltage	V	Measured DC-Bus Voltage
O.9	Unit Temperature	°C	Heatsink temperature
O.10	Calc. MotorTemp	%	Calculated motor temperature based on the motor nameplate information and the calculated motor load
O.11	Analog Input 1	V	Voltage input at Terminals AI1 + and GND

The menu is navigated by using the left and right arrow buttons. If a reference level is available for setting, the up and down arrow buttons adjust the value. To exit the Operate Menu to access the other menus, depress the ENTER button for 2 seconds. While in the other menus, if there is no keypad activity, the display will return to the Operate Menu after 30 seconds. **Figure 5-5** illustrates the Operate Menu button function.

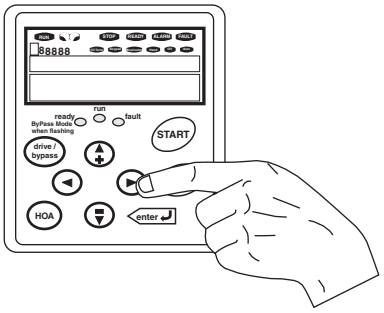
Note: Once enabled, bypass operation (across the input line) will be controlled through whichever control source is selected.

Application Settings

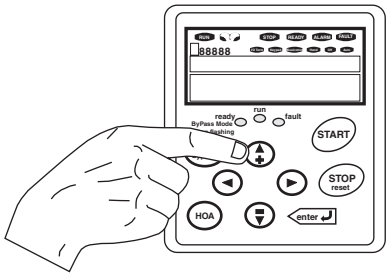
To enable the bypass:
1. Press the DRIVE/BYPASS button



The display will read "IntelliPass"
If IntelliPass is "Disabled" the display actually jumps to the Parameter P1.11.1.
Default is "Disabled" vs "Enabled".
2. Press the Right arrow key



The display will flash.
3. Press the UP arrow key



The display will flash "Enabled".
4. Press the ENTER key to accept the change.

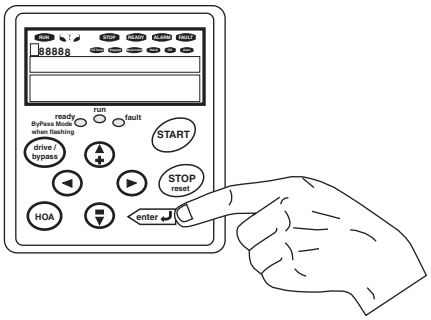


Figure 5-6: Enable Bypass

Note: See Parameter Group 1.11 "IntelliPass Parameters" for more information on customizing bypass operation.

Additional Instructions

Step-by-step procedure to run in bypass operation from keypad.

1. Press the BYPASS button: “Activate bypass? Press ENTER” will appear on keypad display.
2. Press the ENTER button: “Run in bypass? Press START!” will appear on keypad display.
3. Press the START button: “Running in bypass!” will appear on the keypad display.
4. To enable the bypass operation for I/O terminal or Fieldbus control, either go directly to Parameter 10.1 (IntelliPass) and select BypasEnabled or pressing the BYPASS button will take you directly to Parameter 10.1. Pressing the BYPASS button will not work when in the Operate Menu unless Parameter 10.1 has already been ENABLED.

- Drive is running in bypass.

Step-by-step procedure to return to drive operation from keypad.

1. Press the STOP button: “Run in bypass? Press START!” will appear on keypad display.
2. Press the BYPASS button: “Return to drive? Press ENTER!” will appear on keypad display.
3. Press the ENTER button to return to drive operation. Now all control sources will control the drive operation.

Chapter 6 — Menu Information

Keypad Operation

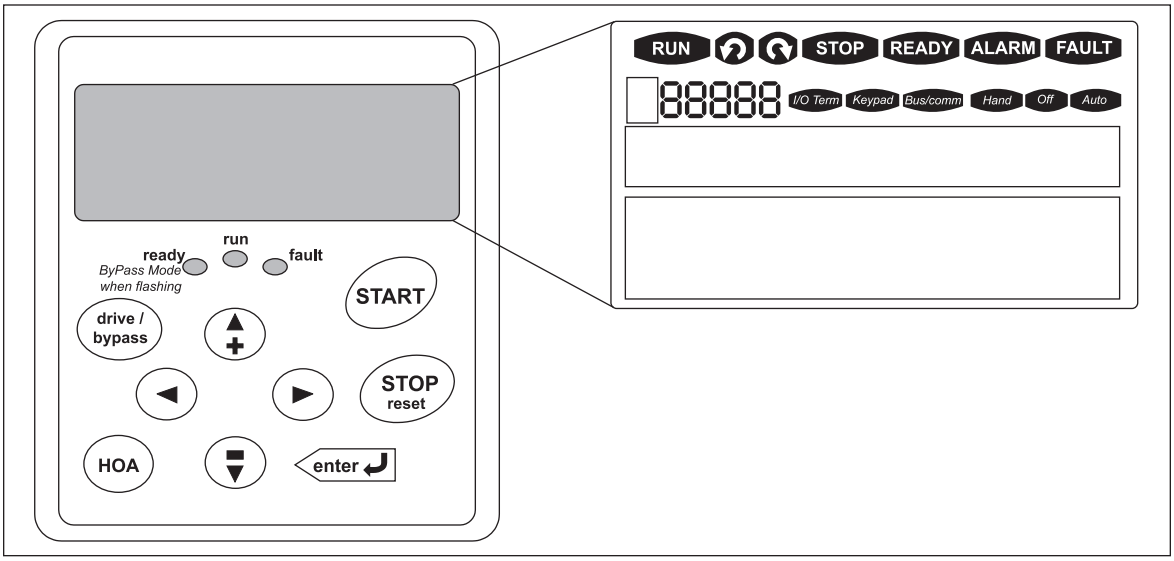


Figure 6-1: Keypad and Display

Table 6-1: LCD Status Indicators

Indicator	Description
RUN	**Run** Indicates that the HVX9000 is running and controlling the load in Drive or Bypass.
	**Counterclockwise Operation** The output phase rotation is **BAC**, corresponding to counterclockwise rotation of most motors.
	**Clockwise Operation** The output phase rotation is **ABC**, corresponding to clockwise rotation of most motors.
STOP	**Stop** Indicates that the HVX9000 is stopped and not controlling the load.
READY	**Ready** Indicates that the HVX9000 is ready to be started. Run Enable/INTLK DIN selection will disable "Ready."
ALARM	**Alarm** Indicates that there is one or more active drive alarm(s).
FAULT	**Fault** Indicates that there is one or more active drive fault(s).
I/O Term	**I/O Terminal** Indicates that the I/O terminal have been chosen for control.
Keypad	**Keypad** Indicates that the keypad has been chosen for control.
Bus/comm	**Bus/Communications** Indicates that the communications bus has been chosen for control.
Hand	**Hand** Indicates that HAND has been chosen in the HOA control mode.
Off	**Off** Indicates that the HVX9000 is stopped while in the HOA control mode. Bypass operation from keypad can still occur even in "Off."
Auto	**Auto** Indicates that AUTO has been chosen in the HOA control mode.

Table 6-2: LED Status Indicators

Indicator	Description
ready	**Ready** — Steady Illumination Indicates that the HVX9000 is ready to be started. **Ready** — Flashing Indicates that the HVX9000 is in Bypass Mode.
run	**Run** Indicates that the HVX9000 or Bypass is operating and controlling the load.
fault	**Fault** Indicates that there is one or more active drive fault(s).

Table 6-3: Navigation Buttons

Button	Description
START	**Start** This button operates as START button for normal operation when the "Keypad" is selected as the active control.
enter	**Enter** This button in the parameter edit mode is used to • leave the programming mode • leave the parameter group • save the parameter setting and move to the next parameter This button is also used to reset Fault History • Fault History is reset if ENTER is pressed on the "Fault History" menu group in "Monitoring Menu" or • if ENTER is pressed while in the "Fault History" menu
STOP reset	**Stop/Reset** This button has three integrated functions. The button operates as the STOP button during normal operation. In the parameter edit mode, it is used to cancel the previous action and back up one step. In the fault mode, it is used as the fault RESET button. • motor STOP from the keypad • used to reset the active fault • in programming mode press STOP/RESET button to cancel the previous action and back up one step
drive / bypass	**Drive/Bypass** Switches between the drive and bypass modes.
HOA	**HOA** Steps through Hand, Off and Auto control modes. Press "Enter" to select mode.
◄	**Left Arrow** • navigation button, movement to left • in display mode, enter parameter group mode • in parameter edit mode, exits mode, backs up one step • cancels edited parameter (exit from a parameter edit mode)
►	**Right Arrow** • navigation button, movement to right • enter parameter group mode • enter parameter mode from group mode
▲ + ▼	**Up and Down Arrows** • move either up or down the operating menu list in order to view the desired operating values • move either up or down the parameter group list in order to select the desired group • move either up or down the parameter list in order to select the desired parameter in the group • increase/decrease the reference value of the selected parameter

Menu Navigation

Navigation Tips

- To navigate within one level of menu, use the up and down arrows.
- To move deeper into the menu structure and back out, use the right and left arrows.
- To edit a parameter, navigate to show that parameter's value, and press the right arrow button to enter the edit mode. In edit mode, the parameter value will flash.
- When in edit mode, the parameter value can be changed by pressing the up or down arrow keys.
- When in edit mode, pressing the right arrow a second time will allow you to edit the parameter value digit by digit.
- To confirm the parameter change you must press the ENTER key. *The value will not change unless the ENTER button is pushed*.
- Parameters identified with a ① in **Appendix B** can not be changed while the HVX9000 is running. The screen will display LOCKED if you attempt to edit these parameters while the drive is running. Stop the drive to edit these parameters.

Main Menu

The data on the control keypad are arranged in menus and submenus.

The first menu level consists of menus M1 to M6 and is called the Main menu. These menus and their submenus are illustrated in **Figures 6-2** and **6-3**.

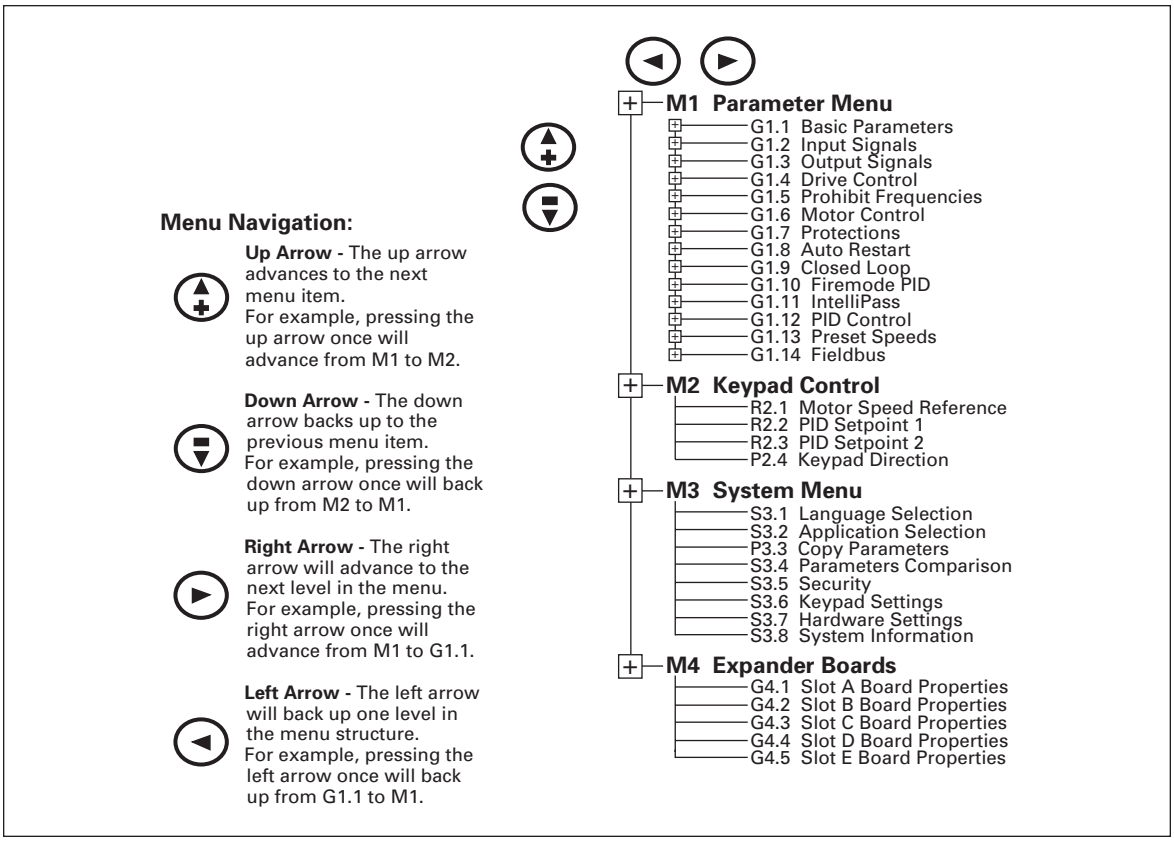


Figure 6-2: Main Menu Navigation — 1 of 2

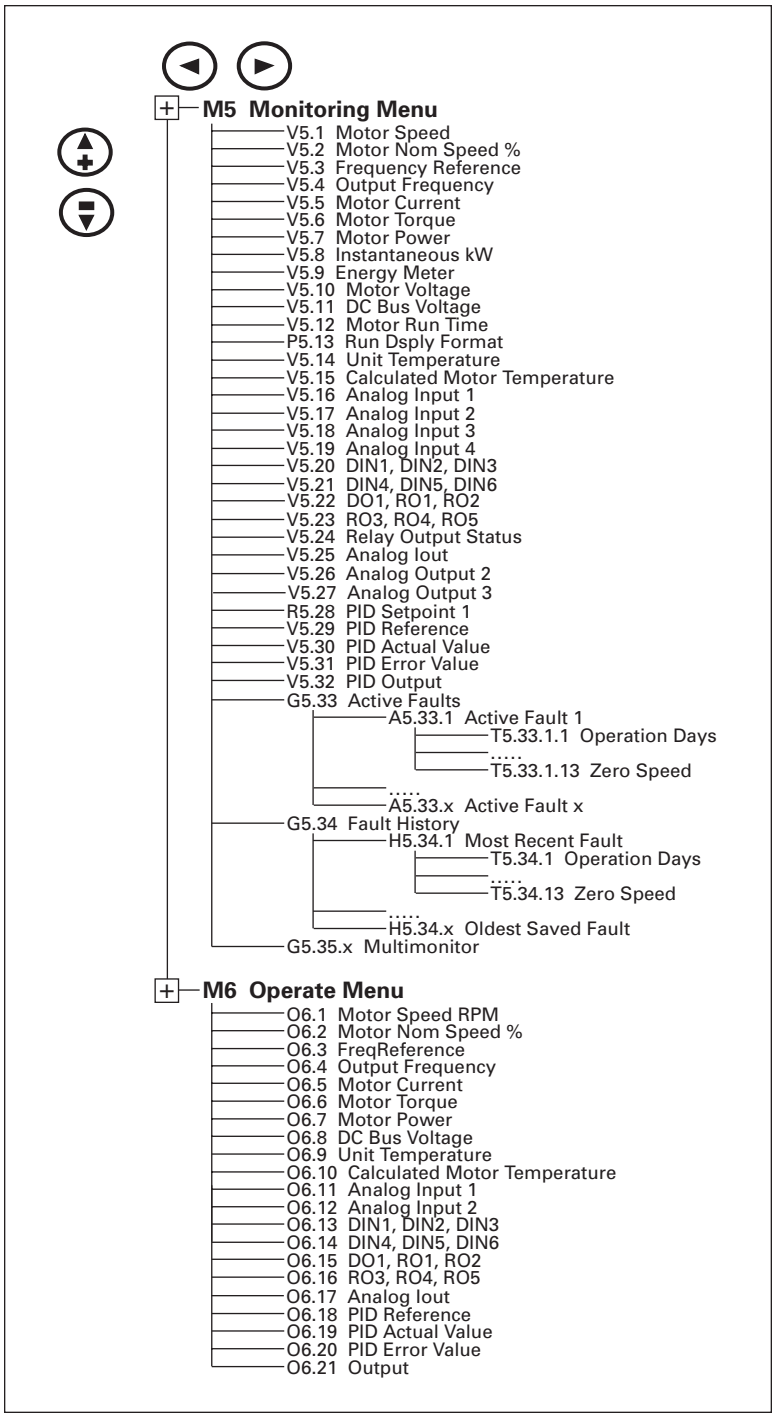


Figure 6-3: Main Menu Navigation — 2 of 2

Parameter Menu (M1)

The Parameter Menu is a multi-level menu, arranged by parameter group as illustrated in **Figure 6-4**. Parameters and parameter groups are explained in further detail in **Chapter 8** and **Appendix B**.

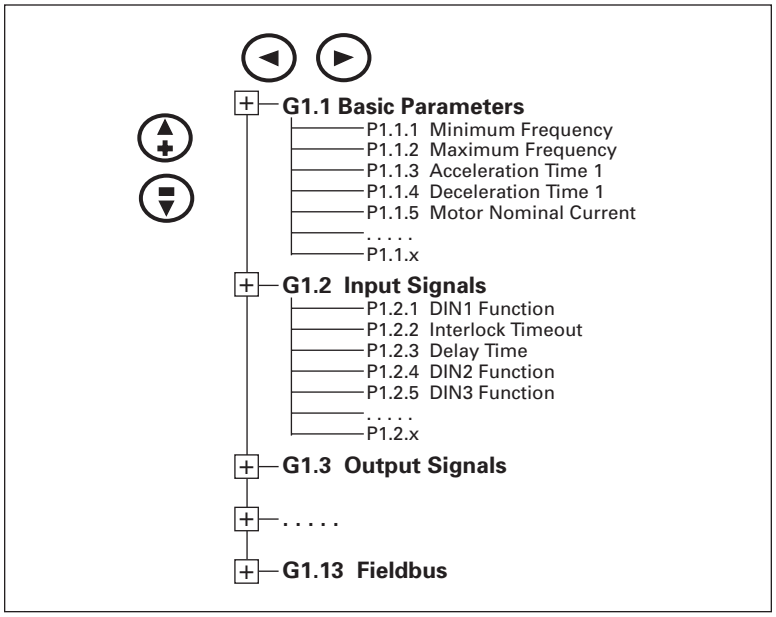


Figure 6-4: Parameter Menu Structure

Keypad Control Menu (M2)

In the Keypad Control Menu, you can set the frequency reference, PID setpoint and reference, reset the operating hours counter, and choose the motor direction for keypad operation. See **Figure 6-5**.

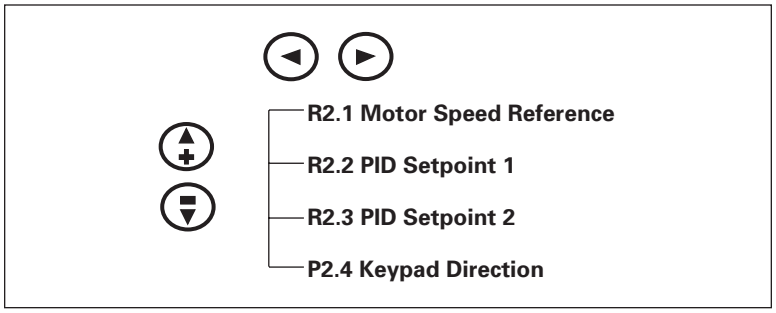


Figure 6-5: Keypad Control Menu

R2.1
Motor Speed Reference

Range: 0.0 – 100.0
Units: Percent
MOTOR SPEED REF
The keypad reference displays and allows the operator to edit the motor speed reference. The changes will take place immediately. This reference value will not, however, influence the motor rotation speed unless the keypad has been selected as the active control place. 100% corresponds to ***Maximum Frequency***.

R2.2
PID Setpoint 1

Range: 0.00 – 100.00 Default: 0.00
Units: Percent
PID SETPOINT 1
This parameter sets the value of the PID setpoint 1 reference, if the keypad is the active control place.

R2.3
PID Setpoint 2

Range: 0.00 – 100.00 Default: 0.00
Units: Percent
PID SETPOINT 2
This parameter sets the value of the PID setpoint 2 reference, if the keypad is the active control place or if PID Ref2 Sel is enabled in the Digital Inputs.

R2.4
Keypad Direction

Range: Clockwise, Counterclockwise Default: Clockwise
KEYPAD DIRECTION
The keypad direction displays and allows the operator to change the rotation direction of the motor. This setting will not, however, influence the rotation direction of the motor unless the keypad has been selected as the active control place.

System Menu (M3)

The controls associated with the general use of the drive, such as application selection, customized parameter sets or information about the hardware and software are located in the System Menu.

Descriptions of the system menu parameters are illustrated in **Figure 6-6**.

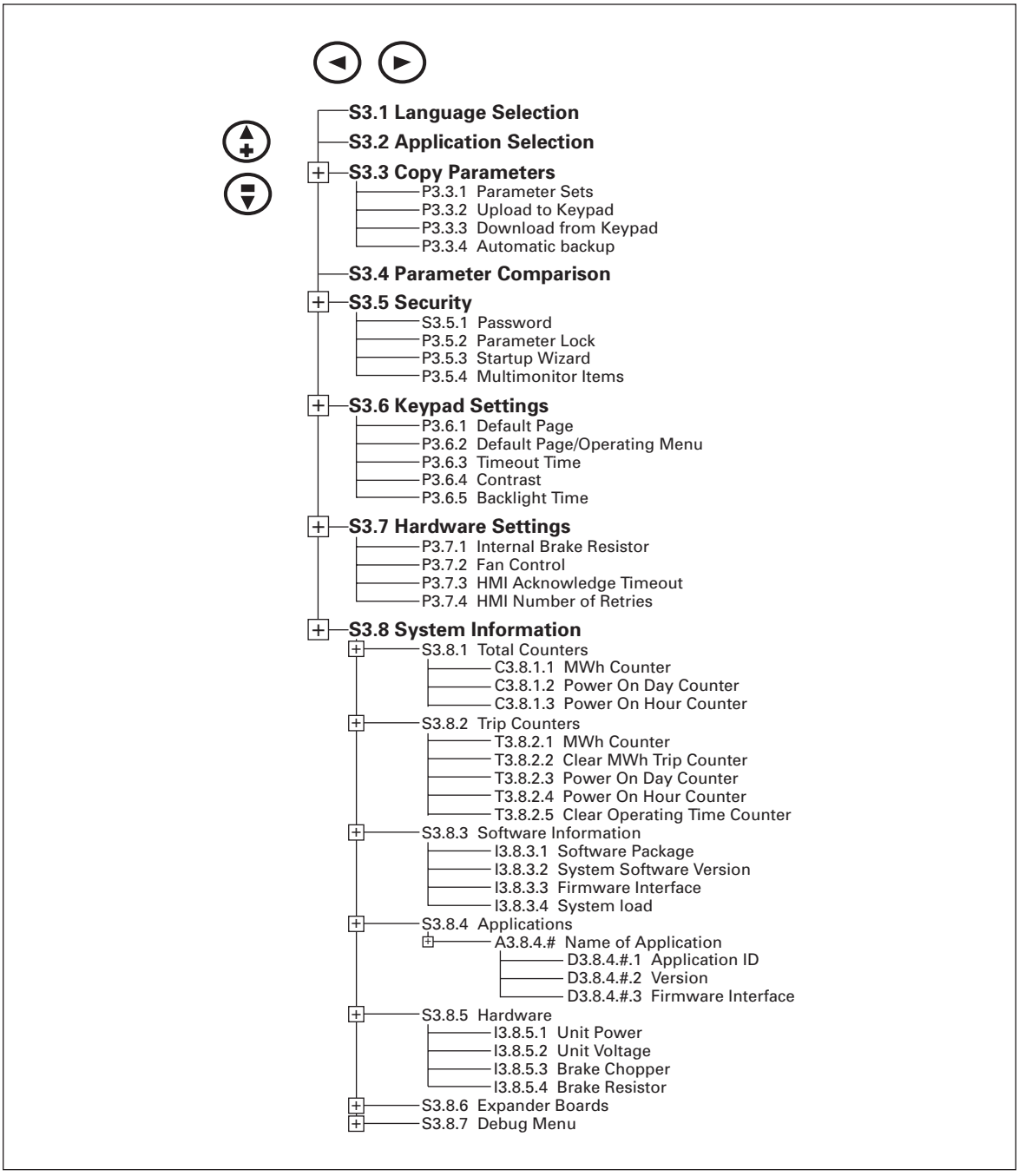


Figure 6-6: System Menu Structure

System Menu Parameters

S3.1 Language Selection

Default: English

LANGUAGE

This parameter offers the ability to control the HVX9000 through the keypad in the language of your choice. Currently available languages are: English, Finnish, Swedish, Danish and German.

S3.2 Application Selection

Default: HVNX Intpass

APPLICATION

This parameter sets the active application if multiple applications have been loaded.

When changing applications, you will be asked if you want the parameters of the new application to be uploaded to the keypad. If you wish to load the new application parameters, push the ENTER button. Pushing any other button saves the parameters of the previously used application in the keypad.

System Menu Copy Parameter Options (S3.3)

The parameter copy function is used when the operator wants to copy one or all parameter groups from one drive to another. All the parameter groups are first uploaded to the keypad, then the keypad is connected to another drive and then the parameter groups are downloaded to it (or possibly back to the same drive).

Note: Before any parameters can successfully be copied from one drive to another, the drive must be stopped when the parameters are downloaded to it.

S3.3.1 Parameter Sets

PARAMETER SETS

This parameter allows you to reload the factory default parameter values, and to store and load two customized parameter sets.

S3.3.2 Load Up to Keypad

UP TO KEYPAD

This function uploads all existing parameter groups to the keypad.

S3.3.3 Download from Keypad

Range: 0 – 3 Default: 0 (All parameters)

DOWN FROM KEYPAD

This function downloads one or all parameter groups from the keypad to the drive.

0 All parameters
1 All, no parameters
2 Application parameters

S3.3.4 Automatic Backup

Range: Yes, No Default: Yes

AUTO. BACKUP

This parameter activates and deactivates the parameter backup function. When the Parameter backup function is activated, the keypad makes a copy of the parameters and settings in the currently active application.

System Menu Parameter Comparison Options (S.3.4)

S3.4 Parameter Comparison

PARAMCOMPARISON

With the Parameter Comparison function, you can compare the actual parameter values to the values of your customized parameter sets and those loaded to the control keypad.

The actual parameter values are first compared to those of the customized parameter Set1. If no differences are detected, a "0" is displayed on the lowermost line of the keypad.

If any of the parameter values differ from those of the Set1 parameters, the number of the deviations is displayed together with symbol P (e.g. P1 → P5 = five deviating values).

By pressing the right arrow button once again you will see both the actual value and the value it was compared to. In this display, the value on the Description line (in the middle) is the default value, and the one on the value line (lowermost line) is the edited value. You can also edit the actual value by pushing the Right Arrow button.

Actual values can also be compared to Set2, Factory Settings and Keypad Set values.

Security Menu Parameter Options (S3.5)

Note: The Security submenu is protected with a password. Store the password in a safe place.

S3.5.1 Password

Range: 0 – 65,535 Default: 0

PASSWORD

The application selection can be protected against unauthorized changes with the Password function. When the password function is enabled, the user will be prompted to enter a password before application changes, parameter value changes, or password changes.

By default, the password function is not in use. If you want to activate the password, change the value of this parameter to any number between 1 and 65,535. The password will be activated after the Timeout time (***Timeout Time***) has expired.

To deactivate the password, reset the parameter value to 0.

S3.5.2 Parameter Lock

Range: ChangeEnable, ChangeDisabl Default: ChangeDisabl

PARAMETER LOCK

This function allows the user to prohibit changes to the parameters. If the parameter lock is activated the text *LOCKED* will appear on the display if you try to edit a parameter value.

Note: This function does not prevent unauthorized editing of parameter values.

S3.5.3 Start-Up Wizard

Range: Yes, No Default: No

START-UP WIZARD

The Start-Up Wizard facilitates commissioning the HVX9000. If selected active, the Start-Up Wizard prompts the operator for the language and application of his/her choice and then returns to the starting menu or page.

This feature can also be selected by pressing the BYPASS button for 5 seconds. Display will then show "Start-Up Wizard Activated". Unit must then be powered down and "SUW" will be displayed on powerup.

S3.5.4 Multi-Monitoring Items

Range: ChangeEnable, Change Disabl Default: ChangeEnable

MULTIMON. ITEM

The keypad display where can display three actual monitored values at the same time. This parameter determines if the operator is allowed to replace the values monitored with other values.

Keypad Settings (S3.6)

There are four parameters (***Default Page*** to ***Backlight Time***) associated with the keypad operation:

P3.6.1 Default Page

Default: 0

DEFAULT PAGE

This parameter sets the view to which the display automatically moves as the ***Timeout Time*** expires or when the keypad power is switched on.

If the Default Page value is 0 the function is not activated, i.e. the last displayed page remains on the keypad display.

P3.6.2 Default Page in the Operating Menu

DEFAULT PAGE/OM

Here you can set the location in the Operating menu to which the display automatically moves as the set ***Timeout Time*** expires, or when the keypad power is switched on. See setting of ***Default Page*** parameter above.

P3.6.3 Timeout Time

Range: 0 – 65,535 Default: 30

Units: Seconds

TIMEOUT TIME

The Timeout Time setting defines the time after which the keypad display returns to the ***Default Page***.

Note: If the Default Page value is 0 the Timeout Time setting has no effect.

P3.6.4 Contrast Adjustment

CONTRAST ADJUSTMENT

If the display is not clear, you can adjust the keypad contrast with this parameter.

P3.6.5 Backlight Time

Range: 1 – 65,535 or Forever Default: 10

Units: Minutes

BACKLIGHT TIME

This parameter determines how long the backlight stays on before going out. You can select here any time between 1 and 65,535 minutes or “Forever”.

Hardware Settings (S3.7)

The Hardware Settings submenu (S3.7) provides parameters for Internal brake resistor connection, Fan control, HMI acknowledge timeout and HMI retry.

P3.7.1 Internal Brake Resistor Connection

Range: Connected, Not Connected Default: Connected

INTERNBRAKERES

With this function you can tell the HVX9000 whether the internal brake resistor is connected or not.

If your drive has an internal brake resistor, the default value of this parameter is "Connected". However, if it is necessary to increase braking capacity by installing an external brake resistor, or if the internal brake resistor is disconnected, it is advisable to change the value of this function to "Not Connected" in order to avoid unnecessary fault trips.

Note: The brake resistor is available as an option for all drives. It can be installed internally in frame sizes FR4 to FR6.

P3.7.2 Fan Control

Range: Continuous, Temperature Default: Temperature

FAN CONTROL

This function allows you to control the HVX9000's cooling fan. You can set the fan to run continuously when the power is switched on or to run based on the temperature of the unit. If the latter function has been selected, the fan is switched on automatically when the heatsink temperature reaches 60°C. The fan receives a stop command when the heatsink temperature falls to 55°C. The fan runs for about a minute after receiving the stop command or switching on the power, as well as after changing the value from "Continuous" to "Temperature."

Note: The fan runs continuously, regardless of this setting, when the HVX9000 is in RUN state.

P3.7.3 HMI Acknowledge Timeout

Range: 200 – 5,000 Default: 200 ms
Units: mseconds

HMI ACK TIMEOUT

This function allows the user to change the timeout of the HMI acknowledgement time.

Note: If the HVX9000 has been connected to a PC with a serial cable, the default values of ***HMI Acknowledge Timeout*** and ***Number of Retries to Receive HMI Acknowledgement*** must not be changed.

If the HVX9000 has been connected to a PC via a modem and there is delay in transferring messages, the value of ***HMI Acknowledge Timeout*** must be set according to the delay as follows:

Example:

- Transfer delay between the frequency converter and the PC = 600 ms
- The value of ***HMI Acknowledge Timeout*** is set to 1200 ms (2 x 600, sending delay + receiving delay)
- The corresponding setting shall be entered in the [Misc]-part of the file NCDrive.ini:

  Retries = 5

  AckTimeOut = 1200

  TimeOut = 6000

It must also be considered that intervals shorter than the ***HMI Acknowledge Timeout*** time cannot be used in HVX9000 drive monitoring.

P3.7.4 Number of Retries to Receive HMI Acknowledgement

Range: 1 – 10 Default: 5

HMI RETRY

With this parameter you can set the number of times the drive will try receive acknowledgement when it has not been received within the acknowledgement time (***HMI Acknowledge Timeout***) or if the received acknowledgement is faulty.

System Information (S3.8)

This section contains hardware and software information as well as operation information.

S3.8.1 Total Counters

TOTAL COUNTERS

In the Total Counters page (***Total Counters***) you can find information related to the HVX9000 operating times, i.e. the total numbers of MWh, operation days and operation hours passed so far. See **Table 6-4**.

Unlike the counters in the Trip Counters, these counters cannot be reset.

Note: The Power On time counter (days and hours) runs always, when the power is on.

Table 6-4: Total Counters

Number	Name	Description
C3.8.1.1	MWh counter	Megawatt hours total operation time counter.
C3.8.1.2	Power On day counter	Number of days the HVX9000 has been supplied with power.
C3.8.1.3	Power On hour counter	Number of hours the HVX9000 has been supplied with power.

S3.8.2 Trip Counters

TRIP COUNTERS

Trip counters are counters the values of which can be reset i.e. restored to zero. You have the following resettable counters at your disposal:

Table 6-5: Trip Counters

Number	Name	Description
T3.8.2.1	MWh counter	Megawatts hours since last reset.
T3.8.2.2	Clear MWh counter	Resets megawatts hours counter and clears Energy Meter in the Monitoring Menu (V5.9).
T3.8.2.3	Power On day counter	Number of days since the last reset.
T3.8.2.4	Power On hour counter	Number of hours the HVX9000 has been supplied with power since the last reset.
T3.8.2.5	Clear Operation time counter	Reset the power on the day and hour counter and resets the Motor Run Time in the Monitoring Menu (V5.12).

Note: The trip counters operate only when the motor is running.

The counters can be reset with ***Clear MWh counter*** and ***Clear Operation time counter***.

S3.8.3 Software Information

SOFTWARE

The Software information page includes information on the following software topics:

Table 6-6: Software Information

Number	Content
I3.8.3.1	Software package
I3.8.3.2	System software version
I3.8.3.3	Firmware interface
I3.8.3.4	System load

S3.8.4 Application Information

APPLICATIONS

The Application information page includes information on not only the application currently in use but also all other applications loaded into the HVX9000. The information available is:

Table 6-7: Application Information

Number	Content
A3.8.4.1	Name of application
D3.8.4.1.1	Application ID
D3.8.4.1.2	Version
D3.8.4.1.3	Firmware interface

S3.8.5 Hardware Information

HARDWARE

The Hardware information page provides information on the following hardware-related topics:

Table 6-8: Hardware Information

Number	Content
I3.8.5.1	Nominal power of the unit
I3.8.5.2	Nominal voltage of the unit
E3.8.5.3	Brake chopper
E3.8.5.4	Brake resistor

S3.8.6 Expander Board Information

EXPANDER BOARDS

This parameter and its sub-items provide information about the basic and option boards plugged into the control board. **Table 6-9** provides an example for slot A.

Table 6-9: Slot A Expander Board Information

Number	Content
E3.8.6.1	Slot A board identification
E3.8.6.1.1	Operating state
E3.8.6.1.2	Program version

S3.8.7
Debug Menu

DEBUG

This menu is meant for advanced users and application designers. Contact factory for any assistance needed.

Expander Board Menu (M4)

The Expander Board Menu makes it possible for the user to:

- to see what expander boards are connected to the control board and
- to reach and edit the parameters associated with the expander board.

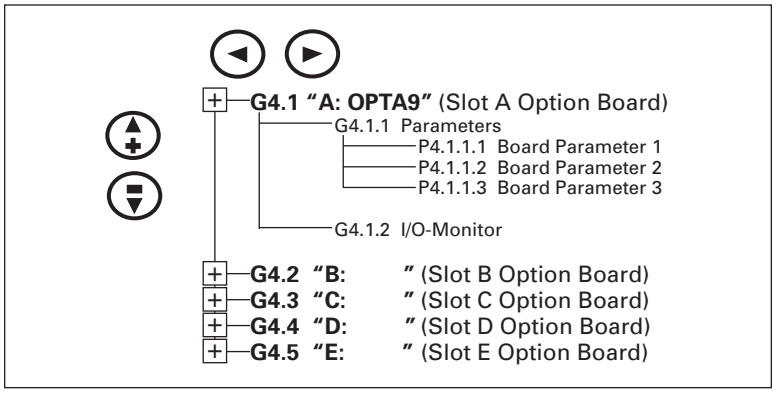


Figure 6-7: Expander Board Menu Structure

Example of Expander Board Parameters for Option Board A9

P4.1.1.1
AI1 Mode

Range: 1 – 5 Default: 3

AI1 MODE

Analog Input 1 input options:
1 0 – 20 mA
2 4 – 20 mA
3 0 – 10V
4 2 – 10V
5 -10 – +10V

P4.1.1.2
AI2 Mode

Range: 1 – 5 Default: 1

AI2 MODE

Analog Input 2 input options:
1 0 – 20 mA
2 4 – 20 mA
3 0 – 10V
4 2 – 10V
5 -10 – +10V

P4.1.1.3
AO1 Mode

Range: 1 – 4 Default: 1

AO1 MODE

Analog Output 1 output options:
1 0 – 20 mA
2 4 – 20 mA
3 0 – 10V
4 2 – 10V

Monitoring Menu (M5)

The Monitoring Menu items are meant for viewing parameter values during operation. Monitored values are updated every 0.3 sec. Monitored items are identified by item numbers V5.1 to V5.30, as listed in **Table 6-10**.

Monitored parameters are not editable from this menu (See Parameter Menu [M1] to change parameter values).

Table 6-10: Monitoring Menu Items

Code	Signal Name	Unit	ID #	Description
V5.1	Motor speed	rpm	2	Calculated motor speed
V5.2	Motor speed %	%	1590	Motor Nominal Speed %
V5.3	Frequency reference	Hz	25	Frequency reference setting
V5.4	Output frequency	Hz	1	Frequency to the motor
V5.5	Motor current	A	1780	Measured motor current
V5.6	Motor torque	%	4	Calculated torque based on nominal motor torque
V5.7	Motor power	%	5	Calculated power based on nominal motor power
V5.8	Instantaneous	kW	1888	Calculated power based on output to motor
V5.9	Energy meter	KwH	1666	Kilowatt hours total usage ①
V5.10	Motor voltage	V	6	Calculated motor voltage
V5.11	DC-bus voltage	V	7	Measured DC-bus voltage
V5.12	Motor run time	Hrs	1701	Motor run time total ①
V5.13	Run Display Format	—	1565	③
V5.14	Unit temperature	ºC	8	Heatsink temperature
V5.15	Calculated motor temperature	ºC	1917	Calculated motor temperature based on the motor nameplate information and the calculated motor load
V5.16	Analog Input 1	V	13	Voltage Input at Terminal AI1+ and GND
V5.17	Analog Input 2	mA	14	Current Input at Terminals AI2+ and AI2–
V5.18	Analog Input 3	mA	1680	Current Input at Terminals AI3+ and AI3–
V5.19	Analog Input 4	mA	1710	Current Input at Terminals AI4+ and AI4–
V5.20	DIN1, DIN2, DIN3	—	15	Digital input status (**Figure 6-8**)
V5.21	DIN4, DIN5, DIN6	—	16	Digital input status (**Figure 6-9**)
V5.22	DO1, RO1, RO2	—	17	Digital and relay output status (**Figure 6-10**)
V5.23	RO3, RO4, RO5	—	1678	Relay output status
V5.24	Relay out status	—	1773	Status of all relay outputs ②
V5.25	Analog Iout	mA	26	Current Output at Terminals AO1+ and AO1–
V5.26	Analog Output 2			
V5.27	Analog Output 3			
R5.28	PID Setpoint 1	%	—	PID Setpoint 1 Level
V5.29	PID Reference	%	20	PID Reference Level
V5.30	PID Actual Level	%	21	PID Actual Level
V5.31	PID Error Value	%	22	PID Error Value
V5.32	PID Output	%	23	PID Output
G5.33	Active Faults	—		See **Page 6-17**
G5.34	Fault History	—		See **Page 6-19**
G5.35	Multimonitor	—		See **Page 6-19**

① Resettable via S.3.8.2 trip counters.
② Includes BIN — Binary to decimal converted value for all digital and relay outputs.
③ See description on **Page 6-17**.

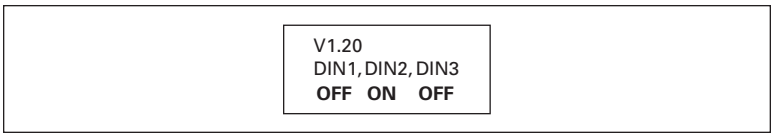


Figure 6-8: Digital Inputs DIN1, DIN2, DIN3 Status

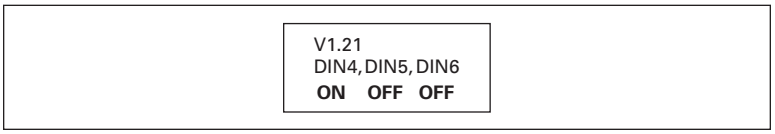


Figure 6-9: Digital Inputs DIN4, DIN5, DIN6 Status

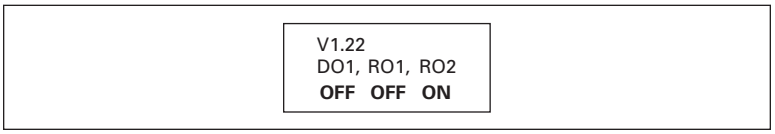


Figure 6-10: Digital Inputs DO1, RO1, RO2 Status

P5.13
Run Display Format

Range: 4 – 7 Default: 5 (Minutes)

RUNDSPLYFORMAT

This sets the format of the display for motor run time for ***Motor Run Time***, V 5.12.

4 Seconds
5 Minutes
6 Hours
7 Days

Active Faults (G5.33)

When a fault occurs, the HVX9000 stops. The sequence indication F1, the fault code, a short description of the fault and the fault type symbol will appear on the display. In addition, the indication FAULT or ALARM is displayed and, in case of a FAULT, the red LED on the keypad starts to blink. If several faults occur simultaneously, the sequence of active faults can be browsed with the Browser buttons. See **Figure 6-11**.

The active faults memory can store the maximum of 10 faults in the sequential order of appearance. The display can be cleared with the STOP/RESET button and the readout will return to the same state it was before the fault trip. The fault remains active until it is cleared with the STOP/RESET button or with a reset signal from the I/O terminal.

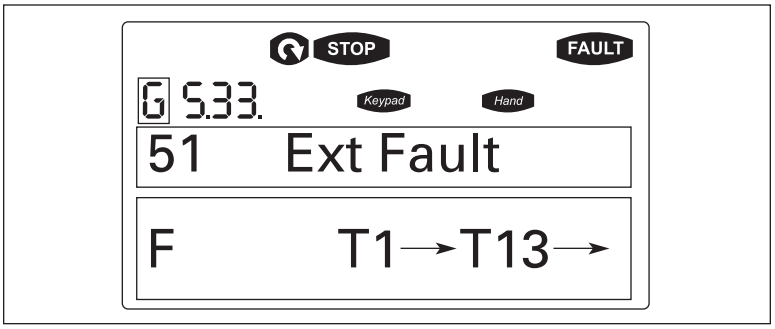


Figure 6-11: Active Fault Display Example

⚠ CAUTION

Remove any External Start signals or permissives before resetting the fault to prevent unintentional restart of the HVX9000, which could result in personal injury or equipment damage.

Fault Type

Range: A, F, AR, FT

FAULT TYPE

There are four different types of faults. These faults and their definitions are given **Table 6-11**.

Table 6-11: Fault Types

Fault Type	Fault Name	Description
A	Alarm	This type of fault is a sign of an unusual operating condition. It does not cause the drive to stop, nor does it require any special actions. The "A fault" remains in the display for about 30 seconds.
F	Fault	An "F fault" is a kind of fault that makes the drive stop. Actions need to be taken in order to restart the drive.
AR	Auto-Restart Fault	If an "AR fault" occurs the drive will also stop immediately. The fault is reset automatically and the drive tries to restart the motor. If the restart is not successful, a fault trip (FT) occurs.
FT	Fault Trip	If the drive is unable to restart the motor after an AR fault, an FT fault occurs. The effect of the "FT fault" is the same as that of the F fault — the drive is stopped.

Fault Code

Range: 1 – 82

FAULT CODE

Fault codes indicate the cause of the fault. A list of fault codes, their descriptions, and possible solutions can be found in **Appendix C** – Fault and Warning Codes.

Fault Time Data

Range: T.1 – T.13

FAULT TIME DATA

In this menu, important data recorded at the time the fault is available. This feature is intended to help the user or the service person to determine the cause of fault. **Table 6-12** indicates the information that is recorded.

Table 6-12: Fault Time Data

Data	Units	Description
T.1 ①	D	Counted operation days (Fault 43: Additional code)
T.2	hh:mm:ss (d)	Counted operation hours (Fault 43: Counted operation days)
T.3	Hz hh:mm:ss	Output frequency (Fault 43: Counted operation hours)
T.4 T.5 T.6 T.7 T.8	A V % % V	Motor current Motor voltage Motor power Motor torque DC bus voltage
T.9 T.10 T.11 T.12 T.13	°C — — — —	Unit temperature Run status Direction Warnings Zero speed

① Real time record:
If real time is set, T.1 and T.2 will appear as follows:

T.1	yyyy-mm-dd	Counted operation days (Fault 43: Additional code)
T.2	hh:mm:ss.sss	Counted operation hours (Fault 43: Counted operation days)

Fault History (G5.34)

All faults are stored in the Fault History Menu, which can be viewed by using the Browser buttons. Additionally, the Fault time data record pages are accessible for each fault as in the Active Faults Menu described above. See **Figure 6-12**.

The HVX9000's memory can store a maximum of 30 faults, in the order of appearance. If there are 30 uncleared faults in the memory, the next occurring fault will erase the oldest fault from the memory.

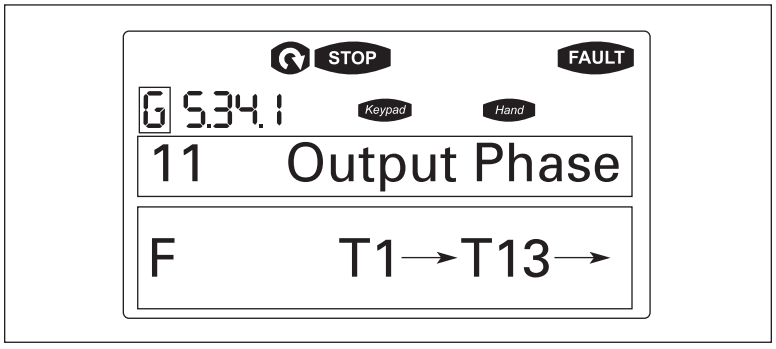


Figure 6-12: Sample Fault History Display

Note: Pressing the ENTER button for 3 seconds will clear the entire fault history.

Multimonitor (G5.35)

This Parameter allows the viewing and selection (if allowed by System menu item, P3.5.4) of three simultaneously monitored items from the Monitored Menu Items illustrated in **Table 6-10**. Use the right arrow key to select the item to be modified and then the up or down arrow keys to select the new item. Press the ENTER key to accept the change.

Operate Menu

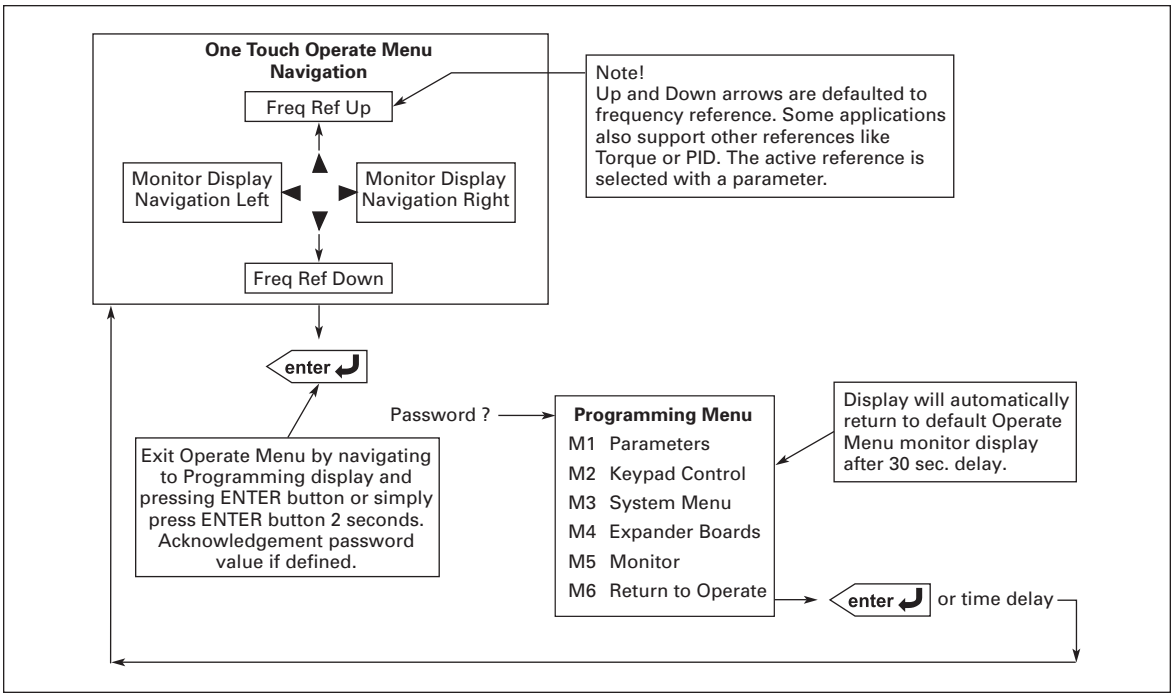


Figure 6-13: Operate Menu Navigation

The Operate Menu provides an easy to use method of viewing key numerical Monitoring Menu items. Some applications also support the setting of reference values in this menu. The items displayed vary by application. **Table 6-13** is an example for the Standard application.

Table 6-13: Operate Menu Items — IntelliPass Application Example

Code	Signal Name	Unit	Description
O.1	Motor Speed	rpm	Calculated motor speed
O.2	Motor Nomspeed	%	Motor nominal speed
O.3	Freq Reference	Hz	Frequency Reference
O.4	Output Frequency	Hz	Output Frequency
O.5	Motor Current	A	Measured Motor Current
O.6	Motor Torque	%	Calculated torque based on nominal motor torque
O.7	Motor Power	%	Calculated motor voltage
O.8	DC-Bus Voltage	V	Measured DC-Bus Voltage
O.9	Unit Temperature	°C	Heatsink temperature
O.10	Calc. MotorTemp	%	Calculated motor temperature based on the motor nameplate information and the calculated motor load
O.11	Analog Input 1	V	Voltage input at Terminals AI1 + and GND

The menu is navigated by using the left and right arrow buttons. If a reference level is available for setting, the up and down arrow buttons adjust the value. To exit the Operate Menu to access the other menus, depress the ENTER button for 2 seconds. While in the other menus, if there is no keypad activity, the display will return to the Operate Menu after 30 seconds. **Figure 6-13** illustrates the Operate Menu button function.

Note: Once enabled, bypass operation (across the input line) will be controlled through whichever control source is selected.

Chapter 7 — Start-Up

Safety Precautions

Before start-up, observe the following warnings and safety instructions.

⚠ WARNING

1. Internal components and circuit boards (except the isolated I/O terminals) are at utility potential when the HVX9000 is connected to the line. This voltage is extremely dangerous and may cause death or severe injury if you come in contact with it.
2. When the HVX9000 is connected to the utility, the motor connections U (T1), V (T2), W (T3) and DC-link/brake resistor connections B–, B+ and R– are live even if the motor is not running.
3. Do not make any connections when the HVX9000 drive is connected to the utility line.
4. Do not open the cover of the HVX9000 immediately after disconnecting power to the unit, because components within the drive remain at a dangerous voltage potential for some time. Wait until at least five minutes after the cooling fan has stopped and the keypad or cover indicators are dark before opening the HVX9000 cover.
5. The control I/O terminals are isolated from the utility potential, but relay outputs and other I/Os may have dangerous external voltages connected even if power is disconnected from the HVX9000.
6. Before connecting to the utility make sure that the cover of the HVX9000 is closed.

Sequence of Operation

1. Read and follow all safety precautions.
2. At installation ensure:
   a. That the HVX9000 and motor are connected to ground.
   b. That the utility and motor cables are in accordance with the installation and connection instructions as detailed in **Chapter 3**.
   c. That the control cables are located as far as possible from the power cables as detailed in **Chapter 4** and **Table 3-1**. That control cable shields are connected to protective ground. That no wires make contact with any electrical components in the HV9000.
   d. That the common input of digital input groups is connected to +24V or ground of the I/O terminal supply or an external supply as detailed in **Chapter 4** and **Figure 4-6**.
   e. If using the HOA (Hand-Off-Auto) mode, that a maintained closed contact or jumper is present at HOA Interlock Contact as a permissive to start the HVX9000.
3. Check the quality of the cooling air as detailed in **Chapter 2**.
4. Check that moisture has not condensed inside the HVX9000.
5. Check that all START/STOP switches connected to the I/O terminals are in the STOP state.
6. Connect the HVX9000 to the utility and switch the power on.
7. Ensure that Group G1.1 parameters match the application by setting the following parameters to match the motor nameplate:
   - P1.1.5 = the motor nominal current.
   - P1.1.6 = the nominal voltage of the motor.
   - P1.1.7 = the nominal nameplate frequency of the motor.
   - P1.1.8 = the nominal nameplate full load speed of the motor.
   - P1.1.9 = the motor power factor.

8. Perform either Test A or Test B without the motor connected to the HVX9000.

   Test A — Control from the Control Panel.

   - Apply input power to the HVX9000.
   - Press HOA button until HAND LCD is flashing, then press ENTER.
   - Press the START button.
   - Go to the Monitoring Menu and check that the output frequency follows the reference as detailed in ***Reference Source Hand***.
   - Press the STOP/RESET button.

   Test B — Control from the I/O Terminals.

   - Apply input supply power to the HVX9000.
   - Change control from the keypad to the I/O terminals. Press HOA button until HAND LCD is flashing, then press ENTER.
   - Change the frequency reference.
   - Check from the monitoring menu at the control panel that the output frequency follows the frequency reference.
   - Stop the drive by opening the start contact at DIN1.

Disconnect all power to the HVX9000. Wait until the cooling fan on the unit stops and the indicators on the panel are not lit. If no keypad is present, check the indicators in the cover. Wait at least five more minutes for the DC bus to discharge. Connect the motor to the HVX9000 and check for correct motor rotation. If possible, perform a start-up test with the motor connected to the HVX9000 but not connected to the process. If the HVX9000 must be tested with the motor connected to the process, perform it under no-load or light load conditions.

Chapter 8 — Application Information

Parameter Menus

Parameter Group G1.1: Basic Parameters

P1.1.1 Minimum Frequency
Range: 0.00 – Max Frequency Default: 12.00
Units: Hertz
MIN FREQUENCY
Defines the minimum output frequency limit setting.

P1.1.2 Maximum Frequency
Range: Min Frequency – 320.00 Default: 60.00
Units: Hertz
MAX FREQUENCY
Defines the maximum output frequency limit setting.

P1.1.3 Acceleration Time 1
Range: 0.1 – 3000.0 Default: 60.0
Units: Seconds
ACCEL TIME 1
This defines the time required for the output frequency to change from the minimum frequency to the maximum frequency as set by ***Minimum Frequency*** and ***Maximum Frequency***. With the use of ***Acceleration Time 1*** and ***Acceleration Time 2***, two different acceleration times can be used for an application. The active set can be selected with one of the programmable digital inputs DIN2, DIN3, DIN4, DIN5 or DIN6.
Note: If the PID-controller is used, ***Acceleration Time 2*** / ***Deceleration Time 2*** is automatically selected.

P1.1.4 Deceleration Time 1
Range: 0.1 – 3000.0 Default: 60.0
Units: Seconds
DECEL TIME 1
This defines the time required for the output frequency to change from the maximum frequency to the minimum frequency as set by ***Maximum Frequency*** and ***Minimum Frequency***. With the use of ***Deceleration Time 1*** and ***Deceleration Time 2***, two different deceleration times can be used for an application. The active set can be selected with one of the programmable digital inputs DIN2, DIN3, DIN4, DIN5 or DIN6.
Note: If the PID-controller is used, ***Acceleration Time 2*** / ***Deceleration Time 2*** is automatically selected as the active set.

P1.1.5 Motor Nominal Current
Range: 0.3 x I_{nHVXL} – 2.0 x I_{nHVXL} Default: I_{nHVXL}
Units: Amperes
MOTOR NOM CURRNT
This is the motor nameplate full load current (I_n).

P1.1.6 Motor Nominal Voltage
Range: 180 – 690 Default: 230 or 460 (Drive Rating)
Units: Volts
MOTOR NOM VOLTG
This is the motor nameplate base voltage. This parameter sets the voltage at the ***Field Weakening Point*** to 100% x V_n.

P1.1.7
Motor Nominal Frequency

Range: 30.00 – 320.00 Default: 60.00
Units: Hertz
MOTOR NOM FREQ
This is the motor nameplate base frequency. This parameter sets the ***Field Weakening Point*** to the same value.

P1.1.8
Motor Nominal Speed

Range: 300 – 20,000 Default: 1760
Units: rpm
MOTOR NOM SPEED
This is the motor nameplate base speed (N_n), which is used for displays using motor speed.

P1.1.9
Motor Power Factor

Range: 0.30 – 1.00 Default: 0.85
MOTORPOWERFACTOR
This is the motor nameplate full load power factor from the motor rating nameplate.

P1.1.10
Current Limit

Range: 0.1 x I_L – 2.5 x I_{nHVX} Default: I_{nHVX}
Units: Amperes
CURRENT LIMIT
This parameter determines the maximum motor current allowed from the HVX9000. The parameter value range differs from size to size and is based on the HVX9000 nameplate full load current.

P1.1.11
HOA Control Source

Range: 0 – 2 Default: 0
HOA CONTROL SRC
This parameter determines whether the HOA function is controlled from the keypad or terminal block.
0 Control from keypad
1 Control from I/O terminals
2 Control from communication bus

P1.1.12
Start Source Hand

Range: 0 – 2 Default: 0
START SRC HAND
This parameter determines where the Hand start is controlled from.
0 Keypad
1 BAS
2 I/O terminals 3-wire Start/Stop

P1.1.13
Reference Source Hand

Range: 0 – 7 Default: 4
REF SOURCE HAND
This parameter determines the frequency reference input source when operating in the Hand mode.
0 Analog Input AI1
1 Analog Input AI2
2 Analog Input AI3
3 Analog Input AI4
4 Keypad reference
5 Communication Bus
6 Motor potentiometer
7 PID-Controller — When selected PID Reference and Actual Value must be programmed in PID Control group.

P1.1.14
Start Source Auto

Range: 0 – 3 Default: 1

START SRCE AUTO

This parameter determines where the Auto start is controlled from.

0 Keypad
1 BAS I/O terminal 2-wire Start/Stop
2 I/O terminals 3-wire Start/Stop
3 Communication bus

P1.1.15
Reference Source Auto

Range: 0 – 7 Default: 0

REF SOURCE AUTO

This parameter determines the frequency reference input source when operating in the Auto mode.

0 Analog Input AI1
1 Analog Input AI2
2 Analog Input AI3
3 Analog Input AI4
4 Keypad
5 Communication Bus
6 Motor potentiometer
7 PID-Controller — When selected PID Reference and Actual Value must be programmed in PID Control group.

P1.1.16
PM Setback Percentage

Range: 0.0 – 100.0 Default: 30.0
Units: Percent

PM SETBACK PCT

This parameter determines the frequency reference for PM setback operation when DIN2, DIN4, DIN5 or DIN6 are set to control PM Setback and is closed.

Parameter Group G1.2: Input Signals

P1.2.1
DIN1 Function

Range: 0 – 3 Default: 0 (Start)

DIN1 FUNCTION

This parameter determines the function of digital input DIN1.

0 Start – standard start
1 Interlocked Start – To use this, a relay output, RO1 or RO2, needs to be programmed for selections 27 "StrtDelayRly," and a digital input DIN2 to DIN6 must be programmed for selection 3 "RunEn/INTLK." The relay output is used to energize an element of the driven system, such as a damper, seal water solenoid, or a pre-lube pump. Upon a return acknowledgement contact closure to the programmed digital input, the HVX9000 will start.
2 Interlock Time Start – This functions the same as the Interlocked Start, except that if the return acknowledgement contact is not received within the ***Interlock Timeout***, an "IntlkTimeExpired RestartDrive" message is displayed and the start sequence will need to be restarted.
3 Delay Start – This start is similar to the Interlocked Start, except that a return contact is not used. After the "Delay Time" following the relay output closure, the HVX9000 starts.

Note: Selections 1 – 3 will only function properly with BAS selected for the "Start Source".

P1.2.2
Interlock Timeout

Range: 1 – 32,500 Default: 5
Units: Seconds

INTLK TIMEOUT

The timeout time used for an Interlocked Time Start, after which the start sequence must be restarted if no acknowledgement contact is received. See ***DIN1 Function***.

P1.2.3 Delay Time

Range: 1 – 32,500 Default: 5
Units: Seconds

DELAY TIME

The delay time following a Delay Start, after which the HVX9000 will be started. See ***DIN1 Function***.

P1.2.4 DIN2 Function

Range: 0 – 15 Default: 1 (Ext fault close)

DIN2 FUNCTION

This parameter determines the function of digital input DIN2.
If DIN2 is not being used, set this parameter value to 0.

0 Not Used
1 Ext. Fault Close
2 Bypass Ovld Fault
3 Run enable/External interlock –
Contact open: HVX9000 start disabled
Contact closed: HVX9000 start enabled
4 Acceleration or deceleration time selection –
Contact open: Acceleration/Deceleration time 1 selected
Contact closed: Acceleration/Deceleration time 2 selected
5 Hand/Auto Select – contact closed: Auto control selected
6 PID Control – contact closed: PID control selected
7 Motor potentiometer down – contact closed: Motor potentiometer down selected
8 PID Reference 2 Select – selects between ***PID Reference*** and PID Setpoint 2 from keypad
9 PM Setback – contact closed: PM Setback enabled
10 Fault reset – contact closed: All faults reset
11 Acceleration/Deceleration prohibited –
Contact closed: No acceleration or deceleration possible until the contact is opened
12 HOA On/Off – contact closed: HOA Off
13 Reserved
14 Fire Mode – contact closed: Fire Mode selected. See **Page 8-46**.
15 Fire Mode Reference Select –
Contact open or closed based on ***FMRefSelFunction***. If this input is "ON", then ***FireModeFreqRef1*** or ***FireModeFreqRef2*** is selected as a "Preset Speed."

Note: This selection is automatically set to 2 (Bypass Ovld Fault) if P1.10.1 (INTELLI-PASS) has BypassEnabled or if P1.10.3 (Auto Bypass) is enabled.

P1.2.5
DIN3 Function

Range: 0 – 15 Default: 10 (Fault Reset)

DIN3 FUNCTION

This parameter determines the function of digital input DIN3. If DIN3 is not being used, set this parameter to 0.

0 Not Used
1 External fault – contact closed: Fault is displayed and motor stopped
2 External fault – contact open: Fault is displayed and motor stopped
3 Run enable/External interlock –
Contact open: HVX9000 start disabled
Contact closed: HVX9000 start enabled
4 Acceleration or deceleration time selection –
Contact open: Acceleration/Deceleration time 1 selected
Contact closed: Acceleration/Deceleration time 2 selected
5 Hand/Auto Select – contact closed: Auto control selected
6 Motor potentiometer up – contact closed: Motor potentiometer up selected
7 PID Control – contact closed: PID control selected
8 PID Reference 2 Select
9 Speed Select 1 – contact closed: Speed 1 selected
10 Fault reset – contact closed: All faults reset
11 Acceleration/Deceleration prohibited –
Contact closed: No acceleration or deceleration possible until the contact is opened
12 DC braking command –
Contact closed: In Stop mode, the DC braking operates until the contact is opened. See **Figure 8-1**.
13 Reserved
14 Fire Mode – contact closed: Fire Mode selected. See **Page 8-46**.
15 Fire Mode Reference Select –
Contact open or closed based on ***FMRefSelFunction***. If this input is "ON", then ***FireModeFreqRef1*** or ***FireModeFreqRef2*** is selected as a "Preset Speed."

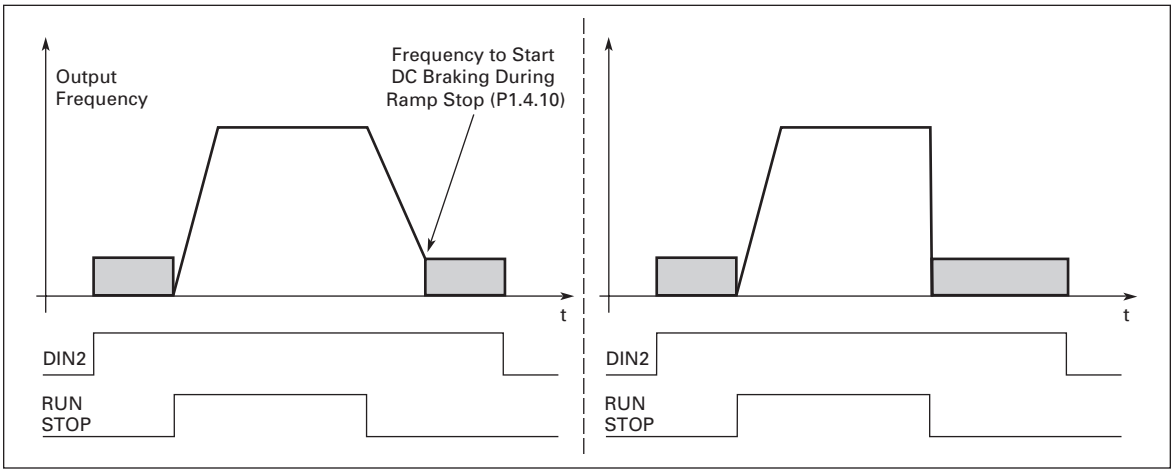


Figure 8-1: DC Braking Command

P1.2.6
DIN4 Function

Range: 0 – 15 Default: 4 (Accel/decel time sel)

DIN4 FUNCTION

This parameter determines the function of digital input DIN4. If DIN4 is not being used, set this parameter to 0.

0 Not Used
1 External fault – contact closed: Fault is displayed and motor stopped
2 External fault – contact open: Fault is displayed and motor stopped
3 Run enable/External interlock –
Contact open: HVX9000 start disabled
Contact closed: HVX9000 start enabled
4 Acceleration or deceleration time selection –
Contact open: Acceleration/Deceleration time 1 selected
Contact closed: Acceleration/Deceleration time 2 selected
5 Hand/Auto Select – contact closed: Auto control selected
6 PID Control – contact closed: PID control selected
7 Motor potentiometer down – contact closed: Motor potentiometer down selected
8 PID Reference 2 Select
9 PM Setback
10 Fault reset – contact closed: All faults reset
11 Speed Select 2
12 DC braking command –
Contact closed: In Stop mode, the DC braking operates until the contact is opened. See **Figure 8-1**.
13 Reserved
14 Fire Mode – contact closed: Fire Mode selected. See **Page 8-46**.
15 Fire Mode Reference Select –
Contact open or closed based on ***FMRefSelFunction***. If this input is "ON", then ***FireModeFreqRef1*** or ***FireModeFreqRef2*** is selected as a "Preset Speed."

P1.2.7
DIN5 Function

Range: 0 – 15 Default: 13 (PM Setback)

DIN5 FUNCTION

This parameter determines the function of digital input DIN5. If DIN5 is not being used, set this parameter to 0.

0 Not Used
1 External fault – contact closed: Fault is displayed and motor stopped
2 External fault – contact open: Fault is displayed and motor stopped
3 Run enable/External interlock –
Contact open: HVX9000 start disabled
Contact closed: HVX9000 start enabled
4 Acceleration or deceleration time selection –
Contact open: Acceleration/Deceleration time 1 selected
Contact closed: Acceleration/Deceleration time 2 selected
5 Hand/Auto Select – contact closed: Auto control selected
6 Motor potentiometer up – contact closed: Motor potentiometer up selected
7 PID Control – contact closed: PID control selected
8 Reverse – contact closed: Reverses motor direction
9 DC Brake Command – contact closed: DC Brake is enabled
10 Fault reset – contact closed: All faults reset
11 Acceleration/Deceleration prohibited –
Contact closed: No acceleration or deceleration possible until the contact is opened
12 HOA On/Off – contact closed: HOA Off
13 PM Setback – contact closed: PM Setback enabled
14 Fire Mode – contact closed: Fire Mode selected. See **Page 8-46**.
15 Fire Mode Reference Select 1 / 2
Contact opened: Fire Mode Reference 1 selected
Contact opened: Fire Mode Reference 2 selected

P1.2.8
DIN6 Function

Range: 0 – 15 Default: 11 (Speed Select 3)

DIN6 FUNCTION

This parameter determines the function of digital input DIN6. If DIN6 is not being used, set this parameter to 0.

0 Not Used
1 External fault – contact closed: Fault is displayed and motor stopped
2 External fault – contact open: Fault is displayed and motor stopped
3 Run enable/External interlock –
Contact open: Drive start disabled
Contact closed: Drive start enabled
4 Acceleration or deceleration time selection –
Contact open: Acceleration/Deceleration time 1 selected
Contact closed: Acceleration/Deceleration time 2 selected
5 Hand/Auto Select – contact closed: Auto control selected
6 Motor potentiometer up – contact closed: Motor potentiometer up selected
7 Motor potentiometer down – contact closed: Motor potentiometer down selected
8 PID Reference 2 Select
9 PM Setback – contact closed: PM Setback enabled
10 Fault reset – contact closed: All faults reset
11 Speed Select 3 – contact closed: Speed 3 selected
12 HOA On/Off – contact closed: HOA Off
13 Reserved
14 Fire Mode – contact closed: Fire Mode selected
15 Fire Mode Reference Select 1 / 2
Contact opened: Fire Mode Reference 1 selected
Contact opened: Fire Mode Reference 2 selected

P1.2.9
AI1 Signal Range

Range: 0 – 2 Default: 0 (0 – 20 mA / 0 – 100%)
Units: Percent

AI1 SIGNAL RANGE

With this parameter you can select the analog input 1 signal range.

0 Signal range 0 – 20 mA / 0 – 100%
1 Signal range 4 – 20 mA / 20 – 100%
2 Customized signal range defined with ***AI1 Custom Minimum*** and ***AI1 Custom Maximum***

P1.2.10
AI1 Custom Minimum

Range: 0.00 – AI1 Custom Maximum Default: 0.00%
Units: Percent

AI1 CUSTOM MIN

This parameter allows the setting of minimum level for the customized analog input 1 as a percentage of 10V.

P1.2.11
AI1 Custom Maximum

Range: AI1 Custom Minimum – 100.00% Default: 100.00%
Units: Percent

AI1 CUSTOM MAX

This parameter allows the setting of the maximum level for the customized analog input 1 as a percentage of 10V.

P1.2.12
AI1 Signal Inversion

Range: 0 – 1 Default: 0 (No Inversion)
AI1 SIGNAL INV
Setting this parameter to 1 causes the maximum set output to occur with the minimum reference input and the minimum set output to occur with the maximum reference input.
0 No Inversion
1 AI1 signal inverted

P1.2.13
AI1 Filter Time

Range: 0.00 – 10.00 Default: 0.10
Units: Seconds
AI1 FILTER TIME
This parameter, given a value greater than 0, activates the function that filters out disturbances from the incoming analog input 1 (V_{in}) signal.
Long filtering time makes the signal change slower. See **Figure 8-2**.

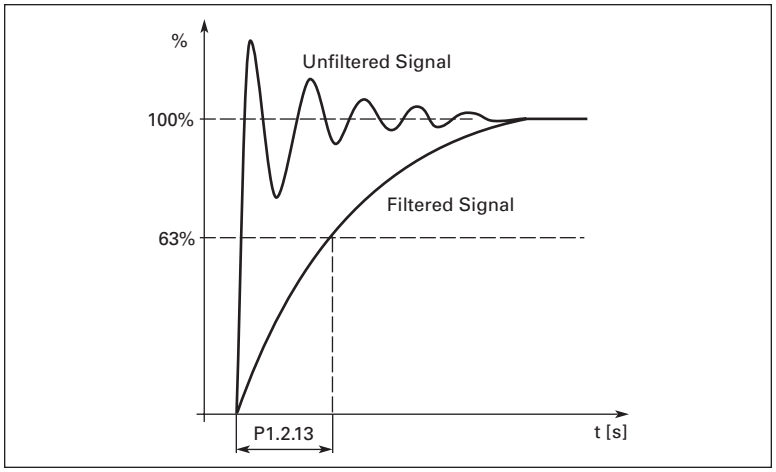


Figure 8-2: AI1 Signal Filtering

P1.2.14
AI2 Signal Range

Range: 0 – 2 Default: 1 (4 – 20 mA / 20 – 100%)
Units: Percent
AI2 SIGNAL RANGE
0 Signal range 0 – 20 mA / 0 – 100%
1 Signal range 4 – 20 mA / 20 – 100%
2 Custom signal range (see ***AI2 Custom Minimum*** and ***AI2 Custom Maximum***)

P1.2.15
AI2 Custom Minimum

Range: 0.00 – AI2 Custom Max Default: 0.00%
Units: Percent
AI2 CUSTOM MIN
This parameter allows the setting of the minimum level of analog input 2 as a percentage of 20 mA.
See also ***AI1 Custom Minimum***.

P1.2.16
AI2 Custom Maximum

Range: AI2 Custom Min – 100.00% Default: 100.00%
Units: Percent
AI2 CUSTOM MAX
This parameter allows the setting of the maximum level of analog input 2 as a percentage of 20 mA.
See also ***AI1 Custom Maximum***.

P1.2.17
AI2 Signal Inversion

Range: 0 – 1 Default: 0 (No Inversion)

AI2 SIGNAL INV

Setting this parameter to 1 causes the maximum set output to occur with the minimum reference input and the minimum set output to occur with the maximum reference input. See also ***AI1 Signal Inversion***.

0 No Inversion
1 AI2 signal inverted

P1.2.18
AI2 Filter Time

Range: 0.00 – 10.00 Default: 0.10
Units: Seconds

AI2 FILTER TIME

This parameter, given a value greater than 0, activates the function that filters out disturbances from the analog input 2 (I_{in}) signal. A long filtering time makes the signal change slower. See **Figure 8-3**.

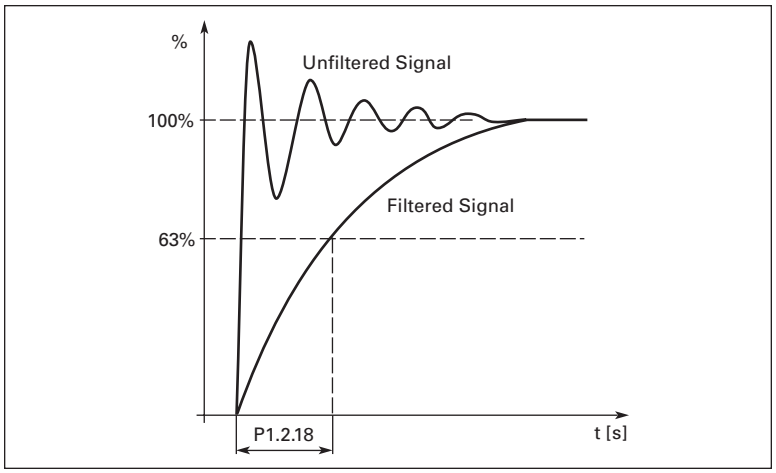


Figure 8-3: AI2 Signal Filtering

P1.2.19
Motor Potentiometer Ramp Time

Range: 0.1 – 2000.0 Default: 10.0
Units: Seconds

MOTORPOT RAMP TIME

Defines the rate of change of the reference from the motor potentiometer.

P1.2.20
Motor Potentiometer Memory Reset (Frequency Reference)

Range: 0 – 2 Default: 1

MOTORPOTMEMFREQREF

This parameter sets whether the memory of the motor potentiometer, when used as a frequency reference, is maintained or reset at stop or power down.

0 No reset
1 Memory reset at stop and power down
2 Memory reset at power down

P1.2.21
Motor Potentiometer Memory Reset (PID Reference)

Range: 0 – 2 Default: 0 (No Reset)

MOTORPOTMEMPIDREF

This parameter sets whether the memory of the motor potentiometer, when used as a PID reference, is maintained or reset at stop or power down.

0 No reset
1 Memory reset at stop and power down
2 Memory reset at power down

P1.2.22 Reference Scale Minimum

Range: 0.00 – Ref Scale Max Default: 0.00
Units: Hertz
REF SCALE MIN

This parameter allows the scaling of the minimum frequency reference from its preset value to a value less than that set by the ***Reference Scale Maximum*** parameter. If no scaling is desired, set this parameter to 0.

An example is shown in **Figure 8-4**. Voltage input AI1, with a signal range of 0 – 10V, is selected for the Place B reference, and its minimum and maximum output values are scaled from their preset values by using the ***Reference Scale Minimum*** and ***Reference Scale Maximum*** parameters.

P1.2.23 Reference Scale Maximum

Range: Ref Scale Min – 320.00 Default: 0.00
Units: Hertz
REF SCALE MAX

This parameter allows the scaling of the maximum frequency reference from its preset value to a value greater than that set by the ***Reference Scale Minimum*** parameter. If no scaling is desired, set this parameter to 0.

An example is shown in **Figure 8-4**. Voltage input AI1, with a signal range of 0 – 10V, is selected for the Place B reference, and its minimum and maximum output values are scaled from their preset values by using the ***Reference Scale Minimum*** and ***Reference Scale Maximum*** parameters.

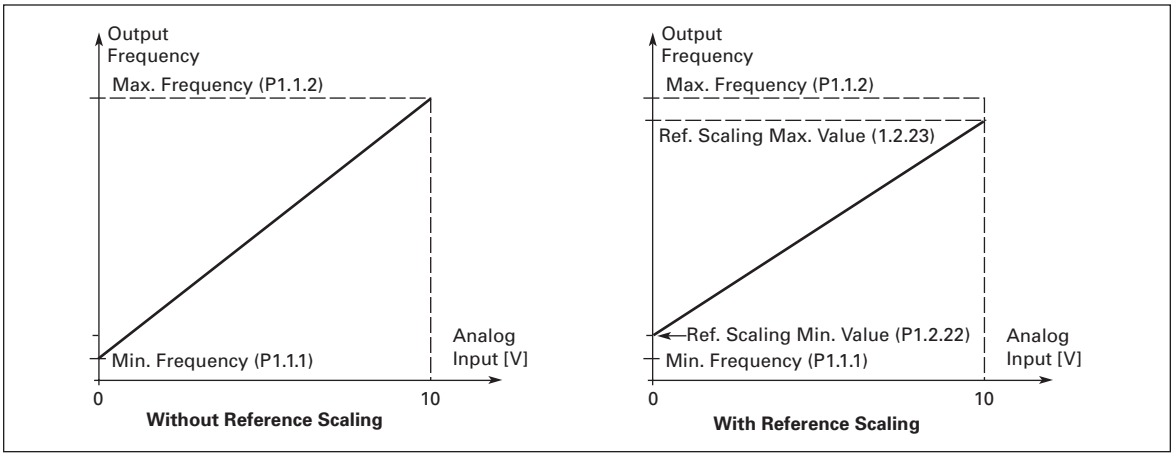


Figure 8-4: Control Place B with and without Reference Scaling

P1.2.24 AI3 Signal Selection

Range: AnIN:0.1 – AnIN:E.10 Default: AnIN:0.1
AI3 SIGNAL SEL

Connect the AI3 signal to the analog input of your choice with this parameter.

P1.2.25 AI3 Signal Range

Range: 0 – 1 Default: 1 (4 – 20 mA/20 – 100%)
AI3 SIGNAL RANGE

This parameter sets the signal range of analog input 3.
0 Signal range 0 – 20 mA / 0 – 100%
1 Signal range 4 – 20 mA / 20 – 100%
This parameter allows the setting of the maximum level of analog input 2 as a percentage of 20 mA. See also ***AI1 Custom Maximum***.

P1.2.26
AI3 Signal Inversion

Range: 0 – 1 Default: 0 (No Inversion)

AI3 SIGNAL INV

Setting this parameter to 1 causes the maximum set output to occur with the minimum reference input and the minimum set output to occur with the maximum reference input.

0 No inversion
1 AI3 signal inverted

P1.2.27
AI3 Filter Time

Range: 0.00 – 10.00 Default: 0.10
Units: Seconds

AI3 FILTER TIME

When this parameter is given a value greater than 0, it activates the function that filters out disturbances from the incoming analog input 3 signal. A long filtering time makes the signal change slower. See **Figure 8-3**.

P1.2.28
AI4 Signal Selection

Range: AnIN:0.1 – AnIN:E.10 Default: AnIN:0.1

AI4 SIGNAL SEL

Connect the AI4 signal to the analog input of your choice with this parameter.

P1.2.29
AI4 Signal Range

Range: 0 – 1 Default: 1 (4 – 20 mA/20 – 100%)

AI4 SIGNAL RANGE

This parameter sets the signal range of analog input 4.

0 Signal range 0 – 20 mA / 0 – 100%
1 Signal range 4 – 20 mA / 20 – 100%

P1.2.30
AI4 Signal Inversion

Range: 0 – 1 Default: 0 (No Inversion)

AI4 SIGNAL INV

Setting this parameter to 1 causes the maximum set output to occur with the minimum reference input and the minimum set output to occur with the maximum reference input.

P1.2.31
AI4 Filter Time

Range: 0.00 – 10.00 Default: 0.10
Units: Seconds

AI4 FILTER TIME

When this parameter is given a value greater than 0, it activates the function that filters out disturbances from the analog input 4 signal. A long filtering time makes the signal change slower. See **Figure 8-3**.

P1.2.32 Interlock/Run Enable Display Text Parameters

Range: 0 – 9

INTLK TEXT DIN2

1.2.32.1
Interlock/Run Enable Text for DIN2 Default: 0

INTLK TEXT DIN3

1.2.32.2
Interlock/Run Enable Text for DIN3 Default: 0

1.2.32.3
Interlock/Run Enable Text for DIN4 Default: 0

INTLK TEXT DIN5

1.2.32.4
Interlock/Run Enable Text for DIN5 Default: 0

INTLK TEXT DIN6

1.2.32.5
Interlock/Run Enable Text for DIN6 Default: 0

When a Digital Input is selected for External Interlock/Run Enable, the user has a choice of the following text displays when the contact is open.

0 Ext Interlock
1 Run Enable
2 Vibration Cutout
3 High Motor Temperature
4 Freeze Stat Trip
5 Low Pressure
6 High Pressure
7 Low Water
8 Smoke Detect
9 3-Wire Off

Parameter Group G1.3: Output Signals

P1.3.1 Analog Output (I_{out}) Content

Range: 0 – 13 Default: 1 (Output Frequency)

IOUT CONTENT

This parameter selects the desired function for the analog output signal.

0 Not used
1 Output frequency (0 – f_{max})
2 Frequency reference (0 – f_{max})
3 Motor speed (0 – Motor nominal speed)
4 Output current (0 – I_{nMotor})
5 Motor torque (0 – T_{nMotor})
6 Motor power (0 – P_{nMotor})
7 Motor voltage (0 – V_{nMotor})
8 DC-link voltage (0 – 1000V)
9 PID controller reference value
10 PID controller actual value 1
11 PID controller actual value 2
12 PID controller error value
13 PID controller output

Defines the maximum output frequency limit setting.

P1.3.2
Analog Output (I_{out}) Filter Time

Range: 0.00 – 10.00 Default: 1.00
Units: Seconds
IOUT FILTER TIME
When this parameter is given a value greater than 0, it activates the function that filters out disturbances from the analog output signal. A long filtering time makes the output signal change slower. If you set a value of 0, no filtering takes place. See **Figure 8-5**.

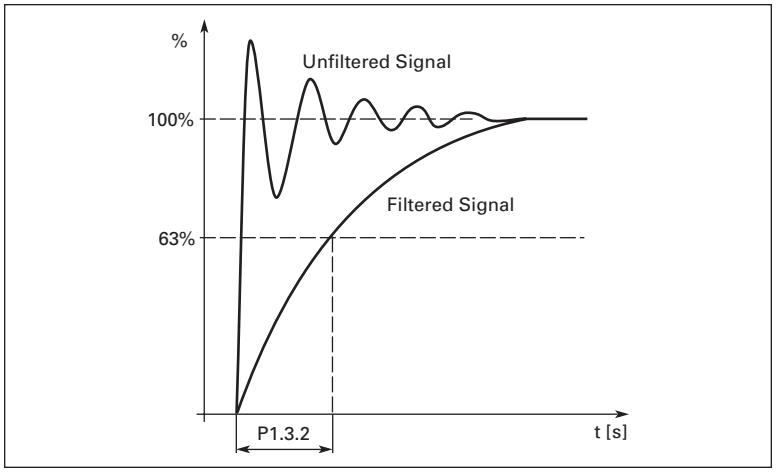


Figure 8-5: Analog Output Filtering

P1.3.3
I_{out} Invert

Range: 0 – 1 Default: 0 (Not Inverted)
IOUT INVERT
Setting this parameter to 1 inverts the analog output signal so that the maximum output occurs at the minimum value of the ***Analog Output (I_{out}) Content*** parameter and the minimum output occurs at the maximum value of the ***Analog Output (I_{out}) Content*** parameter. See **Figure 8-6**.
0 Not inverted
1 Inverted

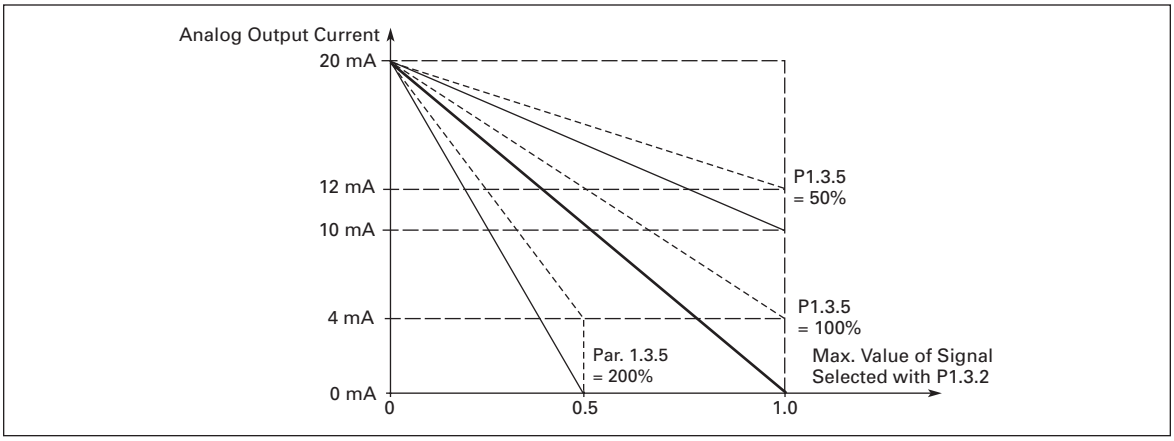


Figure 8-6: Analog Output Inversion

P1.3.4
Analog Output (I_{out}) Minimum

Range: 0 – 1 Default: 0 (0 mA)
IOUT MINIMUM
Sets the signal minimum to either 0 mA or 4 mA.
0 0 mA minimum
1 4 mA minimum

P1.3.5
Analog Output (I_{out}) Scale

Range: 10 – 1000 Default: 100
Units: Percent
IOUT SCALE

See **Figures 8-6** and **8-7** and **Table 8-1** for scaling information and examples.

Table 8-1: Scaling Factor for the Analog Output

Signal	Maximum Value of the Signal
Output frequency	100 x f_{max}
Motor speed	100% x Motor nominal speed
Output current	100% x I_{nMotor}
Motor torque	100% x T_{nMotor}
Motor power	100% x P_{nMotor}
Motor voltage	100% x V_{nmotor}
DC-link voltage	1000 V
PI-ref. value	100% x ref. value max.
PI act. value 1	100% x actual value max.
PI act. value 2	100% x actual value max.
PI error value	100% x error value max.
PI output	100% x output max

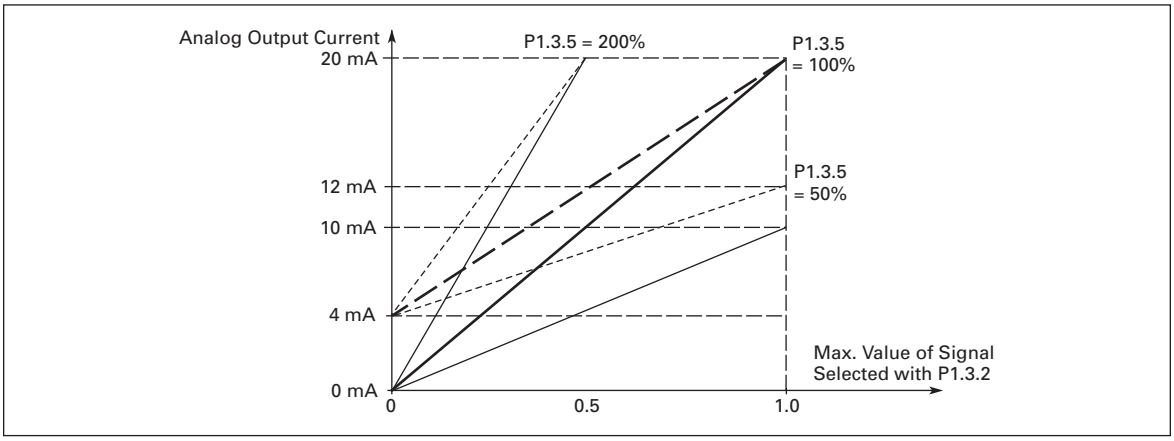


Figure 8-7: Analog Output Scale

P1.3.6 Digital Output 1 (DO1) Content

Range: 1 – 26 Default: 1 (Ready)

DO1 CONTENT

Digital output DO1 sinks current when the selected setting is true. See **Table 8-2** for setting information.

Table 8-2: DO1 Content Settings

Setting		Signal Content
1	Ready	The HVX9000 is ready to operate
2	Run	The HVX9000 is operating (motor is running)
3	Fault	A fault trip has occurred
4	Fault inverted	A fault trip has not occurred
5	Drive overheat warning	The heat-sink temperature exceeds +70C
6	External fault or warning	Fault or warning depending on ***External Fault***
7	Reference fault or warning	Fault or warning depending on ***4 mA (Reference) Fault Response*** — if analogue reference is 4 – 20 mA and signal is <4 mA
8	Warning	Always if a warning exists
9	Reversed	The reverse command has been selected
10	Bypass Run	Bypass has been selected
11	At speed	The output frequency has reached the set reference
12	Motor regulator activated	Overvoltage or overcurrent regulator was activated
13	Output frequency limit 1 supervision	The output frequency is outside the set supervision low limit/high limit (see ***Frequency Supervision Limit 1*** and ***Speed Supervision Value 1***)
14	Output frequency limit 2 supervision	The output frequency is outside the set supervision low limit/high limit (see ***Frequency Supervision Limit 2*** and ***Speed Supervision Value 2***)
15	Torque limit supervision	The motor torque is beyond the set supervision low limit/high limit (see ***Torque Supervision Limit*** and ***Torque Supervision Value***)
16	Reference limit supervision	Active reference is beyond the set supervision low limit/high limit (see ***Reference Supervision Limit*** and ***Reference Supervision Value***)
17	External brake control	External brake ON/OFF control with programmable delay (see ***External Brake Off Delay*** and ***External Brake On Delay***)
18	Control from I/O terminals	In external control mode
19	Drive temperature limit supervision	Frequency converter heatsink temperature goes beyond the set supervision limits (see ***Temperature Limit Supervision*** and ***Temperature Supervision Value***)
20	Unrequested rotation direction	Motor rotation direction is different from the requested one.

Table 8-2: DO1 Content Settings, continued

Signal		Signal Content
21	External brake control inverted	External brake ON/OFF control (see ***External Brake Off Delay*** and ***External Brake On Delay***); Output active when brake control is OFF
22	Thermistor fault or warning	The thermistor input of option board indicates overtemperature. Fault or warning depending on ***Thermistor Fault Response***
23	Pass Through Communications	Output can be "forced" on via Fieldbus
24	Fire Mode	Fire Mode is active
25	Auto Control	In Auto Control mode
26	Hand Control	In Hand Control mode

P1.3.7 Relay Output 1 (RO1) Content

Range: 1 – 28 Default: 2 (Run)

RO1 CONTENT

Relay output RO1 is activated when the selected setting is true. See **Table 8-3** for setting information.

Table 8-3: RO1 Content Settings

Setting		Signal Content
0	Not used	—
1	Ready	The HVX9000 is ready to operate
2	Run	The HVX9000 is operating (motor is running)
3	Fault	A fault trip has occurred
4	Fault inverted	A fault trip has not occurred
5	Drive overheat warning	The heat-sink temperature exceeds +70C
6	External fault or warning	Fault or warning depending on ***External Fault***
7	Reference fault or warning	Fault or warning depending on ***4 mA (Reference) Fault Response*** — if analogue reference is 4 – 20 mA and signal is <4 mA
8	Warning	Always if a warning exists
9	Reversed	The reverse command has been selected
10	Bypass Run	Bypass has been selected
11	At speed	The output frequency has reached the set reference
12	Motor regulator activated	Overvoltage or overcurrent regulator was activated
13	Output frequency limit 1 supervision	The output frequency is outside the set supervision low limit/high limit (see ***Frequency Supervision Limit 1*** and ***Speed Supervision Value 1***)
14	Output frequency limit 2 supervision	The output frequency is outside the set supervision low limit/high limit (see ***Frequency Supervision Limit 2*** and ***Speed Supervision Value 2***)
15	Torque limit supervision	The motor torque is beyond the set supervision low limit/high limit (see ***Torque Supervision Limit*** and ***Torque Supervision Value***)

Table 8-3: RO1 Content Settings, continued

Setting		Signal Content
16	Reference limit supervision	Active reference is beyond the set supervision low limit/high limit (see ***Reference Supervision Limit*** and ***Reference Supervision Value***)
17	External brake control	External brake ON/OFF control with programmable delay (see ***External Brake Off Delay*** and ***External Brake On Delay***)
18	Control from I/O terminals	In external control mode
19	Drive temperature limit supervision	Frequency converter heatsink temperature goes beyond the set supervision limits (see ***Temperature Limit Supervision*** and ***Temperature Supervision Value***)
20	Unrequested rotation direction	Motor rotation direction is different from the requested one
21	External brake control inverted	External brake ON/OFF control (see ***External Brake Off Delay*** and ***External Brake On Delay***); Output active when brake control is OFF
22	Thermistor fault or warning	The thermistor input of option board indicates overtemperature. Fault or warning depending on ***Thermistor Fault Response***
23	Pass Through Communications	Output can be "forced" on via Fleldbus
24	Fire Mode	Fire Mode is active
25	Auto Control	In Auto Control mode
26	Hand Control	In Hand Control mode
27	Start delay relay	Start delay for Interlocked Start in ***DIN1 Function***
28	Run Bypass or Drive	Running in Bypass or Drive

P1.3.8
Relay Output 2 (RO2) Content

Range: 1 – 28 Default: 3 (Fault)

RO2 CONTENT

Relay output RO2 is activated when the selected setting is true. See **Table 8-4** for setting information.

Table 8-4: RO2 Content Settings

Setting		Signal Content
0	Not used	—
1	Ready	The HVX9000 is ready to operate
2	Run	The HVX9000 is operating (motor is running)
3	Fault	A fault trip has occurred
4	Fault inverted	A fault trip has not occurred
5	Drive overheat warning	The heat-sink temperature exceeds +70C
6	External fault or warning	Fault or warning depending on ***External Fault***
7	Reference fault or warning	Fault or warning depending on ***4 mA (Reference) Fault Response*** — if analogue reference is 4 – 20 mA and signal is <4 mA
8	Warning	Always if a warning exists

Table 8-4: RO2 Content Settings, continued

Setting		Signal Content
9	Reversed	The reverse command has been selected
10	Bypass Run	Bypass has been selected
11	At speed	The output frequency has reached the set reference
12	Motor regulator activated	Overvoltage or overcurrent regulator was activated
13	Output frequency limit 1 supervision	The output frequency is outside the set supervision low limit/high limit (see ***Frequency Supervision Limit 1*** and ***Speed Supervision Value 1***)
14	Output frequency limit 2 supervision	The output frequency is outside the set supervision low limit/high limit (see ***Frequency Supervision Limit 2*** and ***Speed Supervision Value 2***)
15	Torque limit supervision	The motor torque is beyond the set supervision low limit/high limit (see ***Torque Supervision Limit*** and ***Torque Supervision Value***)
16	Reference limit supervision	Active reference is beyond the set supervision low limit/high limit (see ***Reference Supervision Limit*** and ***Reference Supervision Value***)
17	External brake control	External brake ON/OFF control with programmable delay (see ***External Brake Off Delay*** and ***External Brake On Delay***)
18	Control from I/O terminals	External control mode
19	Drive temperature limit supervision	Frequency converter heatsink temperature goes beyond the set supervision limits (see ***Temperature Limit Supervision*** and ***Temperature Supervision Value***)
20	Unrequested rotation direction	Motor rotation direction is different from the requested one.
21	External brake control inverted	External brake ON/OFF control (see ***External Brake Off Delay*** and ***External Brake On Delay***); Output active when brake control is OFF
22	Thermistor fault or warning	The thermistor input of option board indicates overtemperature. Fault or warning depending on ***Thermistor Fault Response***
23	Pass Through Communications	Output can be “forced” on via Fieldbus
24	Fire Mode	Fire Mode is active
25	Auto Control	In Auto Control mode
26	Hand Control	In Hand Control mode
27	Start delay relay	Start delay for Interlocked Start in ***DIN1 Function***
28	Run Bypass or Drive	Running in Bypass or Drive

P1.3.9 Relay Output 3 (RO3) Content

Range: 1 – 28 Default: 28 (Run Bypass or Drive)

RO3 CONTENT

Relay output RO3 is activated when the selected setting is true. See **Table 8-5** for setting information.

Table 8-5: RO3 Content Settings

Setting		Signal Content
0	Not used	—
1	Ready	The HVX9000 is ready to operate
2	Run	The HVX9000 is operating (motor is running)
3	Fault	A fault trip has occurred
4	Fault inverted	A fault trip has not occurred
5	Drive overheat warning	The heat-sink temperature exceeds +70C
6	External fault or warning	Fault or warning depending on ***External Fault***
7	Reference fault or warning	Fault or warning depending on ***4 mA (Reference) Fault Response*** — if analogue reference is 4 – 20 mA and signal is <4 mA
8	Warning	Always if a warning exists
9	Reversed	The reverse command has been selected
10	Bypass Run	Bypass has been selected
11	At speed	The output frequency has reached the set reference
12	Motor regulator activated	Overvoltage or overcurrent regulator was activated
13	Output frequency limit 1 supervision	The output frequency is outside the set supervision low limit/high limit (see ***Frequency Supervision Limit 1*** and ***Speed Supervision Value 1***)
14	Output frequency limit 2 supervision	The output frequency is outside the set supervision low limit/high limit (see ***Frequency Supervision Limit 2*** and ***Speed Supervision Value 2***)
15	Torque limit supervision	The motor torque is beyond the set supervision low limit/high limit (see ***Torque Supervision Limit*** and ***Torque Supervision Value***)
16	Reference limit supervision	Active reference is beyond the set supervision low limit/high limit (see ***Reference Supervision Limit*** and ***Reference Supervision Value***)
17	External brake control	External brake ON/OFF control with programmable delay (see ***External Brake Off Delay*** and ***External Brake On Delay***)
18	Control from I/O terminals	External control mode
19	Drive temperature limit supervision	Frequency converter heatsink temperature goes beyond the set supervision limits (see ***Temperature Limit Supervision*** and ***Temperature Supervision Value***)
20	Unrequested rotation direction	Motor rotation direction is different from the requested one.

Table 8-4: RO3 Content Settings, continued

Setting		Signal Content
21	External brake control inverted	External brake ON/OFF control (see ***External Brake Off Delay*** and ***External Brake On Delay***); Output active when brake control is OFF
22	Thermistor fault or warning	The thermistor input of option board indicates overtemperature. Fault or warning depending on ***Thermistor Fault Response***
23	Fault Reset	This output is activated when faults are reset
24	Fire Mode	Fire Mode is active
25	Auto Control	In Auto Control mode
26	Hand Control	In Hand Control mode
27	Start delay relay	Start delay for Interlocked Start in ***DIN1 Function***
28	Run Bypass or Drive	Running in Bypass or Drive

P1.3.10
Relay Output 4 (RO4) Content

Range: 1 – 28 Default: 10 (Bypass Run)

RO4 CONTENT

Relay output RO4 is activated when the selected setting is true. See **Table 8-5** for setting information which is the same as RO3.

P1.3.11
Relay Output 5 (RO5) Content

Range: 1 – 28 Default: 23 (Fault Reset)

RO5 CONTENT

Relay output RO5 is activated when the selected setting is true. See **Table 8-5** for setting information which is the same as RO3.

P1.3.12
Relay Output 6 (RO6) Content

Range: 1 – 28 Default: 0 (Not Used)

RO6 CONTENT

Relay output RO6 is activated when the selected setting is true. See **Table 8-5** for setting information which is the same as RO3. This parameter is only available if optional relay board is added to slot D.

P1.3.13
Relay Output 7 (RO7) Content

Range: 1 – 28 Default: 0 (Not Used)

RO7 CONTENT

Relay output RO7 is activated when the selected setting is true. See **Table 8-5** for setting information which is the same as RO3. This parameter is only available if optional relay board is added to slot D.

P1.3.14
Relay Output 8 (RO8) Content

Range: 1 – 28 Default: 0 (Not Used)

RO8 CONTENT

Relay output RO8 is activated when the selected setting is true. See **Table 8-5** for setting information which is the same as RO3. This parameter is only available if optional relay board is added to slot D.

Note: P1.3.12 – P1.3.14 will be invisible unless there is an OPTB5 option board installed in slot D on drive.

P1.3.15
Frequency Supervision Limit 1

Range: 0 – 2 Default: 0 (No Supervision)

FREQ SUPV LIM 1

If this parameter is set for 1 or 2, and the output frequency goes under/over ***Frequency Supervision Limit 1***, this function generates a warning message via digital output DO1 or via one of the relay outputs RO1 or RO2, dependent upon their settings.

0 No supervision
1 Low limit supervision
2 High limit supervision

P1.3.16
Speed Supervision Value 1

Range: 0.0 – 200.0 Default: 0.0
Units: Percent

SPEEDSUPRVALUE1

Selects the frequency value supervised by ***Frequency Supervision Limit 1*** parameter.

P1.3.17
Frequency Supervision Limit 2

Range: 0 – 2 Default: 0 (No Supervision)

FREQ SUPV LIM 2

If this parameter is set for 1 or 2, and the output frequency goes under/over ***Frequency Supervision Limit 2***, this function generates a warning message via digital output DO1 or via one of the relay outputs RO1 or RO2, dependent upon their settings.

0 No supervision
1 Low limit supervision
2 High limit supervision

P1.3.18
Speed Supervision Value 2

Range: 0.0 – 200.0 Default: 0.0
Units: Percent

SPEEDSUPRVAL 2

Selects the frequency value supervised by ***Frequency Supervision Limit 2*** parameter.

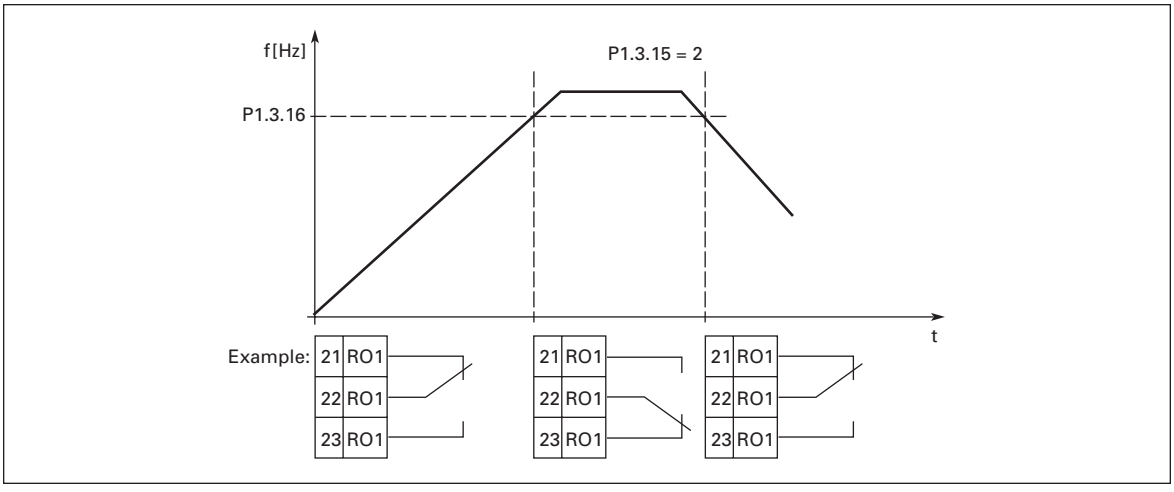


Figure 8-8: Output Frequency Supervision

P1.3.19 Torque Supervision Limit

Range: 0 – 2 Default: 0 (No Supervision)

TORQUE SUPV LIM

If this parameter is set for 1 or 2 and the calculated torque value goes under/over the set limit (***Torque Supervision Value***) this function generates a warning message via digital output DO1 or via one of the relay outputs depending on the settings of ***Digital Output 1 (DO1) Content***, ***Relay Output 1 (RO1) Content*** or ***Relay Output 2 (RO2) Content***.

0 No supervision
1 Low limit supervision
2 High limit supervision

P1.3.20 Torque Supervision Value

Range: 0.0 – 300.0 Default: 100.0%
Units: Percent

TORQUE SUPV VAL

This parameter sets the torque value to be supervised by ***Torque Supervision Limit*** parameter.

P1.3.21 Reference Supervision Limit

Range: 0 – 2 Default: 0 (No Supervision)

REF SUPERV LIM

If this parameter is set for 1 or 2 and the reference value goes under/over the set limit (***Reference Supervision Value***) this function generates a warning message via digital output DO1 or via one of the relay outputs depending on the settings of ***Digital Output 1 (DO1) Content***, ***Relay Output 1 (RO1) Content*** or ***Relay Output 2 (RO2) Content***. The current active reference is supervised. It may come from place A or B depending on the DIN6 input, from the keypad if keypad is the active control or from the communication bus if the communication bus is the active control.

0 No supervision
1 Low limit supervision
2 High limit supervision

P1.3.22 Reference Supervision Value

Range: 0.0 – 100.0 Default: 0.0
Units: Percent

REF SUPERV VAL

This parameter sets the reference value to be supervised by ***Reference Supervision Limit*** parameter.

P1.3.23 External Brake Off Delay

Range: 0.0 – 100.0 Default: 0.5
Units: Seconds

EXT BRAKE OFFDEL

The activation of the external brake can be linked to the Start and Stop control signals with the ***External Brake Off Delay*** and ***External Brake On Delay*** parameters, which define the time for which the external brake remains in its previous position before reacting to the START/STOP signal. See **Figure 8-9**. To program the brake control signal, you can use either the digital output DO1 or the relay outputs RO1 and RO2, see ***Digital Output 1 (DO1) Content***, ***Relay Output 1 (RO1) Content*** or ***Relay Output 2 (RO2) Content***.

P1.3.24
External Brake On Delay

Range: 0.0 – 100.0 Default: 0.5
Units: Seconds
EXT BRAKE ONDEL

The activation of the external brake can be linked to the Start and Stop control signals with the ***External Brake Off Delay*** and ***External Brake On Delay*** parameters, which define the time for which the external brake remains in its previous position before reacting to the START/STOP signal. See **Figure 8-9**. To program the brake control signal, you can use either the digital output DO1 or the relay outputs RO1 and RO2, see ***Digital Output 1 (DO1) Content***, ***Relay Output 1 (RO1) Content*** or ***Relay Output 2 (RO2) Content***.

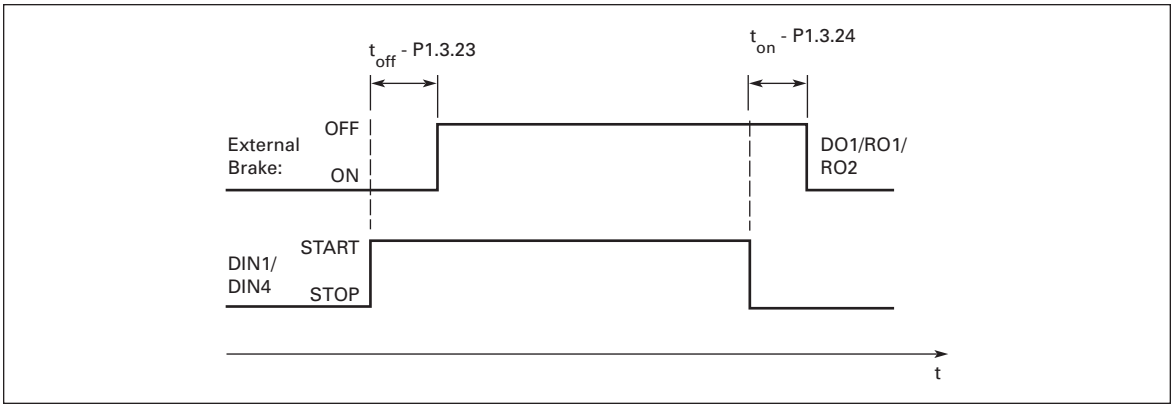


Figure 8-9: External Brake Control

P1.3.25
Temperature Limit Supervision

Range: 0 – 2 Default: 0 (No Supervision)
TEMP LIMIT SUPV

If this parameter is set for 1 or 2 and the HVX9000 temperature goes under/over the set limit (***Temperature Supervision Value***), this function generates a warning message via digital output DO1 or the relay outputs depending on the settings of ***Digital Output 1 (DO1) Content***, ***Relay Output 1 (RO1) Content*** or ***Relay Output 2 (RO2) Content***.

0 No temperature limit supervision
1 Low limit supervision
2 High limit supervision

P1.3.26
Temperature Supervision Value

Range: -10 – 75°C Default: 40°C
Units: degrees Celsius
TEMP SUPV VALUE

This parameter sets the temperature that is supervised by ***Temperature Limit Supervision*** parameter.

P1.3.27
Analog Output 2 (I_{out}) Signal

Range: AnOUT:0.1 – AnOUT:E.10 Default: AnOUT:0.1
IOUT 2 SIGNAL

Connect the AO2 signal to the analog output of choice with this parameter.

P1.3.28 Analog Output 2 (I_{out}) Content

Range: 0 – 13 Default: 4 (Output Current)

IOUT 2 CONTENT

This parameter selects the desired function for the analog output 2 signal.

0 Not used
1 Output frequency (0 – f_{max})
2 Frequency reference (0 – f_{max})
3 Motor speed (0 – Motor nominal speed)
4 Output current (0 – I_{nMotor})
5 Motor torque (0 – T_{nMotor})
6 Motor power (0 – P_{nMotor})
7 Motor voltage (0 – V_{nMotor})
8 DC-link voltage (0 – 1000V)
9 PID controller reference value
10 PID controller actual value 1
11 PID controller actual value 2
12 PID controller error value
13 PID controller output

P1.3.29 Analog Output 2 (I_{out}) Filter Time

Range: 0.00 – 10.00 Default: 1.00
Units: Seconds

IOUT 2 FILTER T

When this parameter is given a value greater than 0, it activates the function that filters out disturbances from the analog output 2 signal. A long filtering time makes the output signal change slower. If you set a value of 0, no filtering takes place. See **Figure 8-5**.

P1.3.30 Analog Output 2 (I_{out}) Inversion

Range: 0 – 1 Default: 0 (No Inversion)

IOUT 2 INVERT

Setting this parameter to 1, inverts the analog output 2 signal so that the maximum output occurs at the minimum value of the parameter selected in ***Analog Output 2 (I_{out}) Content*** and the minimum output occurs at the maximum value of the parameter selected in ***Analog Output 2 (I_{out}) Content***. See **Figure 8-6**.

0 Not inverted
1 Inverted

P1.3.31 Analog Output 2 (I_{out}) Minimum

Range: 0 – 1 Default: 0 (0 mA)

IOUT 2 MINIMUM

Sets the signal minimum to either 0 mA or 4 mA.

0 0 mA minimum
1 4 mA minimum

P1.3.32
Analog Output 2 (I_{out}) Scale

Range: 0 – 1000 Default: 0
Units: Percent
IOUT 2 SCALE

See **Figures 8-6** and **8-7** and **Table 8-6** for scaling information and examples.

Table 8-6: Scaling Factor for the Analog Output

Signal	Maximum Value of the Signal
Output Frequency	100 x f_{max}
Motor speed	100% x Motor nominal speed
Output current	100% x I_{nMotor}
Motor torque	100% x T_{nMotor}
Motor power	100% x P_{nMotor}
Motor voltage	100% x V_{nmotor}
DC-link voltage	1000 V
PI-ref. value	100% x ref. value max.
PI act. value 1	100% x actual value max.
PI act. value 2	100% x actual value max.
PI error value	100% x error value max.
PI output	100% x output max
See ***Analog Output (I_{out}) Scale***.	

Parameter Group G1.4: Drive Control

P1.4.1
Ramp 1 Shape

Range: 0.0 – 10.0 Default: 0.0
Units: Seconds
RAMP 1 SHAPE

The start and end of the acceleration and deceleration ramps can be smoothed with this parameter. Setting the value to 0 gives a linear ramp shape, which causes acceleration and deceleration to act immediately to the changes in the reference signal. Setting a value of 0.1 to 10 seconds produces an S-shaped acceleration/deceleration curve. The ramp times are determined by ***Acceleration Time 1*** and ***Deceleration Time 1***. See **Figure 8-10**.

0 Linear
>0 S-curve acceleration/deceleration ratio

P1.4.2
Ramp 2 Shape

Range: 0.0 – 10.0 Default: 0.0
Units: Seconds
RAMP 2 SHAPE

The start and end of acceleration and deceleration ramps can be smoothed with these parameters. Setting value 0 gives a linear ramp shape, which causes acceleration and deceleration to act immediately to the changes in the reference signal. Setting value 0.1 to 10 seconds for this parameter produces an S-shaped acceleration/deceleration. The acceleration time is determined with ***Acceleration Time 1***/***Deceleration Time 1*** (***Acceleration Time 2***/***Acceleration Time 2***). See **Figure 8-10**.

0 Linear
>0 S-curve acceleration/deceleration ratio

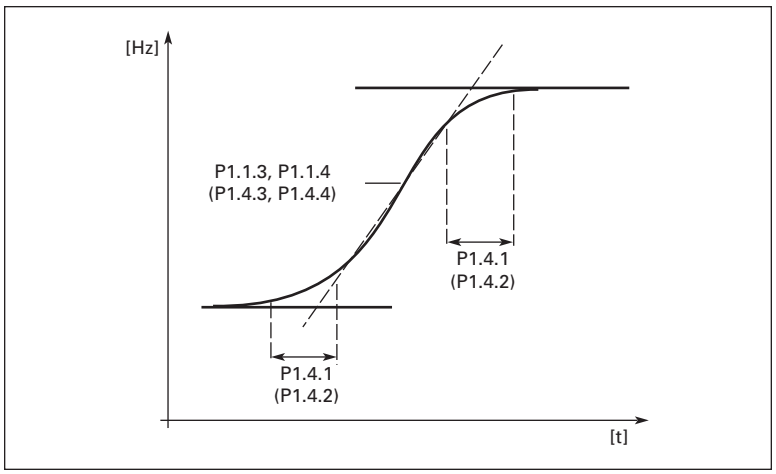


Figure 8-10: Acceleration/Deceleration Curve (S-Shaped)

P1.4.3 Acceleration Time 2
Range: 0.1 – 3000.0 Default: 10.0
Units: Seconds
ACCEL TIME 2
Time required for output frequency to change from the minimum frequency to the maximum frequency set by ***Minimum Frequency*** and ***Maximum Frequency***. With the use of ***Acceleration Time 1*** and ***Acceleration Time 2***, two different acceleration times can be used for an application. The active set can be selected with one of the programmable digital inputs DIN2, DIN3, DIN4, DIN5 or DIN6 (***DIN2 Function***, ***DIN3 Function***, ***DIN4 Function***, ***DIN5 Function***, and ***DIN6 Function***).

Note: If the PID-controller is used, the acceleration/deceleration time set 2 is automatically selected as the active set.

P1.4.4 Deceleration Time 2
Range: 0.1 – 3000.0 Default: 10.0
Units: Seconds
DECEL TIME 2
Time required for output frequency to change from the maximum frequency to the minimum frequency set by ***Minimum Frequency*** and ***Maximum Frequency***. With the use of ***Deceleration Time 1*** and ***Deceleration Time 2***, two different deceleration times can be used for an application. The active set can be selected with one of the programmable digital inputs DIN2, DIN3, DIN4, DIN5 or DIN6 (***DIN2 Function***, ***DIN3 Function***, ***DIN4 Function***, ***DIN5 Function***, and ***DIN6 Function***).

Note: If the PID-controller is used, the acceleration/deceleration time set 2 is automatically selected as the active set.

P1.4.5 Brake Chopper
Range: 0 – 3 Default: 0 (Not Used)
BRAKE CHOPPER
When the HVX9000 is decelerating the motor, the energy stored in the inertia of the motor and the load are fed into an external brake resistor. This enables the HVX9000 to decelerate the load with a torque equal to that of acceleration (provided that the correct brake resistor has been selected). See separate brake resistor installation manual.

0 Brake chopper not used
1 Brake chopper in use
2 External brake chopper
3 In Ready state

P1.4.6
Start Function

Range: 0 – 1 Default: 0 (Ramping)

START FUNCTION

0 Ramp:
The HVX9000 starts from 0 Hz and accelerates to the set reference frequency within the set acceleration time. (Load inertia or starting friction may cause prolonged acceleration times.)

1 Flying start:
The HVX9000 is able to start into a spinning motor by applying a small torque to motor and searching for the frequency corresponding to the speed the motor is spinning at. The searching starts from the maximum frequency towards the spinning equivalent frequency until the correct value is detected. Thereafter, the output frequency will be increased/ decreased to the set reference value following the set acceleration/ deceleration parameters. Use this mode if the motor may be spinning when the start command is given. With the flying start, it is possible to ride through short utility voltage interruptions.

P1.4.7
Stop Function

Range: 0 – 3 Default: 1 (Ramp)

STOP FUNCTION

0 Coasting:
The motor coasts to a halt without control from the HVX9000 after the Stop command.

1 Ramp:
After the Stop command, the speed of the motor is reduced according to the set deceleration parameters. If the regenerated energy is high it may be necessary to use an external braking resistor for faster deceleration.

2 Normal = Ramp/Run Enable: coasting
After the Stop command, the speed of the motor is decelerated according to the set deceleration parameters. However, when the Run Enable signal is energized using one of the digital inputs (e.g. DIN3), the motor coasts to a halt without control from the drive.

3 Normal stop = Coasting/Run Enable: ramping
The motor coasts to a halt without any control from the drive. However, when Run Enable signal is energized using one of the digital inputs (e.g. DIN3), the speed of the motor is decelerated according to the set deceleration parameters. If the regenerated energy is high it may be necessary to use an external braking resistor for faster deceleration.

P1.4.8
DC Brake Current

Range: 0.15 x I_{nHVX} – 1.5 x I_{nHVX} Default: 0.5 x I_{nHVX}

Units: Amperes

DC-BRAKE CURRENT

This parameter's range and default value are determined by the HVX9000 nameplate current rating. It defines the current injected into the motor during DC-braking.

P1.4.9
DC Brake Time at Stop

Range: 0.000 – 60.000 Default: 0.000
Units: Seconds
STOP DC-BRAKETM

Determines if braking is ON or OFF and the on time of the DC-brake when the motor is stopping. The function of the DC-brake depends on the ***Stop Function***.

0 DC-brake is not used

>0 DC-brake is in use and its function depends on ***Stop Function***. The DC-braking time is determined with this parameter.

Stop Function = 0 (Coasting):
After the stop command, the motor coasts to a stop without control from the drive.

With the DC injection, the motor can be electrically stopped in the shortest possible time, without using an optional external braking resistor.
The braking time is scaled by the frequency when the DC-braking starts. If the frequency is greater than the nominal frequency of the motor, this set value determines the braking time. When the frequency is ≤10% of the nominal, the braking time is 10% of this set value. See **Figure 8-11**.

Stop Function = 1 (Ramp):
After the Stop command, the speed of the motor is reduced according to the set deceleration parameters, as fast as possible, to the speed defined with ***DC Brake Frequency In Ramp Stop***, where the DC-braking starts. The braking time is defined with this parameter. If high inertia exists, it is recommended to use an external braking resistor for faster deceleration. See **Figure 8-12**.

Stop Function = 2 (Normal = Ramping/Run Enable = Coasting):
Follows the Coasting or Stopping action described above, dependent upon the status of the Run Enable input.

Stop Function = 3 (Normal = Coasting/Run Enable = Ramping):
Follows the Coasting or Stopping action described above, dependent upon the status of the Run Enable input.

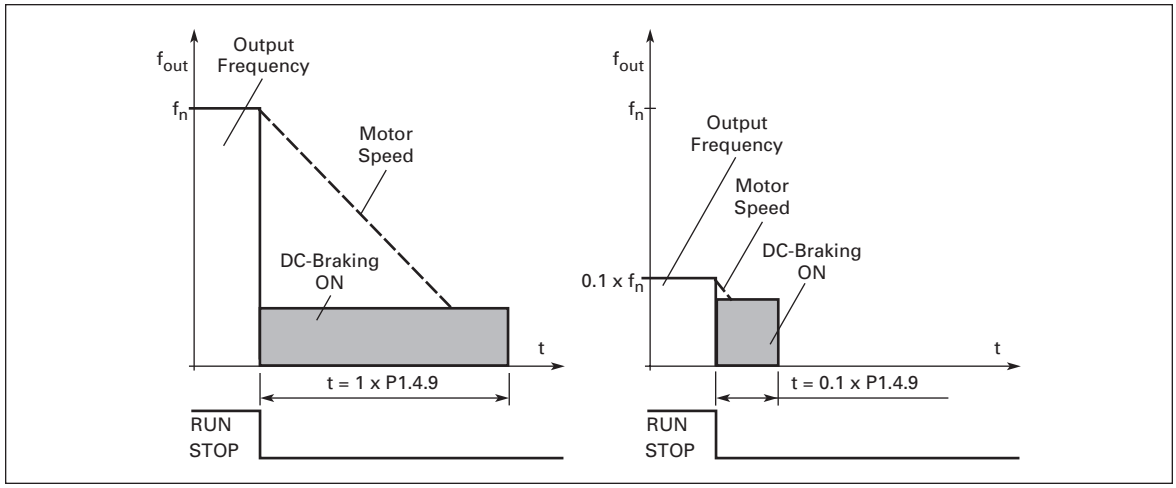


Figure 8-11: DC Braking Time When Stop Mode = Coasting

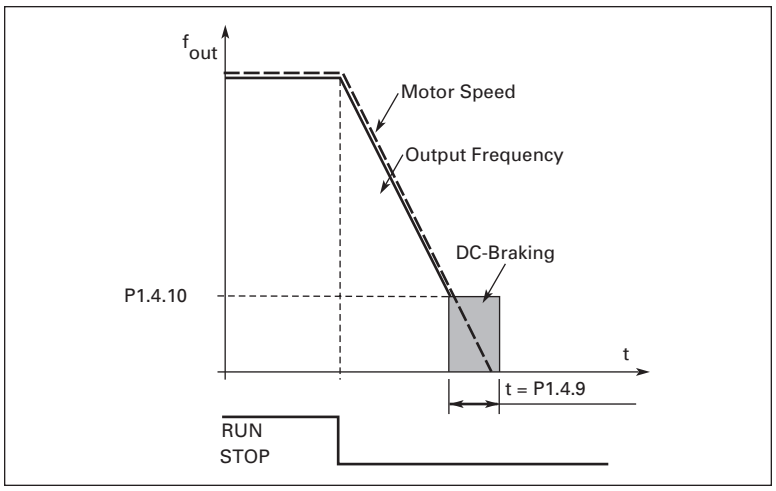


Figure 8-12: DC Braking Time When Stop Mode = Ramp

P1.4.10
DC Brake Frequency In Ramp Stop

Range: 0.10 – 10.00 Default: 1.50
Units: Hertz
STOP DC-BRAKEFR
The output frequency at which the DC-braking is applied. See **Figure 8-13**.

P1.4.11
Start DC Brake Time

Range: 0.000 – 60.000 Default: 0.000
Units: Seconds
START DC-BRAKETM
DC-brake is activated when the start command is given. This parameter defines the time before the brake is de-energized. After the brake is de-energized, the output frequency increases according to the set start function by ***Start Function*** parameter. See **Figure 8-13**.

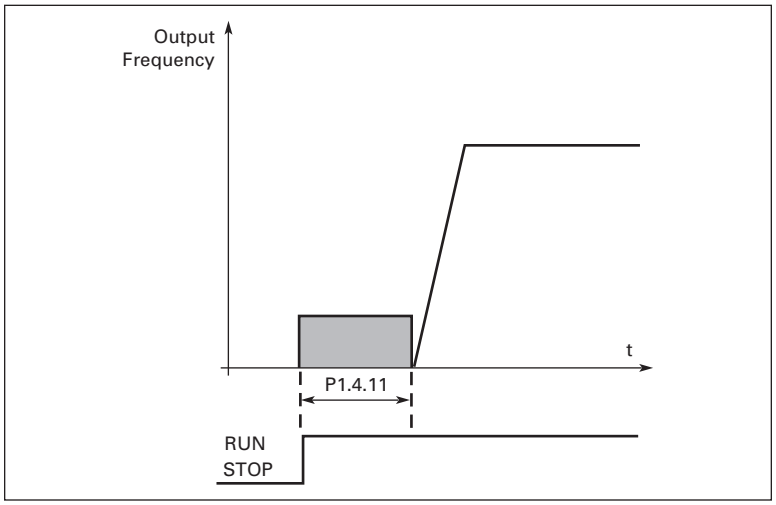


Figure 8-13: DC Braking Time at Start

P1.4.12
Flux Brake

Range: 0 – 1 Default: 0 (Off)
FLUX BRAKE
Braking torque is created by controlling the motor flux.
0 Flux braking OFF
1 Flux braking ON

P1.4.13 Range: 0.1 x I_{nMotor} – ***Current Limit*** Default: 0.5 x I_{nMotor}
Flux Brake Current Units: Amperes
FLUXBRAKECURRENT
Defines the flux braking current value. It can be set between 0.1 x I_{nMot} ***Motor Power Factor*** and the ***Current Limit*** setting.

Parameter Group G1.5: Prohibit Frequencies

P1.5.1 Range: 0.00 – ***Range 1 High Limit*** Default: 0.00
Range 1 Low Limit Units: Hertz
RANGE 1 LOW LIM
In some systems it may be necessary to avoid certain frequencies because of mechanical resonances. Using ***Range 1 Low Limit*** to ***Range 3 High Limit*** parameters, it is possible to set limits for the "skip frequency" region. See **Figure 8-14**.

P1.5.2 Range: ***Range 1 Low Limit*** – Default: 0.00
Range 1 High Limit Max Frequency
Units: Hertz
RANGE 1 HIGH LIM
In some systems it may be necessary to avoid certain frequencies because of mechanical resonances. Using ***Range 1 Low Limit*** to ***Range 3 High Limit*** parameters, it is possible to set limits for the "skip frequency" region. See **Figure 8-14**.
0 No prohibit frequency range 1

P1.5.3 Range: 0.00 – ***Range 2 High Limit*** Default: 0.00
Range 2 Low Limit Units: Hertz
RANGE 2 LOW LIM
In some systems it may be necessary to avoid certain frequencies because of mechanical resonances. Using ***Range 1 Low Limit*** to ***Range 3 High Limit*** parameters, it is possible to set limits for the "skip frequency" region. See **Figure 8-14**.

P1.5.4 Range: ***Range 2 Low Limit*** – Default: 0.00
Range 2 High Limit Max Frequency
Units: Hertz
RANGE 2 HIGH LIM
In some systems it may be necessary to avoid certain frequencies because of mechanical resonances. Using ***Range 1 Low Limit*** to ***Range 3 High Limit*** parameters, it is possible to set limits for the "skip frequency" region. See **Figure 8-14**.
0 No prohibit frequency range 2

P1.5.5 Range: 0 – ***Range 3 High Limit*** Default: 0.00
Range 3 Low Limit Units: Hertz
RANGE 3 LOW LIM
In some systems it may be necessary to avoid certain frequencies because of mechanical resonances. Using ***Range 1 Low Limit*** to ***Range 3 High Limit*** parameters, it is possible to set limits for the "skip frequency" region. See **Figure 8-14**.

P1.5.6
Range 3 High Limit

Range: ***Range 3 Low Limit*** – Max Frequency
Units: Hertz
Default: 0.00

RANGE 3 HIGH LIM

In some systems it may be necessary to avoid certain frequencies because of mechanical resonances. Using ***Range 1 Low Limit*** to ***Range 3 High Limit*** parameters, it is possible to set limits for the "skip frequency" region. See **Figure 8-14**.

0 No prohibit frequency range 3

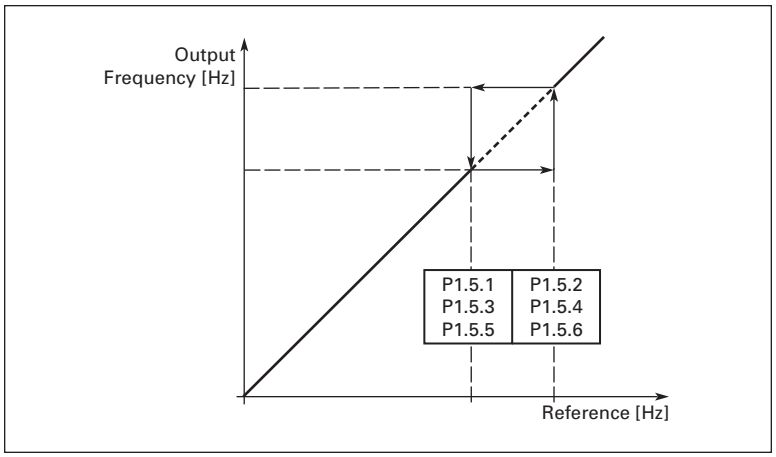


Figure 8-14: Prohibit Frequency Area Setting

P1.5.7
PH Acceleration/ Deceleration Ramp

Range: 0.1 – 10.0
Default: 1.0

PH ACC/DEC RAMP

Defines the acceleration/deceleration time when the output frequency is between the selected prohibit frequency range limits. The ramping speed (selected acceleration/deceleration time 1 or 2) is multiplied with this factor. E.g. value 0.1 makes the acceleration time 10 times shorter than outside the prohibit frequency range limits.

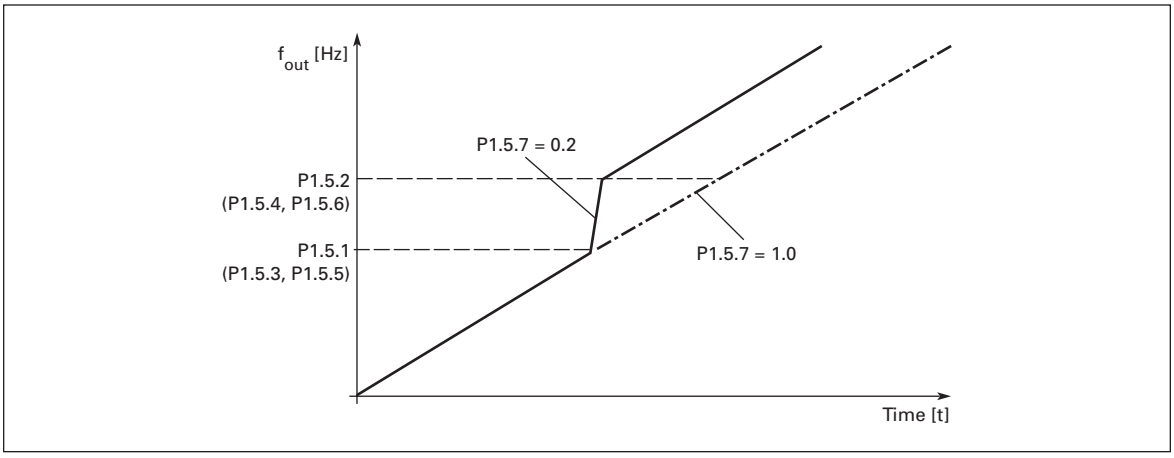


Figure 8-15: Ramp Speed Scaling Between Prohibit Frequencies

Parameter Group G1.6: Motor Control

P1.6.1 Motor Control Mode

Range: 0 – 1 Default: 0 (Frequency control)

MOTOR CTRL MODE

This parameter determines the mode the drive is using to control the motor. The reference may be from the I/O terminals, keypad or the communication bus.

0 Frequency control: The HVX9000 is controlling the output frequency (output frequency resolution = 0.01 Hz).

1 Speed control: The HVX9000 is controlling the motor speed compensating for the motor slip (accuracy ± 0.5%).

P1.6.2 Voltage/Frequency Optimization

Range: 0 – 1 Default: 0 (None)

V/F OPTIMIZATION

0 None

1 Automatic torque boost

This parameter determines if automatic torque boost is used. With automatic torque boost the voltage to the motor changes automatically which allows the motor produce sufficient torque to start and run at low frequencies. The voltage increase depends on the motor type and power. Automatic torque boost can be used in applications where the starting torque required due to high starting friction is large, e.g. in conveyors.

EXAMPLE: What is required to start the load from 0 Hz?

- First set the motor nominal values (***Motor Nominal Current*** to ***Current Limit***).
- Second choose the ***Motor Control Mode***.
- Third choose the Voltage Control Mode.

Option 1: Activate the automatic torque boost (***Voltage/Frequency Optimization*** value 1)
Option 2: Programmable V/f curve

To get torque you need to set the zero point voltage and midpoint voltage/ frequency so the motor has enough current at low frequencies. First select the programmable V/F-curve (***Voltage/Frequency Ratio Selection*** value 2). Increase ***Zero Frequency Voltage*** to get enough current at zero speed. Then set the ***V/f Mid-Point Voltage*** to 1.4142 x ***Zero Frequency Voltage*** and the ***V/f Mid-Point Frequency*** to a value of ***V/f Mid-Point Voltage*** / 100% x ***Motor Nominal Frequency***.

Note: In high torque — low speed applications — it is likely that the motor will overheat.

If the motor has to run a prolonged time under these conditions, special attention must be paid to cooling the motor. Use external cooling for the motor if the temperature tends to rise too high.

P1.6.3 Voltage/Frequency Ratio Selection

Range: 0 – 3 Default: 0 (Linear)

V/F RATIO SELECT

0 Linear: The voltage of the motor changes linearly with the frequency in the constant flux area from 0 Hz to the field weakening point where the nominal voltage is supplied to the motor. Linear V/f ratio should be used in constant torque applications. See **Figure 8-16**.
This default setting should be used if there is no special need for another setting.

1 Squared: The voltage of the motor changes following a squared curve waveform with the frequency in the area from 0 Hz to the field weakening point where the nominal voltage is supplied to the motor. The motor runs under-magnetized below the field weakening point and produces less torque and electromechanical noise. Squared V/f ratio can be used in applications where torque demand of the load is proportional to the square of the speed, e.g in centrifugal fans and pumps.

2 Programmable V/f curve: The V/f curve can be programmed with three different points. Programmable V/f curve can be used if the other settings do not satisfy the needs of the application. See **Figure 8-17**.

3 Linear with flux optimization: The HVX9000 searches for the minimum motor current in order to save energy, and to lower the audible motor noise. This can be used in applications with stable, low peak level motor load, such as fans, pumps, etc.

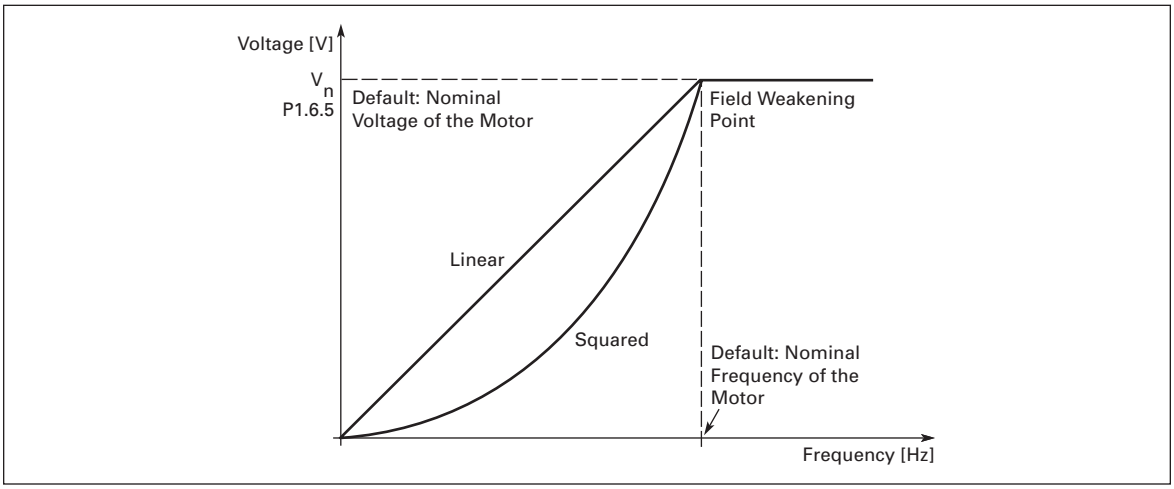


Figure 8-16: Linear and Squared Change of Motor Voltage

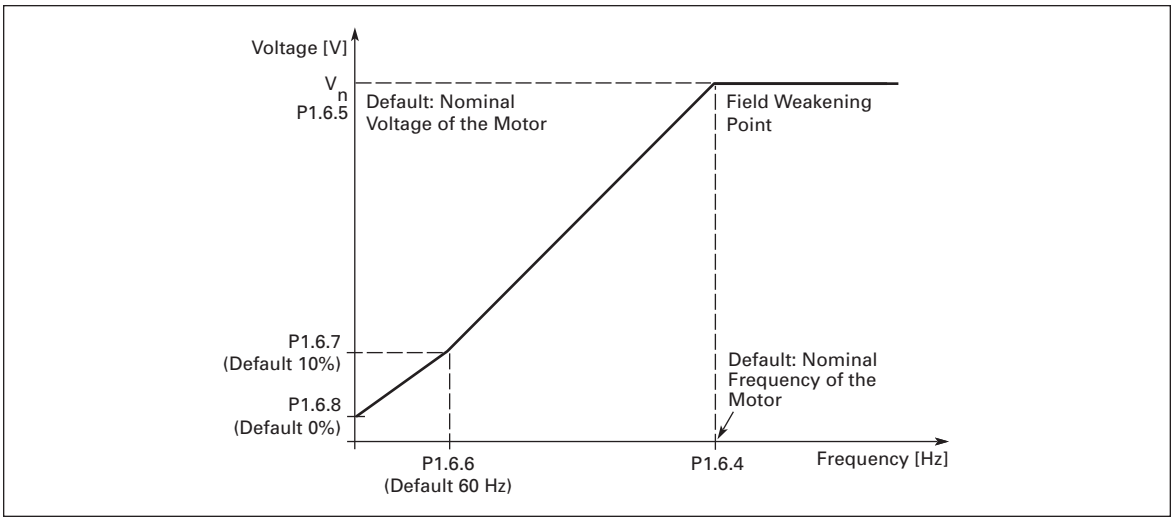


Figure 8-17: Programmable V/f Ratio

P1.6.4 Field Weakening Point

Range: 30.00 – 320.00 Default: 60.00
Units: Hertz
FIELD WEAKNGPNT

The field weakening point is the output frequency at which the output voltage reaches the set maximum value. This usually corresponds to the motor nameplate frequency.

P1.6.5 Voltage at Field Weakening Point

Range: 10.00 – 200.00 Default: 100.00
Units: Percent
VOLTAGE AT FWP

Above the frequency at the field weakening point, the output voltage remains at the set maximum value. Below the frequency at the field weakening point, the output voltage depends on the setting of the V/f curve parameters. See ***Voltage/Frequency Optimization***, ***Voltage/Frequency Ratio Selection***, ***V/f Mid-Point Frequency*** and ***V/f Mid-Point Voltage*** and **Figure 8-17**.

When the ***Motor Nominal Voltage*** and ***Motor Nominal Frequency*** are set, the ***Field Weakening Point*** and ***Voltage at Field Weakening Point*** are automatically given the corresponding values. If you need different values for the field weakening point and the maximum output voltage, change these parameters after setting the ***Motor Nominal Voltage*** and ***Motor Nominal Frequency***.

P1.6.6 V/f Mid-Point Frequency

Range: 0.00 – ***Field Weakening Point*** Default: 60.00
Units: Hertz
V/F MID FREQ

If the programmable V/f curve has been selected with ***Voltage/Frequency Ratio Selection*** this parameter defines the middle point frequency of the curve. See **Figure 8-17**.

P1.6.7 V/f Mid-Point Voltage

Range: 0.00 – 100.00 Default: 100.00
Units: Percent
V/F MID VOLTG

If the programmable V/f curve has been selected with the ***Voltage/Frequency Ratio Selection*** this parameter defines the middle point voltage of the curve. See **Figure 8-17**.

P1.6.8 Zero Frequency Voltage

Range: 0.00 – 40.00 Default: 1.50
Units: Percent
ZERO FREQ VOLTG

If the programmable V/f curve has been selected with the ***Voltage/Frequency Ratio Selection*** this parameter defines the zero frequency voltage of the curve. See **Figure 8-17**.

P1.6.9 Switching Frequency

Range: 1.0 – 16.0 Default: Model dependent
Units: kiloHertz
SWITCHING FREQ

Motor noise can be minimized using a high switching frequency. Increasing the switching frequency reduces the capacity of the HVX9000.

P1.6.10 Overvoltage Controller

Range: 0 – 1 Default: 1 (Switched On)
OVERVOLT CONTR

0 Overvoltage control switched off
1 Overvoltage control switched on

With the overvoltage control switched on, if the utility supply voltage rises, the output frequency will increase to maintain a constant motor V/f relation. This may be useful, for example, if the utility supply voltage varies more than +10% and the motor cannot tolerate this overvoltage.

In some applications the motor is required to operate at the desired set speed, regardless of supply line voltage variations. In this situation, the overvoltage control is switched off, the frequency will not increase as the utility supply voltage increases. This could lead to overexciting the motor, resulting in a large increase in motor current during overvoltage conditions.

Note: Overvoltage trips may occur when the control is switched out of operation.

P1.6.11 Undervoltage Controller

Range: 0 – 1 Default: 1 (Enabled)
UNDERVOLT CONTR

0 Disabled
1 Enabled

With the undervoltage control switched on, if the utility supply voltage declines, the output frequency will decrease to maintain a constant motor V/f relation. This may be useful, for example, if the utility supply voltage varies more than -15% and the motor cannot tolerate this undervoltage.

In some applications the motor is required to operate at the desired set speed, regardless of supply line voltage variations. In this situation, the undervoltage control is switched off, the frequency will not decrease as the utility supply voltage decreases. This could lead to under exciting the motor, resulting in a large increase in motor current during undervoltage conditions.

Note: Undervoltage trips may occur when controllers are switched out of operation.

Parameter Group G1.7: Protections

P1.7.1
4 mA (Reference) Fault Response

Range: 0 – 5 Default: 0 (No Response)
4MA FAULT RESP
A warning or a fault action and message is generated if the 4 – 20 mA reference signal is used and the signal falls below 3.5 mA for 5 seconds or below 0.5 mA for 0.5 seconds. The information can also be programmed into digital output DO1 or relay outputs RO1, RO2 or RO3.
0 No response
1 Warning
2 Warning, frequency applied 10s earlier is set as reference
3 Warning, the ***4 mA Fault Frequency*** is set as reference
4 Fault, stop mode after fault according to ***Stop Function***
5 Fault, stop mode after fault always by coasting

P1.7.2
4 mA Fault Frequency

Range: 0.00 – ***Maximum Frequency*** Default: 0.00
Units: Hertz
4MA FAULT FREQ
If the value of ***4 mA Fault Frequency*** is set to 3 and the 4 mA fault occurs, then the frequency reference to the motor is the value of this parameter.

P1.7.3
External Fault

Range: 0 – 3 Default: 2 (Fault)
EXTERNAL FAULT
A warning or a fault action and message is generated from the external fault signal in the programmable digital inputs DIN2, DIN3, DIN4, DIN5 or DIN6. The information can also be programmed into digital output DO1 or programmed into digital output DO1, and RO2 or RO3.
0 No response
1 Warning
2 Fault, stop mode after fault according to ***Stop Function***
3 Fault, stop mode after fault always by coasting

P1.7.4
Input Phase Supervision

Range: 0 – 3 Default: 0 (No Response)
INPUT PHASE SUPV
The input phase supervision monitors that the input phases of the HVX9000 have approximately equal currents. If not, the response programmed by this parameter occurs.
0 No response
1 Warning
2 Fault, stop mode after fault according to ***Stop Function***
3 Fault, stop mode after fault always by coasting

P1.7.5
Undervoltage Fault Response

Range: 1 – 3 Default: 2 (Fault)
UVOLT FAULT RESP
1 Warning
2 Fault, stop mode after fault according to ***Stop Function***
3 Fault, stop mode after fault always by coasting
Note: This protection can not be inactivated.

P1.7.6 Output Phase Supervision

Range: 0 – 3 Default: 2 (Fault)

OUTPUTPH SUPERV

Output phase supervision monitors that the motor phases have approximately equal currents. If not, the response programmed by this parameter occurs.

0 No response
1 Warning
2 Fault, stop mode after fault according to ***Stop Function***
3 Fault, stop mode after fault always by coasting

P1.7.7 Earth (Ground) Fault

Range: 0 – 3 Default: 2 (Fault)

EARTH FAULT

Earth fault protection monitors the sum of the motor phase currents which is zero if there is no ground fault. In addition, the overcurrent protection function is always operational to protect the HVX9000 from ground faults with high current levels.

0 No response
1 Warning
2 Fault, stop mode after fault according to ***Stop Function***
3 Fault, stop mode after fault always by coasting

Motor Thermal Protection General Information

The motor thermal protection is to protect the motor from overheating. The HVX9000 is capable of supplying higher than nominal current to the motor. If the load requires this high current there is a risk that the motor will be thermally overloaded. In addition, at low frequencies the cooling effect of the integral motor fan is reduced as well as is the motor's torque capacity. If the motor is equipped with an external fan the load reduction at low speeds is small.

The motor thermal protection is based on a calculated model and it uses the output frequency and current of the HVX9000 to determine the load on the motor.

The motor thermal protection can be adjusted with parameters ***Motor Ambient Temperature Factor***, ***Motor Thermal Protection Zero Speed*** and ***MTP Time Constant***.

⚠ CAUTION

The calculated model does not protect the motor if the airflow to the motor is reduced by blocked air intake grill or if the external cooling device is off or fails.

P1.7.8 Motor Thermal Protection

Range: 0 – 3 Default: 2 (Fault)

MOTOR THERM PROT

0 No response
1 Warning
2 Fault, stop mode after fault according to ***Stop Function***
3 Fault, stop mode after fault always by coasting

Deactivating the protection, by setting this parameter to 0, will reset the thermal stage of the motor to 0%.

P1.7.9 Motor Ambient Temperature Factor

Range: -100.0 – 100.00 Default: 0.0

Units: Percent

MOTAMBTEMPFACTOR

When the motor ambient temperature must be taken into consideration, it is recommended to set a value for this parameter. The value of the factor can be set between -100.0% and 100.0% where -100.0% corresponds to °C and 100.0% to the maximum running temperature of the motor. Setting this parameter value to 0% assumes that the motor's ambient temperature is the same as the temperature of the HVX9000's heatsink at power-on.

P1.7.10 Motor Thermal Protection Zero Speed

Range: 0.0 – 150.0 Default: 40.0
Units: Percent
MTP FQ CURRENT

This parameter sets the value of the current allowed at zero frequency. It can be set between 0 – 150.0% of the cooling available at the nominal motor nameplate frequency ***Motor Nominal Frequency***. See **Figure 8-18**.

The default value is set assuming that there is no external fan cooling the motor. If an external fan is used this parameter can be set to 90% (or even higher).

Note: The value is set as a percentage of the motor nameplate data, ***Motor Nominal Current***, not the drive's nominal output current. The motor's nominal current is the current that the motor can withstand in direct on-line use without being overheated.

If you change the ***Motor Nominal Current***, this parameter is automatically restored to the default value.

Setting this parameter does not affect the maximum output current of the HVX9000, which is determined by ***Current Limit*** alone.

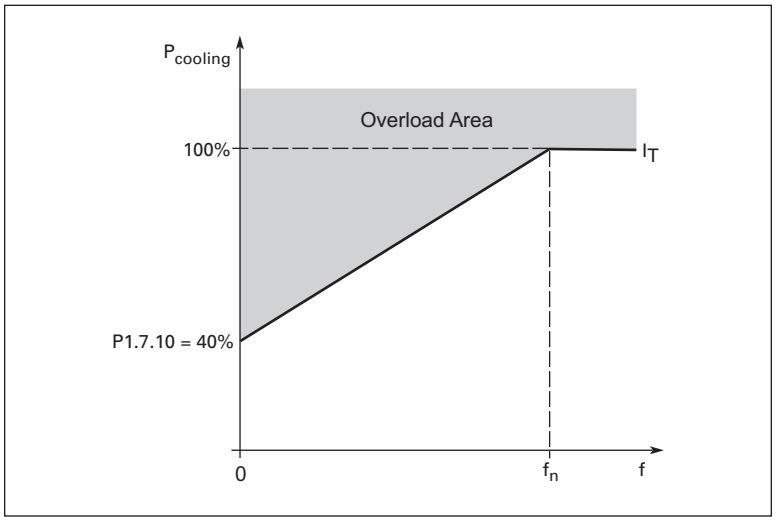


Figure 8-18: Motor Cooling Power

P1.7.11
MTP Time Constant

Range: 1 – 200
Units: Minutes

Default: 24 min.

MTP MOTOR T

This is the thermal time constant of the motor. The larger the motor, the longer the time constant. The time constant is the time within which the calculated thermal stage has reached 63% of its final value.

The motor thermal time is specific to the motor design and it varies between different motor manufacturers.

If the motor's t_6-time (t_6 is the time in seconds the motor can safely operate at six times the rated current) is known (given by the motor manufacturer) the time constant parameter can be set basing on it. As a rule of thumb, the motor thermal time constant in minutes equals to $2xt_6$. If the HVX9000 is stopped, the time constant is internally increased to three times the set parameter value. The cooling at stop is based on convection with an increased time constant. See **Figure 8-19**.

Note: If the ***Motor Nominal Speed*** or the ***Motor Nominal Current*** are changed this parameter is automatically set to the default value.

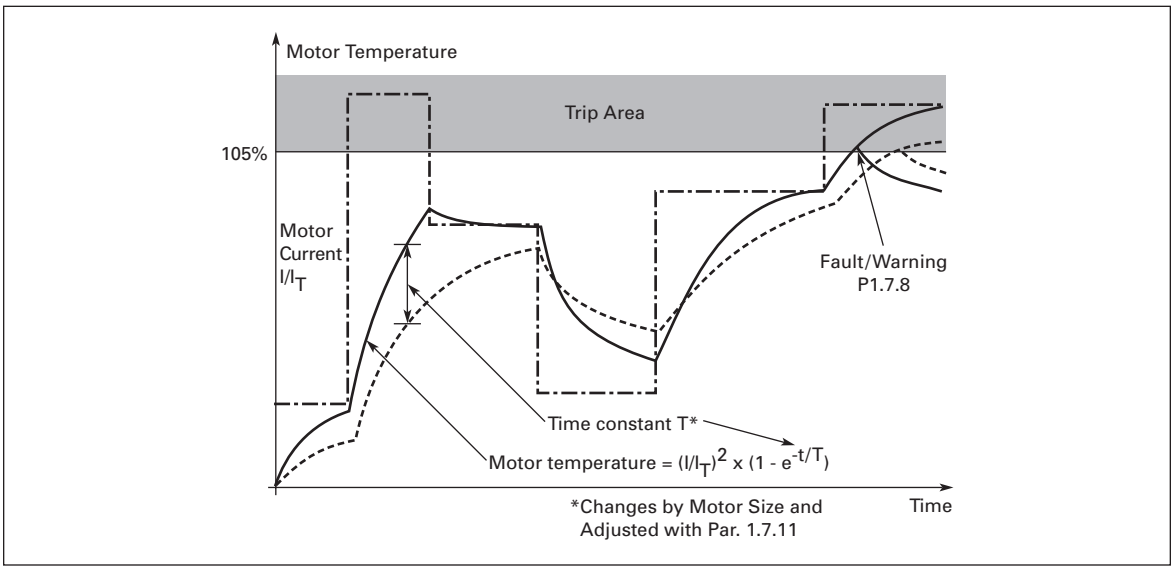


Figure 8-19: Motor Temperature Calculation

P1.7.12
Motor Duty Cycle

Range: 0 – 100
Units: Percent

Default: 100

MOTOR DUTY CYCLE

Defines how much of the nominal motor nameplate load is normally applied.

Stall Protection General Information

The motor stall protection protects the motor from short time overload situations such as one caused by a stalled shaft. The reaction time of the stall protection can be set shorter than that of the motor thermal protection. The stall state is defined with two parameters, ***Stall Protection*** and ***Stall Current Limit***. If the current is higher than the set limit and output frequency is lower than the set limit, the stall state is true. There is actually no direct physical indication of the shaft rotation. Stall protection is a type of overcurrent protection.

P1.7.13
Stall Protection

Range: 0 – 3 Default: 1 (Warning)
STALL PROTECTION
0 No response
1 Warning
2 Fault, stop mode after fault according to ***Stop Function***
3 Fault, stop mode after fault always by coasting
Setting the parameter to 0 will deactivate the protection and reset the stall time counter.

P1.7.14
Stall Current Limit

Range: 0.01 – ***Motor Nominal Current*** Default: ***Motor Nominal Current*** x 1.3 x 2
Units: Amperes
STALL CURRENT
The current can be set between 0.01 and I_{nMotor} x2. For a stall stage to occur, the current must have exceeded this limit. See **Figure 8-20**. The software does not allow entering a greater value than I_{nMotor} x2. If ***Motor Nominal Current*** is changed, this parameter is automatically restored to the default value, I_{nMotor} x1.3.

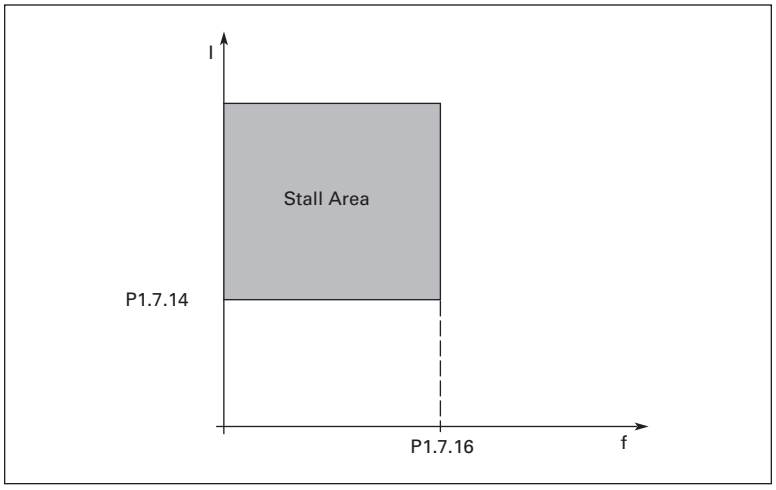


Figure 8-20: Stall Characteristics Settings

P1.7.15
Stall Time Limit

Range: 1.00 – 120.00 Default: 15.00
Units: Seconds
STALL TIME LIM
This is the maximum time allowed for a stall stage. The stall time is counted by an internal up/down counter. If the stall time counter value goes above this limit the protection will cause a trip (see ***Stall Protection***).

P1.7.16
Stall Frequency Limit

Range: 1.00 – ***Maximum Frequency*** Default: 25.00
Units: Hertz
STALL FREQ LIM
For a stall state to occur, the output frequency must be below this limit.

Underload Protection General Information

The purpose of the motor underload protection is to ensure that there is load on the motor when the HVX9000 is running. If the motor loses its load there might be a problem in the process, e.g. a broken belt or a dry pump.

Motor underload protection can be adjusted by setting the underload curve with ***Underload Protection f_{nom} Torque*** (Field weakening area load) and ***Underload Protection f0 Torque*** (Zero frequency load), see below. The underload curve is a squared curve set between the zero frequency and the field weakening point. The protection is not active below 5 Hz (the underload time counter is stopped).

The torque values for setting the underload curve are set in percentage of the nominal nameplate torque of the motor. The motor's nameplate data, the ***Motor Nominal Current*** and the HVX9000 drive's nominal nameplate current rating are used to find the scaling ratio for the internal torque value. If other than a standard motor of the same rating as the HVX9000 is used, the accuracy of the torque calculation decreases.

P1.7.17 Underload Protection

Range: 0 – 3 Default: 0 (No Response)

UNDERLOAD PROTEC

0 No response
1 Warning
2 Fault, stop mode after fault according to ***Stop Function***
3 Fault, stop mode after fault always by coasting

Deactivating the protection by setting the parameter to 0 will reset the underload time counter.

P1.7.18 Underload Protection f_{nom} Torque

Range: 10.0 – 150.0 Default: 50.0
Units: Percent

UP FNOM TORQUE

This parameter is based on a percentage of the nominal nameplate motor torque, T_{nMotor}, and sets the value for the minimum torque allowed when the output frequency is above the field weakening point. See **Figure 8-21**.

If you change the ***Motor Nominal Current***, this parameter is automatically restored to the default value.

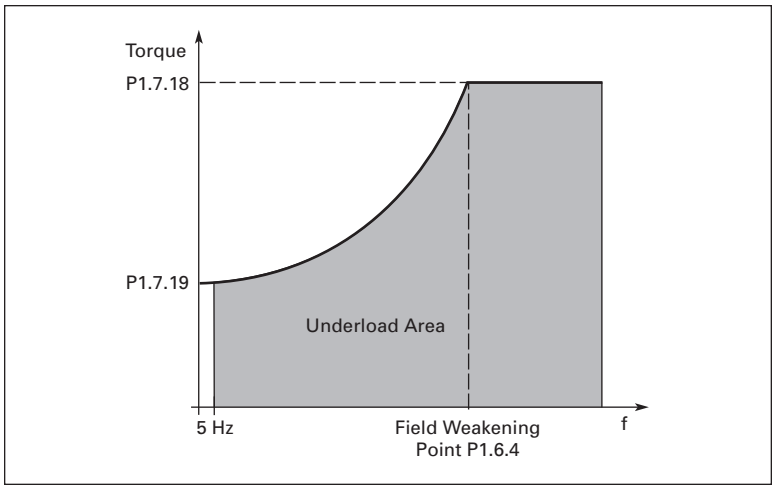


Figure 8-21: Minimum Load Setting

P1.7.19 Underload Protection f0 Torque

Range: 5.0 – 150.0 Default: 10.0
Units: Percent
UP F0 TORQUE
This parameter is based on a percentage of the nominal nameplate motor torque, T_{nMotor}, and sets the value for the minimum torque allowed with zero frequency. See **Figure 8-21**.

If you change the value of ***Motor Nominal Current***, this parameter is automatically restored to the default value.

P1.7.20 Underload Protection Time Limit

Range: 2.00 – 600.00 Default: 20.00
Units: Seconds
UP TIME LIMIT
This is the maximum time allowed for an underload state to exist. An internal up/down counter counts the accumulated underload time. If the underload counter value goes above this limit the protection will cause a trip according to ***Underload Protection***. If the HVX9000 is stopped, the underload counter is reset to zero. See **Figure 8-22**.

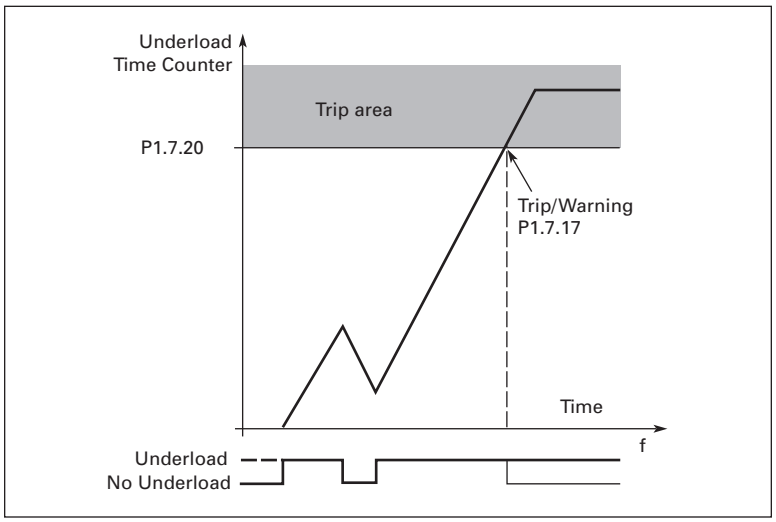


Figure 8-22: Underload Time Counter Function

P1.7.21 Thermistor Fault Response

Range: 0 – 3 Default: 0 (No Response)
THERMISTORF RESP
A high temperature has been detected by an option board connected thermistor.
0 No response
1 Warning
2 Fault, stop mode after fault according to ***Stop Function***
3 Fault, stop mode after fault always by coasting

P1.7.22 Communications Fault Response

Range: 0 – 3 Default: 2 (Fault)
COMM FAULT RESP
The response mode for a communication fault is set with this parameter if a communication board is being used. For more information, see the appropriate Communication Board Manual.
0 No response
1 Warning
2 Fault, stop mode after fault according to ***Stop Function***
3 Fault, stop mode after fault always by coasting

P1.7.23 Slot Communication Fault Response Range: 0 – 3 Default: 2 (Fault)

SLOTCOMFAULTRESP

The response mode for a board slot fault due to missing or failed board.

0 No response
1 Warning
2 Fault, stop mode after fault according to ***Stop Function***
3 Fault, stop mode after fault always by coasting

Parameter Group G1.8: Auto-Restart

The automatic restart function restarts the drive when the cause of the fault, selected with ***Undervoltage Restart Tries*** to ***External Fault Tries*** parameters, has disappeared and the waiting time, ***Wait Time***, has elapsed. ***Undervoltage Restart Tries*** to ***External Fault Tries*** parameters determine the maximum number of automatic restarts during the trial time set by ***Trial Time***. See **Figure 8-23**.

P1.8.1 Wait Time Range: 0.10 – 10.00 Default: 0.50
Units: Seconds

WAIT TIME

Defines the time before the HVX9000 tries to automatically restart the motor after the cause of the fault trip has disappeared.

P1.8.2 Trial Time Range: 0.00 – 60.00 Default: 30.00
Units: Seconds

TRIAL TIME

This parameter sets the trial time for the auto-restart function. The time count starts from the first auto-restart. If the number of faults occurring during the trial time exceeds the values of ***Undervoltage Restart Tries*** to ***External Fault Tries*** parameters, the fault trip is maintained. If the HVX9000 successfully restarts and no other fault occurs, the fault is cleared after the trial time has elapsed. The next fault starts the trial time count again.

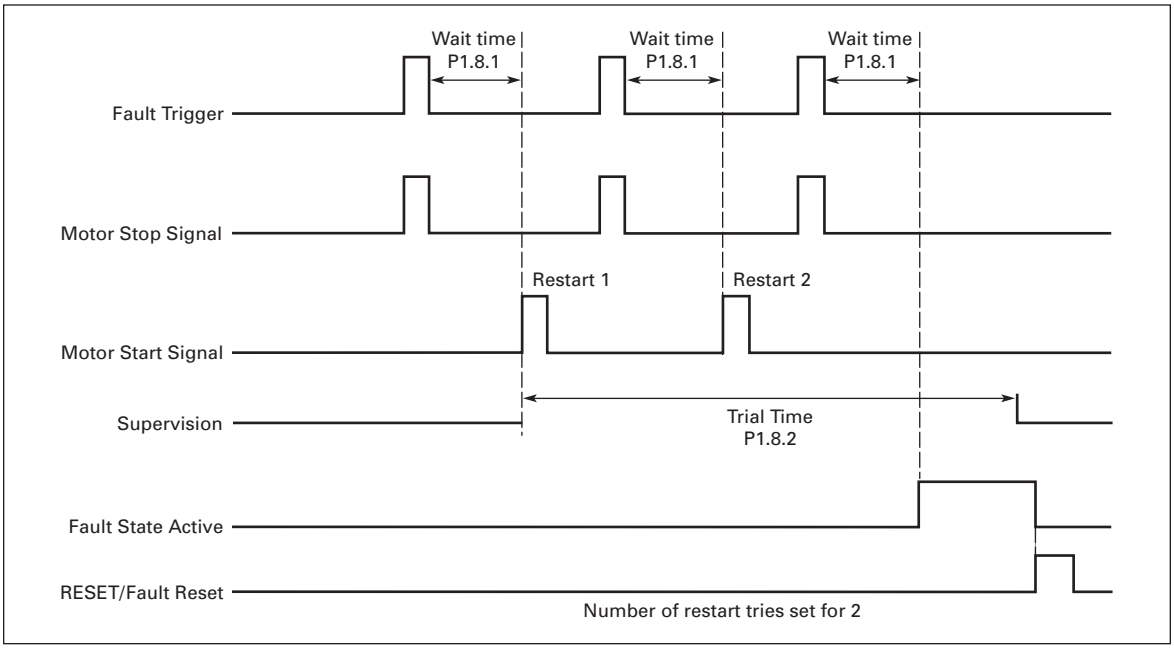


Figure 8-23: Example of Automatic Restart with Two Restarts

P1.8.3 Start Function

Range: 0 – 2 Default: 0 (Ramping)

START FUNCTION

The Start function for automatic restart is selected with this parameter.

0 Ramp start
1 Flying start
2 Start according to ***Start Function***

P1.8.4 Undervoltage Restart Tries

Range: 0 – 10 Default: 0

UNDERVOLT TRIES

This parameter determines how many automatic restarts are allowed during the ***Trial Time*** after an undervoltage trip.

0 No automatic restart after undervoltage fault trip
>0 Number of automatic restarts after undervoltage fault. The fault is reset and the HVX9000 is started automatically after the DC-link voltage has returned to the normal level.

P1.8.5 Overvoltage Restart Tries

Range: 0 – 10 Default: 0

OVERVOLT TRIES

This parameter determines how many automatic restarts are allowed during the ***Trial Time*** after an overvoltage trip.

0 No automatic restart after overvoltage fault trip
>0 Number of automatic restarts after overvoltage fault. The fault is reset and the HVX9000 is started automatically after the DC-link voltage has returned to the normal level.

P1.8.6 Overcurrent Restart Tries

Range: 0 – 3 Default: 0

OVERCURR TRIES

This parameter determines how many automatic restarts are allowed during the ***Trial Time***.

Note: IGBT temperature faults are included in this function.

0 No automatic restart after overcurrent fault trip
>0 Number of automatic restarts after an overcurrent fault trip, saturation trip or IGBT temperature fault.

P1.8.7 4 mA (Reference) Fault Tries

Range: 0 – 10 Default: 0

4 MA FAULT TRIES

This parameter determines how many automatic restarts are allowed during the ***Trial Time***.

0 No automatic restart after reference fault trip
>0 Number of automatic restarts after the analogue current signal (4 – 20 mA) has returned to the normal level (>4 mA)

P1.8.8 Motor Temperature Fault Tries

Range: 0 – 10 Default: 0

MOTTEMPF TRIES

This parameter determines how many automatic restarts are allowed during the ***Trial Time***.

0 No automatic restart after a motor temperature fault trip
>0 Number of automatic restarts after the motor temperature has returned to its normal level.

P1.8.9 External Fault Tries

Range: 0 – 10 Default: 0

EXTFAULT TRIES

This parameter determines how many automatic restarts are allowed during the ***Trial Time***.

0 No automatic restart after external fault trip
>0 Number of automatic restarts after an external fault trip

Parameter Group G1.9: Fire Mode PID

Fire Mode or Smoke Purge

Fire Mode is used to start motor and continue to operate due to emergency conditions. Faults will be changed to warnings to prevent shutdown. The overload should be selected to AUTO to prevent overload trip during "Fire Mode" operation. This is only required if unit is an IntelliPass which uses an electronic overload with contactor to run motor. If set to AUTO on the overload, the overload fault will be ignored and motor will continue to run.

P1.9.1 Fire Mode Function

Range: 0 – 1 Default: 0 (Closed Contact)

FIREMODEFUNCTION

This parameter determines whether the fire mode function is determined by a contact closure or contact opening on digital input.

0 Closing contact initiates fire mode function
1 Opening contact initiates fire mode function

P1.9.2 Fire Mode Reference Selection Function

Range: 0 – 1 Default: 0 (Not Inverted)

FMREFSELFUNCTION

Setting this parameter to 1 causes the maximum frequency to occur with the minimum reference (***Fire Mode Frequency Reference 1*** or ***Fire Mode Frequency Reference 2***) input and the minimum frequency to occur with the maximum reference input.

0 Not inverted
1 Inverted

P1.9.3 Fire Mode Minimum Frequency

Range: ***Minimum Frequency*** – ***Maximum Frequency*** Default: 15.00

Units: Hertz

FIREMODEMINIFREQ

This parameter sets the minimum output frequency for fire mode.

P1.9.4 Fire Mode Frequency Reference 1

Range: 0.0 – 100.0% Default: 75.0

Units: Percent

FIREMODEFREQREF1

This parameter sets the drive operating frequency for fire mode reference 1.

P1.9.5 Fire Mode Frequency Reference 2

Range: 0.0 – 100% Default: 100.0

Units: Percent

FIREMODEFREQREF2

This parameter sets the drive operating frequency for fire mode reference 2.

⚠ IMPORTANT

The electronic overload on the contactor must be set to AUTO, otherwise the overload will function normally.

Note: (1) Fire Mode has no effect on Bypass operation.
(2) Only pushing the STOP button on the drive keypad or removing the "Fire Mode" digital input will stop the drive operation.

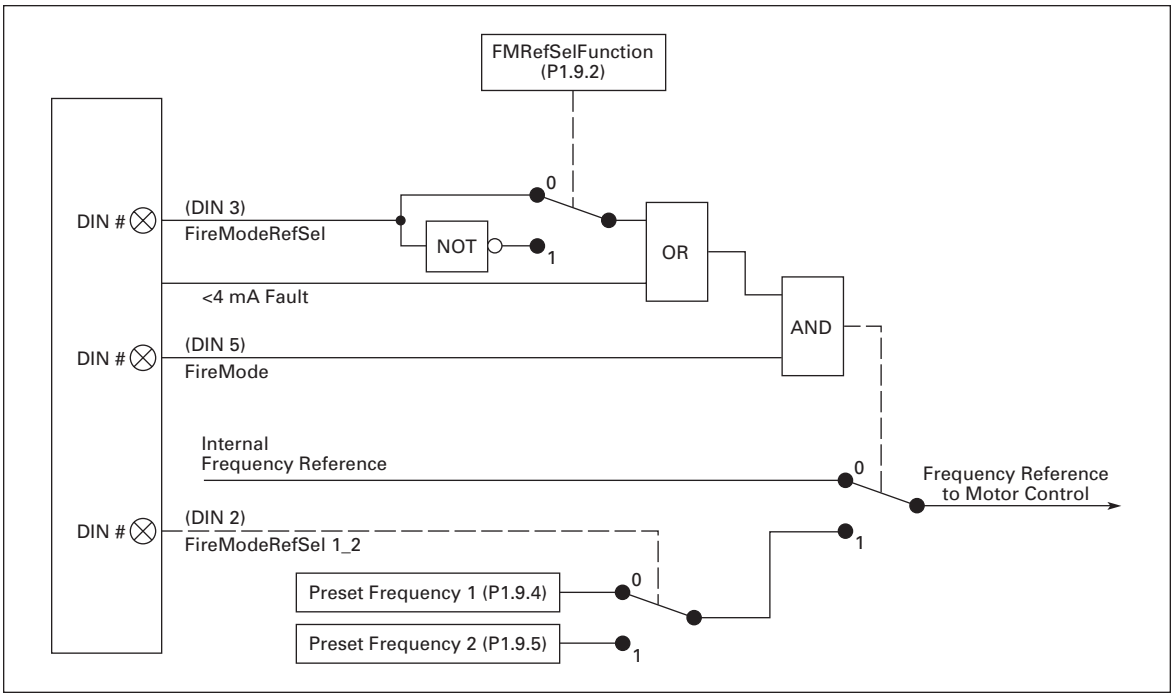


Figure 8-24: Frequency Reference Logic of the Fire Mode PID Application When Running in Fire Mode

P1.9.6 Fire Mode Auto Reset Delay
Range: 0.50 – 10.00 Default: 5.00
Units: Seconds
FMAUTORESETDELAY
Time delay before forced reset after a hardware generated fault while in the fire mode.

Parameter Group G1.10: IntelliPass

P1.10.1 IntelliPass
Range: 0 – 1 Default: 0 (IntelliPass Disabled)
INTELLIPASS
This parameter identifies whether the IntelliPass bypass option is installed and enabled.
0 IntelliPass Disabled – Not used
1 IntelliPass enabled – Used

P1.10.2 Bypass Start Delay
Range: 1 – 32,765 Default: 5
Units: Seconds
BYPASS START DELAY
This parameter specifies the time delay between when the Start Signal is applied in I/O or Fieldbus, to when the motor starts. There is no "Bypass Delay" when starting in BYPASS from the keypad.
The keypad will display "BYPASS Starting! WARNING!!!" until the motor starts in BYPASS. This display is also active when "Auto Bypass" is active and motor is about to start in BYPASS.

P1.10.3
Auto Bypass

Range: 0 – 1 Default: 0 (Auto Bypass Disabled)
AUTO BYPASS
This parameter specifies whether an automatic switch to bypass will occur based on ***Overcurrent Fault Auto Bypass*** to ***Overvoltage Fault Auto Bypass*** parameters.
0 Auto Bypass disabled
1 Auto Bypass enabled

P1.10.4
Auto Bypass Delay

Range: 0 – 32,765 Default: 10
Units: Seconds
AUTO BYPASSDELAY
This parameter specifies the time delay before an automatic switch to bypass, as determined by ***Overvoltage Fault Auto Bypass*** to ***Overvoltage Fault Auto Bypass*** parameters, will occur.

P1.10.5
Overcurrent Fault Auto Bypass

Range: 0 – 1 Default: 0
OVER 1 BYPASENAB
This parameter specifies whether an automatic switch to bypass will occur after the overcurrent fault auto-restart tries have been exceeded.
0 Auto bypass on overcurrent fault tries exceeded disabled
1 Auto bypass on overcurrent fault tries exceeded enabled

P1.10.6
IGBT Fault Auto Bypass

Range: 0 – 1 Default: 0
IGBT FLT BYPASEN
This parameter specifies whether an automatic switch to bypass will occur after the IGBT fault auto-restart tries have been exceeded.
0 Auto bypass on IGBT fault tries exceeded disabled
1 Auto bypass on IGBT fault tries exceeded enabled

P1.10.7
4 mA (Reference) Fault Auto Bypass

Range: 0 – 1 Default: 0
NO REF BYPASENAB
This parameter specifies whether an automatic switch to bypass will occur after the loss of reference fault auto-restart tries have been exceeded.
0 Auto bypass on loss of reference fault tries exceeded disabled
1 Auto bypass on loss of reference fault tries exceeded enabled
Note: P1.7.1 (***4 mA (Reference) Fault Auto Bypass***) must be set to 4 or 5 (Fault).

P1.10.8
Overvoltage Fault Auto Bypass

Range: 0 – 1 Default: 0
OVOLT BYPASSENAB
This parameter specifies whether an automatic switch to bypass will occur after the overvoltage fault auto-restart tries have been exceeded.
0 Auto bypass on overvoltage fault tries exceeded disabled
1 Auto bypass on overvoltage fault tries exceeded enabled

P1.10.9
Undervoltage Fault Auto Bypass

Range: 0 – 1 Default: 0
UV BYPASSENAB
This parameter specifies whether an automatic switch to bypass will occur after the undervoltage fault auto-restart tries have been exceeded.
0 Auto bypass on undervoltage fault tries exceeded disabled
1 Auto bypass on undervoltage fault tries exceeded enabled

Parameter Group G1.11: PID Control

P1.11.1
PID Reference

Range: 0 – 4 Default: 0 (AI1)

PID REFERENCE

Defines which frequency reference source is selected for the PID controller.

0 Analog voltage reference from terminals 2 – 3, e.g. potentiometer or voltage source
1 Analog current reference from terminals 4 – 5, e.g. transducer
2 PID reference from the Keypad
3 Reference from the communication bus
4 Motor potentiometer

P1.11.2
PID Sum Point Reference Selection

Range: 0 – 7 Default: 0 (No additional reference)

PID SUMPOINT REF

Defines which reference source is added to PID controller output if PID controller is used. See **Figure 8-25**.

0 No additional reference (Direct PID output value)
1 PID output + AI1 reference from terminals 2 and 3 (e.g. potentiometer)
2 PID output + AI2 reference from terminals 4 and 5 (e.g. transducer)
3 PID output + AI3 reference
4 PID output + AI4 reference
5 PID output + PID keypad reference
6 PID output + Communication bus
7 PID output + Motor potentiometer

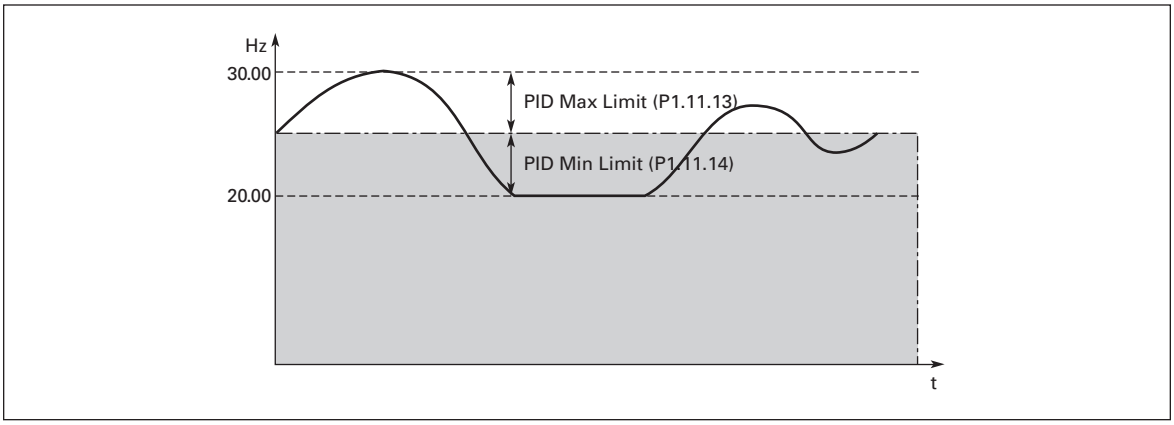


Figure 8-25: PID Output + Motor Potentiometer Reference

Note: The maximum and minimum limits illustrated in the picture limit only the PID output, no other outputs.

P1.11.3
Actual Value Selection

Range: 0 – 7 Default: 0 (Actual Value 1)

ACT VALUE SELECT

This parameter selects the PID controller actual value input signal source.

0 Actual value 1
1 Actual value 1 + Actual value 2
2 Actual value 1 - Actual value 2
3 Actual value 1 * Actual value 2
4 Smaller of Actual value 1 and Actual value 2
5 Greater of Actual value 1 and Actual value 2
6 Mean value of Actual value 1 and Actual value 2
7 Square root of Actual value 1 + Square root of Actual value 2

P1.11.4 Actual Value 1 Input

Range: 0 – 9 Default: 2 (AI2)

ACTUAL 1 INPUT

This parameter selects the PID controller actual value 1 input signal source.

0 Not used
1 Analog Input AI1 (control board terminals 2 and 3)
2 Analog Input AI2 (control board terminals 4 and 5)
3 Analog input AI3
4 Analog input AI4
5 Communication bus
6 Motor torque
7 Motor speed
8 Motor current
9 Motor power

P1.11.5 Actual 1 Maximum Scale

Range: -1000.0 – 1000.0 Default: 100.0%
Units: Percent

ACT 1 MAX SCALE

This parameter sets the maximum scaling point for actual value 1. 100% is equivalent to no maximum scaling. See **Figure 8-26**.

P1.11.6 Actual 1 Minimum Scale

Range: -1000.0 – 1000.0 Default: 0.0
Units: Percent

ACT 1 MIN SCALE

This parameter sets the minimum scaling point for actual value 1. 0% is equivalent to no minimum scaling. See **Figure 8-26**.

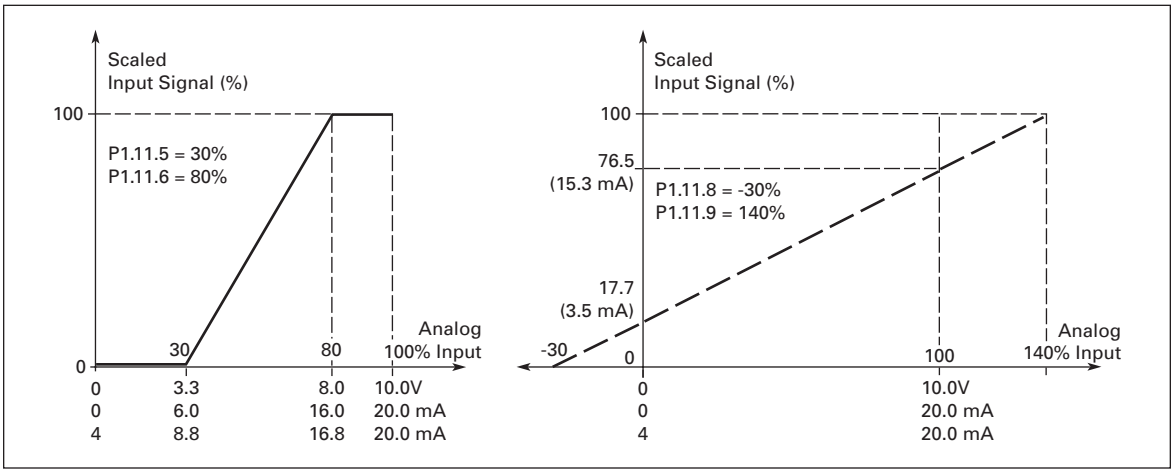


Figure 8-26: Examples of Actual Value Signal Scaling

P1.11.7
Actual Value 2 Input

Range: 0 – 9 Default: 0 (Not used)

ACTUAL 2 INPUT

This parameter selects the PID controller actual value 2 input signal source.

0 Not used
1 Analog Input AI1 (control board terminals 2 and 3)
2 Analog Input AI2 (control board terminals 4 and 5)
3 Analog input AI3
4 Analog input AI4
5 Communication bus
6 Motor torque
7 Motor speed
8 Motor current
9 Motor power

P1.11.8
Actual 2 Maximum Scale

Range: -1000.0 – 1000.0 Default: 100.0
Units: Percent

ACTUAL 2 MAX SCALE

This parameter sets the maximum scaling point for actual value 2. 100% is equivalent to no maximum scaling. See **Figure 8-26**.

P1.11.9
Actual 2 Minimum Scale

Range: -1000.0 – 1000.0 Default: 0.0
Units: Percent

ACTUAL 2 MIN SCALE

This parameter sets the minimum scaling point for actual value 2. 0% is equivalent to no minimum scaling. See **Figure 8-26**.

P1.11.10
PID Control Gain

Range: 0.0 – 1000.0 Default: 100.0%
Units: Percent

PID-CONTR GAIN

This parameter defines the gain of the PID controller. If the value of the parameter is set to 100%, a change of 10% in the error value causes the controller output to change by 10%. If the parameter value is set to 0, the PID controller operates as an ID-controller. See examples 1, 2 and 3 below.

P1.11.11
PID Control I Time

Range: 0.00 – 320.00 Default: 1.00
Units: Seconds

PID-CONTR I TIME

This parameter defines the integration time of the PID controller. If this parameter is set to 1.00 second, a change of 10% in the error value causes the controller output to change by 10.00%/s. If the parameter value is set to 0.00 s, the PID controller will operate as a PD controller. See examples 1, 2 and 3 below.

P1.11.12
PID Control D Time

Range: 0.00 – 10.00 Default: 0.00
Units: Seconds

PID-CONTR D TIME

This parameter defines the derivation time of the PID controller. If this parameter is set to 1.00 seconds, a change of 10% in the error value during 1.00 s causes the controller output to change by 10.00%. If the parameter value is set to 0.00 s the PID controller will operate as a PI controller. See examples 1, 2 and 3 below.

Example 1:

In order to reduce the error value to zero, with the given values, the drive output behaves as follows:

Given values:

PID Control Gain, P = 0%
PID Control I Time, I-time = 1.00 s
PID Control D Time, D-time = 0.00 s
Error value (setpoint – process value) = 10.00%
PID Max Limit = 100.0%
PID Min Limit = 0.0%
Min Frequency = 0 Hz
Max Frequency = 60 Hz

In this example, the PID controller operates practically as I-controller only. According to the given value of parameter ***PID Control I Time*** (I-time), the PID output increases by 5 Hz (10% of the difference between the maximum and minimum frequency) every second until the error value is 0.

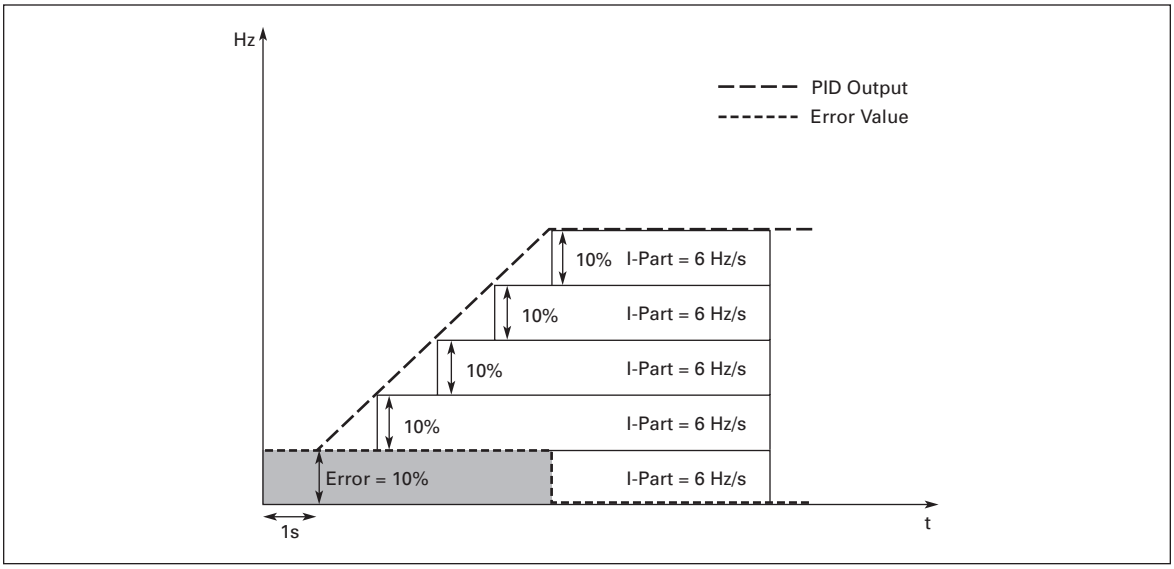


Figure 8-27: PID Controller D-Time, Example 1

Example 2:

Given values:

PID Control Gain, P = 0%
PID Control I Time, I-time = 1.00 s
PID Control D Time, D-time = 1.00 s
Error value (setpoint – process value) = ±10%
PID Max Limit = 100.0%
PID Min Limit = 0.0%
Min Frequency = 0 Hz
Max Frequency = 60 Hz

As the power is switched on, the system detects the difference between the setpoint and the actual process value and starts to either raise or decrease (in case the error value is negative) the PID output according to the I-time. Once the difference between the setpoint and the process value has been reduced to 0, the output is reduced by the amount corresponding to the value of ***PID Control I Time***. In case the error value is negative, the HVX9000 reacts reducing the output correspondingly. See below.

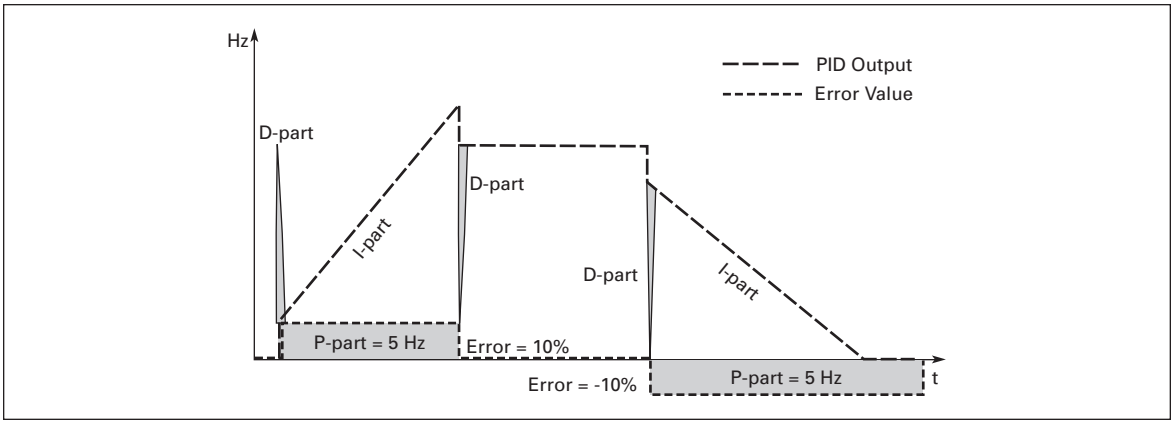


Figure 8-28: PID Controller D-Time, Example 2

Example 3:

Given values:

PID Control Gain, P = 0%
PID Control I Time, I-time = 0.00 s
PID Control D Time, D-time = 1.00 s
Error value (setpoint – process value) = ±10%/s

PID Max Limit = 100.0%
PID Min Limit = 0.0%
Min Frequency = 0 Hz
Max Frequency = 60 Hz

As the error value increases, also the PID output increases according to the set values (D-time = 1.00s)

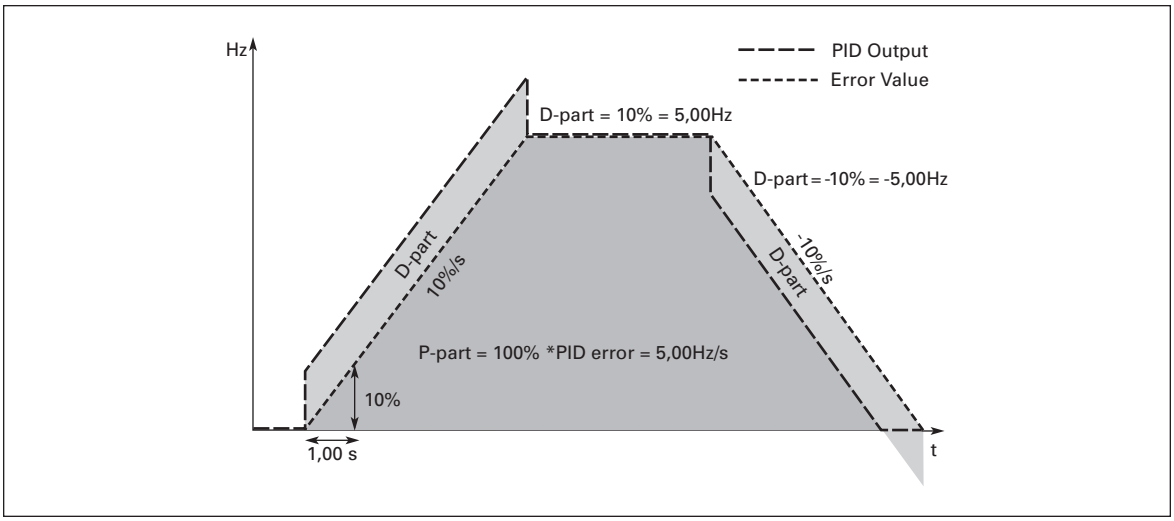


Figure 8-29: PID Controller D-Time, Example 3

P1.11.13
PID Controller Maximum Limit

Range: ***PID Min Limit*** – 1000.0 Default: 100.0%
Units: Percent
PID MAX LIMIT

With this parameter you can set the maximum limit for the PID controller output.

Limit setting: -100.0% (of f_{max}) < ***PID Controller Minimum Limit*** < ***PID Controller Maximum Limit*** < 100.0% (of f_{max}).

These limits are of importance for example when you define the gain, I-time and D-time for the PID controller.

P1.11.14
PID Controller Minimum Limit

Range: 1000.0 – ***PID Max Limit*** Default: 0.0%
Units: Percent
PID MIN LIMIT
With this parameter you can set the minimum limit for the PID controller output.

Limit setting: -100.0% (of f_{max}) < ***PID Controller Maximum Limit*** < ***PID Controller Minimum Limit*** < 100.0% (of f_{max}).

These limits are of importance for example when you define the gain, I-time and D-time for the PID controller.

P1.11.15
PID Reference Rise Time

Range: 0.0 – 100.0 Default: 5.0
Units: Seconds
PID REF RISE TIM
Defines the time during which the PID controller reference rises from 0% to 100%.

P1.11.16
PID Reference Fall Time

Range: 0.0 – 100.0 Default: 5.0
Units: Seconds
PID REF FALL TIM
Defines the time during which the PID controller reference falls from 100% to 0%.

P1.11.17
PID Error Value Inversion

Range: 0 – 1 Default: 0 (No Inversion)
ERROR INVERSION
This parameter allows you to invert the error value of the PID controller (and thus the operation of the PID controller).
0 No inversion
1 Inverted

P1.11.18
Easy Changeover

Range: 0 – 1 Default: 0 (Keep Reference)
EASY CHANGEOVER
0 Keep reference
1 Copy reference
If Copy reference has been selected it is possible to switch from direct control to PID control and back without scaling the reference and actual value.

For example: The process is driven with direct frequency reference (Control place I/O B, fieldbus or keypad) to some point and then the control place is switched to one where the PID controller is selected. The PID control starts to maintain that point. The PID controller error value is forced to zero when the control place is changed.

It is also possible to change the control source back to direct frequency control. In this case, the output frequency is copied as the frequency reference. If the destination place is Keypad the run status (Run/Stop, Direction and Reference) will be copied.

The changeover is smooth when the reference of the destination source comes from the Keypad or an internal motor potentiometer.

P1.11.19 Sleep Function Enabled

Range: 0 – 1 Default: 0

SLEEP FUNC ENABL

0 Disabled

1 Enabled

This parameter sets whether the sleep function is enabled or disabled. If the sleep function is enabled, the HVX9000 is stopped automatically if its operating frequency falls below the Sleep level defined by ***Sleep Frequency*** for a time greater than that determined by ***Sleep Delay***. During the Stop state, the PID controller is operating. The HVX9000 will switch to the Run state when the actual value signal either falls below or exceeds (see ***Wake Up Action***) the Wake-Up level determined by ***Wake Up Limit***. See **Figure 8-30**.

P1.11.20 Sleep Frequency

Range: ***Min Frequency*** – ***Max Frequency*** Default: 10.00

Units: Hertz

SLEEP FREQUENCY

The frequency converter is stopped automatically if the frequency of the HVX9000 falls below the Sleep level defined with this parameter for a time greater than that determined by ***Sleep Delay***. During the Stop state, the PID controller is operating. The HVX9000 will switch to the Run state when the actual value signal either falls below or exceeds (see ***Wake Up Action***) the ***Wake Up Limit***. See **Figure 8-30**.

P1.11.21 Sleep Delay

Range: 0 – 32,500 Default: 30

Units: Seconds

SLEEP DELAY

The minimum amount of time the frequency has to remain below the Sleep level before the HVX9000 is stopped. See **Figure 8-30**.

P1.11.22 Wake Up Limit

Range: 0.00 – 100.00 Default: 25.00

Units: Percent

WAKE UP LIMIT

The wake up limit defines the frequency below which the actual value must fall or which has to be exceeded before the Run state of the HVX9000 is restored. See **Figure 8-30**.

P1.11.23 Wake Up Action

Range: 0 – 1 Default: 0 (Below Level)

WAKE UP ACTION

This parameter defines if the restoration of the Run state occurs when the actual value signal falls below or exceeds the ***Wake Up Limit***. See **Figure 8-30**.

0 Wake up falling below limit

1 Wake up exceeding limit

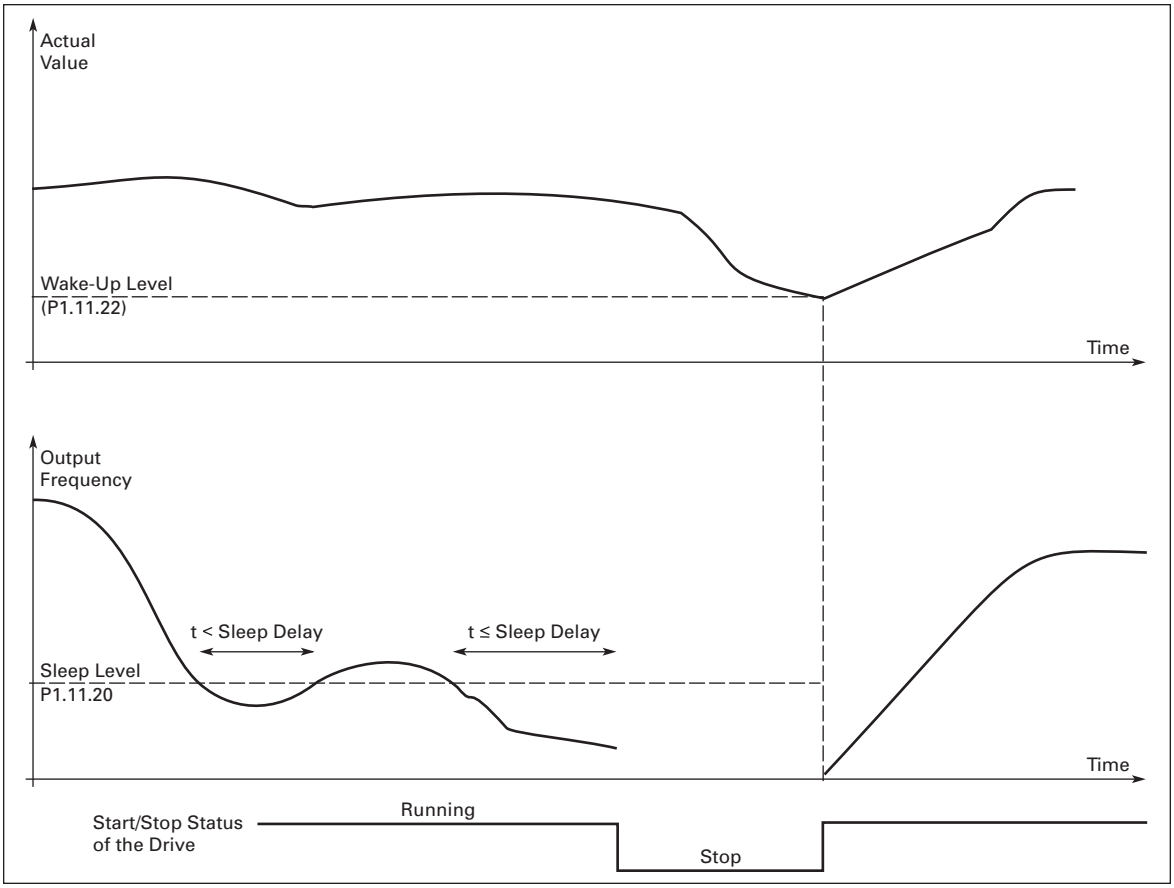


Figure 8-30: Frequency Converter Sleep Function

Parameter Group G1.12: Preset Speeds

P1.12.1 Range: 0.0 – 100.0 Default: 10.0
#1 Preset Speed Units: Percent
#1 PRESET SPEED
This parameter defines the #1 preset speed.

P1.12.2 Range: 0.0 – 100.0 Default: 20.0
#2 Preset Speed Units: Percent
#2 PRESET SPEED
This parameter defines the #2 preset speed.

P1.12.3 Range: 0.0 – 100.0 Default: 30.0
#3 Preset Speed Units: Percent
#3 PRESET SPEED
This parameter defines the #3 preset speed.

P1.12.4 Range: 0.0 – 100.0 Default: 40.0
#4 Preset Speed Units: Percent
#4 PRESET SPEED
This parameter defines the #4 preset speed.

P1.12.5 Range: 0.0 – 100.0 Default: 50.0
#5 Preset Speed Units: Percent
#5 PRESET SPEED
This parameter defines the #5 preset speed.

P1.12.6 Range: 0.0 – 100.0 Default: 75.0
#6 Preset Speed Units: Percent
#6 PRESET SPEED
This parameter defines the #6 preset speed.

P1.12.7 Range: 0.0 – 100.0 Default: 100.0
#7 Preset Speed Units: Percent
#7 PRESET SPEED
This parameter defines the #7 preset speed.

Note: Speeds are selected based on “Speed Select 1” through “Speed Select 3” digital input selections. The “Speed Selects” are based on Binary inputs converted to the “7 Preset Speeds”.

Parameter Group G1.13: Fieldbus

P1.13.1
Fieldbus Data Out 1 Select

Range: 0 – 10000 Default: 1590 (Motor speed – %)

FBDATAOUT1SEL

Allows a parameter or monitored value to be viewed from the communication bus. No decimal point is available, so scaling must be done by the viewing device. See **Table 8-7**.

P1.13.2
Fieldbus Data Out 2 Select

Range: 0 – 10000 Default: 1 (Output frequency – Hz)

FBDATAOUT2SEL

Allows a parameter or monitored value to be viewed from the communication bus. No decimal point is available, so scaling must be done by the viewing device. See **Table 8-7**.

P1.13.3
Fieldbus Data Out 3 Select

Range: 0 – 10000 Default: 25 (Frequency reference – Hz)

FBDATAOUT3SEL

Allows a parameter or monitored value to be viewed from the communication bus. No decimal point is available, so scaling must be done by the viewing device. See **Table 8-7**.

P1.13.4
Fieldbus Data Out 4 Select

Range: 0 – 10000 Default: 2 (Motor speed – rpm)

FBDATAOUT4SEL

Allows a parameter or monitored value to be viewed from the communication bus. No decimal point is available, so scaling must be done by the viewing device. See **Table 8-7**.

P1.13.5
Fieldbus Data Out 5 Select

Range: 0 – 10000 Default: 1780 (Motor current)

FBDATAOUT5SEL

Allows a parameter or monitored value to be viewed from the communication bus. No decimal point is available, so scaling must be done by the viewing device. See **Table 8-7**.

P1.13.6
Fieldbus Data Out 6 Select

Range: 0 – 10000 Default: 5 (Motor power)

FBDATAOUT6SEL

Allows a parameter or monitored value to be viewed from the communication bus. No decimal point is available, so scaling must be done by the viewing device. See **Table 8-7**.

P1.13.7
Fieldbus Data Out 7 Select

Range: 0 – 10000 Default: 1701 (Motor run time – minutes)

FBDATAOUT7SEL

Allows a parameter or monitored value to be viewed from the communication bus. No decimal point is available, so scaling must be done by the viewing device. See **Table 8-7**.

P1.13.8
Fieldbus Data Out 8 Select

Range: 0 – 10000 Default: 1666 (Energy meter – kW)

FBDATAOUT8SEL

Allows a parameter or monitored value to be viewed from the communication bus. No decimal point is available, so scaling must be done by the viewing device. See **Table 8-7**.

Table 8-7: Fieldbus Output Selection Examples

Code	Description
1	Output frequency (Hz)
2	Motor speed (rpm)
1780	Motor current (amperes)
4	Motor torque (percent)
5	Motor power (percent)
6	Motor voltage (volts)
7	DC link voltage (volts)
8	Unit temperature
9	Motor temperature
13	AI1
14	AI2
15	DI1, DI2, DI3 status
16	DI4, DI5, DI6 status
17	Digital and relay outputs status
25	Frequency reference (Hz)
26	Analog output current
1680	AI3
1710	AI4
2111	Active fault
1590	Motor nominal speed (percent)
1666	Energy meter (kilowatts)
1701	Motor run time (minutes)

Appendix A — Technical Data

Specifications

Table A-1: HVX9000 Drive Specifications

Description	Specification
Power Connections	
Input Voltage (V_{in})	230V +10%/-15% 480V +10%/-15%
Input Frequency (f_{in})	50/60 Hz (variation up to 45 – 66 Hz)
Connection to Utility Power	Once per minute or less (typical operation)
High Interrupt Rating	The current withstand rating of the drive is 100,000 Amperes When Freedom Starters and an HMCP, the current interrupting rating is 100,000 Amperes When used with ***IT.*** style starters, the current interrupting rating is 36,000 Amperes
Motor Connections	
Output Voltage	0 to V_{in}
Continuous Output Current	Ambient temperature max. +104°F (+40°C), overload 1.1 x I_L (1 min./10 min.)
Starting Torque	110%
Output Frequency	0 to 320 Hz
Frequency Resolution	0.01 Hz
Control Characteristics	
Control Method	Frequency Control (V/f) Open Loop Sensorless Vector Control
Switching Frequency	Adjustable with ***Switching Frequency*** 230V: 1 – 20 hp: 1 to 16 kHz; default 10 kHz 25 – 40 hp: 1 to 10 kHz; default 3.6 kHz 480V: 1 – 40 hp: 1 to 16 kHz; default 10 kHz 50 – 250 hp: 1 to 10 kHz; default 3.6 kHz
Frequency Reference	Analog Input: Resolution 0.1% (10-bit), accuracy ±1% Panel Reference: Resolution 0.01 Hz
Field Weakening Point	30 to 320 Hz
Acceleration Time	0.1 to 3000 sec.
Deceleration Time	0.1 to 3000 sec.
Braking Torque	DC brake: 15% to 150% x T_n (without brake option)

Table A-1: HVX9000 Drive Specifications, continued

Description	Specification
Environment	
Ambient Operating Temperature	14°F (-10°C), no frost to 104°F (+40°C)
Storage Temperature	-40°F (-40°C) to 158°F (70°C)
Relative Humidity	0 to 95% RH, noncondensing, non-corrosive, no dripping water
Air Quality	Chemical vapors: IEC 60721-3-3, unit in operation, class 3C2 Mechanical particles: IEC 60721-3-3, unit in operation, class 3S2
Altitude	100% load capacity (no derating) up to 3300 ft. (1000m); 1% derating for each 330 ft. (100m) above 3300 ft. (1000m); max. 10000 ft. (3000m)
Vibration	EN 50178, EN 60068-2-6 5 to 50 Hz, displacement amplitude 1 mm (peak) at 3 to 15.8 Hz, Max. acceleration amplitude 1 G at 15.8 to 150 Hz
Shock	EN 50178, EN 60068-2-27 UPS Drop test (for applicable UPS weights) Storage and shipping: max. 15 G, 11 ms (in package)
Enclosure Class	NEMA 1/IP21 standard 250 hp and below Open chassis standard 300 hp and above
Standards	
EMC (at default settings)	Immunity: Fulfils all EMC immunity requirements Emissions: EN 61800-3
Safety	UL 508C
Product	IEC 61800-2
Control Connections	
Analog Input Voltage	0 to 10V, R - 200Ω differential (-10 to 10V joystick control) Resolution 0.1%; accuracy ±1%
Analog Input Current	0(4) to 20 mA; R_i – 250Ω differential
Digital Inputs (6)	Positive or negative logic; 18 to 24V DC
Auxiliary Voltage	+24V ±15%, max. 250 mA
Output Reference Voltage	+10V +3%, max. load 10 mA
Analog Output	0(4) to 20 mA; R_L max. 500Ω; Resolution 10 bit; Accuracy ±2% or 0 to 10V, R_L 1 kΩ, select with jumper
Digital Outputs	Open collector output, 50 mA/48V
Relay Outputs	2 programmable Form C relay outputs Switching capacity: 24V DC / 8A, 250V AC / 8A, 125V DC / 0.4A Minimum switching load: 5V/10 mA Continuous capacity: <2 A_{rms}

Table A-1: HVX9000 Drive Specifications, continued

Description	Specification
Protections	
Overcurrent Protection	Yes
Undervoltage Protection	Yes
Ground (Earth) Fault	In case of a ground fault in motor or motor cables, only the HVX9000 is protected
Input Phase Supervision	Trips if any of the input phases are missing
Motor Phase Supervision	Trips if any of the output phases are missing
Overtemperature Protection	Yes
Motor Overload Protection	Yes
Motor Stall Protection	Yes
Motor Underload Protection	Yes
Short Circuit Protection of the +24V and +10V Reference Voltages	Yes

Power Ratings

Table A-2: 230V VT Output Power Ratings

		Three-Phase Input	
Catalog Number ①	**Frame Size**	**Horsepower**	**Current**
HVX001Ax-2A_1	FR4	1	4.8
HVXF15Ax-2A_1		1-1/2	6.6
HVX002Ax-2A_1		2	7.8
HVX003Ax-2A_1		3	11
HVX005Ax-2A_1	FR5	5	17.5
HVX007Ax-2A_1		7-1/2	25
HVX010Ax-2A_1		10	31
HVX015Ax-2A_1	FR6	15	48
HVX020Ax-2A_1		20	61
HVX025Ax-2A_1	FR7	25	75
HVX030Ax-2A_1		30	88

① Insert a "1" for NEMA Type 1 or a "12" for NEMA Type 12 in place of the "x" in the Catalog Number.

Table A-3: 480V VT Output Power Ratings

Catalog Number ①	Frame Size	Three-Phase Input	
		Horsepower	Current
HVXF15Ax-4A_1	FR4	1-1/2	3.3
HVX002Ax-4A_1		2	4.3
HVX003Ax-4A_1		3	5.6
HVX005Ax-4A_1		4	7.6
HVX007Ax-4A_1		7-1/2	12
HVX010Ax-4A_1	FR5	10	16
HVX015Ax-4A_1		15	23
HVX020Ax-4A_1		20	31
HVX025Ax-4A_1	FR6	25	38
HVX030Ax-4A_1		30	46
HVX040Ax-4A_1		40	61
HVX050Ax-4A_1	FR7	50	72
HVX060Ax-4A_1		60	87
HVX075Ax-4A_1		75	105
HVX100Ax-4A_1	FR8	100	140
HVX125Ax-4A_1		125	170
HVX150Ax-4A_1		150	205
HVX200Ax-4A_1	FR9	200	261
HVX250Ax-4A_1		250	300
HVX300A0-4A_1	FR10	300	385
HVX400A0-4A_1		400	520

① Insert a "1" for NEMA Type 1 or a "12" for NEMA Type 12 in place of the "x" in the Catalog Number.

Power Loss and Switching Frequency

In some situations it may be desirable to change the switching frequency of the HVX9000 for some reason (typically e.g. to reduce the motor noise). Raising the switching frequency above the factory default level increases the drive power loss and increases the cooling requirements. **Figures A-1** through **A-6** illustrate the power loss increase for the different HVX9000 models. When operating above the default switching frequency, the HVX9000 output current rating should be derated by the ratio of the increased power loss to the nominal power loss.

Example:

The user of a 40 hp, 61A, 480V HVX9000 wishes to increase the switching frequency from the factory default value of 10 kHz to 15 kHz to reduce motor noise. From **Figure A-3** the loss at the factory default switching frequency of 10 kHz is 1240 watts. The loss at 15 kHz from **Figure A-3** is 1340 watts.

$$\text{Re } rate = 61 \times \frac{1240}{1340} = 56\text{A}$$

Thus at the increased switching frequency, the maximum load allowed is 56A to avoid overheating the HVX9000.

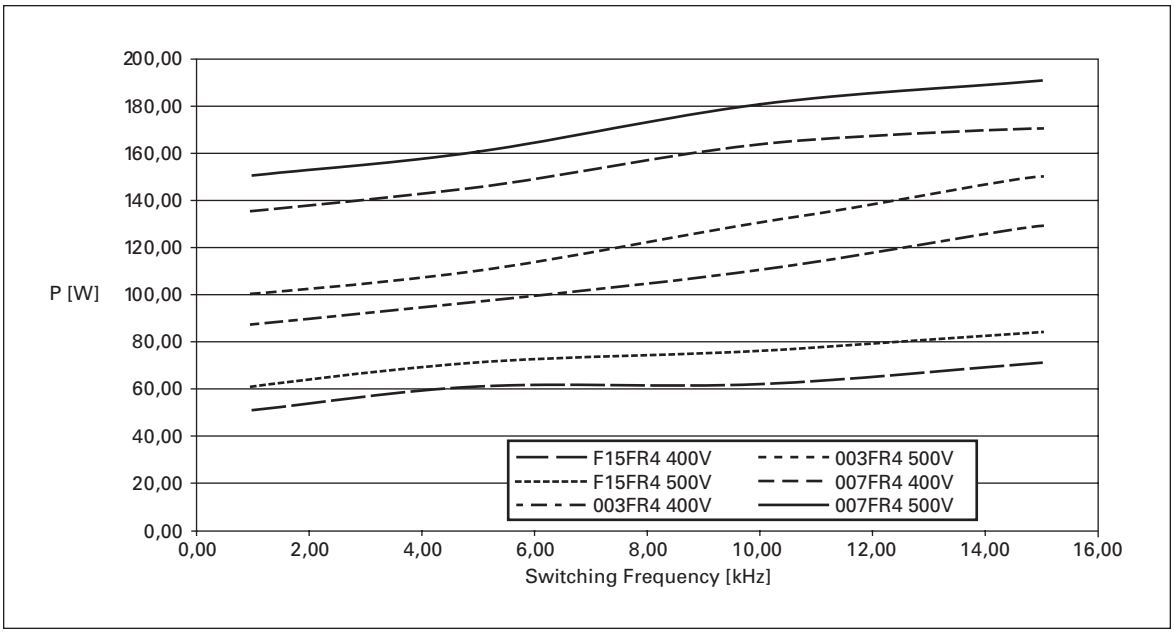


Figure A-1: Power Loss as Function of Switching Frequency: 1 – 3 hp 230V, 1-1/2 – 7-1/2 hp 480V

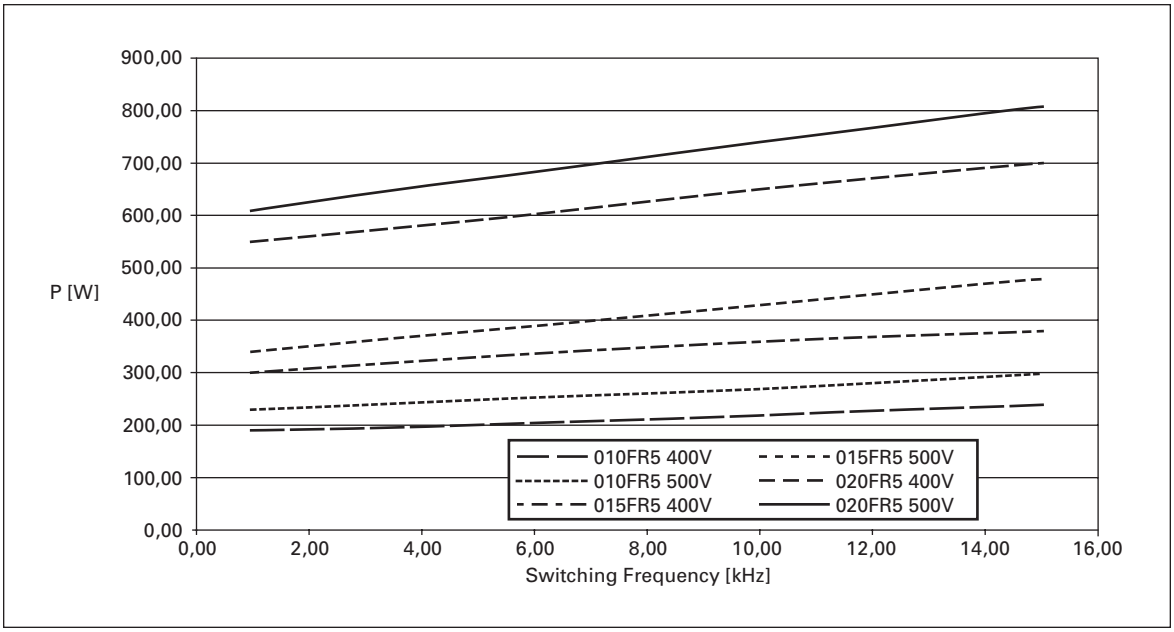


Figure A-2: Power Loss as Function of Switching Frequency: 5 – 10 hp 230V, 10 – 20 hp 480V

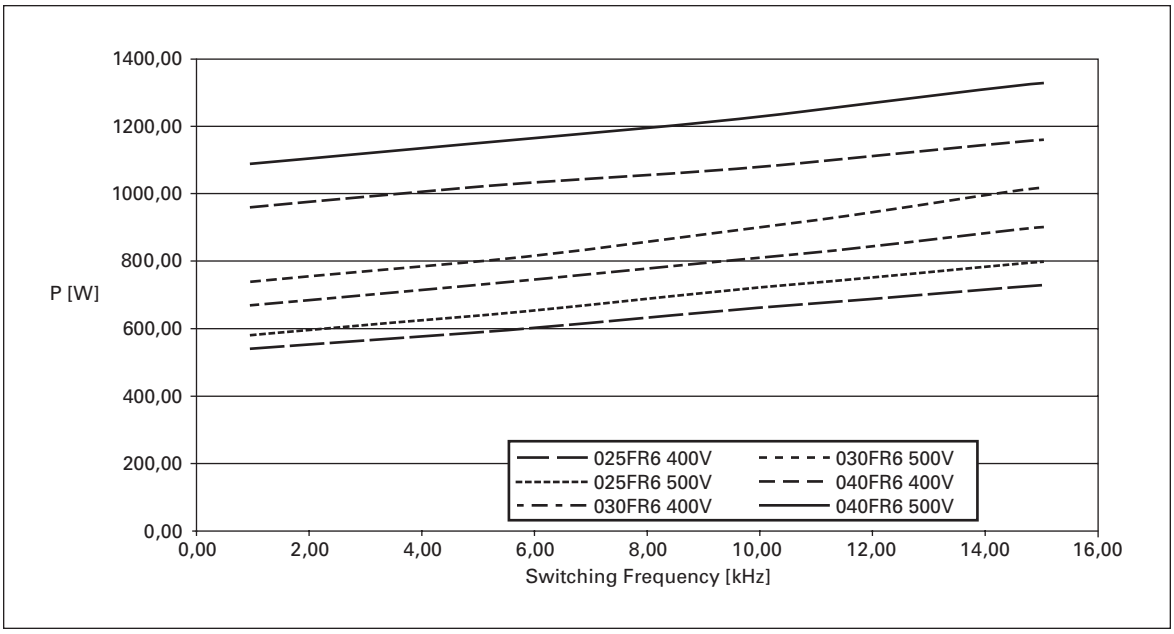


Figure A-3: Power Loss as Function of Switching Frequency: 15 – 20 hp 230V, 25 – 40 hp 480V

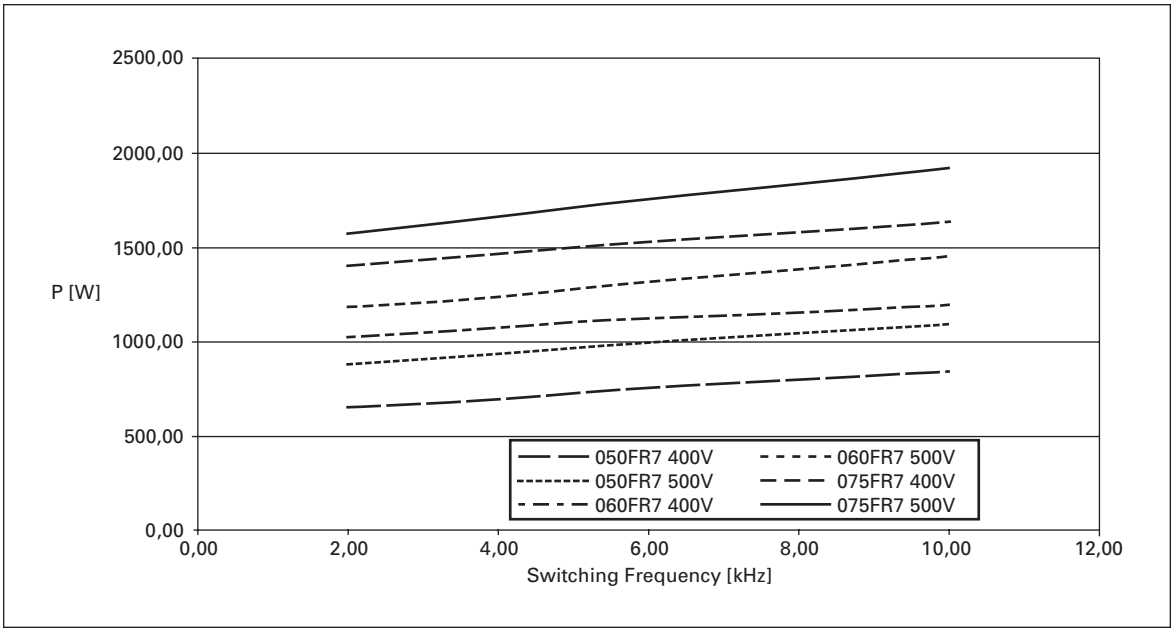


Figure A-4: Power Loss as Function of Switching Frequency: 50 – 75 hp 480V

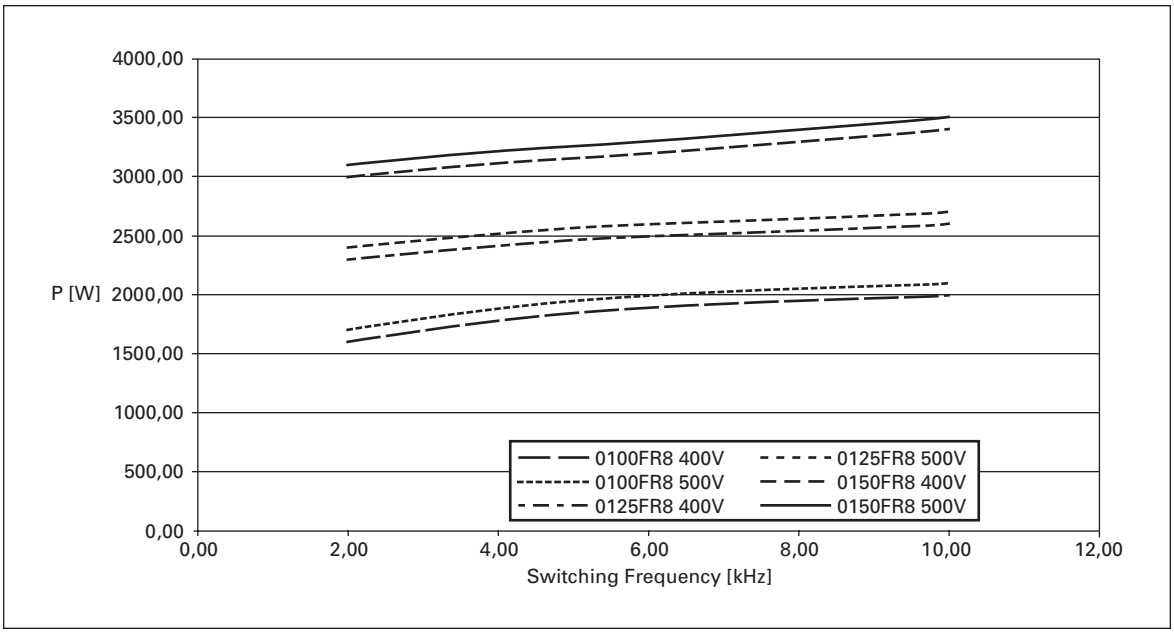


Figure A-5: Power Loss as Function of Switching Frequency: 100 – 150 hp 480V

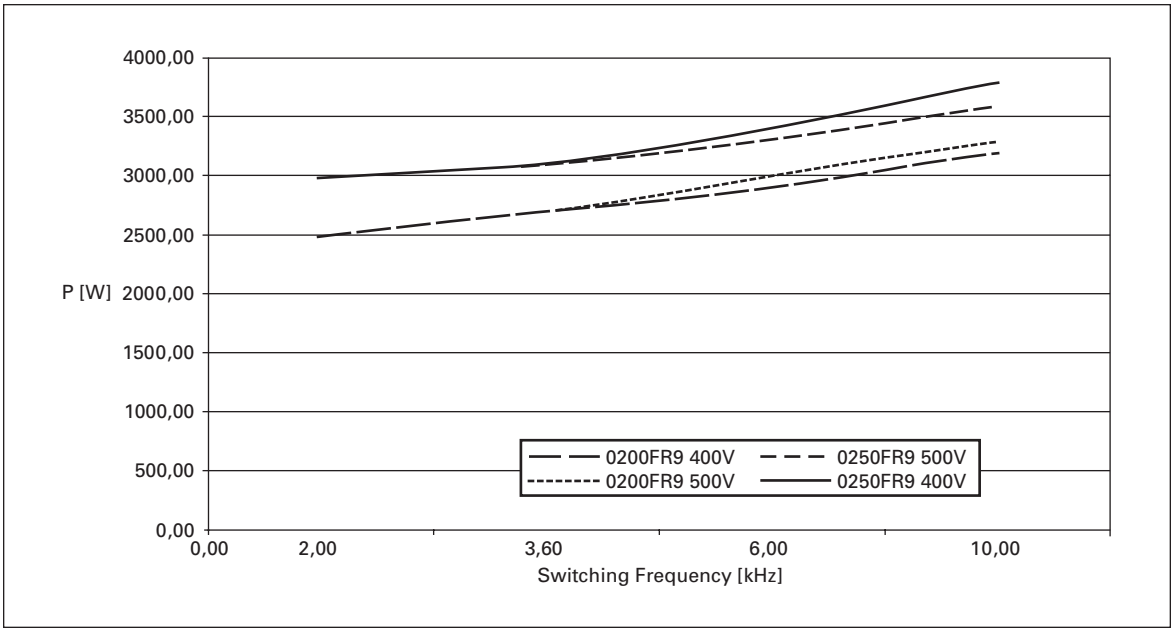


Figure A-6: Power Loss as Function of Switching Frequency: 200 – 250 hp 480V

Dimensions

Dimensions for NEMA 1 Drive and Bypass

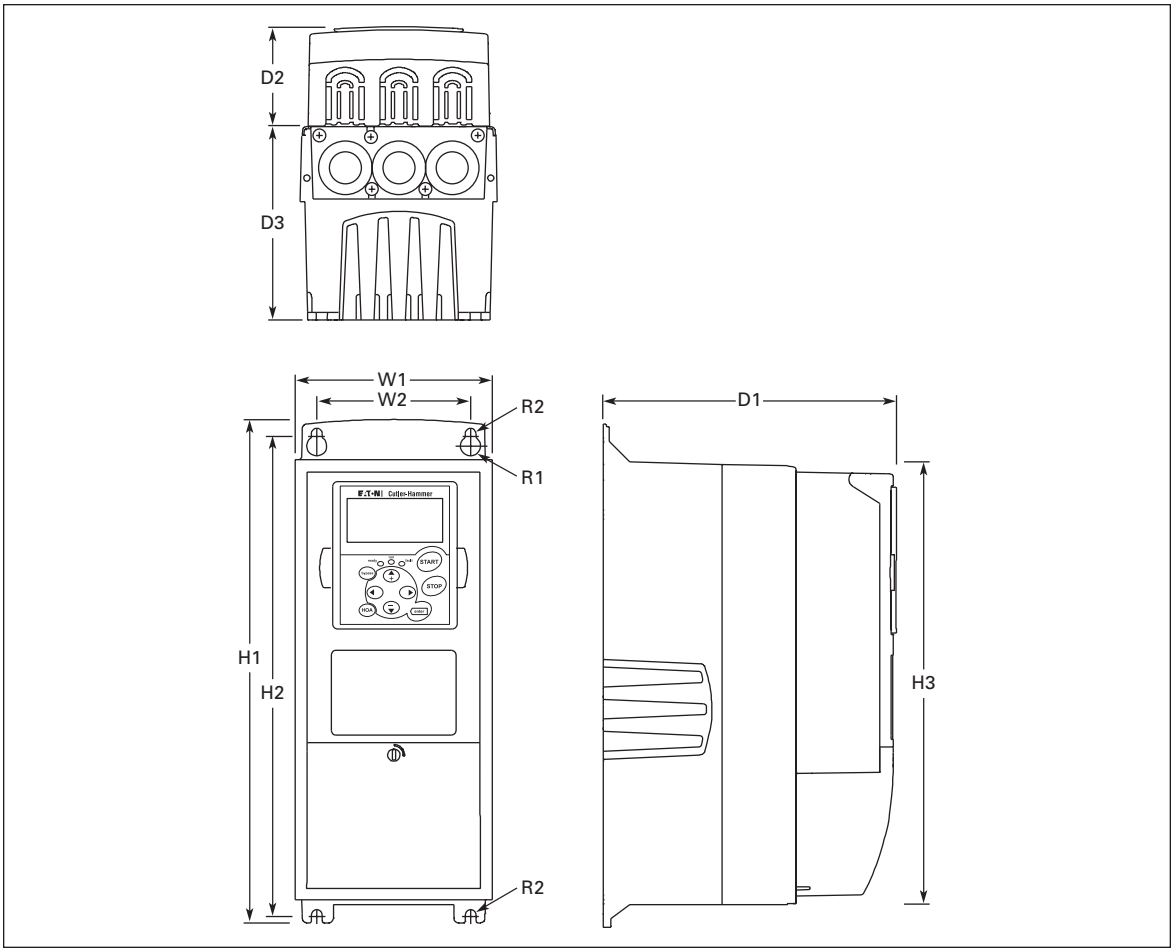


Figure A-7: NEMA Type 1 Enclosure Dimensions

Table A-4: NEMA Type 1 Enclosure Dimensions

Frame Size	Voltage	hp (VT)	Approximate Dimensions in Inches (mm)										Weight Lbs. (kg)
			H1	H2	H3	D1	D2	D3	W1	W2	R1 dia.	R2 dia.	
FR4	230V	1 – 3	12.9 (327)	12.3 (312)	11.5 (292)	7.5 (190)	2.5 (64)	5.0 (126)	5.0 (128)	3.9 (100)	0.5 (13)	0.3 (7)	11 (5)
	480V	1-1/2 – 7-1/2											
FR5	230V	5 – 10	16.5 (419)	16.0 (406)	15.3 (389)	8.4 (214)	2.7 (68)	5.8 (148)	5.6 (143)	3.9 (100)	0.5 (13)	0.3 (7)	17.9 (8.1)
	480V	10 – 20											
FR6	230V	15 – 20	22.0 (558)	21.3 (541)	20.4 (519)	9.3 (237)	2.7 (68)	6.7 (171)	7.7 (195)	5.8 (148)	0.7 (18)	0.4 (9)	40.8 (18.5)
	480V	25 – 40											
FR7	230V	25 – 40	24.8 (630)	24.2 (614)	23.3 (591)	10.1 (257)	2.7 (68)	7.5 (189)	9.3 (237)	7.5 (190)	0.7 (18)	0.4 (9)	77.2 (35)
	480V	50 – 75											
FR8	480V	100 – 150	29.7 (755)	28.8 (732)	28.4 (721)	12.3 (312)	1.3 (34)	11.0 (279)	11.2 (279)	10.0 (255)	0.7 (18)	0.4 (9)	127.8 (58)
FR9	480V	200 – 250	45.3 (1150)	44.1 (1120)	45.3 (1150)	14.3 (362)	5.4 (137)	8.8 (224)	18.9 (480)	15.7 (400)	0.7 (18)	0.4 (9)	321.9 (146)

EMC Capability

General

For products used within the European Community (EC), the Electro Magnetic Compatibility (EMC) directive states that the electrical equipment must not disturb the environment and must be immune to other Electro Magnetic Disturbances in the environment.

The design intent was to develop a family of drives, which is user friendly and cost effective, while fulfilling the user's needs. EMC compliance was a major consideration from the outset of the design.

The HVX9000 derive series is targeted at the world market. To ensure maximum flexibility, yet meet the EMC needs of different regions, all drives meet the highest immunity levels, while emission levels meet the requirements noted in the following section.

EMC Classification

the HVX9000 drive series are EMC classification H capable.

Class H:

HVX9000 drives have been designed to fulfill the requirements of the product standard EN 61800-3_A11 for the 1st environment restricted distribution and the 2nd environment.

The emission levels correspond to the requirements of EN 61000-6-4.

HVX9000 series drives fulfill all applicable EMC immunity requirements (standards EN 61000-6-1, EN 61000-6-2 and EN 61800-3+A11).

Declaration of Conformity

The Manufacturer's Declarations of Conformity assuring the compliance of the HVX9000 drives with the European Community (EC) EMC-directives is available upon request.

Warranty and Liability Information

Eaton Electrical Inc. warrants the product delivered in the Cutler-Hammer shipping package to be free from defects in material and workmanship, under normal use and service, for twenty four (24) months from date of manufacturing. Products that fail during this period will be repaired or replaced at Eaton's discretion, with the same or a functionally equivalent product, provided the original purchaser (A) returns the failed product, and (B) provides proof of original date of purchase. This warranty does not apply, in the judgment of Eaton, to damage caused during shipment, handling, storage, or accidental misuse. The original purchaser of the product must obtain a Cutler-Hammer Return Material Authorization (RMA) number prior to returning any defective product. (When purchased through an Authorized Distributor, the Distributor should supply an RMA number to their customer.)

The maximum liability of this warranty is limited to the purchase price of the product. In no event, regardless of cause, shall Eaton Electrical Inc. be liable (a) for penalties or penalty clauses of any description, or (b) for certification not otherwise specifically provided herein and/or indemnification of purchaser or others for costs, damages or expenses, each arising out of or related to the product or services of any order or (c) for any damages resulting from loss of profits, use of products or for any incidental indirect or consequential damages, even if advised of the possibility of such damages.

Appendix B — Parameter Tables

Table B-1: Parameter Group G1.1: Basic

Code	Parameter	Range	Step	Default	ID #	Description	Page
P1.1.1	Min Frequency	0.00 – Max Frequency	0.01 Hz	12.00	101	Minimum frequency setting	**8-1**
P1.1.2	Max Frequency	Min Frequency – 320.00	0.01 Hz	60.00	102	Maximum frequency setting	**8-1**
P1.1.3	Accel Time 1	0.1 – 3000.0	0.1 s	60.0	103	Time from f_{min} (***Minimum Frequency***) to f_{max} (***Maximum Frequency***)	**8-1**
P1.1.4	Decel Time 1	0.1 – 3000.0	0.1 s	60.0	104	Time from f_{max} (***Maximum Frequency***) to f_{min} (***Minimum Frequency***)	**8-1**
P1.1.5	Motor Nom Currnt ①	0.3 x I_{nHVXL} – 2.0 x I_{nHVXL}	0.1 A	I_{nHVXL}	113	Motor nominal nameplate full load current	**8-1**
P1.1.6	Motor Nom Voltg ①	180 – 690	1 V	230 or 460 (Drive Rating)	110	Motor nominal nameplate base voltage	**8-1**
P1.1.7	Motor Nom Freq ①	30.00 – 320.00	1 Hz	60.00	111	Motor nominal nameplate base frequency	**8-2**
P1.1.8	Motor Nom Speed ①	300 – 20,000	1 rpm	1760	112	Motor nominal nameplate base speed	**8-2**
P1.1.9	MotorPowerFactor ①	0.30 – 1.00	0.1 A	0.85	120	Motor nominal nameplate full load power factor	**8-2**
P1.1.10	Current Limit	0.1 x IL – 2.5 x InHVX Units: Amperes	0.01	InHVX	107	Output current limit level of the HVX9000	**8-2**
P1.1.11	HOA Control Src	0 – 2	1	0	1530	Hand-Off-Auto control source 0 Control from keypad 1 Control from I/O terminals 2 Control from communication bus	**8-2**
P1.1.12	Start Src Hand	0 – 2	1	0	1531	Start source for Hand operation 0 Control from keypad 1 BAS 2 3-wire Start/Stop	**8-2**
P1.1.13	Ref Source Hand	0 – 7	1	4	201	Speed reference source for Hand operation 0 Analog input AI1 1 Analog input AI2 2 Analog input AI3 3 Analog input AI4 4 Keypad 5 Communication Bus 6 Motor potentiometer 7 PID-Controller	**8-2**
P1.1.14	Start Srce Auto	0 – 3	1	1	1532	Start source for Auto operation 0 Control from keypad 1 BAS 2 3-wire Start/Stop 3 Communication Bus	**8-3**
P1.1.15	Ref Source Auto	0 – 7	1	0	202	Speed reference source for Hand operation 0 Analog input AI1 1 Analog input AI2 2 Analog input AI3 3 Analog input AI4 4 Keypad 5 Communication Bus 6 Motor potentiometer 7 PID-Controller	**8-3**
P1.1.16	PM Setback Pct	0.0 – 100.0	0.1%	30.0	1640	Frequency setting for PM setback operation	**8-3**

① Drive must be stopped to edit these parameters.

Table B-2: Parameter Group G1.2: Input Signals

Code	Parameter	Range	Step	Default	ID #	Description	Page
P1.2.1	DIN1 Function	0 – 3	1	0 (Start)	1535	0 Start – standard start 1 Interlocked Start 2 Interlock Time Start 3 Delay Start	**8-3**
P1.2.2	Intlk Timeout	1 – 32,500	1 s	5 s	1561	Used when DIN1 function = 2	**8-3**
P1.2.3	Delay Time	1 – 32,500	1 s	5 s	1580	Used when DIN1 function = 3	**8-4**
P1.2.4	DIN2 Function ①	0 – 15	1	1 (Ext fault close)	1700	0 Not Used 1 Ext Fault Close 2 Bypass Overload Fault 3 Run enable/External interlock 4 Accel/decel time selection 5 Hand/Auto Select 6 PID Control 7 Motor potentiometer down 8 PID Reference 2 Select 9 PM Setback 10 Fault reset 11 Accel/decel prohibited 12 HOA On/Off 13 Reserved 14 Fire Mode 15 Fire Mode Reference Select Enabled	**8-4**
P1.2.5	DIN3 Function ①	0 – 15	1	10 (Fault Reset)	301	0 Not Used 1 External fault, contact closed 2 External fault, contact open 3 Run enable/External interlock 4 Accel/decel time selection 5 Hand/Auto Select 6 Motor potentiometer up 7 PID Control 8 PID Reference 2 Select 9 Speed Select 1 10 Fault reset 11 Accel/decel prohibited 12 DC braking command 13 Reserved 14 Fire Mode 15 Fire Mode Reference Select Enabled	**8-5**
P1.2.6	DIN4 Function ①	0 – 15	1	4 (Accel/ decel time sel)	1536	0 Not Used 1 External fault, contact closed 2 External fault, contact open 3 Run enable/External interlock 4 Accel/decel time selection 5 Hand/Auto Select 6 PID Control 7 Motor potentiometer down 8 PID Reference 2 Select 9 PM Setback 10 Fault reset 11 Speed Select 2 12 DC braking command 13 Reserved 14 Fire Mode 15 Fire Mode Reference Select Enabled	**8-6**

① Drive must be stopped to edit these parameters.

Table B-2: Parameter Group G1.2: Input Signals, continued

Code	Parameter	Range	Step	Default	ID #	Description	Page
P1.2.7	DIN5 Function ①	0 – 15	1	13 (PM Setback)	330	0 Not Used 1 External fault, contact closed 2 External fault, contact open 3 Run enable/External interlock 4 Accel/decel time selection 5 Hand/Auto Select 6 Motor potentiometer up 7 PID Control 8 Reverse 9 DC Brake Comm 10 Fault reset 11 Accel/decel prohibited 12 HOA On/Off 13 PM Setback 14 Fire Mode 15 Fire Mode Reference Select 1 / 2	**8-7**
P1.2.8	DIN6 Function ①	0 – 15	1	11 (Speed Select 3)	1537	0 Not Used 1 External fault, contact closed 2 External fault, contact open 3 Run enable/External interlock 4 Accel/decel time selection 5 Hand/Auto Select 6 Motor potentiometer up 7 Motor potentiometer down 8 PID Reference 2 Select 9 PM Setback 10 Fault reset 11 Speed Select 3 12 HOA On/Off 13 Reserved 14 Fire Mode 15 Fire Mode Reference Select 1 / 2	**8-8**
P1.2.9	AI1 Signal Range	0 – 2	1	0 (0 – 20 mA / 0 – 100%)	320	0 0 – 20 mA 1 4 – 20 mA 2 ID #ized signal range	**8-8**
P1.2.10	AI1 Custom Min	0.00 – AI1 Custom Maximum	0.01 %	0.00%	321	Used when setting of ***AI1 Signal Range*** = 2	**8-8**
P1.2.11	AI1 Custom Max	AI1 Custom Minimum – 100.00%	0.01 %	100.00%	322	Used when setting of ***AI1 Signal Range*** = 2	**8-8**
P1.2.12	AI1 Signal Inv	0 – 1	1	0 (No Inversion)	323	0 No inversion 1 Signal inverted	**8-9**
P1.2.13	AI1 Filter Time	0.00 – 10.00	0.01 s	0.10 s	324	0 No filtering	**8-9**
P1.2.14	AI2 Signal Range	0 – 2	1	1 (4 – 20 mA / 20 – 100%)	325	0 0 – 20 mA 1 4 – 20 mA 2 ID #ized signal range	**8-9**
P1.2.15	AI2 Custom Min	0.00 – AI2 Custom Max	0.01 %	0.00%	326	Used when setting of ***AI2 Signal Range*** = 2	**8-9**
P1.2.16	AI2 Custom Max	AI2 Custom Min – 100.00%	0.01 %	100.00%	327	Used when setting of ***AI2 Signal Range*** = 2	**8-9**
P1.2.17	AI2 Signal Inv	0 – 1	1	0 (No Inversion)	328	0 No inversion 1 Signal inverted	**8-10**
P1.2.18	AI2 Filter Time	0.00 – 10.00	0.01 s	0.10 s	329	0.00 No filtering	**8-10**
P1.2.19	MotorPot Ramp Time	0.1 – 2000.0	0.1 s	10.0 s	331	Ramp rate of motor pot	**8-10**
P1.2.20	MotorPotMemFreqRef	0 – 2	1	1	367	0 No reset 1 Reset at stop and power down 2 Reset at power down	**8-10**
P1.2.21	MotorPotMemPIDRef	0 – 2	1	0 (No Reset)	368	0 No reset 1 Reset at stop and power down 2 Reset at power down	**8-10**
P1.2.22	Ref Scale Min	0.00 – Ref Scale Max	0.01 Hz	0.00	344	Sets the frequency corresponding to the minimum reference signal	**8-11**

① Drive must be stopped to edit these parameters.

Table B-2: Parameter Group G1.2: Input Signals, continued

Code	Parameter	Range	Step	Default	ID #	Description	Page
P1.2.23	Ref Scale Max	Ref Scale Min – 320.00	0.01 Hz	0.00	345	Sets the frequency corresponding to the maximum reference signal	**8-11**
P1.2.24	AI3 Signal Sel	AnIN:0.1 – AnIN:E.10	—	AnIN:0.1	141	Connect the AI3 signal to the analog input	**8-11**
P1.2.25	AI3 Signal Range	0 – 1	1	1 (4 – 20 mA/20 – 100%)	143	0 0 – 20 mA 1 4 – 20 mA	**8-11**
P1.2.26	AI3 Signal Inv	0 – 1	1	0 (No Inversion)	151	0 No inversion 1 Signal inverted	**8-12**
P1.2.27	AI3 Filter Time	0.00 – 10.00	0.01 s	0.10	142	0.00 No filtering	**8-12**
P1.2.28	AI4 Signal Sel	AnIN:0.1 – AnIN:E.10	—	AnIN:0.1	152	Connect the AI4 signal to the analog input of your choice	**8-12**
P1.2.29	AI4 Signal Range	0 – 1	1	1 (4 – 20 mA/20 – 100%)	154	0 0 – 20 mA 1 4 – 20 mA	**8-12**
P1.2.30	AI4 Signal Inv	0 – 1	1	0 (No Inversion)	162	0 No inversion 1 Signal inverted	**8-12**
P1.2.31	AI4 Filter Time	0.00 – 10.00	0.01 s	0.10	153	0 No filtering	**8-12**
P1.2.32	INTLK Text DIN2 – INTLK Text DIN6	0 – 9	1	0	1610 – 1614	0 Ext Interlock 1 Run Enable 2 Vibration Cutout 3 High Motor Temperature 4 Freeze Stat Trip 5 Low Pressure 6 High Pressure 7 Low Water 8 Smoke Detect 9 3-Wire Off	**8-13**

Table B-3: Parameter Group G1.3: Output Signals

Code	Parameter	Range	Step	Default	ID #	Description	Page
P1.3.1	Iout Content	0 – 13	1	1 (Output Frequency)	307	0 Not used 1 Output frequency (0 – f_{max}) 2 Frequency reference (0 – f_{max}) 3 Motor speed (0 – nominal speed) 4 Output current (0 – I_{nMotor}) 5 Motor torque (0 – T_{nMotor}) 6 Motor power (0 – P_{nMotor}) 7 Motor voltage (0 – V_{nMotor}) 8 DC-link voltage (0 – 1000V) 9 PID controller reference value 10 PID controller actual value 1 11 PID controller actual value 2 12 PID controller error value 13 PID controller output	**8-13**
P1.3.2	Iout Filter Time	0.00 – 10.00	0.01 s	1.00	308	0 No filtering	**8-14**
P1.3.3	Iout Invert	0 – 1	1	0 (Not Inverted)	309	0 No inversion 1 Signal inverted	**8-14**
P1.3.4	Iout Minimum	0 – 1	1	0 (0 mA)	310	0 0 mA 1 4 mA	**8-14**
P1.3.5	Iout Scale	10 – 1000	10.0 %	100	311	100 % No scaling	**8-15**

Table B-3: Parameter Group G1.3: Output Signals, continued

Code	Parameter	Range	Step	Default	ID #	Description	Page
P1.3.6	DO1 Content	1 – 26	1	1 (Ready)	312	1 Ready 2 Run 3 Fault 4 Fault inverted 5 HVX9000 overheat warning 6 External fault or warning 7 Reference fault or warning 8 Warning 9 Reversed 10 Bypass Run 11 At speed 12 Motor regulator activated 13 Output frequency limit 1 supervision 14 Output frequency limit 2 supervision 15 Torque limit supervision 16 Reference limit supervision 17 External brake control 18 Control from I/O terminals 19 Drive temp. limit supervision 20 Unrequested rotation direction 21 External brake control inverted 22 Thermistor fault or warning 23 Pass Through Communication 24 Fire mode is active 25 In Auto Control mode 26 In Hand Control mode	**8-16**
P1.3.7	RO1 Content	1 – 28	1	2 (Run)	313	Same as ***Digital Output 1 (DO1) Content*** except 0 Not used 27 Start delay relay 28 Run Bypass or Drive	**8-17**
P1.3.8	R02 Content	1 – 28	1	3 (Fault)	314	Same as ***Digital Output 1 (DO1) Content*** except 0 Not used 27 Start delay relay 28 Run Bypass or Drive	**8-18**
P1.3.9	R03 Content	1 – 28	1	28 (Run Bypass or Drive)	1520	Same as ***Digital Output 1 (DO1) Content*** except 0 Not used 23 Fault Reset 27 Start delay relay 28 Run Bypass or Drive	**8-20**
P1.3.10	R04 Content	1 – 28	1	10 (Bypass Run)	1522	Same as ***Digital Output 1 (DO1) Content*** except 0 Not used 23 Fault Reset 27 Start delay relay 28 Run Bypass or Drive	**8-21**
P1.3.11	R05 Content	1 – 28	1	23 (Fault Reset)	1523	Same as ***Digital Output 1 (DO1) Content*** except 0 Not used 23 Fault Reset 27 Start delay relay 28 Run Bypass or Drive	**8-21**
P1.3.12	R06 Content	1 – 28	1	0 (Not Used)	1626	With optional relay board only. Same as ***Digital Output 1 (DO1) Content*** except 0 Not used 23 Fault Reset 27 Start delay relay 28 Run Bypass or Drive	**8-21**
P1.3.13	R07 Content	1 – 28	1	0 (Not Used)	1633	With optional relay board only. Same as ***Digital Output 1 (DO1) Content*** except 0 Not used 23 Fault Reset 27 Start delay relay 28 Run Bypass or Drive	**8-21**

Table B-3: Parameter Group G1.3: Output Signals, continued

Code	Parameter	Range	Step	Default	ID #	Description	Page
P1.3.14	R08 Content	1 – 28	1	0 (Not Used)	1645	With optional relay board only. Same as ***Digital Output 1 (DO1) Content*** except 0 Not used 23 Fault Reset 27 Start delay relay 28 Run Bypass or Drive	**8-21**
P1.3.15	Freq Supv Lim 1	0 – 2	1	0 (No Supervision)	315	0 No supervision 1 Low limit supervision 2 High limit supervision	**8-22**
P1.3.16	SpeedSuprValue1	0.0 – 200.0	0.1%	0.0	1591	Speed value supervised by ***Frequency Supervision Limit 1***	**8-22**
P1.3.17	Freq Supv Lim 2	0 – 2	1	0 (No Supervision)	346	0 No supervision 1 Low limit supervision 2 High limit supervision	**8-22**
P1.3.18	SpeedSuprVal 2	0.0 – 200.0	0.1%	0.0	1592	Speed value supervised by ***Frequency Supervision Limit 2***	**8-22**
P1.3.19	Torque Supv Lim	0 – 2	1	0 (No Supervision)	348	0 No supervision 1 Low limit supervision 2 High limit supervision	**8-23**
P1.3.20	Torque Supv Val	0.0 – 300.0	0.1 %	100.0%	349	Torque value supervised by ***Torque Supervision Limit***	**8-23**
P1.3.21	Ref SupERv Lim	0 – 2	1	0 (No Supervision)	350	0 No supervision 1 Low limit supervision 2 High limit supervision	**8-23**
P1.3.22	Ref SupERv Val	0.0 – 100.0	0.1 %	0.0	351	Torque value supervised by ***Reference Supervision Limit***	**8-23**
P1.3.23	Ext Brake OffDel	0.0 – 100.0	0.1 s	0.5	352	Off delay after Start/Stop toggle	**8-23**
P1.3.24	Ext Brake OnDel	0.0 – 100.0	0.1 s	0.5	353	On delay after Start/Stop toggle	**8-24**
P1.3.25	Temp Limit Supv	0 – 2	1	0 (No Supervision)	354	0 No supervision 1 Low limit supervision 2 High limit supervision	**8-24**
P1.3.26	Temp Supv Value	-10 – 75°C	1°C	40°C	455	Temperature value supervised by ***Temperature Limit Supervision***	**8-24**
P1.3.27	Iout 2 Signal	AnOUT:0.1 – AnOUT:E.10	1	AnOUT:0.1	471	Connect the AO2 signal to the analog output of choice	**8-24**
P1.3.28	Iout 2 Content	0 – 13	1	4 (Output Current)	472	0 Not used 1 Output frequency (0 – f_{max}) 2 Frequency reference (0 – f_{max}) 3 Motor speed (0 – nominal speed) 4 Output current (0 – I_{nMotor}) 5 Motor torque (0 – T_{nMotor}) 6 Motor power (0 – P_{nMotor}) 7 Motor voltage (0 – V_{nMotor}) 8 DC-link voltage (0 – 1000V) 9 PID controller reference value 10 PID controller actual value 1 11 PID controller actual value 2 12 PID controller error value 13 PID controller output	**8-25**
P1.3.29	Iout 2 Filter T	0.00 – 10.00	0.01 s	1.00	473	0.00 No filtering	**8-25**
P1.3.30	Iout 2 Invert	0 – 1	1	0 (No Inversion)	474	0 No inversion 1 Signal inverted	**8-25**
P1.3.31	Iout 2 Minimum	0 – 1	1	0 (0 mA)	475	0 0 mA 1 4 mA	**8-25**
P1.3.32	Iout 2 Scale	0 – 1000	10 %	0	476	—	**8-26**

Table B-4: Parameter Group G1.4: Drive Control

Code	Parameter	Range	Step	Default	ID #	Description	Page
P1.4.1	Ramp 1 Shape	0.0 – 10.0	0.1	0.0	500	0 Linear >0 S-curve accel/decel	**8-26**
P1.4.2	Ramp 2 Shape	0.0 – 10.0	0.1	0.0	501	0 Linear >0 S-curve accel/decel	**8-26**
P1.4.3	Accel Time 2	0.1 – 3000.0	0.1 s	10.0	502	Time from f_{min} (***Minimum Frequency***) to f_{max} (***Maximum Frequency***)	**8-27**
P1.4.4	Decel Time 2	0.1 – 3000.0	0.1 s	10.0	503	Time from f_{max} (***Maximum Frequency***) to f_{min} (***Minimum Frequency***)	**8-27**
P1.4.5	Brake Chopper ①	0 – 3	1	0 (Not Used)	504	0 Brake chopper not used 1 Brake chopper in use (no testing) 2 External brake chopper (no testing) 3 In Ready state (no testing)	**8-27**
P1.4.6	Start Function	0 – 1	1	0 (Ramping)	505	0 Ramp 1 Flying start	**8-28**
P1.4.7	Stop Function	0 – 3	1	1 (Ramp)	506	0 Coasting 1 Ramp 2 Normal-ramp, Run enable-coasting 3 Normal-coasting, Run enable-ramp	**8-28**
P1.4.8	DC-Brake Current	0.15 x I_{nHVX} – 1.5 x I_{nHVX}	0.01	0.5 x I_{nHVX}	507	DC-brake current in amperes	**8-28**
P1.4.9	Stop DC-BrakeTm	0.000 – 60.000	0.001 s	0.000	508	0 DC-brake not used at stop >0 DC-brake in use at stop for set time	**8-29**
P1.4.10	Stop DC-BrakeFr	0.10 – 10.00	0.01 Hz	1.50	515	Output frequency DC-brake applied	**8-30**
P1.4.11	Start DC-BrakeTm	0.000 – 60.000	0.001 s	0.000	516	0 DC-brake not used at start >0 DC-brake in use at start for set time	**8-30**
P1.4.12	Flux Brake	0 – 1	1	0 (Off)	520	0 Flu braking off 1 Flux braking on	**8-30**
P1.4.13	FluxBrakeCurrent	0.1 x I_{nMotor} – Current Limit	0.1 x I_{nMotor}	0.5 x I_{nMotor}	519	Flux brake current in amperes	**8-31**

① Drive must be stopped to edit these parameters.

Table B-5: Parameter Group G1.5: Prohibit Frequencies

Code	Parameter	Range	Step	Default	ID #	Description	Page
P1.5.1	Range 1 Low Lim	0.00 – Range 1 High Limit	0.01 Hz	0.00	509	Prohibit frequency range 1 low limit	**8-31**
P1.5.2	Range 1 High Lim	Range 1 Low Limit – Max Frequency	0.01 Hz	0.00	510	Prohibit frequency range 1 high limit	**8-31**
P1.5.3	Range 2 Low Lim	0.00 – Range 2 High Limit	0.01 Hz	0.00	511	Prohibit frequency range 2 low limit	**8-31**
P1.5.4	Range 2 High Lim	Range 2 Low Limit – Max Frequency	0.01 Hz	0.00	512	Prohibit frequency range 2 high limit	**8-31**
P1.5.5	Range 3 Low Lim	0 – Range 3 High Limit	0.01 Hz	0.00	513	Prohibit frequency range 3 low limit	**8-31**
P1.5.6	Range 3 High Lim	Range 3 Low Limit – Max Frequency	0.01 Hz	0.00	514	Prohibit frequency range 3 high limit	**8-32**
P1.5.7	PH Acc/Dec Ramp	0.1 – 10.0	0.1	1.0	518	Ramp time multiplier in prohibit range	**8-32**

Table B-6: Parameter Group G1.6: Motor Control

Code	Parameter	Range	Step	Default	ID #	Description	Page
P1.6.1	Motor Ctrl Mode ①	0 – 1	1	0 (Frequency control)	600	0 Frequency control 1 Speed control	8-33
P1.6.2	V/f Optimization ①	0 – 1	1	0 (None)	109	0 None 1 Automatic torque boost	8-33
P1.6.3	V/f Ratio Select ①	0 – 3	1	0 (Linear)	108	0 Linear 1 Squared 2 Programmable V/f curve 3 Linear with flux optimization	8-34
P1.6.4	Field WeakngPnt ①	30.00 – 320.00	0.01 Hz	60.00	602	Usually corresponds to ***Motor Nominal Frequency***	8-35
P1.6.5	Voltage at FWP ①	10.00 – 200.00	0.01 %	100.00	603	Usually corresponds to ***Motor Nominal Voltage***	8-35
P1.6.6	V/f Mid Freq ①	0.00 – Field Weakening Point	0.01 Hz	60.00	604	Midpoint frequency of the curve	8-35
P1.6.7	V/f Mid Voltg ①	0.00 – 100.00	0.01 %	100.00	605	Maximum value is ***Voltage at Field Weakening Point***	8-35
P1.6.8	Zero Freq Voltg ①	0.00 – 40.00	0.01 %	1.50	606	Voltage at zero frequency	8-36
P1.6.9	Switching Freq ①	1.0 – 16.0	0.1 kHz	—	601	HVX9000 model dependent	8-36
P1.6.10	Overvolt Contr ①	0 – 1	1	1 (Switched On)	607	0 Overvoltage control switched off 1 Overvoltage control switched on	8-36
P1.6.11	Undervolt Contr ①	0 – 1	1	1 (Enabled)	608	0 Disabled 1 Enabled	8-36

① Drive must be stopped to edit these parameters.

Table B-7: Parameter Group G1.7: Protections

Code	Parameter	Range	Step	Default	ID #	Description	Page
P1.7.1	4mA Fault Resp	0 – 5	1	0 (No Response)	700	0 No response 1 Warning 2 Warning, 10 s earlier set frequency used as reference 3 Warning, preset frequency ***4 mA Fault Frequency*** used as reference 4 Fault, stop as set by ***Stop Function*** 5 Fault, stop by coasting	8-37
P1.7.2	4mA Fault Freq	0.00 – Maximum Frequency	0.01 Hz	0.00	728	Used for 4 mA fault when ***4 mA (Reference) Fault Response*** = 3	8-37
P1.7.3	External Fault	0 – 3	1	2 (Fault)	701	0 No response 1 Warning 2 Fault, stop as set by ***Stop Function*** 3 Fault, stop by coasting	8-37
P1.7.4	Input Phase Supv	0 – 3	1	0 (No Response)	730	0 No response 1 Warning 2 Fault, stop as set by ***Stop Function*** 3 Fault, stop by coasting	8-37
P1.7.5	UVolt Fault Resp	1 – 3	1	2 (Fault)	727	1 Warning 2 Fault, stop as set by ***Stop Function*** 3 Fault, stop by coasting	8-37
P1.7.6	OutputPh Superv	0 – 3	1	2 (Fault)	702	0 No response 1 Warning 2 Fault, stop as set by ***Stop Function*** 3 Fault, stop by coasting	8-38

Table B-7: Parameter Group G1.7: Protections, continued

Code	Parameter	Range	Step	Default	ID #	Description	Page
P1.7.7	Earth Fault	0 – 3	1	2 (Fault)	703	0 No response 1 Warning 2 Fault, stop as set by ***Stop Function*** 3 Fault, stop by coasting	**8-38**
P1.7.8	Motor Therm Prot	0 – 3	1	2 (Fault)	704	0 No response 1 Warning 2 Fault, stop as set by ***Stop Function*** 3 Fault, stop by coasting	**8-38**
P1.7.9	MotAmbTempFactor	-100.0 – 100.00	0.1 %	0.0	705	0 Motor at same ambient as HVX9000 heatsink <>0 Motor at different ambient than HVX9000 heatsink	**8-38**
P1.7.10	MTP f0 Current	0.0 – 150.0	0.1 %	40.0	706	Current allowed at zero frequency based on a percentage of ***Motor Nominal Frequency***	**8-39**
P1.7.11	MTP Motor T	1 – 200	1 m	24 min.	707	Motor thermal time constant - t_6 time	**8-40**
P1.7.12	Motor Duty Cycle	0 – 100	1 %	100	708	Defines how much of the nominal motor nameplate load is normally applied	**8-40**
P1.7.13	Stall Protection	0 – 3	1	1 (Warning)	709	0 No response 1 Warning 2 Fault, stop as set by ***Stop Function*** 3 Fault, stop by coasting	**8-41**
P1.7.14	Stall Current	0.01 – Motor Nominal Current x 2	0.1 A	Motor Nominal Current x 1.3	710	Stall current	**8-41**
P1.7.15	Stall Time Lim	1.00 – 120.00	0.01 s	15.00	711	Maximum stall time	**8-41**
P1.7.16	Stall Freq Lim	1.00 – Maximum Frequency	0.01 Hz	25.00	712	Maximum stall frequency	**8-41**
P1.7.17	Underload Protec	0 – 3	1	0 (No Response)	713	0 No response 1 Warning 2 Fault, stop as set by ***Stop Function*** 3 Fault, stop by coasting	**8-42**
P1.7.18	UP fnom Torque	10.0 – 150.0	0.1 %	50.0	714	Minimum torque setting as percentage of the nominal motor nameplate torque at ***Motor Nominal Frequency***	**8-42**
P1.7.19	UP f0 Torque	5.0 – 150.0	0.1 %	10.0	715	Minimum torque setting as percentage of the nominal motor nameplate torque at f0	**8-43**
P1.7.20	UP Time Limit	2.00 – 600.00	0.01 s	20.00	716	Maximum time allowed for underload	**8-43**
P1.7.21	ThermistorF Resp	0 – 3	1	0 (No Response)	732	0 No response 1 Warning 2 Fault, stop as set by ***Stop Function*** 3 Fault, stop by coasting	**8-43**
P1.7.22	Comm Fault Resp	0 – 3	1	2 (Fault)	733	0 No response 1 Warning 2 Fault, stop as set by ***Stop Function*** 3 Fault, stop by coasting	**8-43**
P1.7.23	SlotComFaultResp	0 – 3	1	2 (Fault)	734	0 No response 1 Warning 2 Fault, stop as set by ***Stop Function*** 3 Fault, stop by coasting	**8-44**

Table B-8: Parameter Group G1.8: Auto-Restart Parameters

Code	Parameter	Range	Step	Default	ID #	Description	Page
P1.8.1	Wait Time	0.10 – 10.00	0.01 s	0.50	717	Auto restart delay after fault cause clears	**8-44**
P1.8.2	Trial Time	0.00 – 60.00	0.01 s	30.00	718	Time limit for max set number of faults before fault is maintained	**8-44**
P1.8.3	Start Function	0 – 2	1	0 (Ramping)	719	0 Ramp start 1 Flying start 2 Start per ***Start Function***	**8-45**
P1.8.4	Undervolt Tries	0 – 10	1	0	720	0 No auto restart >0 Number of auto restarts allowed during trial time	**8-45**
P1.8.5	Overvolt Tries	0 – 10	1	0	721	0 No auto restart >0 Number of auto restarts allowed during trial time	**8-45**
P1.8.6	Overcurr Tries	0 – 3	1	0	722	0 No auto restart >0 Number of auto restarts allowed during trial time	**8-45**
P1.8.7	4 mA Fault Tries	0 – 10	1	0	723	0 No auto restart >0 Number of auto restarts allowed during trial time	**8-45**
P1.8.8	MotTempF Tries	0 – 10	1	0	726	0 No auto restart >0 Number of auto restarts allowed during trial time	**8-45**
P1.8.9	ExtFault Tries	0 – 10	1	0	725	0 No auto restart >0 Number of auto restarts allowed during trial time	**8-45**

Table B-9: Parameter Group G1.9: Fire Mode

Code	Parameter	Range	Step	Default	ID #	Description	Page
P1.9.1	FireModeFunction	0 – 1	1	0 (Closed Contact)	1501	0 Closed contact initiates fire mode 1 Open contact initiates fire mode	**8-46**
P1.9.2	FMRefSelFunction	0 – 1	1	0 (Not Inverted)	1502	0 No inversion 1 Signal inverted	**8-46**
P1.9.3	FireModeMiniFreq	Minimum Frequency – Maximum Frequency	0.01 Hz	15.00	1503	Minimum HVX9000 frequency in fire mode	**8-46**
P1.9.4	FireModeFreqRef1	0.0 – 100.0%	0.1%	75.0	1712	HVX9000 reference 1 frequency in fire mode	**8-46**
P1.9.5	FireModeFreqRef2	0.0 – 100%	0.1%	100.0	1711	HVX9000 reference 2 frequency in fire mode	**8-46**
P1.9.6	FMAutoResetDelay	0.50 – 10.00	0.01 s	5.00	1506	Auto restart delay in fire mode after fault cause clears	**8-47**

Table B-10: Parameter Group G1.10: IntelliPass Parameters

Code	Parameter	Range	Step	Default	ID #	Description	Page
P1.10.1	IntelliPass	0 – 1	1	0 (IntelliPass Disabled)	1521	0 Disabled – Not used 1 IntelliPass enabled	**8-47**
P1.10.2	Bypass Start Delay	1 – 32,765	1 s	5	1545	Time delay before motor is switched from HVX9000 to bypass after digital input closed	**8-47**
P1.10.3	Auto Bypass	0 – 1	1	0 (Auto Bypass Disabled)	1525	0 Auto bypass disabled 1 Auto bypass enabled	**8-48**
P1.10.4	Auto BypassDelay	0 – 32,765	1 s	10	1526	Time delay before auto bypass occurs	**8-48**
P1.10.5	Over 1 BypasEnab	0 – 1	1	0	1553	0 Auto bypass on overcurrent disabled 1 Auto bypass on overcurrent after restart tries exceeded enabled	**8-48**
P1.10.6	IGBT FLT BypasEn	0 – 1	1	0	1552	0 Auto bypass on IGBT fault disabled 1 Auto bypass on IGBT fault after restart tries exceeded enabled	**8-48**
P1.10.7	No Ref BypasEnab	0 – 1	1	0	1554	0 Auto bypass on 4 mA loss disabled 1 Auto bypass on 4 mA loss after restart tries exceeded enabled	**8-48**
P1.10.8	Ovolt BypassEnab	0 – 1	1	0	1555	0 Auto bypass on overvoltage disabled 1 Auto bypass on overvoltage after restart tries exceeded enabled	**8-48**
P1.10.9	UV BypassEnab	0 – 1	1	0	1550	0 Auto bypass on undervoltage disabled 1 Auto bypass on undervoltage after restart tries exceeded enabled	**8-48**

Table B-11: Parameter Group G1.11: PID Control

Code	Parameter	Range	Step	Default	ID #	Description	Page
P1.11.1	PID Reference ①	0 – 4	1	0 (AI1)	332	0 Analog voltage AI1, terminals 2-3 1 Analog current AI2, terminals 4-5 2 Reference from keypad 3 Reference from communication bus 4 Reference from motor potentiometer	**8-49**
P1.11.2	PID SumPoint Ref ①	0 – 7	1	0 (No additional reference)	376	0 No additional reference (direct output) 1 PID output + AI1, terminals 2-3 2 PID output + AI2, terminals 4-5 3 PID output + AI3 reference 4 PID output + AI4 reference 5 PID output + PID keypad reference 6 PID output + Communication bus 7 PID output + Motor potentiometer	**8-49**
P1.11.3	Act Value Select ①	0 – 7	1	0 (Actual Value 1)	333	0 Actual value 1 1 Actual value 1 + actual value 2 2 Actual value 1 – actual value 2 3 Actual value 1 x actual value 2 4 Greater of actual value 1 and actual value 2 5 Smaller of actual value 1 and actual value 2 6 Mean value of actual value 1 and actual value 2 7 Square root of actual value 1 + square root of actual value 2	**8-49**

① Drive must be stopped to edit these parameters.

Table B-11: Parameter Group G1.11: PID Control, continued

Code	Parameter	Range	Step	Default	ID #	Description	Page
P1.11.4	Actual 1 Input ①	0 – 9	1	2 (AI2)	334	0 Not used 1 Analog voltage AI1, terminals 2-3 2 Analog current AI2, terminals 4-5 3 Analog current AI3 4 Analog current AI4 5 Communication bus 6 Motor torque 7 Motor speed 8 Motor current 9 Motor power	**8-50**
P1.11.5	Act 1 Max Scale ①	-1000.0 – 1000.0	0.1 %	100.0%	337	100 % = no maximum scaling	**8-50**
P1.11.6	Act 1 Min Scale ①	-1000.0 – 1000.0	0.1 %	0.0	336	0 % = no minimum scaling	**8-50**
P1.11.7	Actual 2 Input ①	0 – 9	1	0 (Not used)	335	0 Not used 1 Analog voltage AI1, terminals 2-3 2 Analog current AI2, terminals 4-5 3 Analog current AI3 4 Analog current AI4 5 Communication bus 6 Motor torque 7 Motor speed 8 Motor current 9 Motor power	**8-51**
P1.11.8	Actual 2 Max Scale	-1000.0 – 1000.0	0.1 %	100.0	339	100 % no maximum scaling	**8-51**
P1.11.9	Actual 2 Min Scale	-1000.0 – 1000.0	0.1 %	0.0	338	0 % no minimum scaling	**8-51**
P1.11.10	PID-Contr Gain	0.0 – 1000.0	0.1 %	100.0%	118	0 % PID controller acts as ID controller	**8-51**
P1.11.11	PID-Contr I Time	0.00 – 320.00	0.01 s	1.00	119	0.00 s PID controller acts as PD controller	**8-51**
P1.11.12	PID-Contr D Time	0.00 – 10.00	0.01 s	0.00	132	0.00 s PID controller acts as PI controller	**8-51**
P1.11.13	PID Max Limit	PID Min Limit – 1000.0	0.1 %	100.0%	360	Sets the maximum limit for PID controller output	**8-53**
P1.11.14	PID Min Limit	1000.0 – PID Max Limit	0.1 %	0.0%	359	Sets the minimum limit for PID controller output	**8-54**
P1.11.15	PID Ref Rise Tim	0.0 – 100.0	0.1 s	5.0	341	Time for reference to rise from 0 % to 100 %	**8-54**
P1.11.16	PID Ref Fall Tim	0.0 – 100.0	0.1 s	5.0	342	Time for reference to fall from 100 % to 0 %	**8-54**
P1.11.17	Error Inversion	0 – 1	1	0 (No Inversion)	340	0 No inversion 1 Signal inverted	**8-54**
P1.11.18	Easy ChangeOver	0 – 1	1	0 (Keep Reference)	366	0 Keep reference 1 Copy reference	**8-54**
P1.11.19	Sleep Func Enabl	0 – 1	1	0	1560	0 Disabled 1 Enabled	**8-55**
P1.11.20	Sleep Frequency	Min Frequency – Max Frequency	0.01 Hz	10.00	1016	Level below which a sleep stop will occur	**8-55**
P1.11.21	Sleep Delay	0 – 32,500	1 s	30	1017	Delay before which a sleep stop will occur	**8-55**
P1.11.22	Wake Up Limit	0.00 – 100.00	0.01 %	25.00	1018	Actual value to cause run after sleep stop	**8-55**
P1.11.23	Wake Up Action	0 – 1	1	0 (Below Level)	1019	0 Wake up after falling below limit 1 Wake up after exceeding limit	**8-55**

① Drive must be stopped to edit these parameters.

Table B-12: Parameter Group G1.12: Preset Speeds

Code	Parameter	Range	Step	Default	ID #	Description	Page
P1.12.1	#1 Preset Speed	0.0 – 100.0	0.1%	10.0	1600	Defines #1 preset speed as a percentage of Max Frequency.	**8-57**
P1.12.2	#2 Preset Speed	0.0 – 100.0	0.1%	20.0	1601	Defines #2 preset speed as a percentage of Max Frequency.	**8-57**
P1.12.3	#3 Preset Speed	0.0 – 100.0	0.1%	30.0	1602	Defines #3 preset speed as a percentage of Max Frequency.	**8-57**
P1.12.4	#4 Preset Speed	0.0 – 100.0	0.1%	40.0	1603	Defines #4 preset speed as a percentage of Max Frequency.	**8-57**
P1.12.5	#5 Preset Speed	0.0 – 100.0	0.1%	50.0	1604	Defines #5 preset speed as a percentage of Max Frequency.	**8-57**
P1.12.6	#6 Preset Speed	0.0 – 100.0	0.1%	75.0	1605	Defines #6 preset speed as a percentage of Max Frequency.	**8-57**
P1.12.7	#7 Preset Speed	0.0 – 100.0	0.1%	100.0	1606	Defines #7 preset speed as a percentage of Max Frequency.	**8-57**

Table B-13: Parameter Group G1.13: Communication Bus

Code	Parameter	Range	Step	Default	ID #	Description	Page
P1.13.1	FBDataOut1Sel	0 – 10000	1	1590 (Motor speed – %)	852	Motor Speed (Percent)	**8-58**
P1.13.2	FBDataOut2Sel	0 – 10000	1	1 (Output frequency – Hz)	853	Output Frequency (Hz)	**8-58**
P1.13.3	FBDataOut3Sel	0 – 10000	1	25 (Frequency reference – Hz)	854	Frequency Reference (Hz)	**8-58**
P1.13.4	FBDataOut4Sel	0 – 10000	1	2 (Motor speed – rpm)	855	Motor Speed (rpm)	**8-58**
P1.13.5	FBDataOut5Sel	0 – 10000	1	1780 (Motor current)	856	Motor Current	**8-58**
P1.13.6	FBDataOut6Sel	0 – 10000	1	5 (Motor power)	857	Motor Power	**8-58**
P1.13.7	FBDataOut7Sel	0 – 10000	1	1701 (Motor run time – minutes)	1701	Motor Run Time (Minutes)	**8-58**
P1.13.8	FBDataOut8Sel	0 – 10000	1	1666 (Energy meter – kW)	1666	Energy Meter (Kilowatts)	**8-58**

Appendix C — Fault and Warning Codes

Table C-1: Fault Codes

Fault Code	Fault	Possible Cause	Solution
1	Overcurrent	HVX9000 has detected a high current (>4xI_n) in its output due to: • sudden heavy load increase • short in the motor • short in the cables to the motor • unsuitable motor	Check loading. Check motor. Check cables.
2	Overvoltage	The DC-link voltage has exceeded its high limit due to: • too short a deceleration time • high voltage levels or surges in the utility supply	Make the deceleration time longer. Use brake chopper and brake resistor (standard on some models, available as options on others). Correct utility supply voltage (level is too high). Add input impedance to limit surges.
3	Ground (Earth) Fault	Current sensing indicates that the sum of motor phase currents is not zero. • insulation failure in motor or motor cables	Check motor and motor cables.
5	Charging Switch	The charging switch was open, when the START command was given due to: • faulty operation • component failure	Reset the fault and restart. Should the fault re-occur, contact your Cutler-Hammer distributor.
6	Emergency stop	An Emergency stop signal was received from one of the digital inputs	Determine reason for the Emergency stop and remedy it.
7	Saturation trip	• defective component • motor or motor cable short	Cannot be reset from the keypad. Switch off power. IF THE PROBLEM IS NOT IN THE MOTOR OR ITS CABLES, DO NOT RE-CONNECT POWER! Contact your Cutler-Hammer distributor. If this fault appears simultaneously with Fault 1, check the motor and motor cables.
8	System fault	• component failure • faulty operation **Note:** exceptional fault data record, see Active Fault Menu for more information	Reset the fault and restart. Should the fault re-occur, contact your Cutler-Hammer distributor.

Table C-1: Fault Codes, continued

Fault Code	Fault	Possible Cause	Solution
9	Undervoltage	DC-link voltage is less than the minimum safe operating voltage limit • most probable cause: too low a utility supply voltage • HVX9000 internal fault	If there was a supply voltage loss or dip, reset the fault and restart the HVX9000. Check the supply voltage. If it was within specification at the time of the fault, an internal failure has occurred. Contact your Cutler-Hammer distributor.
10	Input line supervision	Input line phase is low or missing.	Check the utility supply voltage, cables and connections.
11	Output phase supervision	Current sensing indicates that there is no current in one motor phase	Check the motor cables, connections and motor.
12	Brake chopper supervision	• no brake resistor installed • brake resistor is broken • brake chopper failure	Check the brake resistor. If the resistor is ok, the chopper is faulty. Contact your Cutler-Hammer distributor.
13	HVX9000 undertemperature	Heatsink temperature is under -10°C	Provide supplemental heating or relocate the HVX9000 to a warmer location.
14	HVX9000 overtemperature	Heatsink temperature is over 90°C.	An overtemperature warning is issued when the heatsink temperature exceeds 85°C, a fault occurs at 90°C. Check for the correct amount and unrestricted flow of cooling air. Check the heatsink for dust or dirt buildup. Check the highest ambient temperature level. Make sure that the switching frequency is not set too high in relation to the ambient temperature and motor load.
15	Motor stalled	• motor or load mechanical failure • load too high • stall parameter settings incorrect	Check the motor, mechanical system and load level. Confirm the stall parameter settings.
16	Motor overtemperature	• motor is overloaded • motor overheating has been detected by HVX9000 motor temperature model	Decrease the motor load. If no motor overload exists, check the temperature model parameters.
17	Motor underload	• mechanical or load problem • underload parameter settings incorrect	Check the motor, check for a loose belt, broken coupling or load problems. Confirm underload parameter settings.

Table C-1: Fault Codes, continued

Fault Code	Fault	Possible Cause	Solution
22 23	EEPROM checksum fault	Parameter save fault • faulty operation • component failure	Upon reset of this fault, the HVX9000 will automatically reload the parameter default settings. Check all parameter settings after reset. If the fault reoccurs, contact your Cutler-Hammer distributor.
25	Microprocessor watchdog fault	• faulty operation • component failure	Reset the fault and restart. If the fault reoccurs, contact your Cutler-Hammer distributor.
26	Start-up prevented	Start-up of the drive has been prevented.	Check Start Enable/Interlock settings.
29	Thermistor fault	The thermistor input of an option board has detected a high motor temperature	Check the motor cooling and the motor loading. Check the thermistor connection. (If the thermistor input of an option board is not being used, it must be short-circuited.)
32	Fan cooling	The HVX9000 cooling fan did not start when commanded	Contact your Cutler-Hammer distributor.
34	CAN bus communication	Sent message not acknowledged	Ensure that there is another device on the bus with the appropriate configuration.
36	Control unit	Control unit cannot control the power unit and vise-versa	Change control unit.
37	Device change	• option board changed • different power rating of drive	Reset. **Note:** No fault time data record!
38	Device added	• option board added • drive of different power rating added	Reset. **Note:** No fault time data record!
39	Device removed	• option board removed • drive removed	Reset. **Note:** No fault time data record!
40	Device unknown	Unknown option board or drive	Contact your Cutler-Hammer distributor.
41	IGBT temperature	IGBT Inverter Bridge overtemperature protection has detected high short term overload current	Check loading. Check motor size.
42	Brake resistor overtemperature	Brake resistor overtemperature protection has detected excessive braking	Set the deceleration time longer. Use an external brake resistor.

Table C-1: Fault Codes, continued

Fault Code	Fault	Possible Cause	Solution
43	Encoder fault	**Note:** the exceptional Fault data record. See Active Fault Menu for more information. Additional codes: 1 Encoder 1 channel A is missing 2 Encoder 1 channel B is missing 3 Both encoder 1 channels are missing 4 Encoder reversed	Check encoder channel connections. Check the encoder board.
50	Analog input I_{in} < 4 mA (for signal range 4 to 20 mA)	Current at the analog input is < 4 mA • control cable is broken or loose • signal source has failed	Check the current loop, signal source and wiring.
51	External fault	Digital input set as an external fault input has been triggered.	Check source of trigger.
52	Keypad communication fault	The connection between the control keypad and the HVX9000 has been lost.	Check keypad connection and keypad cable.
53	Communication bus fault	The data connection between the communication bus master and the communication bus board has failed	Check installation. If installation is correct, contact your Cutler-Hammer distributor.
54	Slot fault	Defective option board or slot	Check that the board is properly installed and seated in slot. If installation is correct, contact your Cutler-Hammer distributor.
82	BypassOverLoad	The motor has been overloaded while connected to the bypass	Decrease the motor load. Disable the Current Imbalance feature – see the ***IT.*** manual.

November 2003

Company Information

Eaton Electrical Inc. is a global leader in electrical control, power distribution, and industrial automation products and services. Through advanced product development, world-class manufacturing methods, and global engineering services and support, Eaton Electrical® provides customer-driven solutions under brand names such as Cutler-Hammer®, Durant®, Heinemann®, Holec® and MEM®, which globally serve the changing needs of the industrial, utility, light commercial, residential, and OEM markets. For more information, visit **www.eatonelectrical.com**.

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EATON | Cutler-Hammer

Printed in USA
Publication No. TD04008003E/CPG
November 2003