

SQUARE D

Instruction Bulletin

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Omegapak® Class 8803 Type P AC Drive

1 to 125 hp
Constant Torque

 **DANGER**

HAZARDOUS VOLTAGE.

- Read and understand this manual in its entirety before installing or operating Omegapak AC drive controllers. Installation, adjustment, repair and maintenance of these controllers must be performed by qualified personnel.
- Disconnect all power before servicing drive controller. WAIT TEN MINUTES until bus capacitors discharge, then measure bus capacitor voltage between + and - terminals to verify DC voltage is zero (see page 15).
- DO NOT short across capacitors or touch unshielded components or terminal strip screw connections with voltage present.
- Install all covers and close door before applying power or starting and stopping the controller.
- User is responsible for conforming to all applicable code requirements with respect to grounding all equipment. See Figure 2-10 on page 26 and Figure 2-11 on page 27 for drive controller grounding points.
- Many parts in this drive controller, including printed wiring boards, operate at line voltage. DO NOT TOUCH. Use only electrically insulated tools while making adjustments.

Before installing controller:

- Disconnect all power.
- Place a "DO NOT TURN ON" label on the controller disconnect.
- Lock disconnect in open position.

Failure to observe these precautions will cause shock or burn, resulting in severe personal injury or death!

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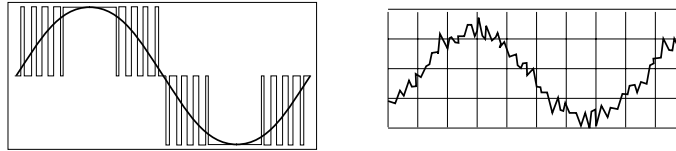
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INTRODUCTION

This manual covers the constant torque Omegapak[®] Type P AC drive, an adjustable frequency controller operating on the principle of synthesizing a sine wave by pulse width modulation (PWM). The resulting current waveform is very close to a sine wave, as shown below. Throughout this manual, the drive is referred to as a drive controller.



When associated with a standard three-phase synchronous or asynchronous motor, this drive controller provides a simple and reliable motor/drive controller combination.



DANGER

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- Disconnect all power before servicing drive controller. WAIT TEN MINUTES until bus capacitors discharge, then measure bus capacitor voltage between + and - terminals to verify DC voltage is zero (see page 15).
- DO NOT short across capacitors or touch unshielded components or terminal strip screw connections with voltage present.
- Install all covers and close door before applying power or starting and stopping the controller.
- User is responsible for conforming to all applicable code requirements with respect to grounding all equipment. See Figure 2-10 on page 26 and Figure 2-11 on page 27 for drive controller grounding points.
- Many parts in this drive controller, including printed wiring boards, operate at line voltage. DO NOT TOUCH. Use only electrically insulated tools while making adjustments.

Failure to observe these precautions will cause shock or burn, resulting in severe personal injury or death!


HANDLING THE DRIVE CONTROLLER

Do not remove the drive controller from the carton until it is at the final installation site. The carton protects the controller and prevents damage to its exterior. Handle the controller carefully to avoid damage to the internal components, frame or exterior. When handling a controller, balance it carefully to keep it from tipping.

Two lifting straps are supplied with 50 to 125 hp controllers for removing them from the carton. Once removed from the carton, the controllers can be handled:

- With a hoist, attaching a spreader bar to the two lifting rings on top of the drive controller as shown in Figure 1-1, or
- In a horizontal position, with the back of the controller resting on a pallet.

Place the drive controller in an upright position.

 WARNING
<p>HAZARD OF SEVERE PERSONAL INJURY OR DEATH. Keep area below any equipment being lifted clear of all personnel and property. Use lifting method shown below in Figure 1-1. Failure to observe these precautions can result in severe personal injury or death!</p>

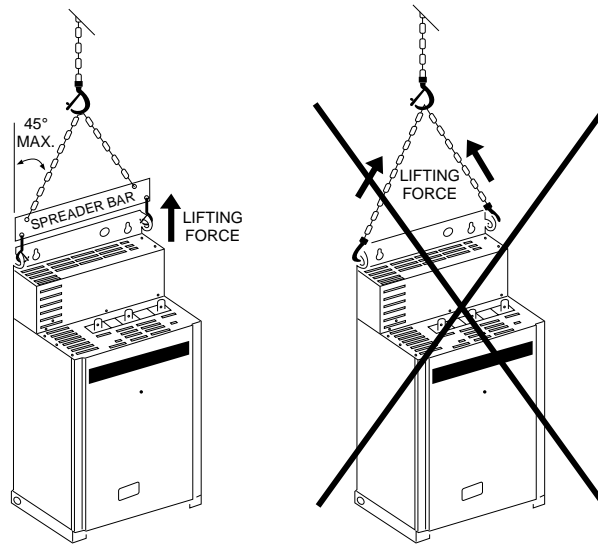



Figure 1-1 Hoisting the 50 to 125 hp Controller

**PRELIMINARY
INSPECTION**

The controller must be thoroughly inspected before storing or installing:

1. Remove the drive controller from its packaging and visually inspect exterior for shipping damage.
2. Make sure controller label conforms to the packing slip and corresponding purchase order.
3. Visually verify that the terminal strip is properly seated, securely fastened and undamaged.
4. Open the drive controller door or remove access covers.
5. Visually verify that the control board is properly seated, securely fastened and undamaged. Verify that internal wiring connections are tight. Inspect all connections for damage.
6. Close and secure the drive controller door or replace access covers.
7. If any shipping damage is found, notify the carrier and your Square D representative.

 CAUTION
<p>HAZARD OF PERSONAL INJURY OR EQUIPMENT DAMAGE. Do not operate or install any drive controller that appears damaged! Failure to observe this precaution could result in personal injury, product damage or property damage.</p>

DESIGN AND OPERATION

Omegapak 1 to 5 hp Controllers

This section applies to the following 1 to 5 hp drive controllers:

- ❑ 1 and 3 hp at 230 V: PØØCO2C and PØØCO2E
- ❑ 1 to 5 hp at 460 V: PØØCO4C to PØØCO4F

For all the above Omegapak Type P drive controllers, the measurement board components, rectifier, filter capacitors, thermal sensor and the six transistor modules are all mounted on the power board. The dialog unit and control jumpers are located on the control board.

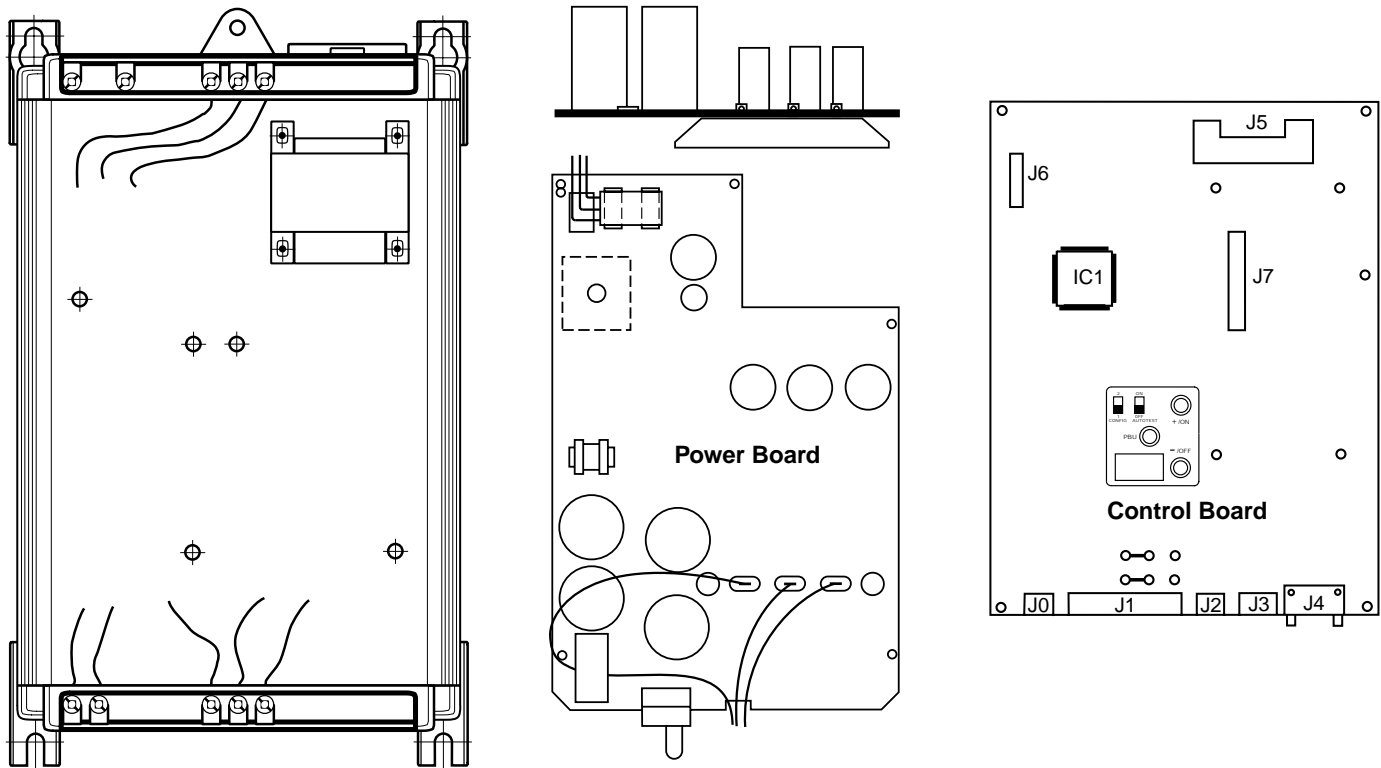


Figure 1-2 Design of 1 to 5 hp Controllers

Functional Block Diagram

DANGER

NON-ISOLATED CIRCUIT.

- Speed regulation circuits are at line voltage potential.
- External devices connected to speed regulation circuits must be insulated for line voltage with respect to ground.

Failure to observe this precaution will cause shock or burn, resulting in severe personal injury or death!

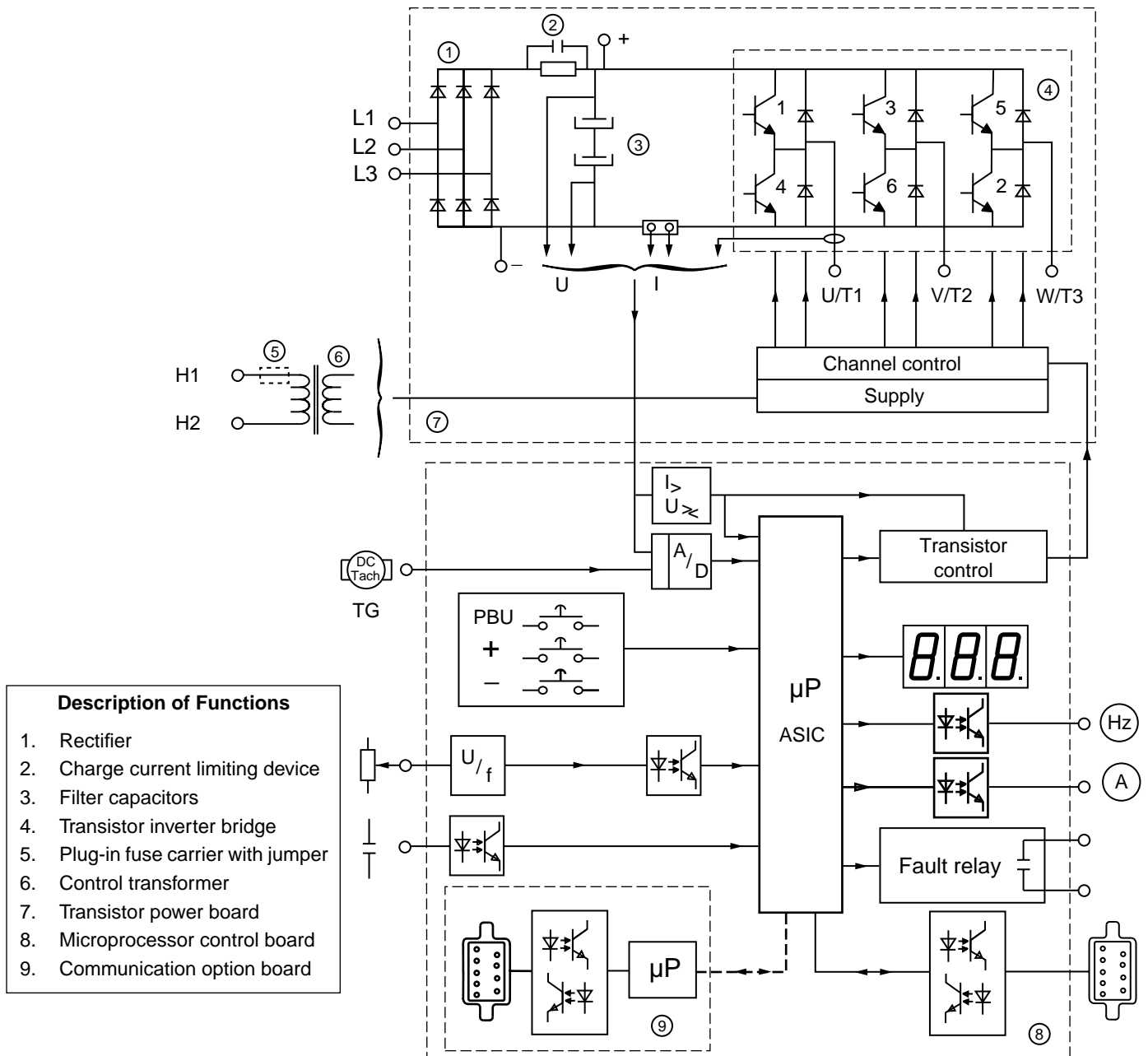


Figure 1-3 Functional Block Diagram for 1 to 5 hp Controllers

Omegapak 5 to 40 hp
Controllers

This section applies to the following 5 to 40 hp drive controllers:

- ❑ 5 to 20 hp at 230 V: PØØCO2F to 2K
- ❑ 7.5 to 40 hp at 460 V: PØØCO4G to 4N

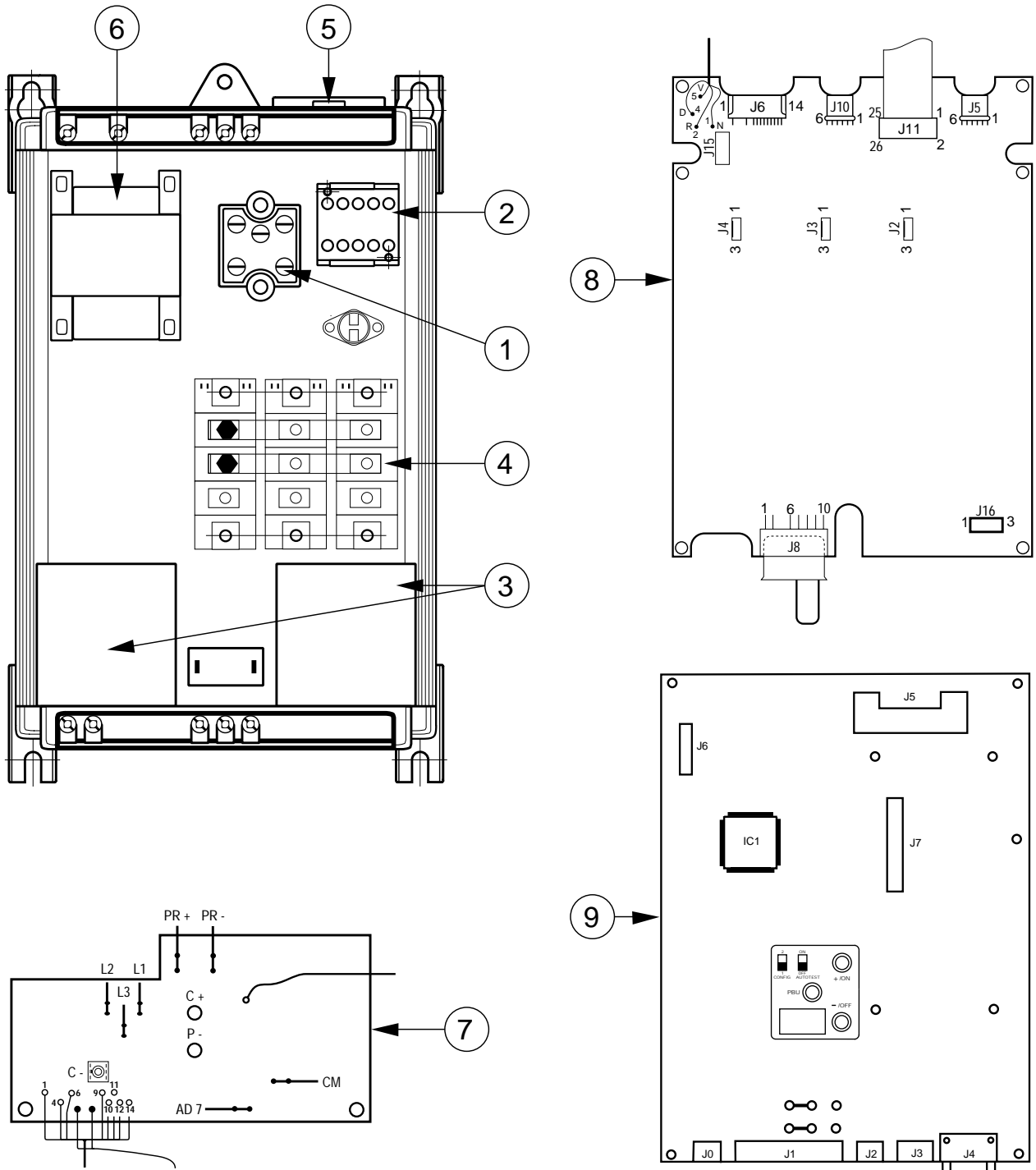


Figure 1-4 Design of 5 to 40 hp Controllers

Functional Block Diagram

DANGER

NON-ISOLATED CIRCUIT.

- Speed regulation circuits are at line voltage potential.
- External devices connected to speed regulation circuits must be insulated for line voltage with respect to ground.

Failure to observe this precaution will cause shock or burn, resulting in severe personal injury or death!

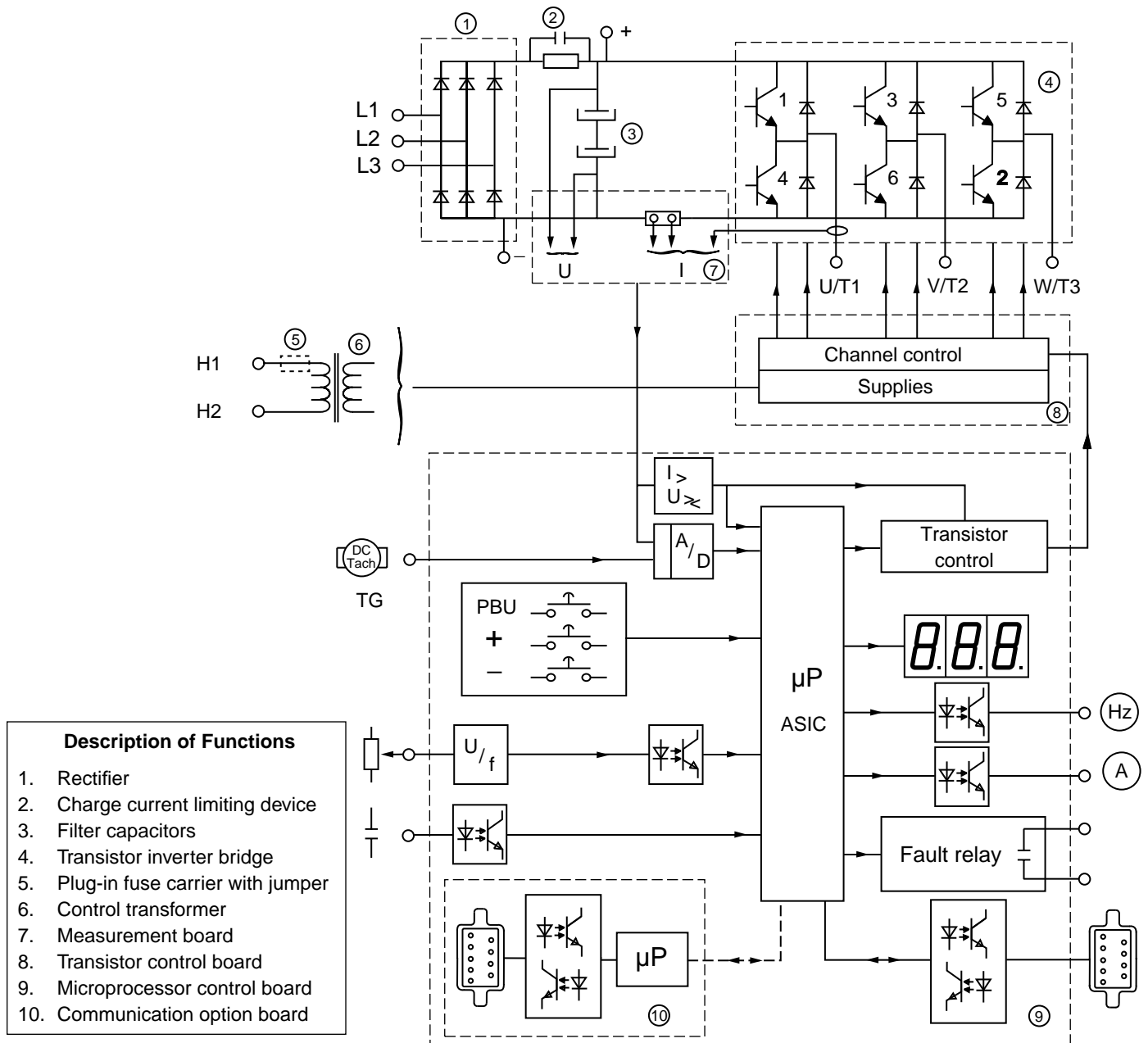


Figure 1-5 Functional Block Diagram for 5 to 40 hp Controllers

Omegapak 50 to
125 hp Controllers

This section applies to the following 50 to 125 hp drive controllers:

❑ 50 to 125 hp at 460 V:

PØØCO4P to 4T

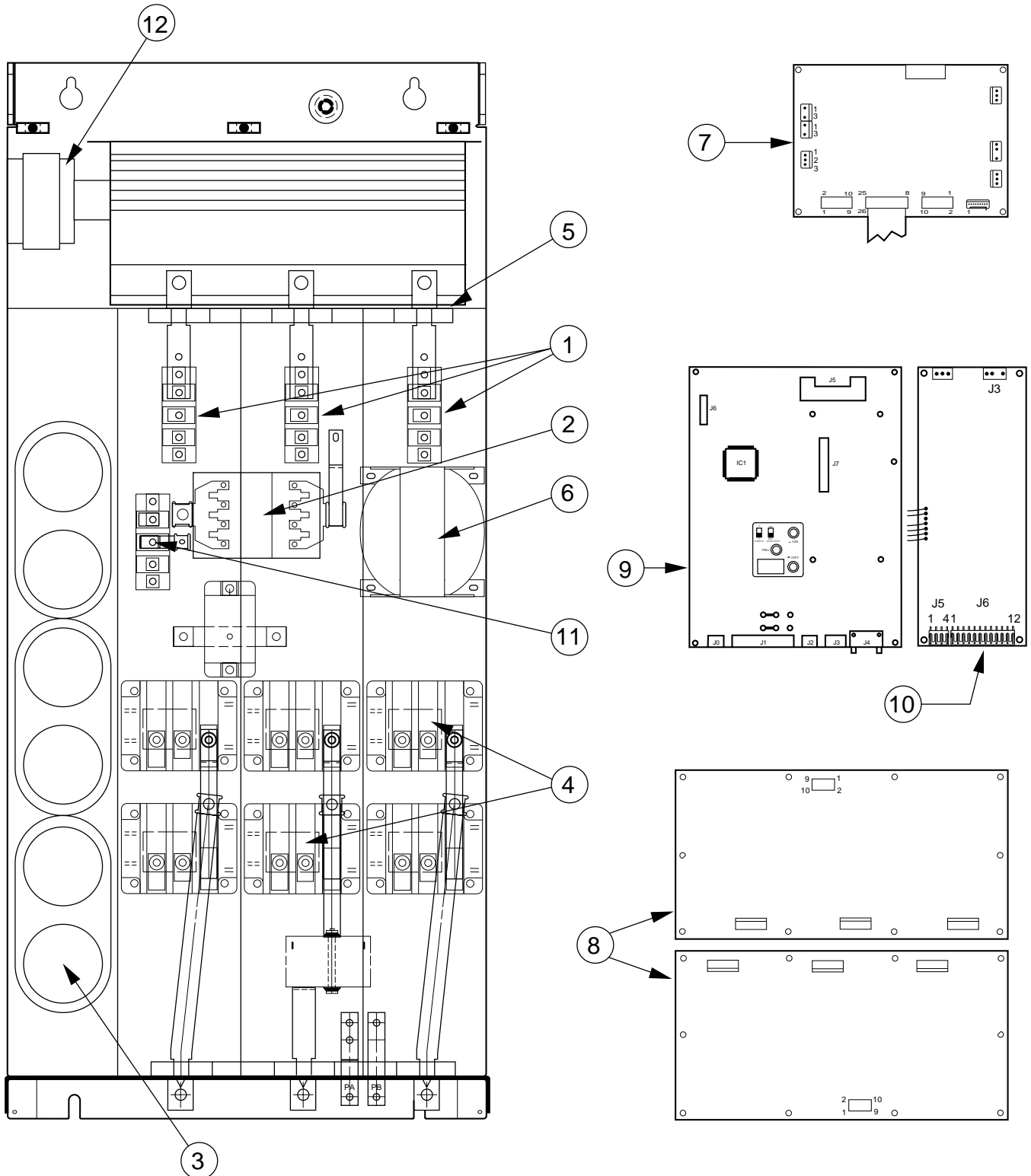


Figure 1-6 Design of 50 to 125 hp Controllers

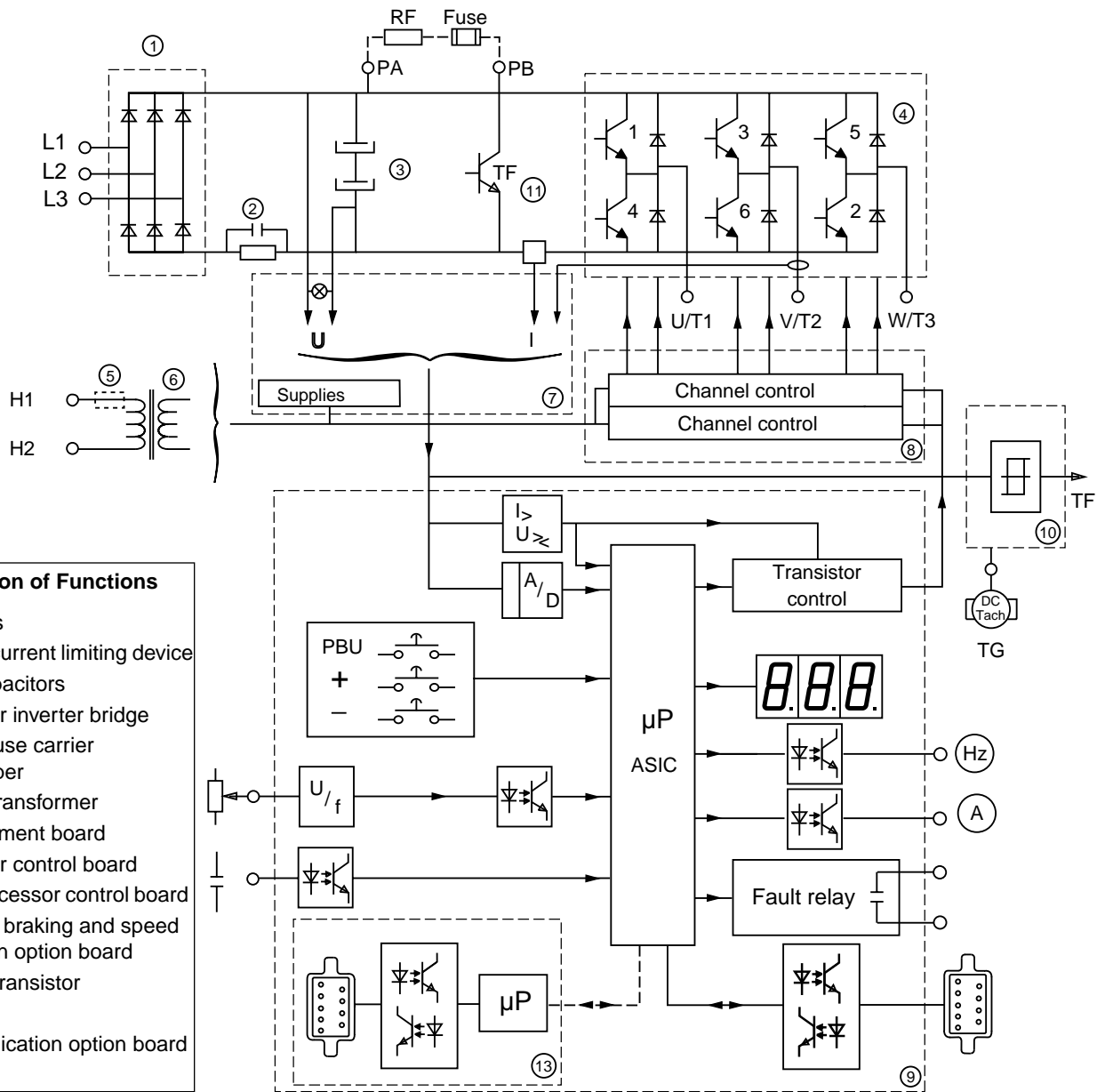
Functional Block Diagram

DANGER

NON-ISOLATED CIRCUIT.

- Speed regulation circuits are at line voltage potential.
- External devices connected to speed regulation circuits must be insulated for line voltage with respect to ground.

Failure to observe this precaution will cause shock or burn, resulting in severe personal injury or death!



- Description of Functions**
1. Rectifiers
 2. Charge current limiting device
 3. Filter capacitors
 4. Transistor inverter bridge
 5. Plug-in fuse carrier with jumper
 6. Control transformer
 7. Measurement board
 8. Transistor control board
 9. Microprocessor control board
 10. Dynamic braking and speed regulation option board
 11. Braking transistor
 12. Fan
 13. Communication option board

Figure 1-7 Functional Block Diagram for 50 to 125 hp Controllers

TECHNICAL
CHARACTERISTICS

Table 1-1 Drive Controller Power and Current

Supply Voltage	Part No.	Motor Power		Line Current ^[1]	Rated Output Current	Transient Output Current	Total Dissipated Power @ Rated Load ^[2]	Fault Withstand Current
		kW	hp					
230 V +10%/-15% 50/60 Hz	PØØCO2C	0.75	1	5	3.6	5.4	75	5,000
	PØØCO2E	2.2	3	14	9.6	13.5	115	5,000
	PØØCO2F	4	5	27	18	24.5	165	5,000
	PØØCO2G	5.5	7.5	33	22	30	195	5,000
	PØØCO2H	7.5	10	42	28	41.2	270	5,000
	PØØCO2J	11	15	63	42	57	360	5,000
	PØØCO2K	15	20	80	54	76	480	5,000
460 V +10%/-15% 50/60 Hz	PØØCO4C	.75	1	2.7	1.8	3	75	5,000
	PØØCO4D	1.5	2	5	3.4	5.5	95	5,000
	PØØCO4E	2.2	3	7	4.8	7.5	115	5,000
	PØØCO4F	4	5	11	7.6	11.5	165	5,000
	PØØCO4G	5.5	7.5	16	11	16.5	195	5,000
	PØØCO4H	7.5	10	21	14	21	270	5,000
	PØØCO4J	11	15	31	21	31	360	5,000
	PØØCO4K	15	20	40	27	40	480	5,000
	PØØCO4L	18.5	25	51	34	51	590	5,000
	PØØCO4M	22	30	60	40	60	650	5,000
	PØØCO4N	30	40	78	52	78	750	5,000
	PØØCO4P	37	50	98	65	98	850	5,000
	PØØCO4R	55	75	144	96	144	1250	10,000
	PØØCO4S	75	100	186	124	186	1700	10,000
PØØCO4T	90	125	234	156	234	2000	10,000	

^[1] The values given correspond to the current absorbed by the drive controller on a low impedance input line supply, with the rated load and speed conditions, for the associated motor. These values can be reduced by adding line inductors (page 48), or when power is supplied via a suitable transformer or autotransformer (page 47).

^[2] Multiply by 3.41 to obtain BTU per hour.

Table 1-2 Specifications

Output voltage	Maximum voltage equal to input line voltage
Frequency range	1 to 67/80 Hz, 1 to 110/132 Hz, 1 to 87/104/120 Hz (page 60) 1 to 200 Hz (option, page 99)
Torque/overtorque	See page 42
Speed reference	0-10 V, 0-20 mA, 4-20 mA, 20-4 mA (page 39) Also see Chapter 6, Configuration and Adjustments
Frequency resolution	Analog reference: 0.015 Hz Digital reference (by serial link): 0.1 Hz
Reference response time	10 ms < t < 20 ms
Low speed/high speed limits	Adjustable (page 62)
Ramps	Acceleration: 0.2 to 990 seconds (page 62) Deceleration: 0.2 to 990 seconds (page 62)
Speed regulation	With optional tachogenerator (page 90)
Reversing	Control inputs (page 34) Optional: adaptation for ±10 V control (page 73)
Braking to standstill	By DC injection: Automatic for 0.5 s if frequency drops below 1 Hz Manual by external signal (page 30)
Dynamic braking	By optional resistor (page 73)
Drive controller protection	Against short circuits: Between output phases ^[1] Between output phases and ground Against input line supply under/overvoltage Against overheating (thermal sensor)
Motor protection	Incorporated electronic thermal protection (page 40)
Automated system dialog	Incorporated point-to-point serial link (page 113) Optional multidrop serial link (page 98) Complete programming by DOS-compatible computer (page 138) or by optional commissioning terminal (page 99)
Temperature	Operation: + 32 to + 104 °F (0 to + 40 °C) Storage: - 13 to + 158 °F (- 25 to + 70 °C)
Humidity	90% maximum without condensation or dripping water (see recommendations on page 34) ^[2]
Altitude	≤ 3300 ft (1000 m); above this derate by 3% for every 3300 ft; max. 6600 ft (2000 m)
Degree of protection	Open: NEMA Open/IP20 (1 to 40 hp) NEMAOpen/IP10 (50 to 125 hp) Optional: NEMA Type 12/IP54 (page 96)
Pollution	Protect the drive controller against dust, corrosive gases and splashing liquid ^[2]

^[1] PØØCO4S, 4T: protection assured if length of motor-drive controller cables is greater than 75 ft (25 m). Otherwise, install line inductors (page 48).

^[2] Controller electrical creepages are designed for use in a Pollution Degree 2 environment per NEMA ICS-111A and IEC 664A.

CATALOG NUMBER
IDENTIFICATION

Consult Figure 1-8 below for the interpretation of the catalog numbers that appear throughout this manual.

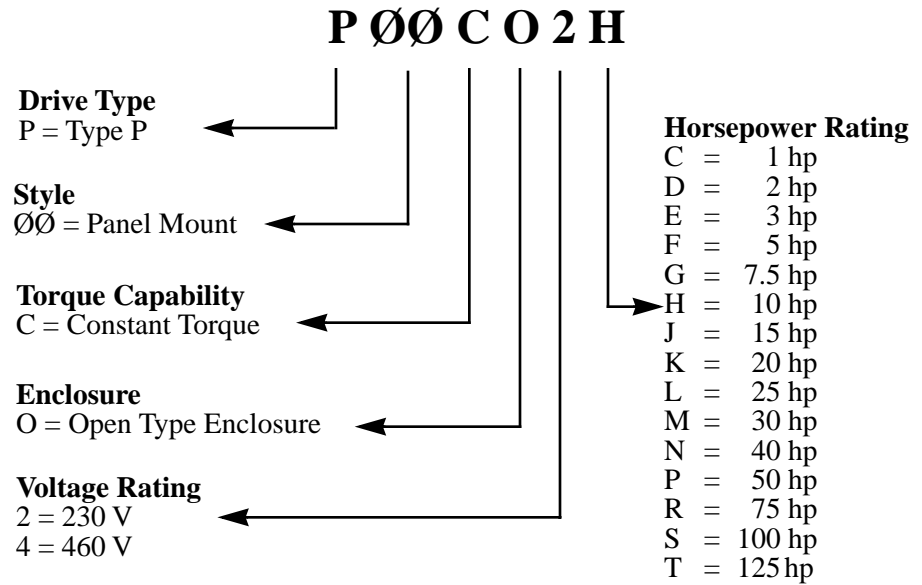


Figure 1-8 Catalog Number Identification

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INSTALLATION PRECAUTIONS



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- Disconnect all power before servicing drive controller. WAIT TEN MINUTES until bus capacitors discharge, then measure bus capacitor voltage between + and - terminals to verify DC voltage is zero (see page 15).
- DO NOT short across capacitors or touch unshielded components or terminal strip screw connections with voltage present.
- Install all covers and close door before applying power or starting and stopping the controller.
- User is responsible for conforming to all applicable code requirements with respect to grounding all equipment. See Figure 2-10 on page 26 and Figure 2-11 on page 27 for drive controller grounding points.
- Many parts in this drive controller, including printed wiring boards, operate at line voltage. DO NOT TOUCH. Use only electrically insulated tools while making adjustments.

Before installing controller:

- Disconnect all power.
- Place a "DO NOT TURN ON" label on the controller disconnect.
- Lock disconnect in open position.

Failure to observe these precautions will cause shock or burn, resulting in severe personal injury or death!

Follow these precautions when installing the drive controller:

- When installation surface is not even, put a spacer behind the controller mounting pads to eliminate gaps. The controller exterior may be damaged if fastened to an uneven surface.
- Controllers are open devices and must be installed in suitable enclosures or controlled access areas. The environment around the controller must meet Pollution Degree 2 requirements as defined in NEMA ICS 1-111A or IEC 664A.



WARNING

HAZARDOUS VOLTAGE.

Omegapak Class 8803 Type P drive controllers are open style devices and must be mounted in a NEMA Type 12 enclosure or equipment room with a controlled environment relatively free of contaminants.

Failure to observe this precaution may cause shock or burn, resulting in severe personal injury or death!

- ❑ The controller generates heat. It must be properly ventilated when installed inside a control panel. Refer to Table 1-1 on page 10 for power dissipated.
- ❑ When several drive controllers are installed in a control panel, arrange them in a row. Stacking controllers is not recommended because the heat generated from the bottom controller may cause the ambient temperature of the top controller to rise, causing an overtemperature trip.
- ❑ Voltage and frequency specifications of the input line must match the drive controller configuration.
- ❑ A disconnect switch must be installed between the input line and controller.

Turn off all power before installing the drive controller. Place a “DO NOT TURN ON” label on the controller disconnect. Before proceeding with the installation, lock the disconnect in the open position. Depending on the model, the controller may operate on numerous voltages, frequencies and phases. Verify the AC line being connected to the controller matches the nameplate rating on the controller.

Measuring Bus Capacitor Voltage

DC bus capacitor voltage is measured between the + and - terminals of the drive controller. The DC bus capacitors are discharged slowly when input power is removed from the controller. To ensure the capacitors are fully discharged, always disconnect all power, wait 10 minutes, then test with a DC voltmeter (1000 VDC scale) before wiring, troubleshooting or working inside the drive controller. If no reading is shown on the voltmeter, reduce scale and test again.

Measuring Bus Capacitor Voltage on 1 to 40 hp Controllers

The + and - terminals are located near the bottom of 1 to 40 hp controllers (see Figure 2-1). To measure the bus capacitor voltage:

1. Disconnect all power from controller.
2. Wait 10 minutes to allow the DC bus to discharge.
3. Set the voltmeter to the 1000 VDC scale. Measure the bus capacitor voltage between the + and - terminals to verify the DC voltage is zero. **Do not short across capacitor terminals with voltage present!**
4. If the bus capacitors are not fully discharged, contact your local Square D representative – **do not operate the controller.**

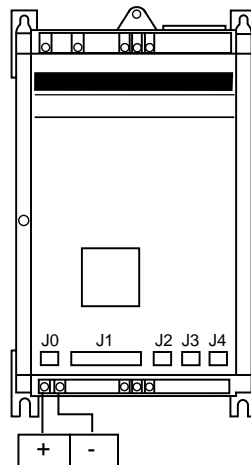


Figure 2-1 Measuring DC Bus Voltage on 1 to 40 hp Controllers

Measuring Bus Capacitor Voltage on 50 to 125 hp Controllers

The + and - terminals are located behind the top panel of 50 to 125 hp controllers (see Figure 2-2). To measure the bus capacitor voltage:

1. Disconnect all power from controller.
2. Wait 10 minutes to allow the DC bus to discharge.
3. Carefully remove the front cover from the controller. **Hazardous voltage may still be present! Do not touch any components!**
4. Set the voltmeter to the 1000 VDC scale. Measure the bus capacitor voltage between the + and - terminals to verify the DC voltage is zero. **Do not short across capacitor terminals with voltage present!**
5. If the bus capacitors are not fully discharged, contact your local Square D representative – **do not operate the controller.**

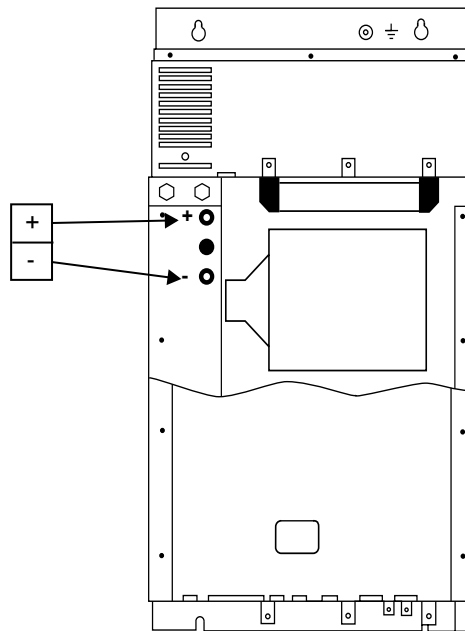


Figure 2-2 Measuring DC Bus Voltage on 50 to 125 hp Controllers

GENERAL WIRING PRACTICES

Good wiring practice requires the separation of control circuit wiring from all power (line) wiring. Power wiring to the motor must have the maximum possible separation from all other power wiring, whether from the same drive or other drives; **do not run in the same conduit.** This separation reduces the possibility of coupling electrical transients from power circuits into control circuits or from motor power wiring into other power circuits.

CAUTION

HAZARD OF PERSONAL INJURY OR EQUIPMENT DAMAGE. Follow wiring practices described in this document in addition to those already required by the National Electrical Code and local electrical codes.

Failure to observe this precaution could result in personal injury, product damage or property damage.

Follow the practices below when wiring Omegapak Type P drive controllers:

- ❑ Use metallic conduit for all controller wiring. Do not run control and power wiring in the same conduit.
- ❑ Metallic conduits carrying power wiring or low-level control wiring must be separated by at least 4 in (10 cm).
- ❑ Non-metallic conduits or cable trays used to carry power wiring must be separated from metallic conduit carrying low-level control wiring by at least 12 in (30.5 cm).
- ❑ Whenever power and control wiring cross, the metallic conduits and non-metallic conduits or trays must cross at right angles.

Branch Circuit Connections

All branch circuit components and equipment (such as transformers, feeder cables, disconnect devices and protective devices) must be rated for the maximum input current of the Omegapak Type P drive controller, not the motor full load current. The drive controller input current is stamped on the nameplate.

WARNING

HAZARD OF PERSONAL INJURY OR EQUIPMENT DAMAGE.

- Branch circuit components and equipment must be rated for the maximum drive controller rated current.
- If the system short circuit capacity (current) available at the input line terminals is larger than the nameplate rating, higher-than-rated line currents will be drawn from the input line and equipment misoperation may occur.

Failure to observe this precaution can result in severe personal injury, product damage or property damage.

In some installations, conducted emissions to the line from the controller must be attenuated to prevent interference with telecommunication, radio and sensitive electronic equipment. In these instances, attenuating filters may be required. Consult factory for selection and application of these filters.

Control Wiring Precautions

Certain control wiring precautions must be followed:

- ❑ All external devices and conductors connected to the J3 connector terminals of the drive controller or the terminals of the optional dynamic brake must be insulated for line voltage with respect to ground. All other control inputs and outputs of the controller are isolated from the input lines.
- ❑ Control wiring conductor runs must be kept short and direct. Follow the conduit and circuit separation requirements listed at the top of this page.
- ❑ Control contacts used with the controller inputs must be rated for operation at open circuit voltages and closed circuit currents of 24 VDC and 14 mADC respectively when used with the internal power supply. (Also refer to "CONTROL INPUT FUNCTIONS" on page 34.)

- ❑ Twisted cable with a pitch of 1 to 2 inches is required for analog inputs and outputs. Use of a cable shield is recommended. The shield must be terminated to ground at one end only. It is generally recommended that the shield be terminated at the controller.
- ❑ The coils of all relays and solenoids connected to the output contacts of the controller must be equipped with appropriate transient suppressors.

Output Wiring Precautions

The drive controller is sensitive to the amount of capacitance (either phase-to-phase or phase-to-ground) present on the output power conductors. If excessive capacitance is present, the controller may trip on overcurrent. Follow the guidelines below when selecting output cable:

- ❑ Cable type: the cable selected must have a low capacitance phase-to-phase and to ground. Do not use mineral impregnated cable because it has a very high capacitance. Immersion of cables in water increases capacitance.
- ❑ Cable length: the longer the cable, the greater the capacitance. Cable lengths greater than 320 ft (100 m) may cause problems.
- ❑ Proximity to other output cables: because of the high frequency switching and increased capacitance, the drive may fault under some conditions.
- ❑ Do not use lightning arrestors on output of drive controller.

For installation where cable capacitances may be a problem, an inductor installed between the controller and the motor can be utilized. See page 48 for additional information.

 CAUTION
--

CONTROLLER SWITCH FAILURE.


For proper controller electronic short circuit protection, certain values of inductance may be required in the output power wiring (see page 48 for values). Inductance can be supplied by the power wiring or auxiliary inductors.

Failure to observe this precaution could result in controller damage.

Grounding

For safe, dependable operation, drive controllers must be grounded according to National Electrical Code and all local codes. To ground the drive controller:

- ❑ Connect a copper wire from the grounding terminal to the power system ground conductor. Wire size is determined by the drive size, the National Electrical Code and local electrical codes.
- ❑ Verify that resistance to ground is one ohm or less. Improper grounding causes intermittent and unreliable operation.

 **DANGER**

HAZARDOUS VOLTAGE.

- Ground equipment using screw provided. Drive panel must be properly grounded before applying power.
- Do not use metallic conduits as a ground conductor.

Failure to observe these precautions will cause shock or burn, resulting in severe personal injury or death!

Multiple drives must be grounded as shown in Figure 2-3. Do not loop or series the ground cables.

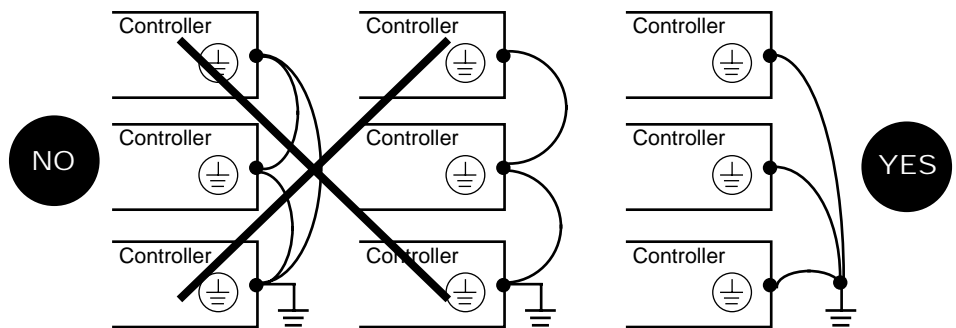


Figure 2-3 Grounding Multiple Controllers

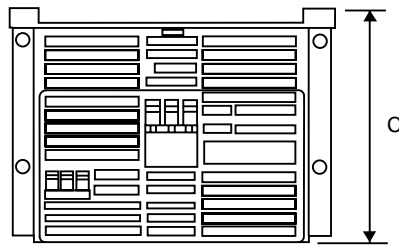
1 to 40 hp
CONTROLLERS

Table 2-1 Dimensions and Weights for 1 to 40 hp Controllers

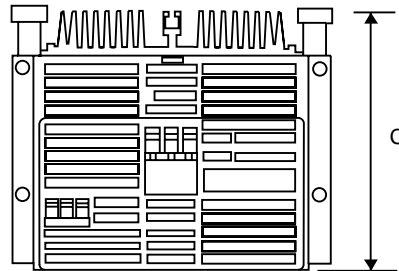
Dimensions and Weights

Drive Part No.	A in (mm)	B in (mm)	C in (mm)	G in (mm)	H in (mm)	Weight lb (kg)
PØØCO_C PØØCO_D	9.41 (239)	15.04 (382)	6.69 (170)	8.35 (212)	14.17 (360)	17.6 (8) 18.7 (8.5)
PØØCO_E PØØCO_F	9.41 (239)	15.83 (402)	7.56 (192)	8.35 (212)	14.96 (380)	24.2 (11) 25.3 (11.5)
PØØCO4G	9.41 (239)	17.4 (442)	7.56 (192)	8.35 (212)	16.54 (420)	27.5 (12.5)
PØØCO2G PØØCO2H,4H	9.21 (234)	15.94 (405)	10.55 (268)	8.19 (208)	14.17 (360)	33 (15) 33 (15)
PØØCO_J	9.21 (234)	21.85 (555)	10.55 (268)	8.19 (208)	20.08 (510)	46.2 (21)
PØØCO_K PØØCO4L PØØCO4M	9.21 (234)	23.43 (595)	10.55 (268)	8.19 (208)	21.65 (550)	51.7 (23.5) 55 (25) 55 (25)
PØØCO4N	9.21 (234)	32.28 (820)	10.55 (268)	8.19 (208)	29.53 (750)	66 (30)

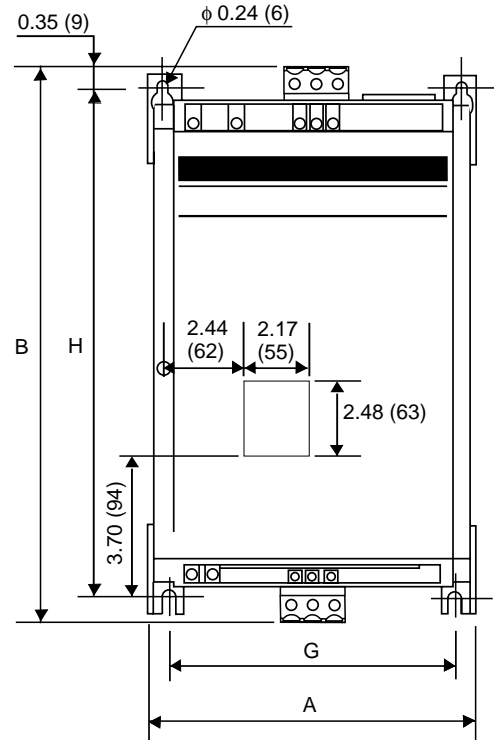
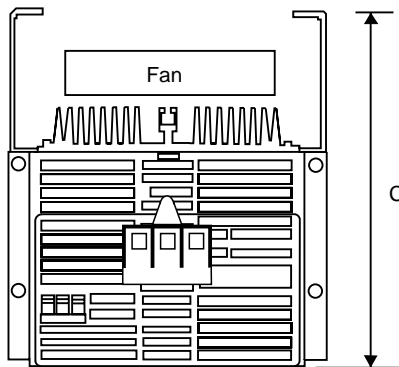
PØØCO_C
PØØCO_D



PØØCO_E
PØØCO_F
PØØCO4G



PØØCO2G
PØØCO_H
PØØCO_J
PØØCO_K
PØØCO4L
PØØCO4M
PØØCO4N



Dual Dimensions: in (mm)

Figure 2-4 Dimension Drawing for 1 to 40 hp Controllers

Mounting Precautions

WARNING

HAZARDOUS VOLTAGE.

Omegapak Class 8803 Type P drive controllers are open style devices and must be mounted in a NEMA Type 12 enclosure or equipment room with a controlled environment relatively free of contaminants.

Failure to observe this precaution may cause shock or burn, resulting in severe personal injury or death!

CAUTION

EQUIPMENT DAMAGE HAZARD.

- Mount the controller vertically.
 - Do not locate controller near heat radiating elements.
- Failure to observe this precaution could result in product damage or property damage.

Mounting in General Purpose Metal Enclosure

Degree of protection: NEMA Type 1 (IP23). When mounted in this type of enclosure, the controller must be installed in an equipment room with a controlled environment relatively free of contaminants.

To ensure adequate air flow inside the drive controller:

- Leave sufficient space around the controller: $A \geq 2$ in (50 mm), $B \geq 4$ in (100 mm), see Figure 2-5.
- Provide ventilation.
- Check that ventilation is sufficient; if not, install a cooling fan with filters.

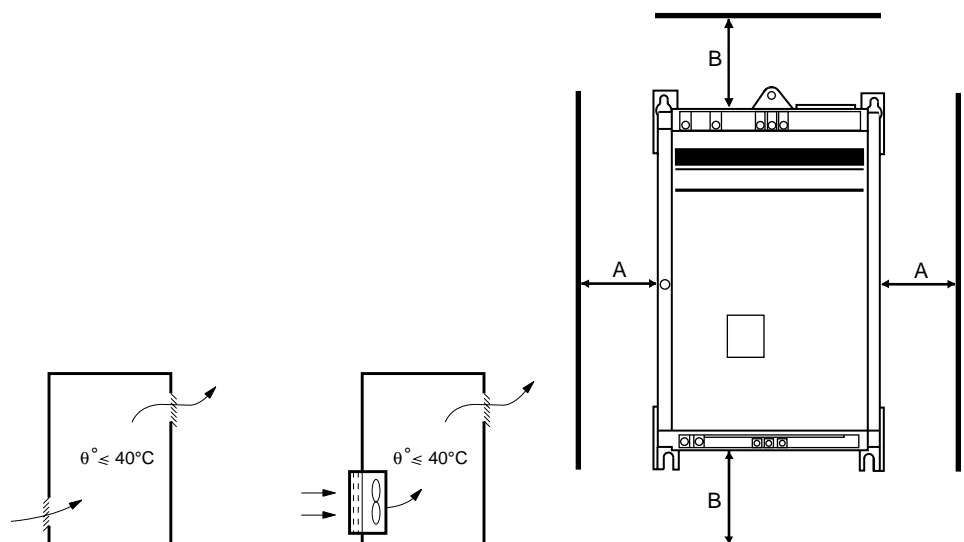


Figure 2-5 Ventilation and Clearances for 1 to 40 hp Controllers

Mounting in Dust- and Damp-Proof Metal Enclosure

Degree of protection: NEMA Type 12 (IP54)

Provide a stirring fan to circulate the air inside the enclosure and prevent hot spots in the drive controller. This allows operation of the controller in an enclosure with a maximum internal temperature of 140 °F (60 °C). Ventilation kit VY1-A05107 may be used for this purpose (page 97).

Locate the fan to ensure:

- Air movement over the control and power boards.
- Air flow inside enclosure = 200 CFM (100 dm³/s), fan mounted beneath the controller at a maximum distance of 2 in (50 mm); see Figure 2-6.

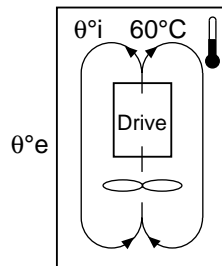


Figure 2-6 Ventilation for Dust- and Damp-Proof Enclosure

Calculating Enclosure Size for Non-Ventilated Enclosures

Below is the equation for calculating Rth (°C/W), the maximum allowable thermal resistance of the enclosure:

$$R_{th} = \frac{60 - \theta^{\circ e}}{P}$$

$\theta^{\circ e}$ = Maximum external temperature (°C)
 P = Total power dissipated in enclosure (W)

For the power dissipated by the controllers at rated load, see Table 1-1 on page 10.

Useful heat exchange surface area of a wall mounted enclosure S (in²) consists of the sides, top and front. The minimum surface area required for a controller enclosure is calculated as follows:

$$S = \frac{K}{R_{th}}$$

Rth = Thermal resistance of the enclosure (calculated previously)
 K = 300 for a painted metal enclosure

Do not use polymetric enclosures, since they have poor thermal conduction. Do not install enclosures where external heat sources can add to enclosure heat load.

Below is an example of how to calculate the enclosure size for a PØØCO4F (5 hp) mounted in a NEMA 12 enclosure with internal stirring fan.

- Maximum external temperature: 30 °C
- Power dissipated inside the enclosure: 165 W
- Maximum allowable thermal resistance:

$$R_{th} = \frac{60 - 30}{165} = 0.18 \text{ °C/W}$$

- ❑ Minimum useful heat exchange surface area:

$$\frac{300}{0.18} = 1667 \text{ in}^2$$

Useful heat exchange surface area of the proposed wall mounted enclosure:

- ❑ Height: 40 in (1016 mm)
- ❑ Width: 20 in (508 mm)
- ❑ Depth: 10 in (254 mm)

$$S = \begin{matrix} \text{front area} & \text{top area} & \text{side area} \\ \downarrow & \downarrow & \downarrow \\ (40 \times 20) & + (10 \times 20) & + 2(40 \times 10) = 1800 \text{ in}^2 \end{matrix}$$

Recess Mounting

To reduce power dissipated in the enclosure, the drive controller can be recess mounted in the back of the enclosure, with the heat sink on the outside. This arrangement necessitates a cut-out and a gasket kit (see "MOUNTING IN DUST- AND DAMP-PROOF METAL ENCLOSURE" on page 96). To obtain a temperature that does not exceed 140 °F (60 °C), the air inside the enclosure must be stirred by the addition of a fan with a flow rate of 100 CFM (44 dm³/s).

The minimum metal enclosure dimensions enabling the mounting of one drive controller with an internal fan in an external ambient air temperature less than 86 °F (30 °C) are given in Table 2-2 below:

Table 2-2 Minimum Metal Enclosure Dimensions

Gasket Kit Part No.	Drive Part No.	H in (mm)	W in (mm)	D in (mm)	Pi ^[1] (W)
VY1-A451U1501	PØØCO_C	19.69 (500)	11.81 (300)	7.87 (200)	70
	PØØCO_D	19.69 (500)	15.75 (400)	9.84 (250)	85
VY1-A451U4001	PØØCO_E	19.69 (500)	15.75 (400)	9.84 (250)	85
	PØØCO_F	23.62 (600)	15.75 (400)	9.84 (250)	105
VY1-A451U7501	PØØCO_G	23.62 (600)	15.75 (400)	9.84 (250)	120
	PØØCO2H,4H	23.62 (600)	15.75 (400)	9.84 (250)	80
VY1-A451D1101	PØØCO_J	27.56 (700)	19.69 (500)	9.84 (250)	95
VY1-A451D1501	PØØCO_K	27.56 (700)	19.69 (500)	9.84 (250)	110
	PØØCO4L	27.56 (700)	19.69 (500)	9.84 (250)	130
	PØØCO4M ^[2]	27.56 (700)	19.69 (500)	9.84 (250)	130
VY1-A451D3001	PØØCO4N ^[2]	35.43 (900)	27.56 (700)	11.81 (300)	150

^[1] Pi = power dissipated in the enclosure by a recess mounted drive controller.

^[2] Gasket kit does not maintain dust- and damp-proof integrity of interior of 30-40 hp drive controller enclosures (bus capacitors protrude through heat sink).

50 to 125 hp
CONTROLLERS

Dimensions And Weights

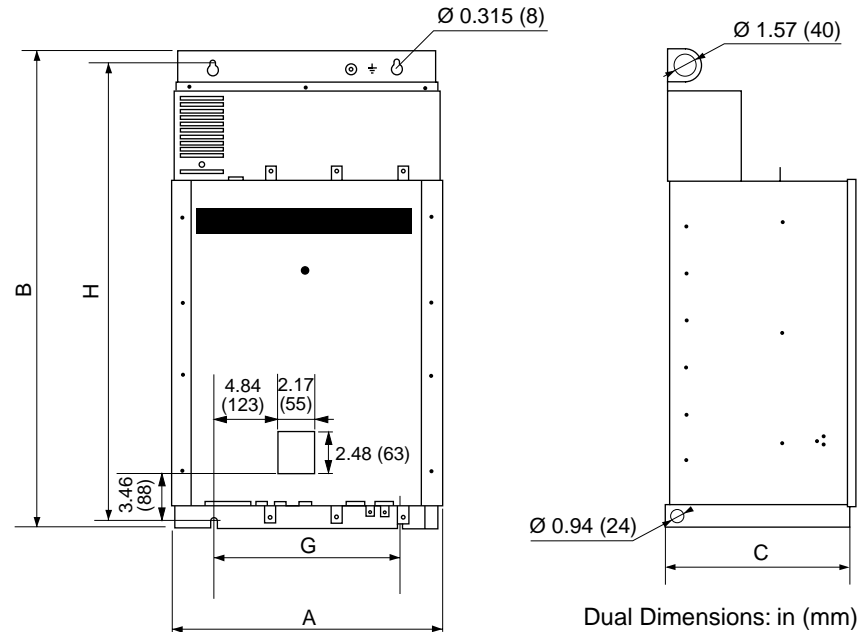


Figure 2-7 Dimension Drawing for 50 to 125 hp Controllers

Table 2-3 Dimensions and Weights for 50 to 125 hp Controllers

Drive Part No.	A in (mm)	B in (mm)	C in (mm)	G in (mm)	H in (mm)	Weight lb (kg)
PØØCO4P	19.06 (484)	33.86 (860)	13.78 (350)	13.19 (335)	32.28 (820)	189 (86)
PØØCO4R	19.06 (484)	40.94 (1040)	13.78 (350)	13.19 (335)	39.37 (1000)	231 (105)
PØØCO4S	23.42 (595)	46.77 (1188)	14.37 (365)	17.52 (445)	45.67 (1160)	308 (140)
PØØCO4T	23.42 (595)	46.77 (1188)	14.37 (365)	17.52 (445)	45.67 (1160)	308 (140)

Drive Controller Ventilation

The Omegapak Type P drive controller is forced air cooled. A tangential fan is placed in the upper part of the controller (see Figure 2-8) and is protected by a perforated cover. The fan draws in the ambient air and expels it vertically from top to bottom over the heat sink fins, which hold the power components. When mounting the controller, be sure the air inlets and outlets are not obstructed.

Fan characteristics:

- ❑ Flow rate: 450 CFM (210 dm³/s)
- ❑ Supply: from the control voltage
- ❑ Controlled by a thermal sensor attached to the heat sink. Thermal sensor closes when the temperature reaches 122 °F (50 °C) and opens when the temperature falls to 86 °F (30 °C).

Thermal protection of the drive controller is ensured by another thermal sensor attached to the heat sink, which opens when the temperature reaches 167 °F (75 °C). When this contact opens:

- ❑ Drive controller locks and fault code **hF** appears on dialog unit display.
- ❑ Ventilation system continues operating if control supply is maintained, enabling controller to be rapidly cooled down.

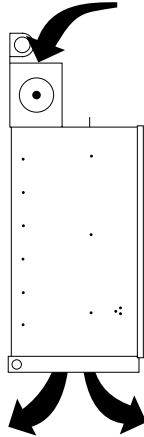


Figure 2-8 Ventilation for 50 to 125 hp Controllers

Mounting Precautions

WARNING

HAZARDOUS VOLTAGE.

Omegapak Class 8803 Type P drive controllers are open style devices and must be mounted in a NEMA Type 12 enclosure or equipment room with a controlled environment relatively free of contaminants.

Failure to observe this precaution may cause shock or burn, resulting in severe personal injury or death!

CAUTION

HAZARD OF PERSONAL INJURY OR EQUIPMENT DAMAGE.

- Mount controller vertically.
- Do not locate controller near heat radiating elements.

Failure to observe this precaution could result in personal injury or equipment damage.

Mounting in General Purpose Metal Enclosure

Degree of protection: NEMA Type 1 (IP23) When mounted in this type of enclosure, the controller must be installed in an equipment room with a controlled environment relatively free of contaminants.

To ensure adequate air flow inside the drive controller:

- Leave sufficient space around the controller: A \geq 2 in (50 mm), B \geq 4 in (100 mm), see Figure 2-5.
- Provide ventilation.
- Check that ventilation is sufficient. If not, install a cooling fan with filters.

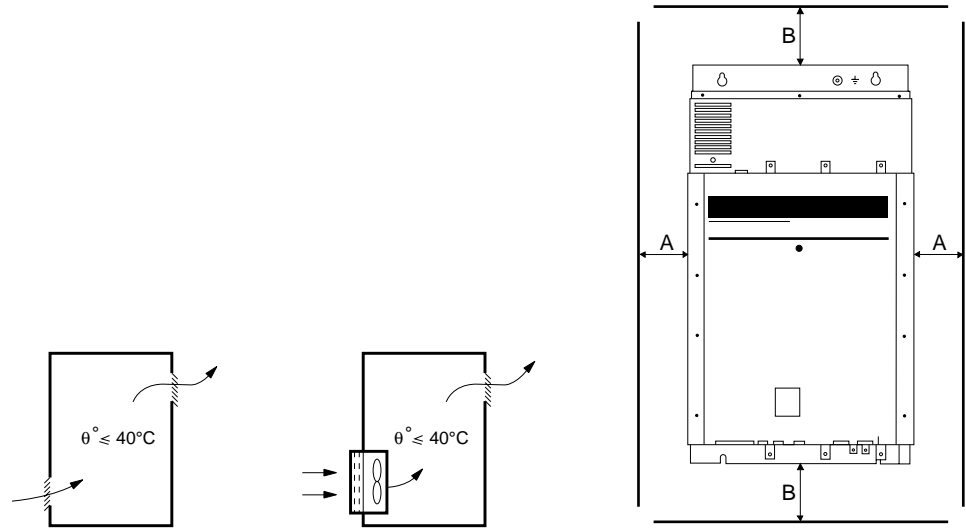


Figure 2-9 Ventilation and Clearances for 50 to 125 hp Controllers

Mounting in Dust- and Damp- Proof Metal Enclosure

Degree of protection: NEMA Type 12 (IP54)

Provide a stirring fan to circulate the air inside the enclosure and prevent hot spots on the drive controller.

- ❑ See power dissipated by drive controllers, listed in Table 1-1 on page 10.
- ❑ Refer to "Calculating Enclosure Size for Non-Ventilated Enclosures" on page 22.

TERMINAL STRIP CONNECTIONS

1 to 40 hp

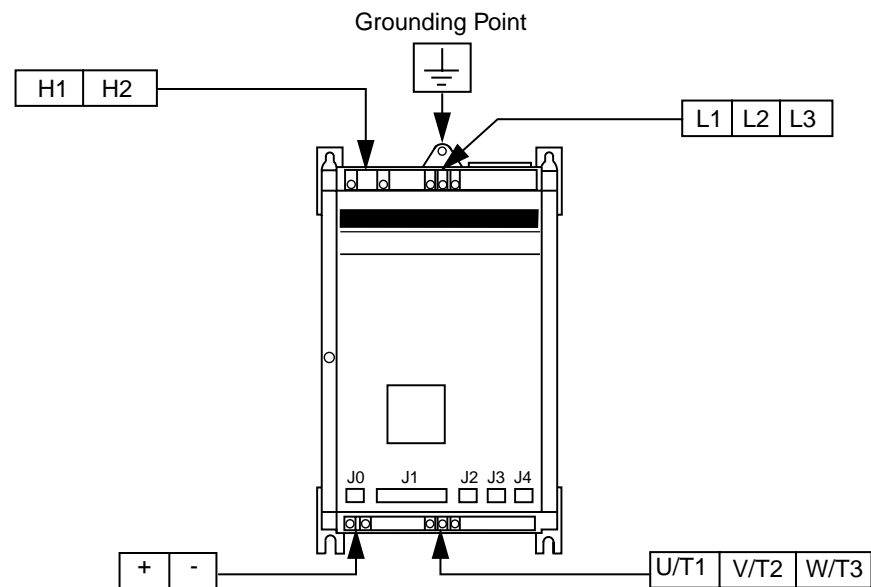


Figure 2-10 Terminal Strip Connections for 1 to 40 hp Controllers

50 to 125 hp

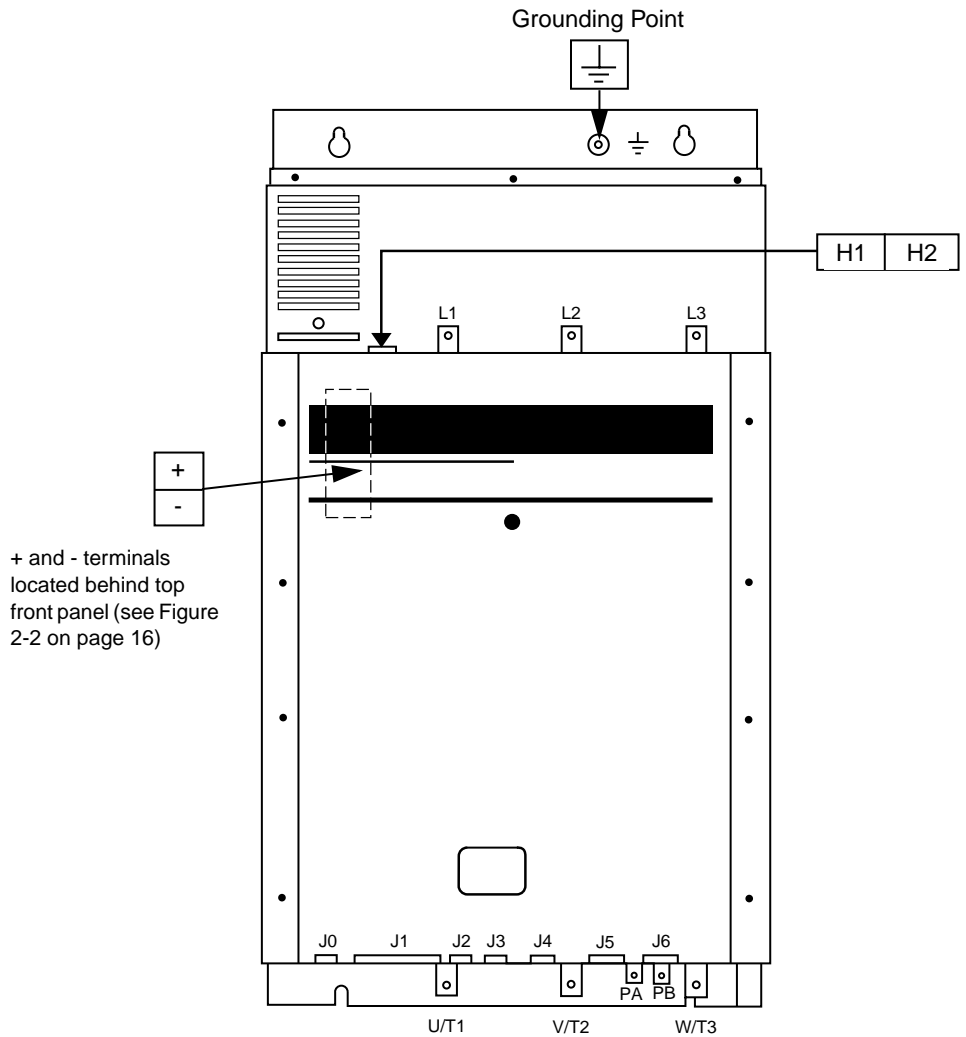


Figure 2-11 Terminal Strip Connections for 50 to 125 hp Controllers

Table 2-4 Terminal Strip Characteristics for
1 to 40 hp Controllers


Jumper	Item	Function		Characteristics	
				PØØCO2_	PØØCO4_
	L1 L2 L3	3-phase power supply		230 V +10%/-15% 50/60 Hz	460 V +10%/-15% 50/60 Hz
	H1 H2	Single phase control supply		230 V	460V
	U/T1 V/T2 W/T3	Output connections to the motor		230 V @ 50/60 Hz	460 V @ 50/60 Hz
	+ -	Filtered DC voltage		290 to 435 V	550 to 800 V
J0	LI1	Logic input 1		24 V (minimum 19 V, maximum 30 V), Impedance = 1.5 kΩ	
	LI2	Logic input 2		24 V (minimum 19 V, maximum 30 V), Impedance = 1.5 kΩ	
	PL	Control inputs supply		24 V, Is = 40 mA maximum	
J1	OE1	Speed reference		0V	
	E1	Input 1 - Speed reference voltage		0 - 10 V, Impedance = 28 kΩ	
	P10	Output voltage		10 V, Is = 10 mA	
	E2	Input 2 - Speed reference voltage		0 - 10 V, Impedance = 28 kΩ	
	EC	Input 3 - Speed reference current		0 - 20 mA, 4 - 20 mA, Impedance = 100 Ω	
	A01	Analog output 1		0 - 20 mA, 10 V maximum	
	A02	Analog output 2		0 - 20 mA, 10 V maximum	
	PL NL FW RV DCB	Control inputs supply Negative supply Forward control input Reverse control input DC injection braking control input		24 V, Is = 60 mA maximum -15 V, Is = -10 mA maximum 24 V (minimum 19 V, maximum 30 V), Impedance = 1.5 kΩ 24 V (minimum 19 V, maximum 30 V), Impedance = 1.5 kΩ 24 V (minimum 19 V, maximum 30 V), Impedance = 1.5 kΩ	
J2	SA SB	Fault relay output		Closes when supply is switched on, opens on fault Voltage free contact (230 V, 50/60 Hz, 2 A maximum) Vmin = 10 V, Imin = 16 mA	
	SN+ OVN SGN PN	Speed signal Common Speed sign Option present	Braking and speed regulation option (page 73/page 90)	SN+ to OVN: 0 - 5 V, Impedance = 10 kΩ  DANGER NON-ISOLATED CIRCUIT. <ul style="list-style-type: none"> • Speed regulation circuits are at line voltage potential. • External devices connected to speed regulation circuits must be insulated for line voltage with respect to ground. Failure to observe this precaution will cause shock or burn, resulting in severe personal injury or death!	
J4	1	REC (current loop receiver)		Serial link for communication with DOS-compatible computer, programmable controller or terminal	
	2	RX (reception RS-232C)			
	3	TX (transmission RS-232C)			
	4	Reserved			
	5	GND (common RS-232C) and EMI-			
	6	REC+ (current loop receiver, +15 V)			
	7	Reserved			
	8	Reserved			
	9	EMI+ (current loop transmitter)			
J8		Braking and speed regulation option (page 73/page 90)		If braking option is not used, connector delivered with drive controller must be plugged into J8 to disable temperature control of braking resistor.	

Table 2-5 Terminal Strip Characteristics for
50 to 125 hp Controllers


Jumper	Item	Function	Characteristics
	L1 L2 L3	3-phase power supply	460 V +10%/-15% 50/60 Hz
	H1 H2	Single phase control supply	460V
	U/T1 V/T2 W/T3	Output connections to the motor	460 V @ 50/60 Hz
	PA PB	Braking resistance	Refer to "Selecting a Braking Resistor" on page 79.
J0	LI1 LI2 PL	Logic input 1 Logic input 2 Control inputs supply	24 V (minimum 19 V, maximum 30 V), Impedance = 1.5 kΩ 24 V (minimum 19 V, maximum 30 V), Impedance = 1.5 kΩ 24 V, Is = 40 mA maximum
J1	OE1	Speed reference	0V
	E1	Input 1 – Speed reference voltage	0 - 10 V, Impedance = 28 kΩ
	P10	Output voltage	10 V, Is = 10 mA
	E2	Input 2 – Speed reference voltage	0 - 10 V, Impedance = 28 kΩ
	EC	Input 3 – Speed reference current	0 - 20 mA, 4 - 20 mA, Impedance = 100 Ω
	A01 A02	Analog output 1 Analog output 2	0 - 20 mA, 10 V maximum 0 - 20 mA, 10 V maximum
J2	PL	Control inputs supply	24 V, Is = 60 mA maximum
	NL	Negative supply	-15 V, Is = -10 mA maximum
	FW	Forward control input	24 V (minimum 19 V, maximum 30 V), Impedance = 1.5 kΩ
	RV	Reverse control input	24 V (minimum 19 V, maximum 30 V), Impedance = 1.5 kΩ
	DCB	DC injection braking control input	24 V (minimum 19 V, maximum 30 V), Impedance = 1.5 kΩ
J2	SA SB	Fault relay output	Closes when supply is switched on, opens on fault Voltage free contact (230 V, 50/60 Hz, 2 A maximum) Vmin = 10 V, Imin = 16 mA
J3	SN+	Speed signal	SN+ to OVN: 0 - 5 V, Impedance = 10 kΩ  DANGER NON-ISOLATED CIRCUIT. • Speed regulation circuits are at line voltage potential. • External devices connected to speed regulation circuits must be insulated for line voltage with respect to ground. Failure to observe this precaution will cause shock or burn, resulting in severe personal injury or death!
	OVN	Common	
	SGN	Speed sign	
	PN	Option present	
		Braking and speed regulation option (page 73/ page 90)	
J4	1	REC (current loop receiver)	Serial link for communication with DOS-compatible computer, programmable controller or terminal
	2	RX (reception RS-232C)	
	3	TX (transmission RS-232C)	
	4	Reserved	
	5	GND (common RS-232C) and EMI-	
	6	REC+ (current loop receiver, +15 V)	
	7	Reserved	
	8	Reserved	
	9	EMI+ (current loop transmitter)	

Table 2-5 Terminal Strip Characteristics for
50 to 125 hp Controllers (Cont'd)

Jumper	Item	Function	Characteristics
J5	SN+	Speed signal	NON-ISOLATED CIRCUIT. <ul style="list-style-type: none"> Speed regulation circuits are at line voltage potential. External devices connected to speed regulation circuits must be insulated for line voltage with respect to ground. Failure to observe this precaution will cause shock or burn, resulting in severe personal injury or death!
	SGN	Speed sign	
J6	PN	Option present	Voltage free contact (230 V, 50/60 Hz, 2 A max) Vmin = 10 V, Imin = 16 mA
	300 V	Tachogenerator	
	145 V		
	70 V		
10 V	Braking resistor		
0V		Optional thermal sensor	
PZ	Mechanical brake control relay		
PY			
LA			
LB			

RECOMMENDED
CIRCUIT DIAGRAM

The circuit diagram in Figure 2-12 shows how to connect a branch circuit disconnect device, protective fusing and optional line isolation contactor (KM1). The sequencing of contactor KM1 is designed for energizing and deenergizing the drive controller power circuit. Use of S1 and S2 for starting and stopping the controller may not be appropriate for all control situations. Additional sequencing logic may be required.

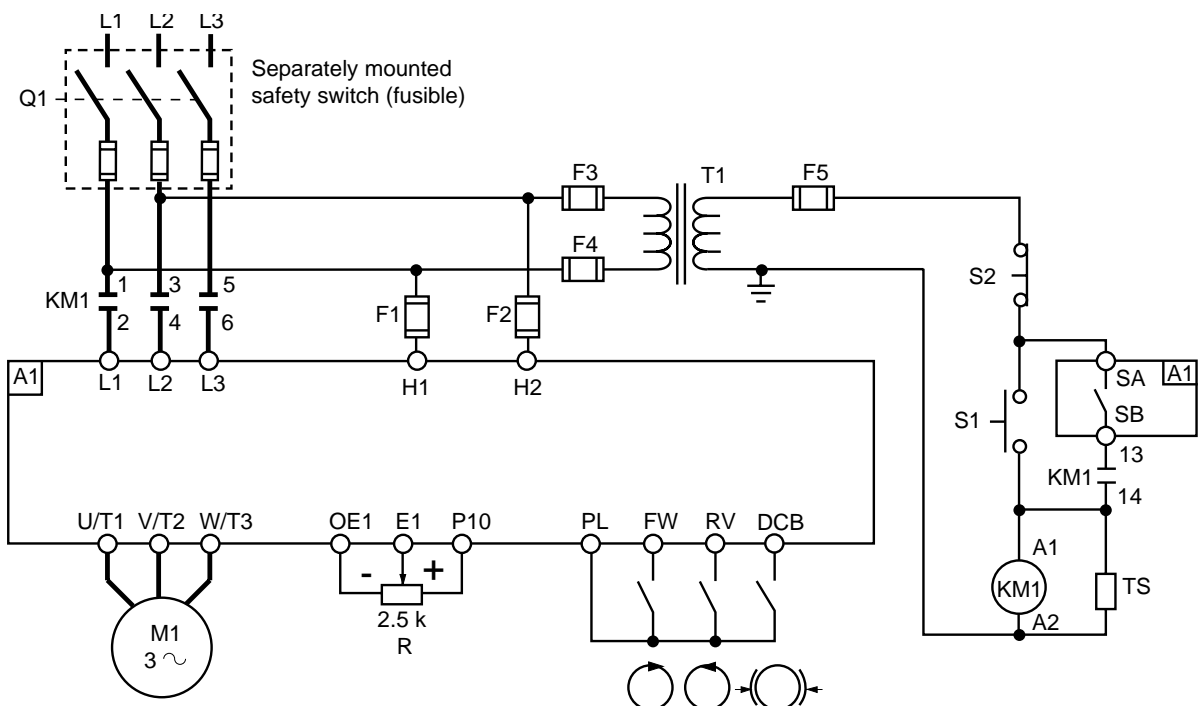


Figure 2-12 Recommended Circuit Diagram

EQUIPMENT
REQUIREMENTS

The equipment lists in the following tables are valid for both versions of the circuit diagram (see Figure 2-12 on page 30 and Figure 2-13 on page 33).

Table 2-6 Equipment Required for all Controllers

F1- F5	Fuse carriers	Class 9080 FB1611CC
R1	Potentiometer	Class 9001 K2106
S1-S2	Push buttons	Class 9001 KR1UH13
	Control station enclosure ^[1]	Class 9001 KYAF3

^[1] Accepts R1, S1 and S2.

Table 2-7 Equipment Required for 230 V Controllers

M1	Motor hp (kW)	1 (0.75)	3 (2.2)	5 (4)	7.5 (5.5)	10 (7.5)	15 (11)	20 (15)
A1	Drive	PØØCO2C	PØØCO2E	PØØCO2F	PØØCO2G	PØØCO2H	PØØCO2J	PØØCO2K
Q1	Safety switch (fusible)	Class 3110 H321N		Class 3110 H322N			Class 3110 H323N	
	+ 3 fuses ^[1]	KTN-R-8	KTN-R-20	KTN-R-35	KTN-R-40	KTN-R-50	KTN-R-80	KTN-R-100
KM1	Contactor	Class 8502 PC3.10EV02	Class 8502 PD3.10EV02	Class 8502 PF1.11V02		Class 8502 PF3.11V02	Class 8502 PG1.11V02	Class 8502 PG3.11V02
		Class 9999 PZV250	Class 9999 PRV250	Class 9999 PSF220				
T1	Transformer	Class 9070 K50D1		Class 9070 K75D1			Class 9070 K150D1	
F1, F2	Control fuses ^[1]	FNQ-R-1.0						
F3, F4	Control fuses ^[1]	FNQ-R-1/4		FNQ-R-1/2			FNQ-R-8/10	
F5	Control fuse ^[1]	FNQ-R-1/2		FNQ-R-3/4			FNQ-R-1.5	

^[1] Bussman (or equivalent).

Table 2-8 Terminal Wire Range for 230 V Controllers

Terminals	Drive Part No.	Max. Wire Size ^[1]		Required Terminal Torque lb-in
		AWG	mm ²	
H1,H2	All ratings	14	2.5	
PL,FW,RV,DCB,SA,SB OE1,E1,P10,E2,EC	All ratings	18	1	
L1,L2,L3,U/T1,V/T2,W/T3	PØØCO2C	8	10	15
	PØØCO2E	8	10	15
	PØØCO2F,2G	8	10	15
	PØØCO2H ^[2]	8	10	15
	PØØCO2J ^[2]	8	10	15
	PØØCO2K ^[2]	8	10	15

^[1] 60/75 °C copper only.

^[2] Controller shipped with terminal adaptor that accepts AWG 4 wire max. (part no. LA9Z960).

Table 2-9 Equipment Required for 1 to 40 hp 460 V Controllers

M1	Motor hp (kW)	1 (0.75)	2 (1.5)	3 (2.2)	5 (4)	7.5 (5.5)	10 (7.5)	15 (11)	20 (15)	25 (18.5)	30 (22)	40 (30)	
A1	Drive PØØCO	4C	4D	4E	4F	4G	4H	4J	4K	4L	4M	4N	
Q1	Safety switch (fusible)	Class 3110 H361						Class 3110 H362		Class 3110 H363			
	+ 3 fuses ^[1]	KTS-R-4	KTS-R-6	KTS-R-10	KTS-R-15	KTS-R-20	KTS-R-25	KTS-R-40	KTS-R-50	KTS-R-70	KTS-R-80	KTS-R-100	
KM1	Contactor	Class 8502 PC3.10EV02		Class 8502 PD2.10EV02	Class 8502 PD3.10EV02	Class 8502 PE4.10EV02	Class 8502 PF1.11V02	Class 8502 PF3.11V02	Class 8502 PG1.11V02	Class 8502 PG3.11V02			
TS	Suppressor	Class 9999 PZV250			Class 9999 PRV250			Class 9999 PSF220					
T1	Transformer	Class 9070 K50D1						Class 9070 K75D1		Class 9070 K150D1			
F1, F2	Control fuses ^[1]	FNQ-R-1.0											
F3, F4	Control fuses ^[1]	FNQ-R-1/4								FNQ-R-1/2			
F5	Control fuse ^[1]	FNQ-R-1/2					FNQ-R-3/4			FNQ-R-1.5			

^[1] Bussman (or equivalent).

Table 2-10 Equipment Required for 50 to 125 hp 460 V Controllers

M1	Motor hp (kW)	50 (37)	75 (55)	100 (75)	125 (90)
A1	Drive	PØØCO4P	PØØCO4R	PØØCO4S	PØØCO4T
Q1	Safety switch (fusible)	Class 3110 H364		Class 3110 H365	
	+ 3 fuses ^[1]	KTS-R-125	KTS-R-175	KTS-R-225	KTS-R-250
KM1	Contactor	Class 8502 PJ1.11V02	Class 8502 PJ3.11V02	Class 8502 PK1.11V02	
TS	Suppressor	Class 9999 PSJ220			
T1	Transformer	Class 9070 K200D1		Class 9070 K250D1	
F1, F2	Control fuses ^[1]	FNQ-R-3.0			
F3, F4	Control fuses ^[1]	FNQ-R-1/2		FNQ-R-3/4	
F5	Control fuse ^[1]	FNQ-R-2.0		FNQ-R-2.5	

^[1] Bussman (or equivalent).

Table 2-11 Terminal Wire Range for 460 V Controllers

Terminals	Drive	Max. Wire Size ^[1]		Mounting Screw ^[2]	Req'd Terminal Torque lb-in
		AWG	mm ²	mm	
H1,H2	All ratings	14	2.5		
PL,FW,RV,DCB,SA,SB OE1,E1,P10,E2,EC	All ratings	18	1	N/A	
L1,L2,L3,U/T1,V/T2,W/T3,+,-	PØØCO4C,4D	8	10	N/A	15
	PØØCO4E	8	10	N/A	15
	PØØCO4F,4G	8	10	N/A	15
	PØØCO4H	8	10	N/A	15
	PØØCO4J,4K	8	10	N/A	15
	PØØCO4L ^[3] ,4M ^[3]	8	10	N/A	15
	PØØCO4N	2	30	N/A	30
	PØØCO4P	N/A	N/A	20 x 3 M6 screw	
	PØØCO4R	N/A	N/A	25 x 3 M8 screw	
	PØØCO4S	N/A	N/A	25 x 3 M10 screw	
	PØØCO4T	N/A	N/A	25 x 3 M10 screw	
PA-PB	PØØCO4P,4R	N/A	N/A	15 x 3 M6 screw	
	PØØCO4S,4T	N/A	N/A	15 x 3 M6 screw	

[1] 60/75 °C copper only.

[2] Requires user-supplied wire lug.

[3] Controller shipped with terminal adaptor that accepts AWG 4 wire max. (part no. LA9Z960).

ALTERNATE CIRCUIT
 DIAGRAM

The alternate circuit diagram shown in Figure 2-13 may be used when the drive controller is connected to the load-side of an existing starter circuit. The alternate circuit minimizes modifications required to existing circuits. The circuit does have the characteristic that fault and thermal protection memory is lost if contactor KM1 deenergizes. In addition, self-diagnostics cannot be performed. Use of the fault relay (terminals SA-SB) is recommended for signalling if the drive controller locks out.

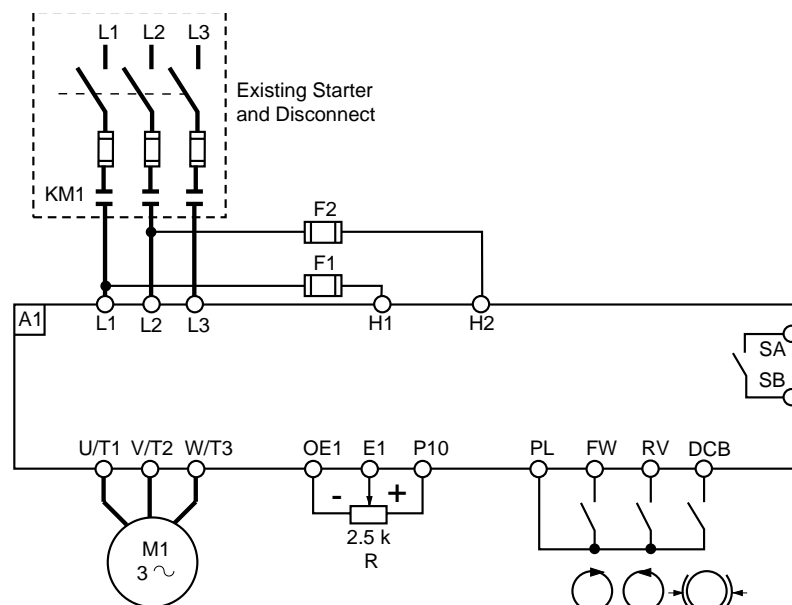



Figure 2-13 Alternate Circuit Diagram

PRECAUTIONS

 WARNING
<p>HAZARD OF PERSONAL INJURY OR EQUIPMENT DAMAGE.</p> <p>Check power connections before energizing controller. Controller will be damaged if input line voltage is applied to output terminals (U/T1, V/T2, W/T3).</p> <p>Failure to observe this precaution can result in severe personal injury, product damage or property damage.</p>

NOTE
<ul style="list-style-type: none">• Avoid switching output while controller is running.• If an output contactor is required for switching between the controller and motor, use a special timing sequence (see page 45).

Humidity

If there is a possibility of condensation, keep the control supply switched on during periods when the motor is not running or, alternatively, install anti-condensation heaters.

CONTROL INPUT
FUNCTIONS

Direction of Rotation

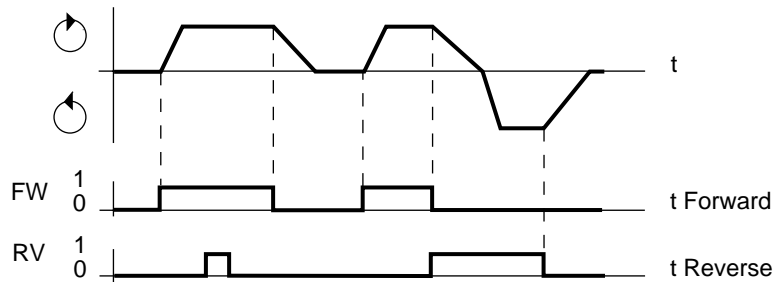


Figure 2-14 Direction of Rotation

- Direction control input selected first takes priority over the other.
- When the automatic DC injection function is selected, automatic DC injection braking will begin within 0.5 s after the drive controller output frequency drops below 1 Hz.

DC Injection Braking

WARNING

NO HOLDING TORQUE.

- DC injection braking does not provide holding torque at zero speed.
- DC injection braking does not function during loss of power or controller fault.
- When required, use separate brake function for holding torque.

Failure to observe this precaution can result in severe personal injury or equipment damage.

CAUTION

MOTOR OVERHEATING AND DAMAGE.

Application of DC injection braking for long periods of time can cause motor overheating and damage. Protect motor from extended periods of DC injection braking.

Failure to observe this precaution could result in personal injury, product damage or property damage.

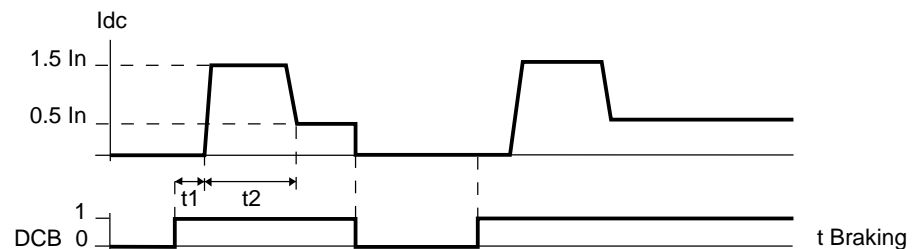


Figure 2-15 DC Injection Braking

- t_1 = time delay from 0 to 4 seconds (period determined by drive controller)
- t_2 = 3 seconds

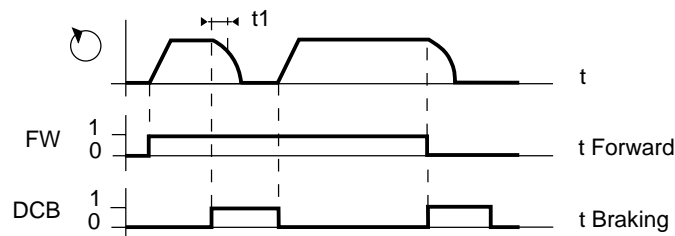


Figure 2-16 Control Circuit Priority for DC Injection Braking

- Braking control has priority over direction control signals.

Typical Braking Curves

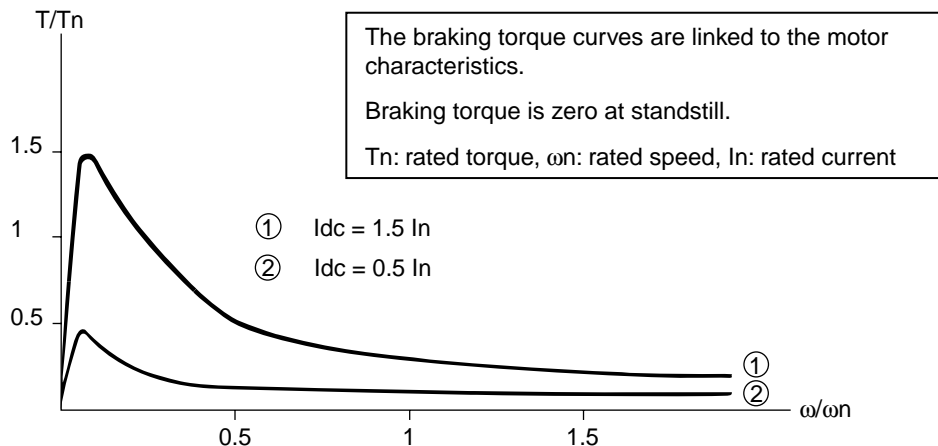


Figure 2-17 Typical Braking Curves

The DC current can be adjusted to a lower value. Refer to Chapter 6, Configuration and Adjustments.

Freewheel Stop (Coast to Stop)

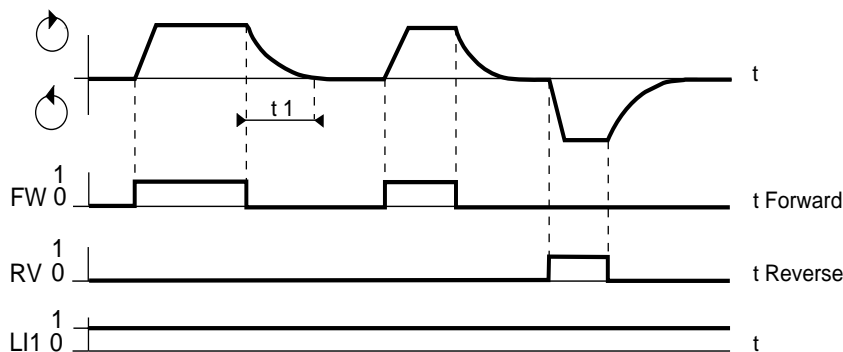


Figure 2-18 Freewheel Stop

- ❑ A freewheel stop is deceleration with no power applied to the motor (drive controller output disabled).
- ❑ t_1 depends on motor speed, machine inertia and resistive torque.

NOTE

- Restarting a coasting motor may cause controller to trip on overcurrent.
- Restarting a coasting motor may subject motor and driven load to acceleration and deceleration rates that exceed controller ramp settings.

Fast Stop

WARNING

EXTENDED STOPPING TIME.

Deceleration time during fast stop may be automatically extended depending on braking ability of controller. A dynamic brake or mechanical stopping/holding brake may be required for consistent stopping times independent of motor load conditions.

Failure to observe this precaution can result in severe personal injury, product damage or property damage.

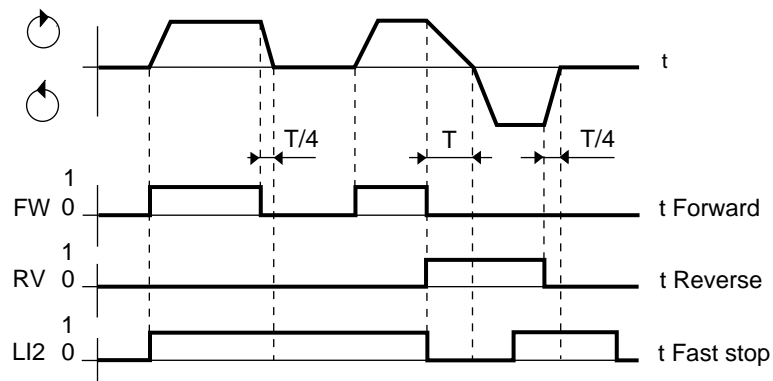


Figure 2-19 Fast Stop

Fast stop modifies the deceleration ramp setting when stop is enabled.

- Deceleration time is divided by 4 with a minimum of 0.2 s, depending on load conditions of the motor/drive controller combination.
- Input LI1 (freewheel stop) has priority over LI2 (fast stop).

Other Functions

It is possible to assign the logic inputs to functions other than those described above. Refer to Chapter 6, Configuration and Adjustments.

USING THE CONTROL
 INPUTS

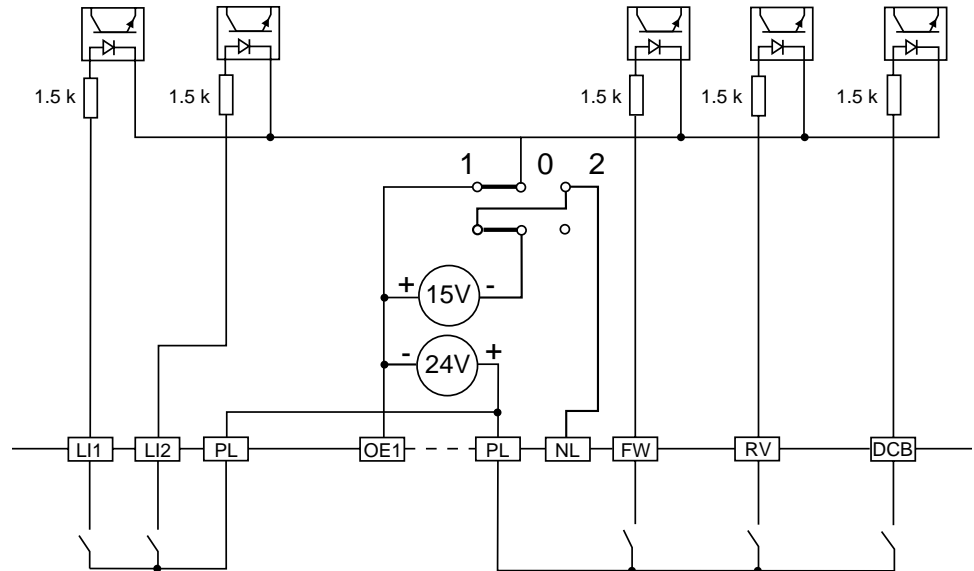


Figure 2-20 Operating from Internal Power Supply

In Figure 2-20:

- The control inputs are isolated from the input line.
- The control inputs have a common point with the reference inputs.
- Both jumpers must be to the left.

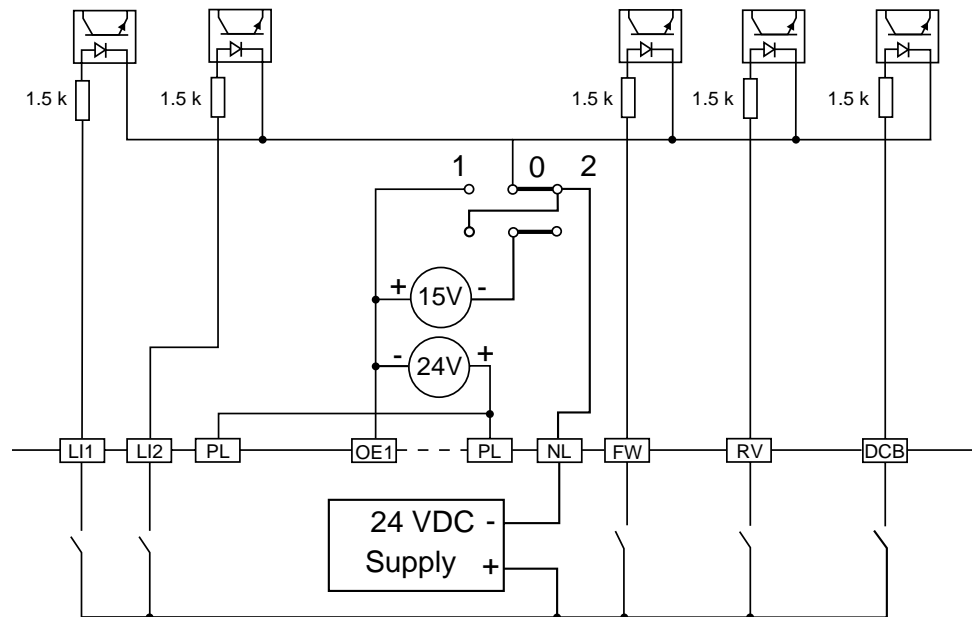


Figure 2-21 Operating from External Power Supply

In Figure 2-21:

- The control inputs are isolated from the input line.
- The control inputs are isolated from the reference inputs.
- Both jumpers must be to the right.

SPEED REFERENCE
INPUT FUNCTIONS

- ❑ The reference sets the speed of the rotating field in the motor. The actual speed remains dependent on the acceleration and deceleration ramps as well as the torque capabilities of the motor/drive controller combination.
- ❑ The resulting reference value is the algebraic sum of the different speed references applied simultaneously, within the limits of the frequency range selected.
- ❑ Speed range is limited by low and high speed threshold settings (page 62).
- ❑ Speed reference inputs are isolated from the input line.
- ❑ 10 V internal supply (terminals OE1-P10) is protected against short circuits.

USING THE SPEED
REFERENCE INPUTS

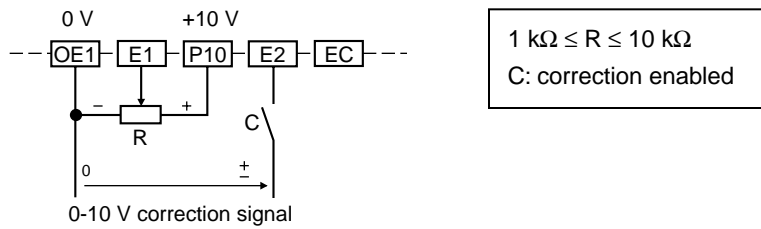


Figure 2-22 Example 1: Manual Reference with Correction Signal

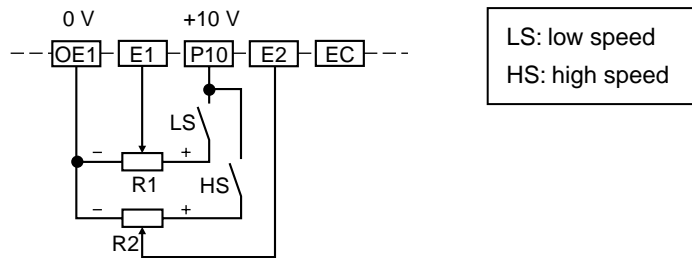


Figure 2-23 Example 2: Selection of Two Manual References

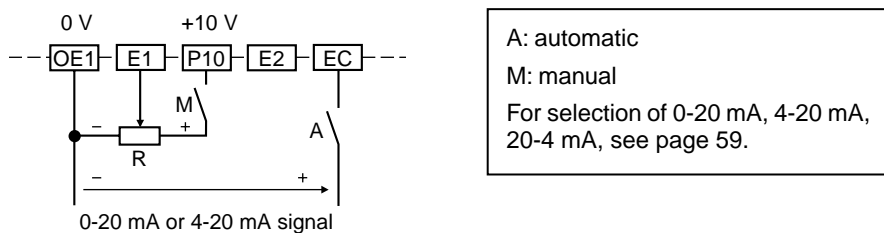


Figure 2-24 Example 3: Automatic Reference from 0-20 mA, 4-20 mA or 20-4 mA Sensor

For other uses of the speed reference inputs, refer to Chapter 6, Configuration and Adjustments.

ANALOG OUTPUTS

The drive controller has two 0-20 mA analog outputs: A01 and A02. The current supplied by these two outputs is proportional to:

- A01: motor frequency
- A02: motor current

Maximum output voltage: +10 V for a maximum impedance of 500 Ω.

Scale factor:

- A01: 20 mA corresponds to high speed (see page 62)
- A02: 20 mA corresponds to the maximum transient current of the drive (see Table 1-1 on page 10).

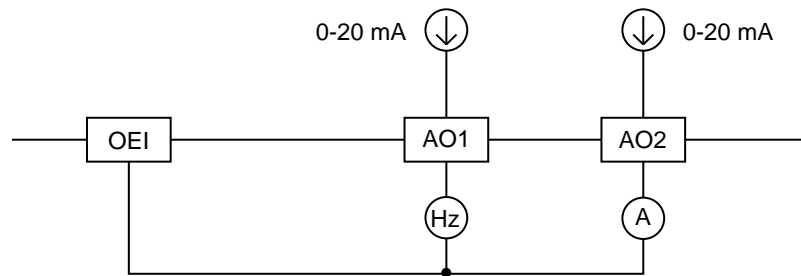


Figure 2-25 Analog Outputs

NOTE

The two analog outputs can be modified to 4-20 mA and assigned to other variables. Refer to Chapter 6, Configuration and Adjustments.

THERMAL (OVERLOAD) PROTECTION OF THE MOTOR

Indirect thermal (overload) protection of the motor is incorporated in the drive controller, taking into account:

- Current absorbed by the motor
- Motor speed (ventilation)
- Ambient air temperature of 104 °F (40 °C)

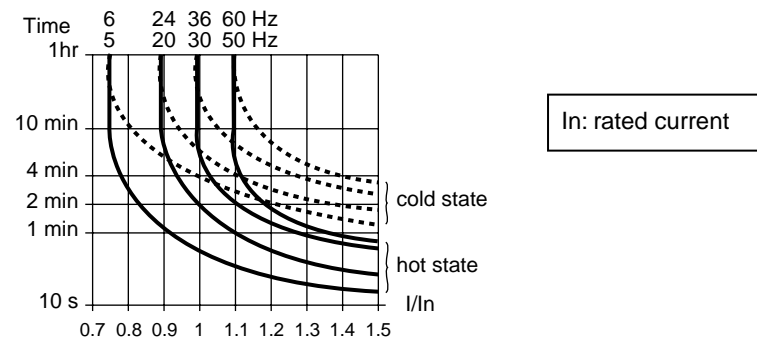



Figure 2-26 Thermal Trip Curves

To adjust the motor thermal (overload) protection, see page 64.

 CAUTION
<p>MOTOR OVERHEATING AND DAMAGE.</p> <p>This drive controller does not provide direct thermal protection for the motor. Use of a thermal sensor in the motor may be required for protection at all speeds or loading conditions. Consult motor manufacturer for thermal capability of motor when operated over desired speed range.</p> <p>Failure to observe this precaution could result in personal injury, product or property damage.</p>

INTERMITTENT DUTY

The controller can supply output current in excess of its rating for a finite duration of time. The allowable magnitude and duration of a non-periodic overload for a controller is defined by the transient output current and the thermal trip curves shown in Figure 2-26 on page 40. For this case, I_n equals the controller rated output current.

For intermittent (periodic) overloads, the controller overload period must be followed by a cool-down period as illustrated in Figure 2-27 below. The relationship between the magnitude and period of overload versus cool-down is given by the formula in Figure 2-28. The formula assumes operation at output frequencies of 50/60 Hz. For frequencies below 50/60 Hz, the rated current, I_n , must be decreased by the amount shown in Figure 2-26 to prevent tripping the thermal (overload) protection. If the thermal (overload) protection is set for a force-cooled motor, no reduction is required.

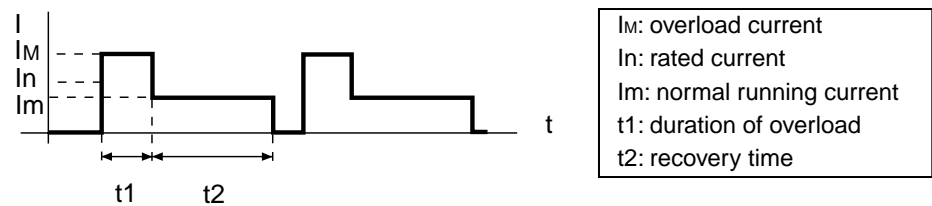


Figure 2-27 Intermittent Duty

The curves in Figure 2-28 can be used to determine the ratio between the overload duration and the operating time at 80% of the rated current at 50/60 Hz. For example, following an overload of 1.3 I_n for 10 seconds, it would require 20 seconds at 0.8 I_n to return to the previous thermal state.

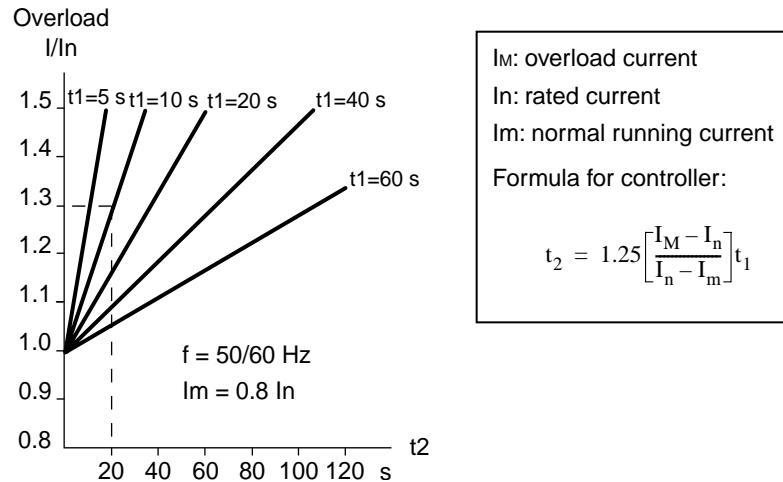


Figure 2-28 Overload Curves for Controller

If the normal running frequency is lower than 50/60 Hz, In may need to be reduced.

AVAILABLE MOTORING TORQUE

Continuous Duty

For continuous duty reduced speed applications, motor torque derating may be necessary. This derating is linked to two causes:

- ❑ Although the current waveform is very close to a sine wave, motor heating is slightly greater than that obtained by direct supply from the input line. The resulting torque derating is approximately 5%. For 1.0 service factor motors, this derating must be considered when choosing the continuous torque production capability of the motor at nameplate speed. For 1.15 service factor motors, no derating of motor continuous torque capability is required at nameplate rated speed.
- ❑ For self-ventilating motors, the ventilation produced by the internal shaft fan decreases as the speed is reduced. This necessitates derating of the maximum continuous torque capability of the motor. Generally, the required derating occurs at approximately 50% of nameplate motor speed. Since motor designs vary, the motor manufacturer should be consulted for the required derating for a specific motor.


Overtorque Capability

The driving overtorque capabilities of a given motor are determined by: the motor NEMA design category (Design B, Design D, etc.), no-load (magnetizing) current of the motor at nameplate speed, maximum transient output current of the controller and the applied V/f at reduced speed.

- ❑ For NEMA design B motors whose no-load currents are less than 58% of the motor nameplate current, the maximum overtorque capability is approximately 170% of motor rated torque with 150% of motor rated current.
- ❑ With constant V/f excitation, the motor overtorque capability begins to decrease below 50% of motor nameplate speed. To improve low speed overtorque performance, adjust $\boxed{UF_r}$.

**Overspeed Operation
($f \geq 50/60$ Hz)**

With an adjustable frequency controller, operation at speeds greater than motor nameplate speed may be possible. The following issues must be considered:


CAUTION

MACHINERY OVERSPEED.
Some motors and/or loads may not be suited for operation above nameplate motor speed and frequency. Consult motor manufacturer before operating motor above rated speed. Failure to observe this precaution could result in personal injury, product damage or property damage.

- ❑ Above some output frequency, the controller is incapable of producing additional output voltage. Generally, this frequency is 50/60 Hz. When operated in this region, the available continuous motor torque will begin to decrease along with the motor maximum overtorque capability. The motor manufacturer should be consulted concerning the continuous and overtorque torque capabilities of the particular motor.

Driving Torque Production Envelope

Figure 2-29 below illustrates typical continuous torque and overtorque driving capability for a typical NEMA Design B, 1.0 service factor motor whose no-load current is less than 58% of the motor rated current. The motor is operated with constant V/f excitation. In addition, the controller rated output current is greater than or equal to the motor nameplate current and the controller transient output current capability is no less than 150% of controller rated output current.

For 1.15 service factor motors, the continuous torque rating is 1.0 times the motor rated torque value from 50 to 100% of motor nameplate rated speed.

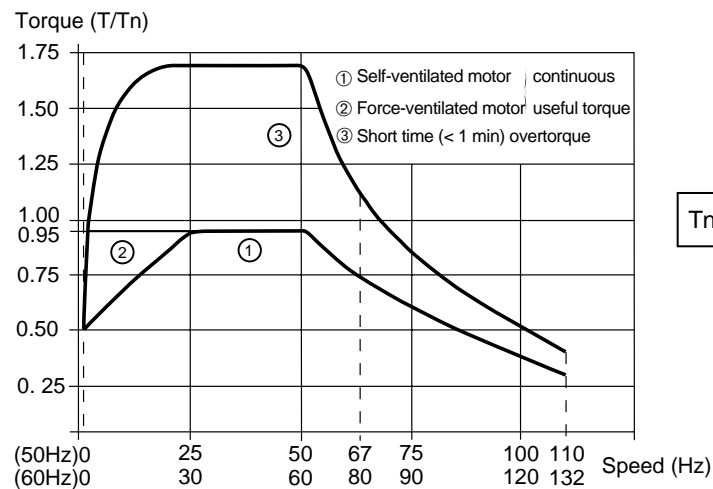


Figure 2-29 Typical Driving Torque Curves

Tn: rated torque of motor

ASSOCIATION WITH DIFFERENT MOTORS

Omegapak Type P drive controllers are designed to drive motors with a corresponding power rating. However, they can be used with motors having different power ratings as long as certain precautions are observed. Depending on the motor characteristics and performance necessary for the application, special configuration may be necessary. See Chapter 6, Configuration and Adjustments.

Omegapak Type P drive controllers are selected on the basis of required output current and power over the expected frequency range. Under no circumstances should the motor continuous power or current requirements for a given load situation exceed the drive controller's continuous output current and power rating.

When Motor Power is Less Than or Equal to Controller Rated Power

It is permissible for motor power to be less than or equal to the drive rated power. However, since compensation is not at the optimum level, this can lead to a reduction in continuous torque at low speed. Adjust the V/f ratio if necessary (page 63).

If the motor rated current is less than 50% of drive rated output current, correct adjustment of motor thermal protection is impossible (page 64) and nuisance tripping of the controller on \overline{DLF} fault may result. In this case, disable the internal protection and use standard external protection (overload relay or thermal sensor).

When Motor Power is Greater Than Controller Rated Power

Magnetizing current peaks generally limit this combination to the motor power immediately above the drive rating. Compensation is not at the optimum level, and the V/f ratio should be adjusted if necessary (page 63). The motor current must remain less than or equal to the drive controller's rated current. In addition, the power required by the load should not exceed the power rating of the controller. If necessary, install a three-phase inductor between the drive controller and the motor (page 48).

Motors in Parallel

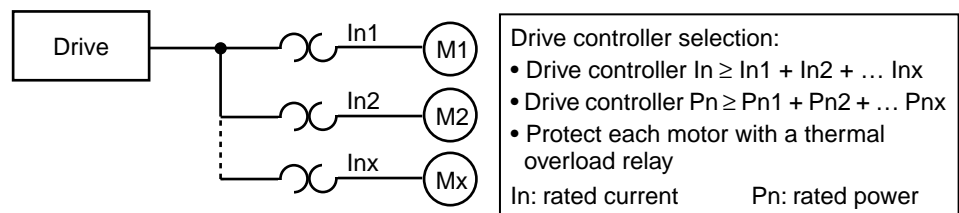


Figure 2-30 Motors in Parallel

When motors are in parallel, compensation is not at the optimum level. Adjust the V/f ratio if necessary (page 63). If the motors have different power ratings, the ratio adjustment can only be a compromise. If the load is to be shared between the motors, override the slip compensation (page 59).

If there are three or more motors in parallel, installation of a three phase inductor between the drive controller and the motor is recommended (page 48).

Additional Motor Connected Downstream of the Drive Controller

When connecting an additional motor, comply with the timing sequence shown in Figure 2-31:

- ❑ $t_1 = 20 \text{ ms}$
- ❑ $t_2 =$ time required for motor residual voltage to reach 10% of motor name-plate voltage.

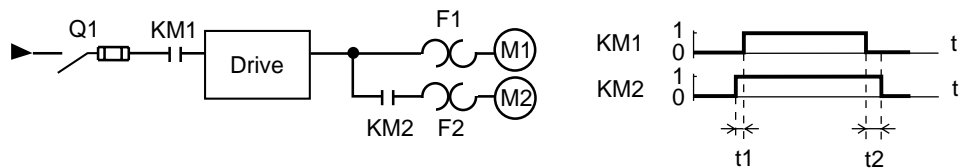


Figure 2-31 Connecting an Additional Motor

If the motor is to be connected to the controller while the controller is running, the sum of the running motor current(s) plus the expected starting current of the switched motor must not exceed 90% of the controller’s transient output current rating.

Bypassing the Drive Controller

When bypassing the drive controller or inserting an isolation contactor between the controller and motor, comply with the timing sequence shown in Figure 2-32:

- ❑ $t_1 = 20 \text{ ms}$
- ❑ $t_2 =$ time required for motor residual voltage to reach 10% of motor name-plate voltage.

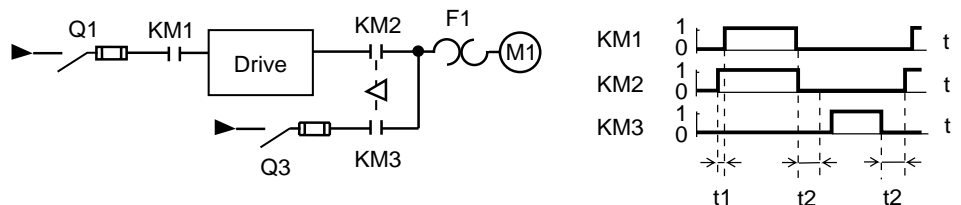


Figure 2-32 Bypassing the Drive (Direct Coupling)

Using a Brake Motor

Electric Brake Solenoid

Make sure that the brake winding is brought out to terminals, without a common point to the stator. The brake should be supplied separately at its rated voltage and switched on simultaneously with the motor.

Tapered Rotor Motor

The brake on a tapered rotor motor is released by the magnetic field of the motor. This kind of motor can be used with a frequency inverter, but requires special adjustments. Refer to Chapter 6, Configurations and Adjustments.

Using a Synchronous Permanent Magnet or Wound-Field Motor


It is possible to operate a synchronous motor as long as the following conditions are met:

- Slip compensation is overridden (see page 59).
- Internal overload protection (see page 64) is disabled and external protection (overload relay or thermal sensor) is used.
- Operation only at constant V/Hz.
- Appropriate field excitation and protection is provided for externally-excited motors.

Using a Synchronous Reluctance Motor

It is possible to operate a synchronous reluctance motor as long as the slip compensation is overridden (see page 59).

OPERATION AT
CONSTANT TORQUE IN
OVERSPEED

 CAUTION
<p>MACHINERY OVERSPEED. Some motors and/or loads may not be suited for operation above nameplate motor speed and frequency. Consult motor manufacturer before operating motor above rated speed. Failure to observe this precaution could result in personal injury, product damage or property damage.</p>

Operation is possible at constant torque in overspeed as long as the motor is reconnected for the lower voltage configuration and the V/f ratio is adjusted. For example, Figure 2-33 shows the curves for a 460 V drive connected to a 250 (Δ) / 440 V (Y) motor.

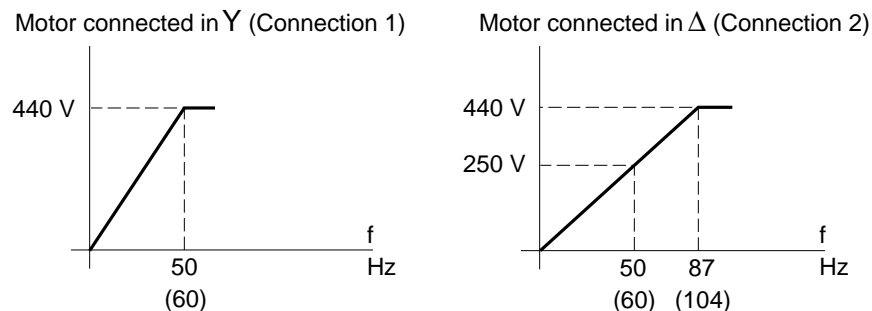


Figure 2-33 Operation at Constant Torque in Overspeed

For example, when operating a 5 hp, 1760 rpm, 7.6 A FLC (1800 rpm syn.), wye-connected, 60 Hz motor at constant torque at overspeed, the windings are reconnected in delta. The motor is now connected for 250 V, 13.2 A FLC (1.73 x 7.6 A). At 440 V, 104 Hz, the motor power capability is 9 hp (1.73 x 5 hp). Select a drive controller that supplies 13.2 A at 440 V. Therefore, a P00CO4H (10 hp, 14 A) controller is required.

Table 2-12 Possible Motor Connections for Overspeed Operation

Drive	Rated Voltage	Connection 2 / Connection 1
PØØCO2_	230 V	127 V (Δ) / 220 V (Y) 139 V (Δ) / 240 V (Y)
PØØCO4_	460 V	250 V (Δ) / 440 V (Y) 290 V (Δ) / 500 V (Y) 230 V (L) / 460 V (H)

INSTALLING THE MOTOR

Mount and connect the motor carefully, so as to eliminate any possible problems with vibrations and resonance.

Adaptation to the Motor Load

The motor/drive controller combination must be adequately rated to:

- Overcome the load torque of motor load over entire speed range used.
- Supply transient overtorque needed for required accelerations (see Figure 2-29 on page 43).

If braking is required for rapid deceleration, refer to:

- DC injection braking (page 35)
- Dynamic braking (page 73)

Depending on the type of machine load, some precautions must be taken:

- Constant torque load (conveyors): ensure that starting torque is compatible with available overtorque.
- Quadratic torque load (fans and centrifugal pumps): adjust V/f ratio (page 63) and override slip compensation (page 59). Torque increases rapidly with speed and it may be necessary to limit maximum speed to avoid exceeding capabilities of the motor-controller combination.
- Constant power load (winders): check the speed range. If torque is highest at low speed, check torque capability at lowest speed and provide forced ventilation if necessary.
- Overhauling load/high inertia: examine braking methods (page 73), and adjust if necessary (Chapter 6, Configuration and Adjustments).
- Machines with fast cycles: see Chapter 6, Configuration and Adjustments.

ADAPTATION TO THE INPUT LINE

If a suitable input line is not available, the drive controller can be supplied via a three-phase transformer or autotransformer, rated as shown in Table 2-13.

Table 2-13 Suitable Transformers

Drive	Transformer Rating	Drive	Transformer Rating	Drive	Transformer Rating
PØØCO_C	1.5 kVA	PØØCO_H	12 kVA	PØØCO4N	45 kVA
PØØCO_D	3 kVA	PØØCO_J	16 kVA	PØØCO4P	52 kVA
PØØCO_E	4 kVA	PØØCO_K	22 kVA	PØØCO4R	75 kVA
PØØCO_F	7 kVA	PØØCO4L	28 kVA	PØØCO4S	100 kVA
PØØCO_G	9 kVA	PØØCO4M	32 kVA	PØØCO4T	125 kVA

LINE INDUCTORS

Use line inductors in the following circumstances:

- Input lines subject to interference from other loads (interference, overvoltage).
- Drive controller supplied by a line with very low impedance (fed from power transformers with more than 10 times the drive power).
- Large number of adjustable frequency drives installed on the same line.

In the cases above, using line inductors provides the following advantages:

- Increased protection of input rectifier bridge against overvoltage and spikes.
- Reduction of current absorbed by drive controller at full load.
- Reduction of harmonic current load on power factor correction capacitors, when used.

Inductors Between the Drive Controller and the Motor

The addition of inductors between the drive controller and the motor is recommended in the following circumstances:

- Wire connecting drive controller and motor is longer than 320 ft (100 m).
- For PØØCO4S and 4T, if drive-motor connection wires are less than 82 ft (25 m) (to ensure protection against short circuits between output phases).
- More than three motors being controlled in parallel.
- Motor has more than six poles, with a high power factor and low stator inductance.
- Motor with a higher power rating than the controller power rating.

In the cases above, using line inductors enables reduction of:

- Values of current peaks absorbed by the motor.
- Ground leakage interference currents.
- Radio interference created by motor connection wiring.
- Vibrations and motor noise.

Recommended Three-Phase Inductors

The inductors listed in Table 2-14 can be used between the input line and drive controller and/or between the drive controller and the motor.

Table 2-14 Suitable Inductors

Inductor Characteristics		Drive	Drive Ratings	
Inductance	Amperes (continuous) [1]		Horsepower	Voltage
4.2 mH	12 A	PØØCO2C PØØCO4C,D,E,F,G	1 hp 1 to 7.5 hp	230 V 460 V
1.2 mH	35 A	PØØCO2E,F,G,H PØØCO4H,J,K	3 to 10 hp 10 to 20 hp	230 V 460 V
0.70 mH	80 A	PØØCO2J,K PØØCO4L,M,N,P,Q	15 to 20 hp 25 to 50 hp	230 V 460 V
0.30 mH	130 A	PØØCO4R,S	75 to 100 hp	460 V
0.185 mH	200 A	PØØCO4T	125 hp	460 V

[1] Continuous rms current rating. To prevent inductor saturation, inductor peak current rating must be 3 to 4 times the continuous current rating.

UNIDIRECTIONAL SPEED REGULATION

Measurement of the actual motor speed with a tachogenerator allows the speed to be regulated. In this case, automatic slip compensation (depending on the load incorporated in the drive) is cancelled and replaced by the speed regulation loop.

When the motor is used in one direction only, the tachogenerator can be connected to the drive controller via a simple adaptation circuit, as shown in Figure 2-34.

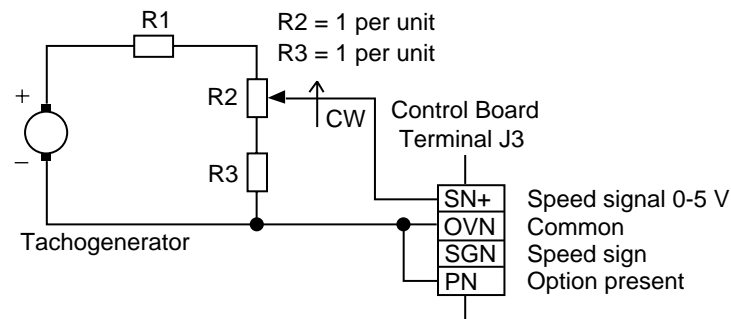


Figure 2-34 Tachogenerator Connections

Accuracy: $\pm 0.1\%$ of the maximum speed for:

- A torque variation from 0.2 T_n to T_n
- A speed range from 1 to 50/60 Hz

To calculate R1, calculate the maximum voltage provided by the tachogenerator. For example, if:

- Motor = 1500 rpm at 50 Hz
- Tachogenerator = 0.06 V/rpm
- Frequency range = 67 Hz
- Voltage = $0.06 \times 1500 \times (67 \div 50) = 120.6 \text{ V}$
- With R2 in middle position, $R1 = 1.5 \times (120.6 \div 5) - 2 = 34 \text{ per unit}$
- Let R2 = 1 k Ω , then R3 = 1 k Ω and R1 = 34 k Ω (use 33 k Ω)

Adjustments



DANGER

NON-ISOLATED CIRCUIT.

- Speed regulation circuits are at line voltage potential.
- External devices connected to speed regulation circuits must be insulated for line voltage with respect to ground.
- User-selected potentiometer must be insulated for line voltage with respect to ground.
- Potentiometer shaft and adjustment knob must be insulated from the potentiometer windings and wiper.
- Insulation system must be rated for line voltage.

Failure to observe these precautions will cause shock or burn, resulting in severe personal injury or death!



CAUTION

HAZARD OF PERSONAL INJURY OR EQUIPMENT DAMAGE.

- Comply with polarities shown for tachogenerator connections.
- SN+ terminal voltage must be $\leq +5 \text{ V}$.
- Tie PN to OVN (common).
- Use controller in the forward direction only (terminal FW).
- Connect tachogenerator using twisted.

Failure to observe this precaution could result in personal injury, product damage or property damage.

To adjust the tachogenerator circuit:

1. Remove all power and refer to Danger statement above.
2. Connect a voltmeter to the tachogenerator terminals.
3. Adjust external potentiometer to its minimum setting, fully counter-clockwise.
4. Apply power to drive controller and start motor. Verify tachogenerator polarity is correct.
5. Set the maximum speed using the speed reference potentiometer.
6. Turn external potentiometer clockwise until the corresponding voltage (calculated from example above) is obtained.

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INTRODUCTION



HAZARDOUS VOLTAGE.

- Read and understand this manual in its entirety before installing or operating Omegapak AC drive controllers. Installation, adjustment, repair and maintenance of these controllers must be performed by qualified personnel.
- Disconnect all power before servicing drive controller. WAIT TEN MINUTES until bus capacitors discharge, then measure bus capacitor voltage between + and - terminals to verify DC voltage is zero (see page 15).
- DO NOT short across capacitors or touch unshielded components or terminal strip screw connections with voltage present.
- Install all covers and close door before applying power or starting and stopping the controller.
- User is responsible for conforming to all applicable code requirements with respect to grounding all equipment. See Figure 2-10 on page 26 and Figure 2-11 on page 27 for drive controller grounding points.
- Many parts, including printed wiring boards, in this drive controller operate at line voltage. DO NOT TOUCH. Use only electrically insulated tools while making adjustments.

Before servicing controller:

- Disconnect all power.
- Place a "DO NOT TURN ON" label on the controller disconnect.
- Lock disconnect in open position.

Failure to observe these precautions will cause shock or burn, resulting in severe personal injury or death!

The Omegapak Type P drive controller is factory preset to meet the most common application requirements.

NOTE

The following conventions are used throughout this chapter:

- Preset values are marked with an asterisk (*)
- Values specific to PØØCO4_ drive controllers are marked with two asterisks (**)

Make sure the preset values are compatible with your requirements. If they are:

1. Check drive controller connections (see Figure 2-12 on page 30).
2. Close and secure all enclosures.
3. Be sure dialog unit CONFIG switch is set to 1 and AUTOEST switch is off.
4. Apply power to controller.

If the preset values are not compatible with your requirements, readjust the settings as described in this chapter. Setting controls are grouped on front of the control board and are accessible without removing the front cover by lifting the protective flap.

DRIVE CONTROLLER SETTINGS

Complete access to the control board is necessary in order to modify the position of the control jumpers (shown in Figure 3-1 below):

- ❑ Remove all power and refer to Danger statement on page 52.
- ❑ For ≤ 40 hp models: undo the quarter-turn fasteners and open the cover from the left to the right.
- ❑ For ≥ 50 hp models: remove the cover, secured at four points by captive screws.

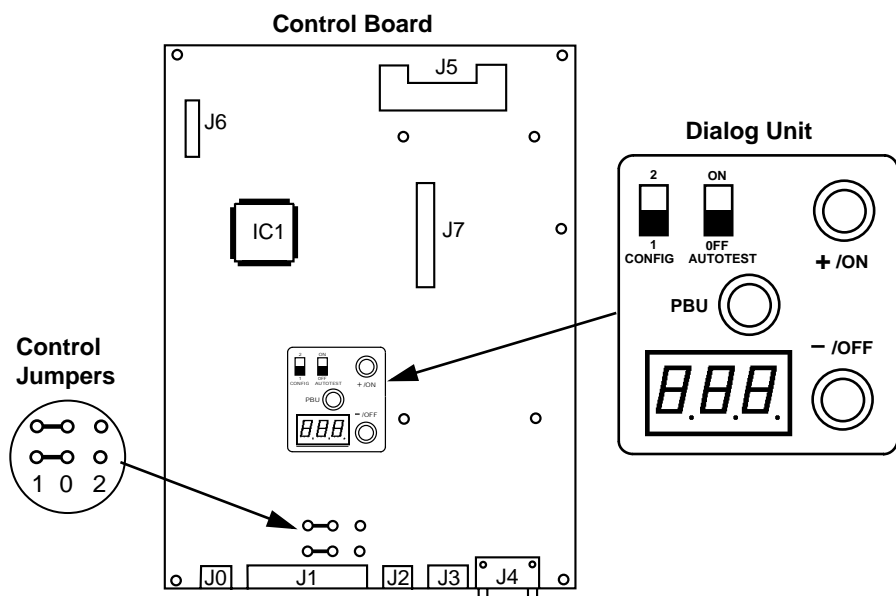


Figure 3-1 Drive Controller Settings

Control Jumpers

The control jumpers allow selection of the control inputs supply (see "USING THE CONTROL INPUTS" on page 38).

The two jumpers must be either to the left or to the right, as shown in Figure 3-2 below. After setting jumpers, reinstall all covers and close doors.

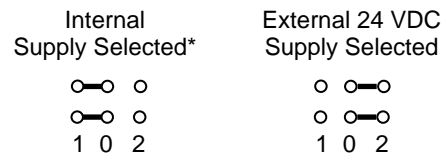


Figure 3-2 Selecting Control Inputs Supply

Dialog Unit Switches

The dialog unit has two switches, shown in Figure 3-3. The CONFIG switch enables access to the configuration parameters. The AUTOTEST switch selects the test sequence.

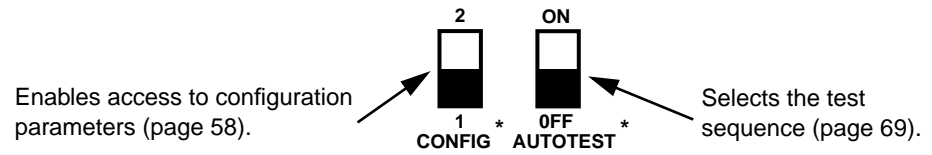



Figure 3-3 Switches on Dialog Unit

Dialog Unit Push Buttons

 **WARNING**

UNINTENDED EQUIPMENT ACTION.

- Parameter changes affect controller operation.
- Read and understand this manual before using internal keypad (dialog unit).

Failure to observe these precautions may cause severe personal injury or equipment damage.

- PBU: When this push button is pressed and released, the parameter name and then its value is displayed (see Figure 3-4). If the parameter value is already displayed, pressing and releasing this push button causes the parameter name to be displayed (see Figure 3-5). Pressing and holding this push button causes the parameter names to scroll on the display.
- +/ON: Pressing this push button allows a user to increase a parameter value or enable a function.
- /OFF: Pressing this push button allows a user to decrease a parameter value or disable a function.

Figure 3-4 shows how to change a parameter value.

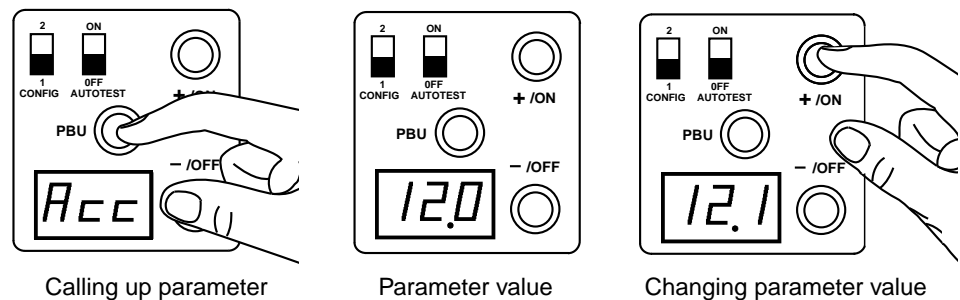


Figure 3-4 Changing a Parameter Value

Simultaneous pressing of PBU and +/ON enables scrolling of the parameters in the reverse order shown on page 56 and page 57.

When a parameter value is displayed, the nature of the parameter can be called up again by briefly pressing PBU (see Figure 3-5).

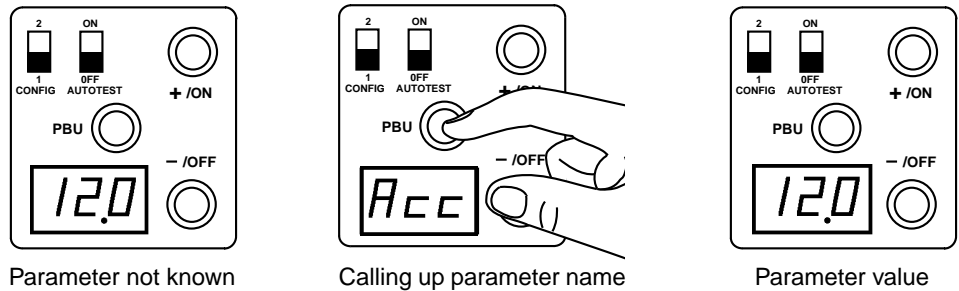


Figure 3-5 Calling up a Parameter Name

DISPLAYING SETTINGS AND ELECTRICAL VALUES

With the CONFIG selector switch in position 1, and without a push button being pressed, the displays shown below are possible.

Operation Parameters

Drive Controller Stopped

`rdy`

Drive controller ready.

`--F`

Possible fault, see Table 4-1 on page 68.

`SLC`

Controller ready with serial communication option board or commissioning software.

Drive Controller Running

`FrH` ➔ `450`

Value of the frequency reference, or another parameter selected during the previous operating period. For example:

`Lcr` ➔ `23.7` Motor Current

Other Displays Possible During Operation

`dcB`

DC braking: braking by DC injection enabled. This code shows that the braking command has been accepted.

`ObR`

Overbraking: excessive braking causes capacitor overvoltage. Increase deceleration time or install optional dynamic brake.



Display flashing: controller is operating in current limit.

Simplified Input Display

When the CONFIG selector switch is in position 1, press and hold the PBU push button to display the main operating parameters in the order shown in Figure 3-6.

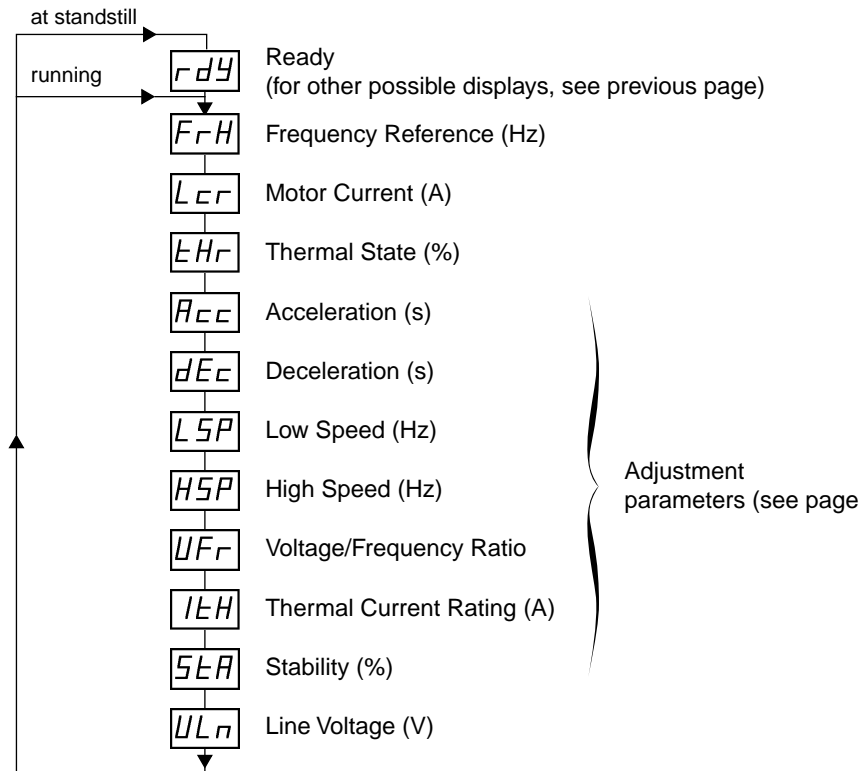
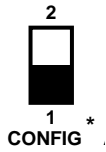


Figure 3-6 Simplified Input Display

NOTE

Value of input line voltage ULn is valid only when drive controller is in standby mode (rdy). In addition, value displayed may be incorrect if input line voltage is subject to waveform distortion.

Complete Display

To view all operating parameters, apply power to the drive controller's control circuit and move the CONFIG selector switch to position 2. Press and hold PBU to display all operating parameters in the order shown in Figure 3-7.

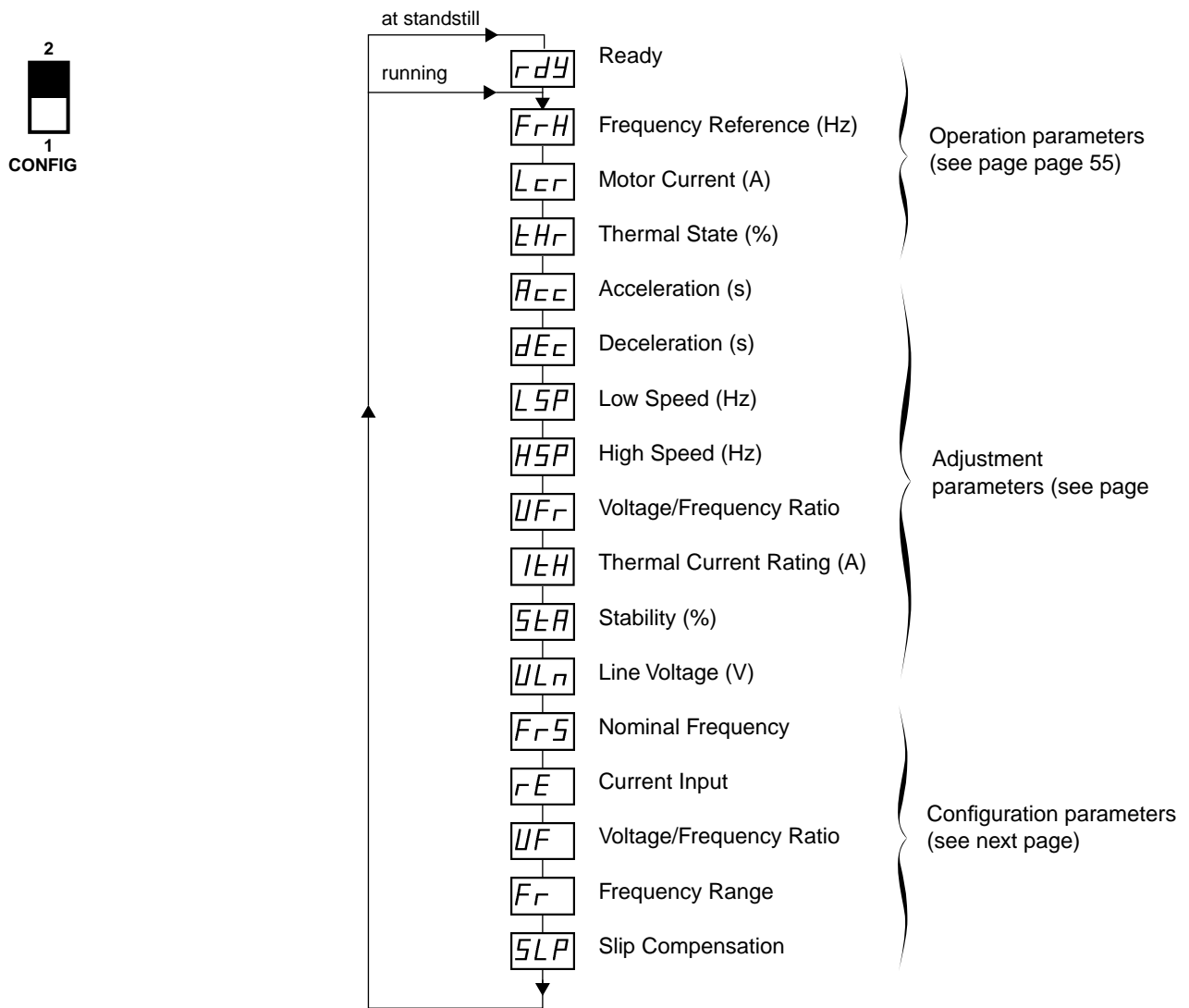


Figure 3-7 Complete Display

CONFIGURATION
PARAMETERS

**Displaying Configuration
Parameters**

Configuration parameters can be displayed at any time by putting the CONFIG selector switch in position 2. These parameters can be modified as long as the CONFIG selector switch is in position 2 when power is applied to the drive controller's control circuit. When in this mode, the controller will not start while the switch is in position 2. The serial link port is inactive in this mode.

Press and hold PBU to display the configuration parameters in the order shown in Figure 3-8.

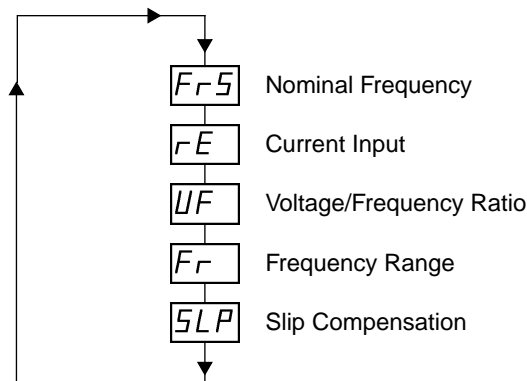
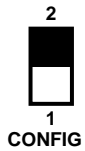


Figure 3-8 Display of Configuration Parameters

**Changing Configuration
Parameter Values**

NOTE
All configuration parameter changes are STORED in controller's permanent memory (EEPROM) when CONFIG switch is moved from position 2 to position 1.

Figure 3-9 shows how to change a configuration parameter value.

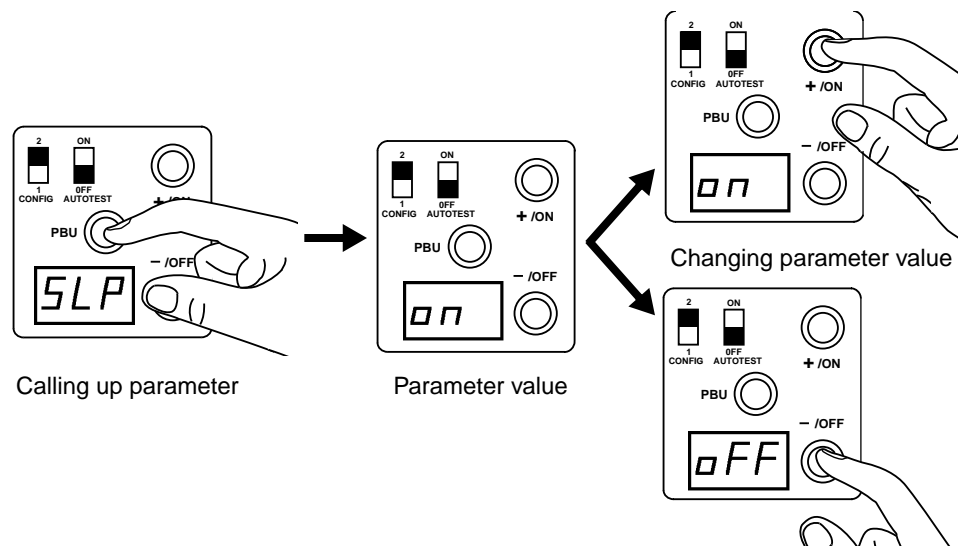


Figure 3-9 Changing Configuration Parameter Values

! WARNING
<p>UNINTENDED EQUIPMENT ACTION.</p> <ul style="list-style-type: none"> • Depending on state of controller's external inputs, controller may start when CONFIG switch is moved from position 2 to 1. • ALL external inputs to controller must be set to prevent controller operation when CONFIG switch is moved to position 1. <p>Failure to observe this precaution can result in severe personal injury or death!</p>

After changing the value of any parameter, turn the CONFIG switch to position 1 to return to the list of parameters on page 56. When the CONFIG switch is moved from position 2 to position 1, values of the configuration parameters are STORED in permanent memory (EEPROM). If value of one parameter is changed, new value is recorded in memory the moment the CONFIG switch is moved to position 1. If power is removed before value is recorded, the parameter remains unchanged.

Figure 3-10 lists the configuration parameters and their possible values. Preset values are marked with an asterisk (*). Values specific to P00CO4_ (460 V) drive controllers are marked with two asterisks (**).

Fr5	<div style="border: 1px solid black; padding: 2px; display: inline-block; margin-right: 5px;">50</div> *	Nominal motor frequency: 50 Hz
	<div style="border: 1px solid black; padding: 2px; display: inline-block; margin-right: 5px;">60</div> **	Nominal motor frequency: 60 Hz
rE	<div style="border: 1px solid black; padding: 2px; display: inline-block; margin-right: 5px;">0.20</div> *	Current reference: 0 - 20 mA
	<div style="border: 1px solid black; padding: 2px; display: inline-block; margin-right: 5px;">4.20</div>	Current reference: 4 - 20 mA
	<div style="border: 1px solid black; padding: 2px; display: inline-block; margin-right: 5px;">20.4</div>	Current reference: 20 - 4 mA
UF	<div style="border: 1px solid black; padding: 2px; display: inline-block; margin-right: 5px;">1-H</div> *	Voltage/frequency with connection 1 (high), see page 46
	<div style="border: 1px solid black; padding: 2px; display: inline-block; margin-right: 5px;">2-L</div>	Voltage/frequency with connection 2 (low), see page 46
Fr	<div style="border: 1px solid black; padding: 2px; display: inline-block; margin-right: 5px;">67</div> * or	<div style="border: 1px solid black; padding: 2px; display: inline-block; margin-right: 5px;">80.4</div> ** Maximum frequency
	<div style="border: 1px solid black; padding: 2px; display: inline-block; margin-right: 5px;">87</div> or	<div style="border: 1px solid black; padding: 2px; display: inline-block; margin-right: 5px;">104</div> or
		<div style="border: 1px solid black; padding: 2px; display: inline-block; margin-right: 5px;">110</div> or
		<div style="border: 1px solid black; padding: 2px; display: inline-block; margin-right: 5px;">120</div> or
		<div style="border: 1px solid black; padding: 2px; display: inline-block; margin-right: 5px;">132</div>
SLP	<div style="border: 1px solid black; padding: 2px; display: inline-block; margin-right: 5px;">on</div> *	Slip compensation on
	<div style="border: 1px solid black; padding: 2px; display: inline-block; margin-right: 5px;">off</div>	Slip compensation off

Figure 3-10 Configuration Parameters and Values

It may be necessary to disable slip compensation for certain applications, such as:

- Supply of synchronous or synchronous reluctance motors
- Fans and centrifugal pumps

NOTE
<p>If controller is fitted with optional Serial Communication Board (page 98), addr (address) parameter appears after parameters above. See Instruction Bulletin 50006-378-05, supplied with Serial Communication Board.</p>

Voltage/Frequency

The various voltage/frequency possibilities, dependent on the settings of parameters $\boxed{Fr5}$, \boxed{UF} and \boxed{Fr} , are given in Table 3-1 below.

Table 3-1 Voltage/Frequency Curves

$\boxed{Fr5}$	\boxed{UF}	\boxed{Fr}	Drive Controller V/F Curve ^[1]	P00C02_	P00C04_
$\boxed{50}$	$\boxed{1-H}$	$\boxed{67}$		230 V	460 V
		$\boxed{110}$		230 V	460 V
	$\boxed{2-L}$	$\boxed{87}$		230 V 127/139 V	460 V 250/290 V
		$\boxed{110}$		230 V 127/139 V	460 V 250/290 V
$\boxed{60}$	$\boxed{1-H}$	$\boxed{80.4}$		230 V	460 V
		$\boxed{132}$		230 V	460 V
	$\boxed{2-L}$	$\boxed{104}$ $\boxed{120}$		230 V: 104 Hz 127/139 V: 60 Hz	460 V: 120 Hz 230 V: 60 Hz
		$\boxed{132}$		230 V 127/139 V: 60 Hz	460 V 230 V: 60 Hz

[1] Vn: rated voltage.

ADJUSTMENT PARAMETERS

Adjustment parameters can be displayed and modified at any moment, whether the drive is running or not. The parameter values are stored in permanent memory (EEPROM).

Changing Adjustment Parameter Values

WARNING

UNINTENDED EQUIPMENT ACTION.

- Parameter changes affect controller operation.
 - Read and understand this manual before using internal keypad (dialog unit).
- Failure to observe these precautions may cause severe personal injury or equipment damage.

If a parameter is changed from the dialog unit, the new value immediately affects drive operation. The parameter is acted upon even while the display is scrolling through the adjustment range. For example, if acceleration time is modified while the controller is accelerating, a nonlinear acceleration time will result.

The new value is recorded in memory (EEPROM) in one of two ways:

1. Changes are saved if another adjustment parameter is called up (by pressing PBU).
2. There is a 10 second window that starts when the user stops making changes to adjustment parameters. If 10 seconds expires and no additional changes are made, the new values are stored in memory (EEPROM). If additional changes are made before the 10 second window elapses, the window is reset and starts again when the user stops making changes.

If power is removed from the controller before 10 seconds has elapsed, the parameter remains unchanged.

Figure 3-11 shows how to change an adjustment parameter value.

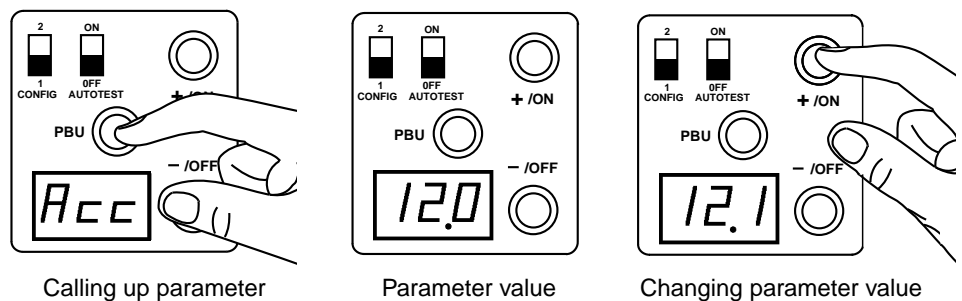


Figure 3-11 Changing an Adjustment Parameter Value

List of Adjustment Parameters

ACC

- Acceleration (0.2 to 990 s) Acceleration time is increased automatically if overtorque occurs.

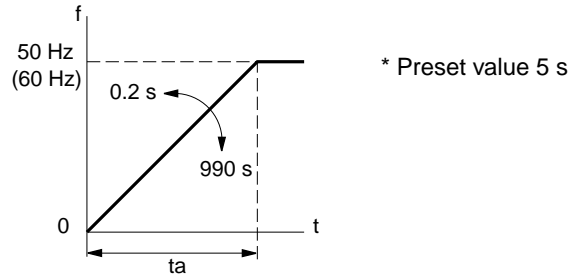


Figure 3-12 Acceleration Curve

DEC

- Deceleration (0.2 to 990 s) Deceleration time is increased automatically if excessive braking occurs (display of code **obr**).

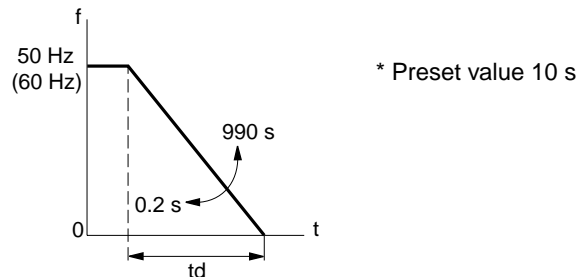
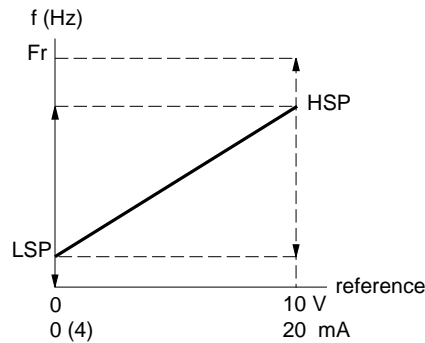


Figure 3-13 Deceleration Curve

LSP

HSP

- Low speed
- High speed



Fr: maximum selected frequency (page 59)

Figure 3-14 Frequency Curve

LSP and **HSP** scale the input range for speed references on the drive controller. **LSP** sets the minimum frequency at which a reference input can command the

drive controller to run. $\boxed{H5P}$ sets the maximum frequency at which a reference input can command the controller to run. For example, with a 0 to 10 V input, if the reference is 0 V and $\boxed{L5P} = 10$, the drive is commanded to run at 10 Hz. If the reference is 10 V and $\boxed{H5P} = 52$, the drive is commanded to run at 52 Hz.

$\boxed{L5P}$ and $\boxed{H5P}$ are not the minimum and maximum frequency clamps of the drive controller. They are the minimum and maximum output frequencies of the controller during normal, steady state operation. During transients or loss of speed feedback, the controller's output frequency is limited to ± 6 Hz of the input reference value.

With $\boxed{L5P}$ set to minimum, the absolute minimum controller speed is 1 Hz. The controller will not run with references less than 1 Hz.

The preset values are:

- $\boxed{L5P}$ minimum
- $\boxed{H5P}$ *50 Hz for PØØCO2_ (230 V)
**60 Hz for PØØCO4_ (460 V)

\boxed{UFR}

- Voltage/frequency ratio * Preset value $\boxed{n00}$: setting corresponding to most applications.

Figure 3-15 shows the V/f curve for applications needing high torque at low speed.

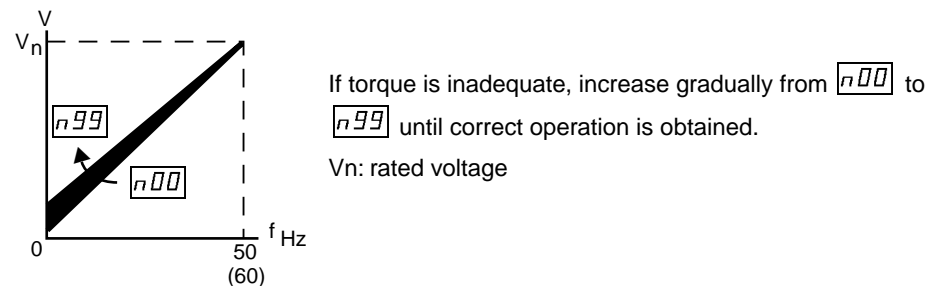


Figure 3-15 High Torque Curve

Figure 3-16 shows the V/f curve for applications with quadratic load torque, such as fans and centrifugal pumps.

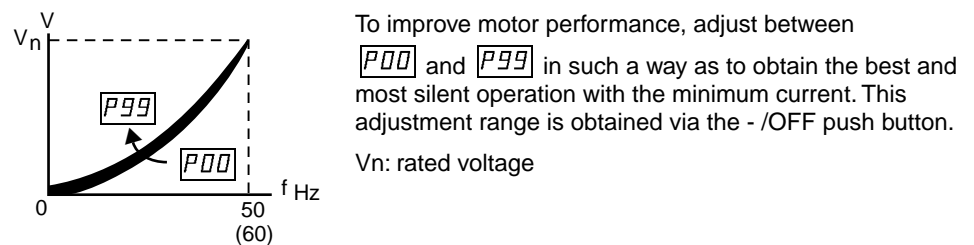


Figure 3-16 Quadratic Torque Curve

I_{LH}

- Thermal (overload) motor protection (page 40) * Preset, in units of amps, to 0.9 of the drive controller's rated current. Setting range: from 0.45 to 1.05 of controller's rated current (see Table 1-1 on page 10).

Set **I_{LH}** to the rated motor current value listed on the motor nameplate.

To disable thermal protection, press and hold the +/ON push button (increasing the value of **I_{LH}**) until the code **n_{LH}** appears.

Force-ventilated motors require special consideration to allow full utilization of motor torque capability at reduced speeds. Two alternatives are available:

- Disable the internal protection and use standard external protection (thermal sensor or thermal overload relays).
- Ensure that the thermal protection is independent of the motor speed. Refer to Chapter 6, Configuration and Adjustments.

S_{EA}

- Stability * Preset value **□**

Instability of the drive controller may be caused by the type of motor load or motor selection. Wide variations in load may cause instability. If instability occurs, increase the value of **S_{EA}** until correct operation is obtained.

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SAFETY PRECAUTIONS

Read the safety statements below before proceeding with any maintenance or troubleshooting procedures.



DANGER

HAZARDOUS VOLTAGE.

- Read and understand this manual in its entirety before installing or operating Omegapak AC drive controllers. Installation, adjustment, repair and maintenance of these controllers must be performed by qualified personnel.
- Disconnect all power before servicing drive controller. WAIT TEN MINUTES until bus capacitors discharge, then measure bus capacitor voltage between + and - terminals to verify DC voltage is zero (see page 15).
- DO NOT short across capacitors or touch unshielded components or terminal strip screw connections with voltage present.
- Install all covers and close door before applying power or starting and stopping the controller.
- User is responsible for conforming to all applicable code requirements with respect to grounding all equipment. See Figure 2-10 on page 26 and Figure 2-11 on page 27 for drive controller grounding points.
- Many parts, including printed wiring boards, in this drive controller operate at line voltage. DO NOT TOUCH. Use only electrically insulated tools while making adjustments.

Before servicing controller:

- Disconnect all power.
- Place a "DO NOT TURN ON" label on the controller disconnect.
- Lock disconnect in open position.

Failure to observe these precautions will cause shock or burn, resulting in severe personal injury or death!

PREVENTIVE MAINTENANCE

The following preventive maintenance procedures are recommended at regular intervals:

- Check the condition and tightness of the connections.
- Make sure that the ventilation is effective and that the temperature around the drive controller remains at an acceptable level.
- Remove dust and debris from the drive controller, if necessary.

If anything unusual occurs when putting the controller into service or during operation, be sure that all the recommendations relating to the environment, mounting and connecting the drive controller have been followed.

FAULT CODES

The Omegapak Type P drive controller can detect a certain number of faults and display them in the form of codes. These fault codes are listed in Table 4-1 on page 68.

Fault Storage

The first fault detected is displayed and stored if the control circuit voltage stays on. The fault relay drops out. Use of the circuit diagram shown on page 30 is recommended.

Erasing Faults

To erase a fault from memory (the fault code may be steady or flashing), remove all power from the drive controller.

















If the fault code is steady, switch the power supply back on; this erases the fault storage and resets the drive controller.

If the fault code is flashing, this indicates that the fault is still present. Find and correct the cause and wait for the code to be steady before switching the power supply back on to reset the drive controller.

Overcurrent due to Short Circuit

The fault code \overline{OCF} requires special attention. With this type of fault, it is essential to switch off the drive controller's power and control circuits and to check the connection cables and motor insulation. Carry out the self-diagnostics before resetting (page 69).

Table 4-1 Fault Codes

Code	Probable Cause	Troubleshooting Procedure
 Display off or partial display	<ol style="list-style-type: none"> 1. No control supply. 2. Control voltage too low. 	<ol style="list-style-type: none"> 1. Check control voltage, supply fuses and connections. ^[1] 2. Check H1-H2 control terminal connections.
 Phase fault	<ol style="list-style-type: none"> 1. No supply to terminals L1-L2-L3. 2. Power fuses blown. 3. Brief input line failure ($t \geq 200$ ms). 4. Internal connections. 	<ol style="list-style-type: none"> 1. Check power supply, supply fuses. 2. Reset drive controller. 3. Check connections. ^[1]
 Undervoltage	<ol style="list-style-type: none"> 1. Supply too low: PØØCO2_: $V \leq 185$ V PØØCO4_: $V \leq 380$ V 2. Temporary voltage drop ($t \geq 200$ ms). 3. Internal connections. 	<ol style="list-style-type: none"> 1. Check supply voltage. 2. Reset drive controller. 3. Check connections. ^[1]
 Overvoltage	<ol style="list-style-type: none"> 1. Supply too high: PØØCO2_: $V \geq 265$ V PØØCO4_: $V \geq 550$ V (50 Hz) PØØCO4_: $V \geq 510$ V (60 Hz) 	<ol style="list-style-type: none"> 1. Check supply voltage. 2. Check parameter  ( or ).
 Overtemperature	<ol style="list-style-type: none"> 1. Heat sink temperature too high (≥ 167 °F / 75 °C). 2. ≤ 30 kW models: J8 on power board disconnected. 3. ≥ 37 kW models: switch on measurement board in wrong position. 4. Braking resistor thermal contact tripped (see page 85). 	<ol style="list-style-type: none"> 1. Check motor load, fan and ambient temperature around drive controller. Wait for controller to cool down before resetting. 2. Check connector J8. 3. Check switch position (page 89). 4. Check dynamic brake connections. Change resistor if necessary.
 (overload)  (loss of current sensor) Motor overload	<ol style="list-style-type: none"> 1. If  $\geq 118\%$, thermal trip due to prolonged overload or phase failure. 2. If  $< 118\%$, thermal trip due to phase T1 (U) failure (≤ 30 kW models) or phase T2 (V) failure (≥ 37 kW models). 3. Motor power rating too low for application. 	<ol style="list-style-type: none"> 1. Check  setting and compare with motor In. Check load and compare with operating speed. Check braking conditions (Possibility of single phase operation). Wait approximately 7 minutes before resetting. 2. Check motor connections for open phase. 3. Verify motor and controller selection is correct for application. 4. For motors whose continuous current rating is less than 50% of drive controller current rating, see page 44.
 (overvoltage)  (overcurrent) Excessive braking	<ol style="list-style-type: none"> 1. Overvoltage or overcurrent due to excessive braking or an overhauling load (even with braking option). 	<ol style="list-style-type: none"> 1. Increase deceleration time. Add braking option if necessary. Reset is possible if : ≤ 265 V: PØØCO2_ ≤ 550 V: PØØCO4_


^[1] See Instruction Bulletin 50006-378-04 (Troubleshooting Manual).

Table 4-1 Fault Codes (Cont'd)

Code	Probable Cause	Troubleshooting Procedure
<p>[OCF] (anti-sat)</p> <p>[OCF] (bus sensor)</p> <p>Overcurrent</p>	<ol style="list-style-type: none"> 1. Short circuit or grounding on the drive controller output. 2. Internal drive fault. 3. Excessive transient operation. 4. Motor improperly applied. 	<ol style="list-style-type: none"> 1. Remove all power and control. Check connecting cables and motor insulation, with drive controller disconnected. 2. Use drive self-diagnostics. 3. Increase acceleration or deceleration time then reset drive controller. 4. Refer to "ASSOCIATION WITH DIFFERENT MOTORS" on page 44.
<p>[CrF]</p> <p>Charge relay fault</p>	<ol style="list-style-type: none"> 1. Capacitor charge relay closure control fault. 	<ol style="list-style-type: none"> 1. Check connections.^[1]
<p>[SPF] (tachogenerator adjustment potentiometer incorrectly set)</p> <p>[SPF] (tachogenerator inoperative)</p> <p>Speed fault</p>	<ol style="list-style-type: none"> 1. Speed regulation incorrectly set. 2. No tachogenerator feedback signal. 	<ol style="list-style-type: none"> 1. Reset tachogenerator adjustment potentiometer on braking option. Check motor load conditions (overhauling load). 2. Check tachogenerator wiring.
<p>[SLF]</p> <p>Serial link fault</p>	<ol style="list-style-type: none"> 1. Serial link communication fault (with communication option board). 	<ol style="list-style-type: none"> 1. Check connections between drive controller and programmable controller (or computer).
<p>[InF] (item not found)</p> <p>[InF] (AUTOTEST switch position)</p> <p>Internal fault</p>	<ol style="list-style-type: none"> 1. Internal connection fault. 2. EEPROM storage fault (operating with commissioning software). 3. AUTOTEST selector switch moved to the ON position during operation. 	<ol style="list-style-type: none"> 1. Check internal connectors, with supply switched off and capacitors discharged (at least 10 minutes, see page 15). 2. See page 104. 3. Move selector switch to OFF. Reset drive controller.

^[1] See Instruction Bulletin 50006-378-04 (Troubleshooting Manual).

SELF-DIAGNOSTICS

 WARNING
<p>HAZARD OF SEVERE PERSONAL INJURY OR EQUIPMENT DAMAGE.</p> <p>Do NOT energize input line connected to L1, L2 and L3 or move AUTOTEST switch during autotest sequence.</p> <p>Failure to observe this precaution may result in equipment damage, severe personal injury or death.</p>

The drive controller has incorporated a self-diagnostic system. It allows a user to check the main functions. To perform the self-diagnostics (autotest):

1. **Remove all power and refer to Danger statement on page 66.**
2. Disconnect U/T1, V/T2 and W/T3 leads at the controller.
3. Select the test sequence by moving the AUTOTEST selector switch on the dialog unit to ON.
4. Do not apply line power to L1, L2 or L3. Connect control power only to H1 and H2 terminals of drive controller.
5. Switch the control supply back on.

Figure 4-1 is the flowchart for the self-diagnostics.

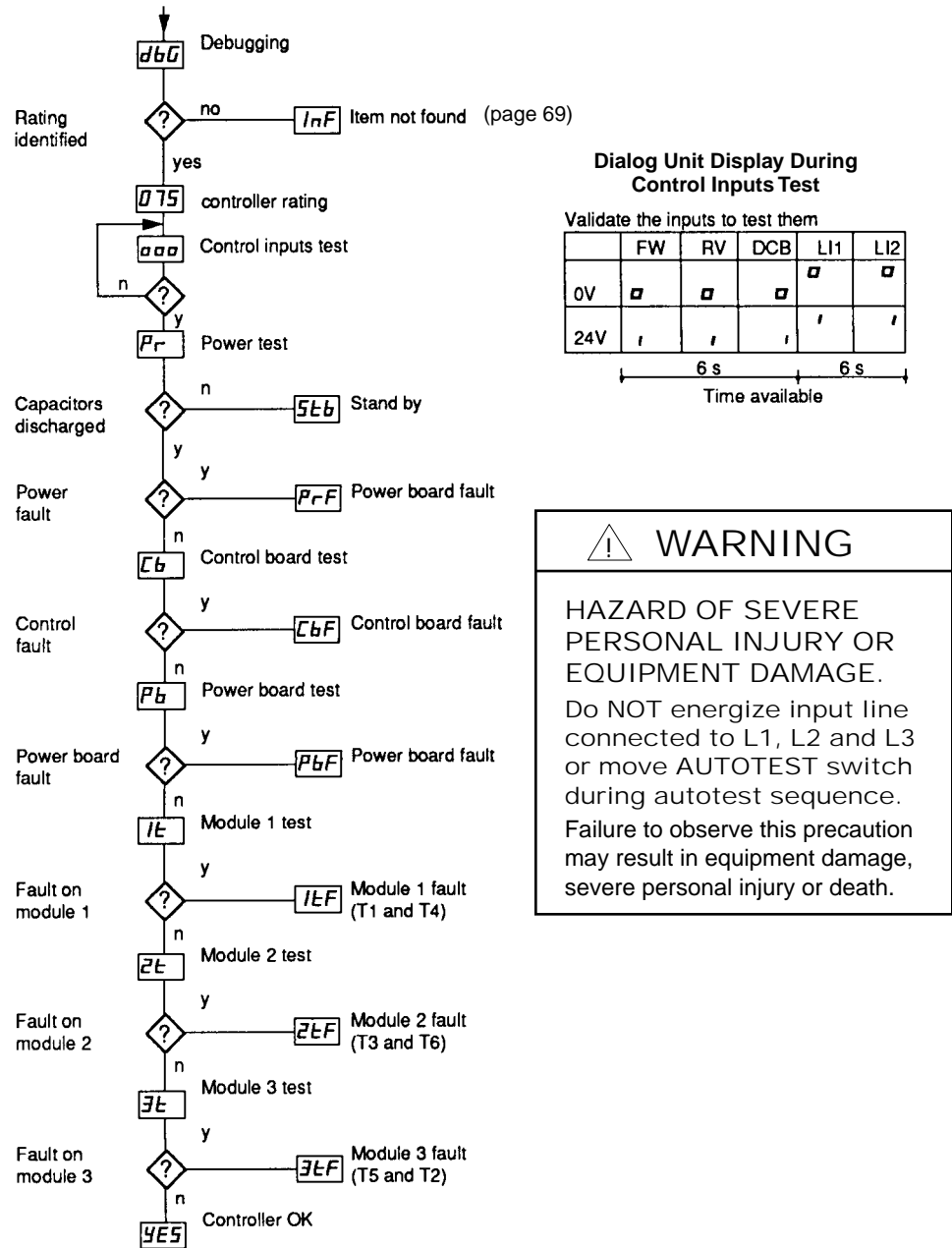


Figure 4-1 Flowchart for Self-Diagnostics

When the autotest is complete:

- ❑ Switch off the control supply to reset the test sequence to zero.
- ❑ After rectifying the fault, run a second test to check the drive controller condition.
- ❑ **Before operating the drive controller, move the AUTOTEST switch back to the OFF position before applying line power.**

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SAFETY
PRECAUTIONS

Read the safety statements below before installing any drive option.



DANGER

HAZARDOUS VOLTAGE.

- Read and understand this manual in its entirety before installing or operating Omegapak AC drive controllers. Installation, adjustment, repair and maintenance of these controllers must be performed by qualified personnel.
- Disconnect all power before servicing drive controller. WAIT TEN MINUTES until bus capacitors discharge, then measure bus capacitor voltage between + and - terminals to verify DC voltage is zero (see page 15).
- DO NOT short across capacitors or touch unshielded components or terminal strip screw connections with voltage present.
- Install all covers and close door before applying power or starting and stopping the controller.
- User is responsible for conforming to all applicable code requirements with respect to grounding all equipment. See Figure 2-10 on page 26 and Figure 2-11 on page 27 for drive controller grounding points.
- Many parts in this drive controller, including printed wiring boards, operate at line voltage. DO NOT TOUCH. Use only electrically insulated tools while making adjustments.


Before installing controller:

- Disconnect all power.
- Place a "DO NOT TURN ON" label on the controller disconnect.
- Lock disconnect in open position.

Failure to observe these precautions will cause shock or burn, resulting in severe personal injury or death!

ADAPTATION FOR
 ±10 V CONTROL

The ±10 V control module, part no. VW3-A45108, is an interface that changes the ±10 V input into a 0 to 10 V speed reference and a rotation direction (forward or reverse) control. It has the following characteristics:

- ❑ Dimensions (H x W x D):
 3.78 in (96 mm) x 1.89 in (48 mm) x 1.65 in (42 mm)
- ❑ Clip-on fastener onto  1.38 in (35 mm) omega rail
- ❑ Two summing analog input terminals, 22 and 23 ($Z_e = 28\text{ k}\Omega$). The resulting speed reference is equal to the absolute value of the sum of references AE1 and AE2.
- ❑ The sign (+ or -) of the sum of the references determines the rotation direction.

The module may be enabled by:

- ❑ Normally open contact or a direct link between terminals 24 and 25 or
- ❑ 24 VDC external supply between terminals 25 (+) and 26 (-)

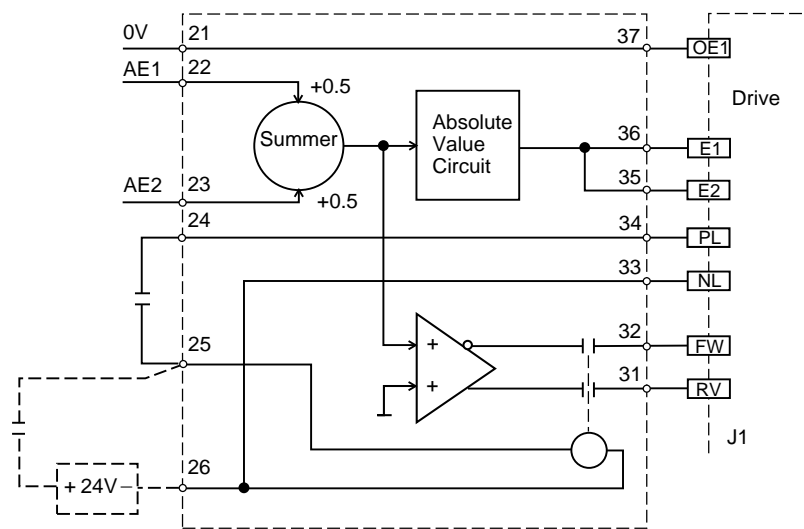


Figure 5-1 Block Diagram of ±10 V Control Module

DYNAMIC BRAKING
 AND SPEED
 REGULATION

This section describes the dynamic braking and speed regulation options for the Class 8803 Type P AC drive. These two functions, grouped together as one option, are available in three versions, according to the drive power:

- ❑ Dynamic braking module 8803 PB01 for 230 V (1 to 30 hp) and 460 V (1 to 30 hp) Omegapak Type P AC drives
- ❑ Dynamic braking module 8803 PB02 for 460 V (40 hp) Omegapak Type P AC drives
- ❑ Dynamic braking board 8803 PB03 for 50 to 125 hp Omegapak Type P AC drives

The braking resistor is not supplied with the dynamic braking option and must be ordered separately. Four resistor kits, 8803 PR01, PR02, PR03 and PR04, are designed specifically for use with Class 8803 Type P AC drives and their associated dynamic braking options. The resistor kits are intended to be mounted separately from the drive controller. For installation and connection of the resistor kits, see page 84.

Dynamic Braking Module



DANGER

HAZARDOUS VOLTAGE.

- DB module power and control terminals are at line potential.
- Ground equipment using screw provided.
- Disconnect all power before servicing DB module.
- High voltage remains after power is removed.
- Bus capacitors do not discharge immediately.

Before servicing:

- WAIT TEN MINUTES.
- Measure bus capacitor voltage between + and - terminals of controller to verify DC voltage is zero (see page 15).
- DO NOT short across capacitor terminals with voltage present.
- Install all covers before applying power to DB module.
- Use insulating tool when adjusting ASP potentiometer.
- External devices connected to DB module must be insulated for line voltage with respect to ground.

Failure to observe these precautions will cause shock or burn, resulting in severe personal injury or death!

This module is mounted on the left side of the drive controller by a clip-on fastener. It is supplied with:

- 2 multi-conductor cables with connectors for termination to the controller:
 - Dynamic braking option: connector J8 of the power board
 - Speed regulation option: connector J3 of the control board
- Connection and mounting instructions

The module has the following features:

- 2 conductors, pre-wired to the module, for connection to terminals + and - of the drive controller
- 2 conductors, pre-wired to the module, for connection to terminals L1 and L2 (PB02 only)
- Environmental conditions: identical to the drive controller
- Degree of protection: NEMA Open / IP20 (open)
- Dimensions (H x W): 10.04 in (255 mm) x 2.17 in (55 mm)
- Weight: 2.64 lb (1.2 kg)

Dynamic Braking Board



HAZARDOUS VOLTAGE.

- DB board components and control terminals are at line potential.
- Disconnect all power before servicing DB board.
- High voltage remains after power is removed.
- Bus capacitors do not discharge immediately.

Before servicing:

- WAIT TEN MINUTES.
- Measure bus capacitor voltage between + and - terminals of controller to verify DC voltage is zero (see page 15).
- DO NOT short across capacitor terminals with voltage present.
- Use insulating tool when adjusting ASP potentiometer.
- External devices connected to DB board must be insulated for line voltage with respect to ground.

Failure to observe these precautions will cause shock or burn, resulting in severe personal injury or death!

The dynamic braking board is supplied with a connection cable to the control board when used in conjunction with the speed regulation option. To mount and connect the board, see page 88.

Dynamic Braking Principles

When the frequency produced by the controller decreases rapidly, the motor behaves like an asynchronous generator and produces a braking torque. The motor feeds energy back to the drive controller. The amount of energy depends on the rate of deceleration, the inertia of the moving mass and the resistive torque.

Since the controller cannot feed the energy back into the supply, this causes an increase in the voltage of the filter capacitors, which limits the braking effect, potentially causing the controller to fault on overvoltage (code **DBF**). Part of the braking energy is dissipated as losses in the motor, the corresponding braking torque varying from 10 to 35% of the rated motor torque.

Dynamic braking allows a higher braking torque to be obtained and ensures dissipation of part of the braking energy in an external resistor. Dynamic braking consists of the following major components:

- Power transistor that switches the braking resistor across the filter capacitor terminals
- Control electronics
- Separately mounted braking resistor and fuse
- Low speed relay, which will control a brake if necessary: pick up at $f > 0$ Hz and motor $I \geq 0.7$ rated drive controller current, drop out at $f \leq 0$ Hz. To modify these values refer, to Chapter 6, Configuration and Adjustments.

For Omegapak 1 to 40 hp drives, the dynamic braking modules contain all the control electronics, power transistor and low speed relay.

For Omegapak 50 to 125 hp drives, the power transistor is incorporated directly into the drive controller. The control electronics and low speed relay are located on the dynamic braking board.

Resistor kits containing resistor(s) and fuses are available for all drive controllers.

Characteristics


Maximum permissible braking current is limited by:


- Braking resistor value
- Associated drive controller's transient current capability
- Maximum power transistor current:
 - 50 A for 8803 PB01 modules
 - 75 A for 8803 PB02 modules
 - 100 A for PØØCO_P and PØØCO4R drive controllers
 - 200 A for PØØCO4S and PØØCO4T drive controllers

Protection

NOTE
The power transistor is protected against short circuits at the braking resistor terminals.

AVAILABLE BRAKING TORQUE

 WARNING
<p>OVERSPEED HAZARD.</p> <ul style="list-style-type: none">• Generation of braking torque throughout the operating speed range of the controller requires dynamic braking be present and operating.• Dynamic braking resistor must be selected to generate required torque. Refer to page 79 for resistor selection procedure. <p>Failure to observe these precautions can result in severe personal injury, product damage or property damage.</p>

 WARNING
<p>NO HOLDING TORQUE.</p> <ul style="list-style-type: none">• Dynamic braking does not provide holding torque at zero speed.• Dynamic braking does not function during loss of power or controller fault.• When required, use separate braking function for holding torque. <p>Failure to observe these precautions can result in severe personal injury, product damage or property damage.</p>

Continuous Duty

Motor torque derating may be necessary for continuous duty reduced speed applications. When supplying braking torque, less derating is required than when the motor is supplying continuous driving torque at reduced speed (see page 42). For applications requiring both driving and braking torque, motor derating based on the continuous driving torque requirements is sufficient.

For applications requiring only braking torque, derating of the maximum continuous torque capability of the motor must generally be done for operation at speeds below 25% of motor nameplate speed. However, since motor designs vary, the motor manufacturer must be consulted for the required derating for a specific motor.

For continuous braking, the dynamic braking resistor must be sized to continuously absorb the nameplate power rating of the motor. To allow the motor power to flow into the resistor, the resistor ohmic value must be selected according to the following formula:

$$R_{db} = \frac{(\sqrt{2}V_c + 40)^2}{P_N}$$

Where:
V_c = Controller nameplate voltage rating
P_N = Motor nameplate power rating (watts)

In no instance should the ohmic value of the resistor chosen be less than the values listed in Table 5-1 on page 79.

Overtorque Capability

The braking overtorque capabilities of a given motor are linked to: the motor NEMA design category (Design B, Design D, etc.), no-load (magnetizing) current of the motor at nameplate speed, maximum transient output current of the controller, applied V/f at reduced speed and selection of the dynamic braking resistor.

For overtorque braking, the value of resistance calculated for continuous duty must be further decreased to assure sufficient instantaneous power can be absorbed.

For 150% overtorque capability, the dynamic braking resistor should be reduced to 67% of the ohmic value calculated for continuous operation. In addition, the controller transient output current capability must be 150% of the motor rated current.

The ohmic value of the resistor chosen must be greater than the values listed in Table 5-1 on page 79.

Braking Torque Production Envelope

Figure 5-2 on the next page illustrates typical continuous torque and overtorque braking capability for a typical NEMA design B motor. The motor is operated with constant V/f excitation. The controller rated output current is greater than or equal to the motor nameplate current. The controller transient output current capability is no less than 150% of the controller rated output current.

For curve 1, the dynamic brake resistor ohmic value is 100% of the value calculated for continuous operation. For curve 2, the dynamic brake resistor ohmic value is 67% of the value calculated for continuous operation.

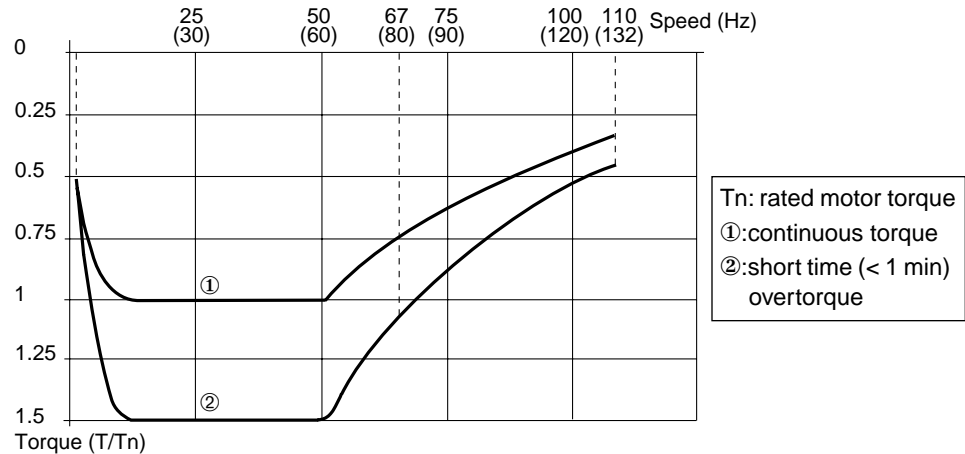


Figure 5-2 Typical Braking Torque Curves

When the frequency is less than 10 Hz, braking torque decreases rapidly. Slip compensation is disabled when the motor is regenerating.

Calculating Braking Power

To calculate braking power for a high inertia machine, non-overhauling load:

- ❑ Braking torque (T_b) on deceleration: $T_b = \frac{Wk^2 \times \Delta rpm}{308 \times \Delta t}$ in lb-ft, where
 Wk^2 = total moment of inertia referred to the motor shaft in lb-ft²
 Δrpm = speed difference in rpm
 Δt = deceleration time in seconds
- ❑ Instantaneous braking power: $P_b = \frac{T_b \times rpm}{7.04}$ in W
- ❑ Average braking power during deceleration: $P_{bd} = \frac{0.5 T_b \times \Delta rpm}{7.04}$ in W
- ❑ Average braking power during one cycle: $P_{bm} = P_{bd} \frac{t}{\tau}$ in W, where
 t = braking time in s, τ = time of one cycle in s

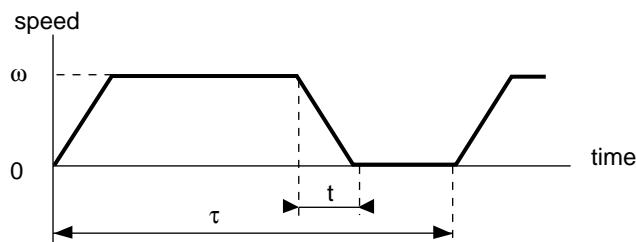


Figure 5-3 Average Braking Power

To calculate braking power for continuous operation of unspecified duration:

- ❑ Braking is treated as continuous braking: $P_b = P_{bm} = \frac{T_b \times rpm}{7.04}$ in W, where
 T_b = braking torque in ft-lb
 rpm = speed in revolutions per minute

NOTE

Whatever the application, the instantaneous braking power necessary must be less than 1.5 times the rated torque of the drive controller. The drive will trip on overcurrent or overvoltage if the load requires too much braking power.

Selecting a Braking Resistor

The braking resistor is defined by its ohmic value and power dissipation capacity. Use the following formula to determine the ohmic value of resistance needed to supply the proper braking torque:

$$R_{db} = \frac{(\sqrt{2}V_c + 40)^2}{P_b}$$

Where:
 V_c = Controller nameplate voltage rating
 P_b = Instantaneous braking power (watts)

The ohmic value of the resistor can be less than the calculation but should never be less than the values listed in Table 5-1.

Table 5-1 Ohmic Value of the Braking Resistor

Drive Controller	Minimum Resistor Value (Ω)
P00CO_C, P00CO_D, P00CO_E, P00CO4F	47
P00CO4G, P00CO4H, P00CO4J	27
P00CO2F, P00CO4K	22
P00CO4L, P00CO4M, P00CO4N	15
P00CO2G, P00CO2H, P00CO2J, P00CO4P	10
P00CO2K, P00CO4R	8
P00CO4S, P00CO4T	5

To determine the power of the resistor, evaluate:

- Rated power (P_n): power that can be dissipated continuously. Must be greater than the average braking power, P_{bm}.
- Maximum power (P_{max}): power that can be dissipated over a short period on intermittent duty. Must be greater than braking power, P_b.

**BRAKING RESISTOR
KITS**

Kits containing standard values of braking resistors and associated fuses are available. Table 5-2 lists the electrical and thermal characteristics of the resistor kits as well as the recommended kits for various drive controllers.

Table 5-2 Standard Braking Resistors

Resistor Kit No.	8803 PR01	8803 PR02	8803 PR03	8803 PR02 (2 ea.)	8803 PR04	8803 PR04 (2 ea.)
Drive	230 V PØØCO2C (1 hp) PØØCO2E (3 hp)	PØØCO2F (5 hp) ^[1]	PØØCO2G (7.5 hp) PØØCO2H (10 hp)	PØØCO2J (15 hp) ^[2] PØØCO2K (20 hp) ^[2]		
	460 V PØØCO4C (1 hp) PØØCO4D (2 hp) PØØCO4E (3 hp) PØØCO4F (5 hp)	PØØCO4G (7.5 hp) PØØCO4H (10 hp) PØØCO4J (15 hp) PØØCO4K (20 hp) ^[1]		PØØCO4L (25 hp) PØØCO4M (30 hp) PØØCO4N (40 hp)	PØØCO4P (50 hp) PØØCO4R (75 hp)	PØØCO4S (100 hp) PØØCO4T (125 hp)
Std. Resistor Config. ^[3]	230 V 460 V	50 Ω (1 ea.) 50 Ω (2 ea.) in series	6.4 Ω (5 ea.) in series 6.4 Ω (5 ea.) in series	6.4 Ω (2 ea.) in series	2 PR02 kits in parallel ^[4] 2 PR02 kits in parallel ^[4]	10 Ω (1 ea.) 2 PR04 kits in parallel ^[4]
Power Rating per Resistor ^[5]		50 W	57.6 W	57.6 W	57.6 W	1440 W
Std. Resistor Value ^[6]		100 Ω	32 Ω	12.8 Ω	16 Ω	10 Ω
Fuse Value		1 A	3 A	3 A	3 A	12 A
Fuse Part No. & Manufacturer ^[7]		TRS1R Gould Shawmut	TRS3R Gould Shawmut	TRS3R Gould Shawmut	TRS3R Gould Shawmut	TRS12R Gould Shawmut

- ^[1] When using kit PR02 with these controllers, one 6.4 Ω resistor may be removed from the resistor string to decrease Rdb. Do not remove more than one resistor.
- ^[2] When using kit PR02 with these controllers, one 6.4 Ω resistor may be removed from each resistor string to decrease Rdb. Do not remove more than one resistor from each string.
- ^[3] Resistors supplied with kits are type PX1 for kits PR01, PR02 and PR03 and type TW27D for kit PR04.
- ^[4] When more than one kit is required to obtain the correct power and resistance values, connect the fuse and resistor supplied with each kit in series to form a group, then connect the groups in parallel. The ohmic value of the combined resistor kits must be greater than or equal to the values listed in Table 5-1 on page 79.
- ^[5] Power ratings per resistor are calculated based on fuse current. Actual resistor power rating is 135 W for kits PR01, PR02 and PR03 and 7290 W for kit PR04.
- ^[6] Standard resistor value represents the total series resistance of the recommended resistor string.
- ^[7] Do not substitute for these fuses, since they can operate correctly at the DC voltages in this application.

Standardized resistances may not be suitable for every application. See calculation example on page 82.

Figure 5-4 shows the overload capability of the various resistors supplied as part of the dynamic braking resistor kits.

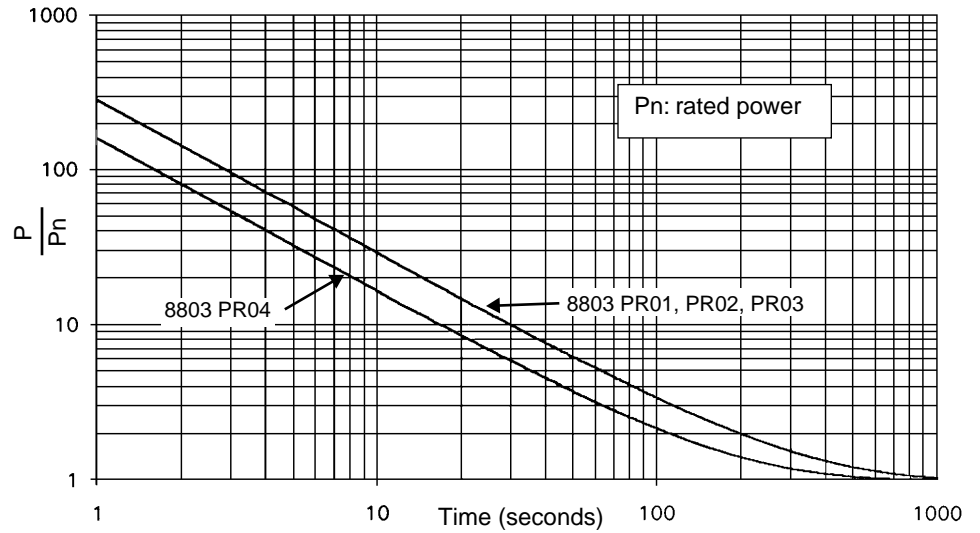


Figure 5-4 Typical Braking Resistor Overload Curve

Figure 5-5 shows the melting time vs. current for the fuses in the dynamic braking resistor kits (8803 PR01, PR02, PR03 and PR04).

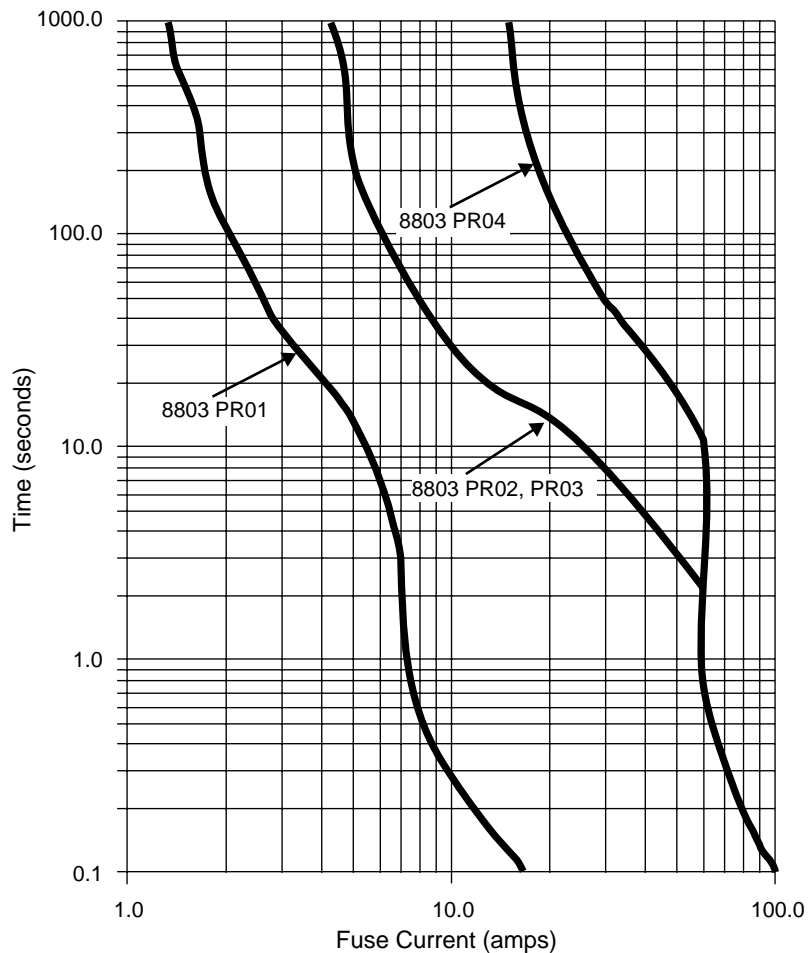


Figure 5-5 Fuse Current vs. Melting Time

Figure 5-6 shows the braking resistor kits.

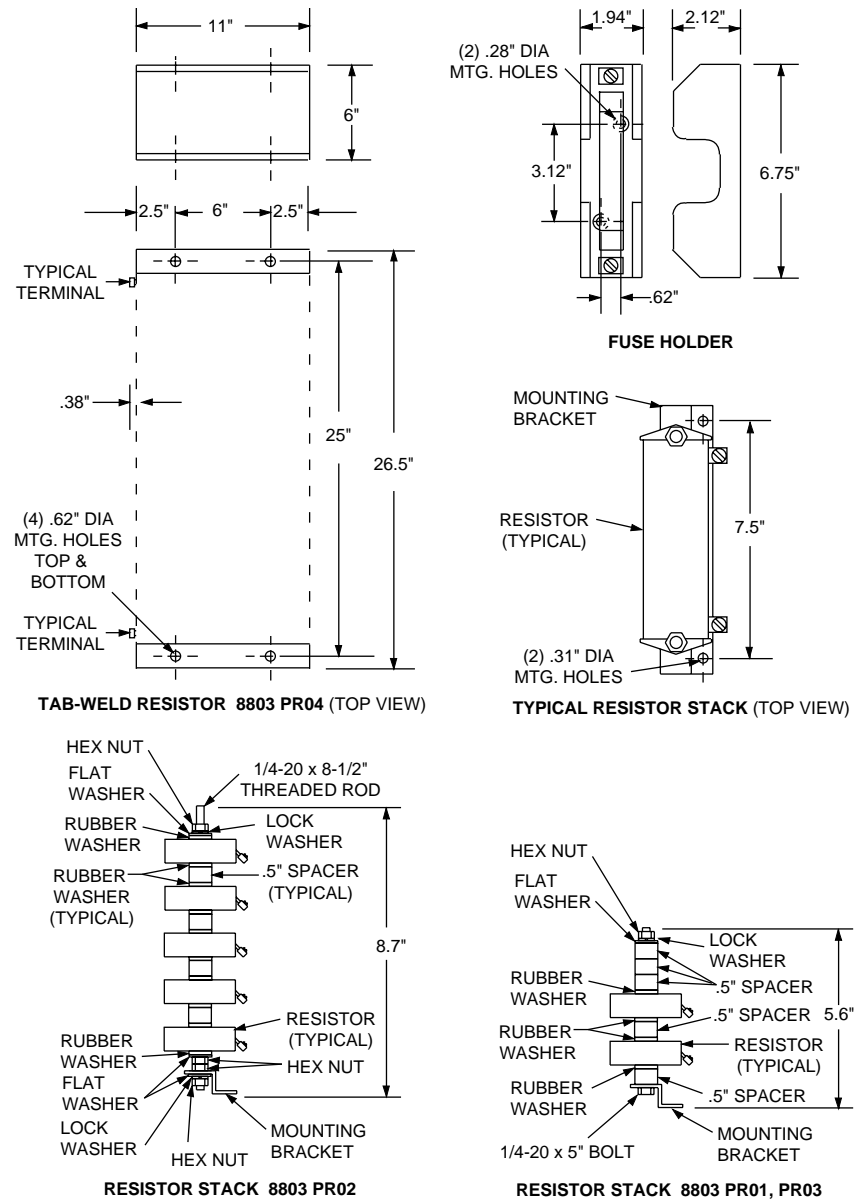


Figure 5-6 Braking Resistor Kits

Resistor Calculation Example

Calculate the resistor needed for a motor with the following characteristics:

- Power: 5 hp
- Rated speed: 1740 rpm
- Moment of inertia: 0.28 lb-ft²

The motor is driving a machine with:

- Inertia 10 times that of the motor with no interposing speed changer
- Resistive torque one tenth of the rated motor torque

The requirement is to stop in 5 seconds from rated speed at a rate of 2 cycles per minute.

Rated motor torque:	$T_n = \frac{\text{hp} \times 5250}{\text{rpm}_{\text{rated}}} = \frac{5 \times 5250}{1740} = 15.1 \text{ lb-ft}$
Resistive torque:	$T_r = \frac{15.1}{10} = 1.51 \text{ lb-ft}$
Total inertia:	$Wk^2 = 0.28 + (10 \times 0.28) = 3.08 \text{ lb-ft}^2$
Braking torque:	$T = \frac{Wk^2 \times \Delta\text{rpm}}{308 \times \Delta t} = \frac{3.08 \times 1740}{308 \times 5} = 3.48 \text{ lb-ft}$
Motor braking torque:	$T_b = T - T_r = 3.48 - 1.51 = 1.97 \text{ lb-ft}$
Instantaneous braking power:	$P_b = \frac{T_b \times \text{rpm}}{7.04} = \frac{1.97 \times 1740}{7.04} = 487 \text{ W}$
Avg. braking power during deceleration:	$P_{bd} = \frac{0.5T_b \times \Delta\text{rpm}}{7.04} = 243 \text{ W}$
Cycle time:	$\tau = \frac{60}{2} = 30 \text{ s}$
Average braking power during one cycle:	$P_{bm} = P_{bd} \frac{t}{\tau} = 243 \times \frac{5}{30} = 40.5 \text{ W}$

For a 460 V drive controller, R_{db} , the ohmic value of resistance required, is:

$$R_{db} = \frac{(\sqrt{2}V_c + 40)^2}{P_b} = \frac{(\sqrt{2} \cdot 460 + 40)^2}{487} = 979 \Omega$$

For this application, the 100 ohm resistor kit (8803 PR01) is sufficient. The operation of the dynamic braking module causes the 100 ohm resistor to appear to have an effective resistance of 979 ohms.

The instantaneous and rated power of the resistor kit exceeds the instantaneous (P_b) and rated (P_{bm}) power calculated.

- For 100 Ω resistor kit (8803 PR01), rated power is 100 W (2 resistors x 50 W).
- As shown in Figure 5-4 on page 81, instantaneous power of resistors is 60 times (6000 W) the rated power for 5 seconds.
- As shown in Figure 5-5 on page 81, fuse will pass approximately 6.2 A for 5 seconds before tripping. This limits the resistors to 3844 W for 5 seconds instead of 6000 W calculated in the previous step.

CAUTION

INSUFFICIENT BRAKING POWER.

Precise calculation of the resistor, as shown above, is essential for severe applications requiring high braking power such as machines with high inertia and overhauling loads.

Failure to observe this precaution could result in personal injury, product damage or property damage.

If the required braking torque is high, choose a resistor with an ohmic value equal to or slightly greater than the minimum value given in Table 5-1 on page 79.

INSTALLING A BRAKING RESISTOR KIT

WARNING

HAZARDOUS VOLTAGE AND HOT COMPONENTS.

Avoid accidental contact with braking resistor. Resistor operating voltage may reach 1000 VDC between terminals and its temperature may reach 752 °F (400 °C).

- Install resistors in appropriate enclosure or restricted area.
- Provide sufficient cooling air and clearance.
- Do not mount on or enclose with combustible materials.
- Use conductors rated for expected voltage and temperature.

Failure to observe these precautions may cause shock or burn, resulting in severe personal injury or death!

Each resistor kit contains the following:

- Fuse, rated to protect the resistors against overload
- Fuse holder
- Resistor(s)
- Mounting plate (as required)

When mounting the resistor and associated fusing, observe the following precautions:

- Resistor and fuse holder must be mounted in an appropriate enclosure or restricted access area to prevent accidental contact with energized parts.
- Sufficient space and air flow must be provided to allow for dissipation of heat produced by braking action. Maintain at least 2 inches between the resistor element and any surface. Do not mount the resistor to combustible surfaces or house the resistor in a combustible enclosure.
- Fuse and fuse holder must be mounted away from the resistor. If mounted too close to the resistor, premature operation of the fuse may result due to temperature effects.
- Resistors supplied within a kit should be connected in series to obtain the recommended resistance values listed in Table 5-2 on page 80. The fuse is then connected in series with the resistor string.

Where more than one resistor kit is recommended to obtain the correct power and resistance values, the fuse and resistor supplied with each kit must be connected in series to form a group. Then connect the groups in parallel. All group resistance values should be equal and set so the resistance of the paralleled groups equals the values recommended in Table 5-2.

- Do not use any fuses with the resistor kits other than those recommended in Table 5-2. Do not substitute fuses with other ratings or manufacturers.
- When connecting the braking resistor to the drive controller, use conductors whose temperature and voltage ratings are suitable for the application. The conductor insulation voltage rating must meet or exceed the input line voltage rating. The conductor insulation temperature rating must be 194 °F (90 °C) or greater.

- ❑ For applications where the resistor continuous power rating may exceed the cooling capability of the surrounding environment, a thermal switch can be used to protect the resistor and its surroundings against overtemperature. All dynamic braking modules and boards are equipped to accept a normally closed thermal switch contact that opens on rising temperature. The switch is connected to the PY-PZ terminals of the braking module or board. When connected, opening the thermal switch causes the drive controller to trip and fault code \overline{DFF} to be displayed on the dialog unit. When not used, thermal switch inputs (PY-PZ) must be jumpered on the braking module. For controllers using the dynamic braking board, the PY-PZ input may be disabled by a jumper select. For more details, refer to the dynamic braking module or board installation procedure.
- ❑ Thermal switch contacts must be capable of operation on circuits whose open circuit voltage is 10 V and closed circuit current is 5 mADC.

INSTALLING THE DYNAMIC BRAKING MODULE – 1 to 40 hp Drive Controllers

To install the dynamic braking module, follow the procedure below.

1. **Remove all power and refer to Danger statement on page 72.**
2. Remove plastic access cover on the side of the dynamic braking module. Removing this cover exposes the resistor connection terminals of the module (see Figure 5-7).

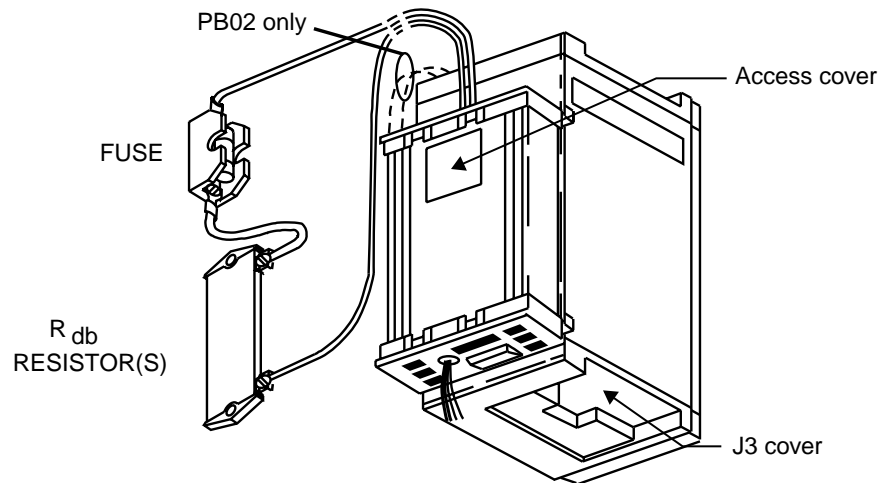



Figure 5-7 Installing the Dynamic Braking Module

3. The dynamic braking module attaches to the left side of the drive controller. To attach the module, place the module rear mounting clips into the rear channel of the side plate of the controller. Push the module against the side of the controller while depressing the spring-loaded mounting tabs on front of the module. The front mounting tabs should engage the front channel of the controller side plate with a “clicking” sound.
4. Connect the green/yellow wire supplied on the dynamic braking module. Ground the connection to the ground terminal of the drive controller.

5. Connect the red and black flying power leads of the module to + and - terminals at the bottom of the drive controller. Connect the red wire to + terminal. Connect the black wire to - terminal.
6. For kit PB02 only, connect the flying leads at the top of the dynamic braking module to L1 and L2 terminals.
7. Remove the shorting plug from connector J8 of the drive controller.
8. Install the short cable provided with the module between module connector J8 and drive controller connector J8.
9. Connect the resistor-fuse power wires to the module resistor power terminal connections, located under the access cover. Replace the access cover (see Figure 5-8).
10. If a thermal switch is used, connect the thermal switch to PY-PZ terminals of the dynamic braking module. If a thermal switch is not used, jumper PY-PZ terminals (see Figure 5-8).

 **DANGER**

NON-ISOLATED CIRCUIT.

- Thermal switch circuit is at line voltage potential.
- Thermal switch and associated wiring must be insulated for line voltage with respect to ground.

Failure to observe these precautions will cause shock or burn, resulting in severe personal injury or death!

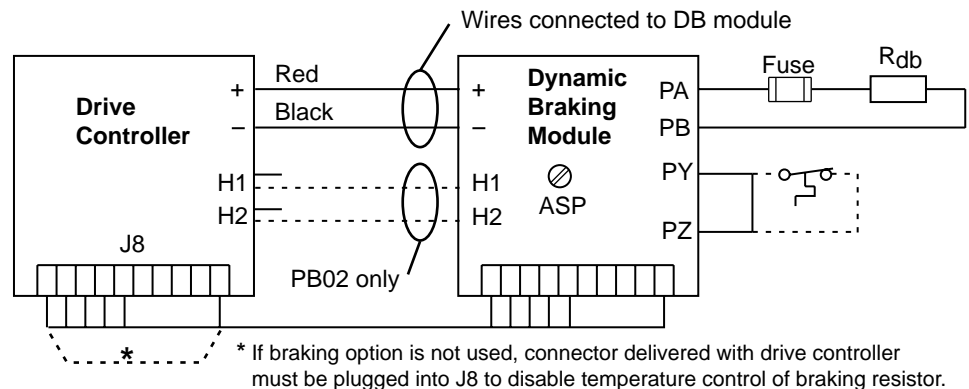


Figure 5-8 Connecting the Dynamic Braking Module

11. If speed regulation is used, remove the drive controller J3 cover and install the short cable supplied with the dynamic braking module between the module and connector J3 of the drive controller. Refer to Figure 5-11 on page 91.
12. If the motor is fitted with a brake with windings accessible via terminals, connect the contact of the low speed relay available at terminals LA-LB into the control sequence. The contact ratings of the relay are: 230 V, 50/60 Hz, 2 A.

Initial Set Up



HAZARDOUS VOLTAGE.

- Disconnect all power before servicing drive controller or adding any option. WAIT TEN MINUTES until bus capacitors discharge, then measure bus capacitor voltage between + and - terminals to verify DC voltage is zero (see page 15).
- DO NOT short across capacitors or touch unshielded components or terminal strip screw connections with voltage present.
- Install all covers and close door before applying power or starting and stopping the controller.

Failure to observe these precautions will cause shock or burn, resulting in severe personal injury or death!

No adjustments are necessary for the initial set up of the braking option. After checking the connections and possibly adjusting the drive controller settings (see Chapter 3, Setting Up the Drive Controller), the drive can be switched on.

If there is any doubt as to the braking power, proceed in the following manner:

1. Set a deceleration ramp time longer than the required braking time.
2. Start up the machine and carry out successive braking operations, gradually reducing the ramp time until the final adjustment is reached, making sure that the braking cycles are identical to those for actual use.

Troubleshooting

In case of problems, refer to the following procedures.

1. If the resistor power rating is exceeded, the series fuse will operate and the controller will trip on `OBF`. If this occurs, check that the controller, motor and resistor combination are properly selected for the application.
2. If insufficient braking capability is produced, an `OBP` or `OBF` fault may result. The series fuse will not operate. If this occurs, check that the controller, motor and resistor combination are properly selected for the application. It may be necessary to reduce the ohmic value of the braking resistor to increase the braking capability.
3. If the resistor ohmic value is set too low or the resistor is short-circuited, a `OBF` fault will result. If this occurs, check that the resistor wiring is correct and that the ohmic value of the resistor is not less than that recommended in Table 5-1 on page 79.

INSTALLING THE
DYNAMIC BRAKING
BOARD – 50 to 125 hp
Drive Controllers

To install the dynamic braking board, follow the procedure below.

1. **Remove all power and refer to Danger statement on page 72.**
2. Remove the drive controller protective covers.
3. The DB board must be installed to the right of the control board. Four internal jumpers labeled J1, J2, J3 and J8 are attached to the support plate. Release these jumpers before mounting the DB board.
4. Unplug removable connectors J5 and J6 from the DB board.
5. Take the DB board, holding it so the components face up and the connectors face down. Via the lower part, slide it onto the two positioning blocks situated at the bottom of the enclosure, and then click the top of the board into position (see Figure 5-9).

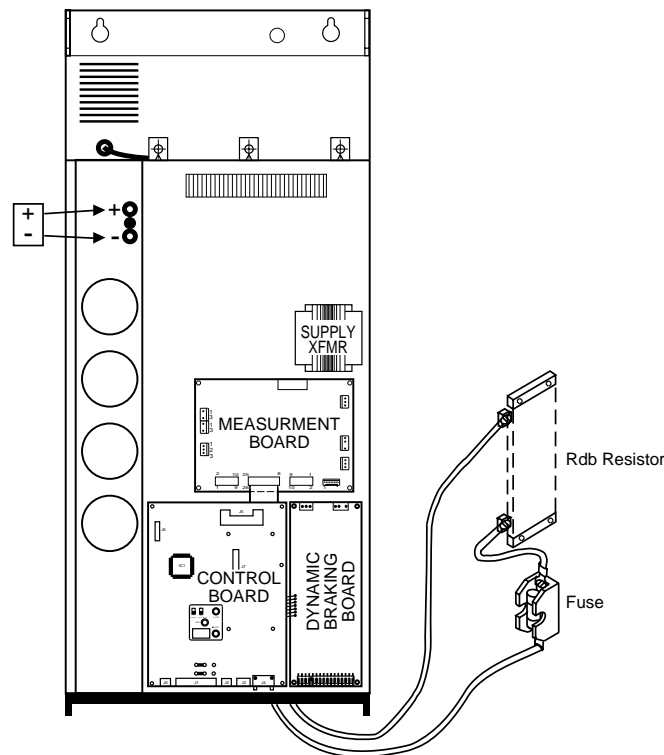


Figure 5-9 Dynamic Braking Board


6. Connect the four jumpers (J1, J2, J3 and J8) to the corresponding connectors on the DB board. There is another jumper on the DB board that must be connected to J13 on the measurement board.



CAUTION

IMPROPER CONNECTIONS MAY DAMAGE EQUIPMENT.
Attach connectors without forcing them, making sure they are correctly oriented, then verify they are correctly seated.
Failure to observe this precaution could result in equipment damage.

7. Reinstall the plug-in terminal block onto connector J6.
8. Connect the resistor-fuse power wires to PA-PB connectors on the drive controller.
9. If a thermal switch is used, connect it to PY-PZ terminals of the DB board and set jumper CV1 on the measurement board as shown in Figure 5-10.

 **DANGER**

NON-ISOLATED CIRCUIT.

- Thermal switch circuit is at line voltage potential.
- Thermal switch and associated wiring must be insulated for line voltage with respect to ground.

Failure to observe these precautions will cause shock or burn, resulting in severe personal injury or death!

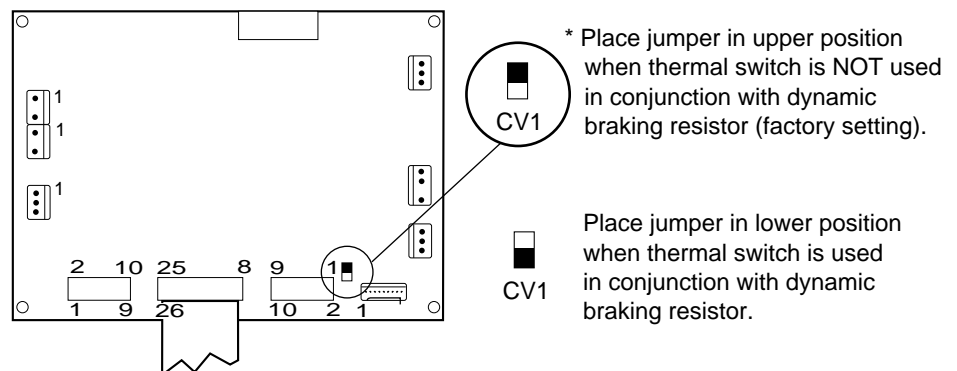


Figure 5-10 Measurement Board

10. If speed regulation is used, install the short cable supplied with the DB board between J5 on the DB board and J3 of the control board.
11. If the motor is fitted with a brake with windings accessible via terminals, connect the contact of the low speed relay available at terminals LA-LB into the control sequence.

Initial Set Up

See initial set up procedures on page 87.

Troubleshooting

See troubleshooting procedures on page 87.

SPEED REGULATION –
1 to 40 hp
Drive Controllers

This section contains information for installing and connecting the speed regulation option in the 1 to 40 hp drive controllers.



DANGER

NON-ISOLATED CIRCUIT.

- Speed regulation circuits are at line voltage potential.
- External devices (tachogenerator) connected to speed regulation circuits must be insulated for line voltage with respect to ground.
- Use insulated tool when adjusting ASP potentiometer.

Failure to observe these precautions will cause shock or burn, resulting in severe personal injury or death!

Measurement of the actual motor speed with a tachogenerator allows the speed to be regulated. In this case, automatic slip compensation (depending on the load incorporated in the drive) is cancelled and replaced by the speed regulation loop.

The speed regulation option ensures the following functions:

- Scaling the voltage value provided by the tachogenerator.
- Developing the absolute value and the sign of the voltage signal to ensure regulation in both directions.

Speed regulation accuracy is $\pm 0.1\%$ of the maximum speed for:

- Torque variation from 0.2 T_n to T_n
- Speed range from 1 to 50/60 Hz

The speed regulation option is associated with dynamic braking and is available in several versions depending on the controller power rating (see page 73).

**Installation and
Connections – 1 to 40 hp
Drive Controllers**

- See page 85 for instructions on installation and connection of the module.
- Use cable supplied with the option to connect the module to the connector J3 on the control board.

To connect the tachogenerator:

1. Calculate maximum voltage provided by tachogenerator. For example:

Motor = 1800 rpm at 60 Hz

Tachogenerator = $\frac{50 \text{ V}}{1000 \text{ rpm}}$

Maximum frequency = 80 Hz

Maximum voltage = $\frac{50 \text{ V}}{1000 \text{ rpm}} \times 1800 \text{ rpm} \times \frac{80 \text{ Hz}}{60 \text{ Hz}} = 120 \text{ V}$

2. Using twisted cable, connect the tachogenerator to the option module. Select input terminal from Table 5-3 based on maximum voltage calculated in step 1 above (i.e. 0-145 V). For recommended wiring methods, refer to "GENERAL WIRING PRACTICES" on page 16.

Table 5-3 Tachogenerator Connections – 1 to 40 hp

Max. Tachogenerator Voltage	Tachogenerator Connections to Speed Regulation Terminals
10 V	Terminal 0 V (+) to terminal 10 V (-)
70 V	Terminal 0 V (+) to terminal 70 V (-)
145 V	Terminal 0 V (+) to terminal 145 V (-)
300 V	Terminal 0 V (+) to terminal 300 V (-)

Figure 5-11 shows how to connect the tachogenerator to the dynamic braking module.

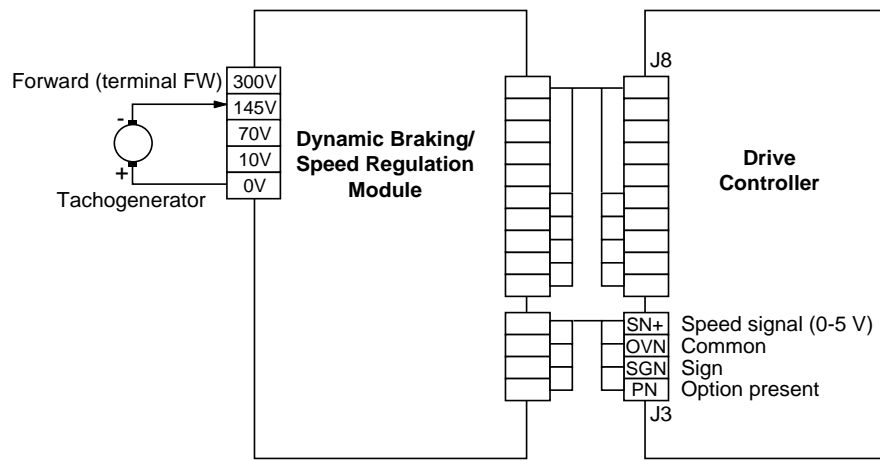


Figure 5-11 Connecting the Tachogenerator to 1 to 40 hp Controllers

Adjustments – 1 to 40 hp Drive Controllers



NON-ISOLATED CIRCUIT.

- Speed regulation circuits are at line voltage potential.
- External devices (tachogenerator) connected to speed regulation circuits must be insulated for line voltage with respect to ground.
- Use insulated tool when adjusting ASP potentiometer.

Failure to observe these precautions will cause shock or burn, resulting in severe personal injury or death!

To adjust the tachogenerator circuit:

1. Connect a voltmeter to the tachogenerator terminals.
2. Adjust potentiometer ASP to its minimum setting, fully counter-clockwise.
3. Start motor. Verify tachogenerator polarity is correct.
4. Set the maximum speed using the speed reference potentiometer.
5. Turn ASP clockwise until the corresponding voltage (calculated as shown in example on page 90) is obtained.

Figure 5-12 shows the location of the adjustable speed potentiometer.

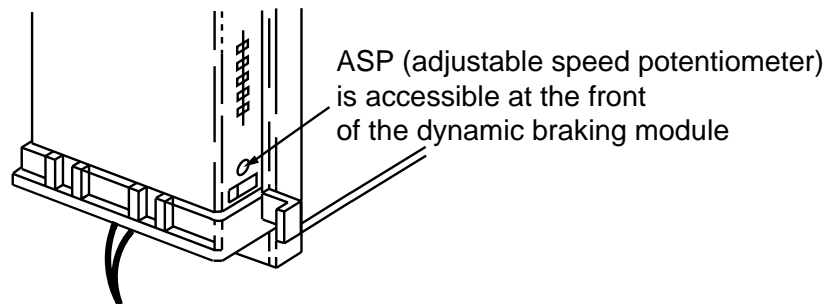


Figure 5-12 Location of Adjustable Speed Potentiometer (ASP) – 1 to 40 hp Controllers

SPEED REGULATION – 50 to 125 hp Drive Controllers

This section contains information for installing and connecting the speed regulation option in the 50 to 125 hp drive controllers.



DANGER

NON-ISOLATED CIRCUIT.

- Speed regulation circuits are at line voltage potential.
 - External devices connected to speed regulation circuits must be insulated for line voltage with respect to ground.
 - Do not adjust ASP potentiometer with power applied.
- Failure to observe these precautions will cause shock or burn, resulting in severe personal injury or death!

Measurement of the actual motor speed with a tachogenerator allows the speed to be regulated. In this case, automatic slip compensation (depending on the load incorporated in the drive) is cancelled and replaced by the speed regulation loop.

The speed regulation option ensures the following functions:

- Scaling the voltage value provided by the tachogenerator.
- Developing the absolute value and the sign of the voltage signal to ensure regulation in both directions.

Speed regulation accuracy is $\pm 0.1\%$ of the maximum speed for:

- Torque variation from 0.2 T_n to T_n
- Speed range from 1 to 50/60 Hz

The speed regulation option is associated with dynamic braking and is available in several versions depending on the controller power rating (see page 73).

Installation and Connections – 50 to 125 hp Drive Controllers

- See page 88 for instructions on mounting and connecting the board in the drive controller.
- Use cable supplied with the option to connect J5 on the option board to connector J3 on the control board.

To connect the tachogenerator:

1. Calculate maximum voltage provided by tachogenerator. For example:

Motor = 1800 rpm at 60 Hz

$$\text{Tachogenerator} = \frac{50 \text{ V}}{1000 \text{ rpm}}$$

Maximum frequency = 80 Hz

$$\text{Maximum voltage} = \frac{50 \text{ V}}{1000 \text{ rpm}} \times 1800 \text{ rpm} \times \frac{80 \text{ Hz}}{60 \text{ Hz}} = 120 \text{ V}$$

2. Select input terminal from Table 5-4 based on maximum voltage calculated in step 1 above (i.e. 0-145 V).

Table 5-4 Tachogenerator Connections – 50 to 125 hp

Max. Tachogenerator Voltage	Tachogenerator Connections to Speed Regulation Terminals
10 V	Terminal 0 V (+) to terminal 10 V (-)
70 V	Terminal 0 V (+) to terminal 70 V (-)
145 V	Terminal 0 V (+) to terminal 145 V (-)
300 V	Terminal 0 V (+) to terminal 300 V (-)

3. The speed feedback circuit must be adjusted with an external potentiometer. Use Table 5-5 to select a potentiometer value for the required voltage range calculated in step 1 above.



DANGER

NON-ISOLATED CIRCUIT.

- Speed regulation circuits are at line voltage potential.
- External devices connected to speed regulation circuits must be insulated for line voltage with respect to ground.
- User-selected potentiometer must be insulated for line voltage with respect to ground.
- Potentiometer shaft and adjustment knob must be insulated from the potentiometer windings and wiper.
- Insulation system must be rated for line voltage.

Failure to observe these precautions will cause shock or burn, resulting in severe personal injury or death!

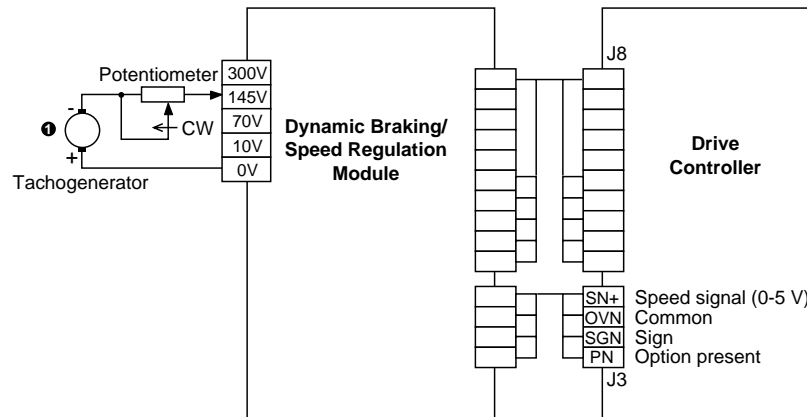
Table 5-5 Selecting Potentiometer for Tachogenerator Connections to 50 to 125 hp Controllers

Speed Regulation Input	Potentiometer Value	Recommended Potentiometer ^[1]
10 V	50 kΩ	Class 9001 Type K2110
70 V	500 kΩ	Class 9001 Type K2113
145 V	750 kΩ	Class 9001 Type K2137
300 V	2.5 MΩ	Class 9001 Type K2115

^[1] These potentiometers, which can be mounted in a Class 9001 Type KY1 enclosure, are recommended because they are double-insulated. If a different potentiometer is used, the shaft and adjustment knob must be insulated from the windings and wiper.

4. Using twisted cable, connect tachogenerator and potentiometer to option board terminals (connector J6). For recommended wiring methods, refer to "GENERAL WIRING PRACTICES" on page 16.

Figure 5-13 shows how to connect the tachogenerator and potentiometer to the dynamic braking module.



① With drive controller operating in "Forward" mode (terminal FW of controller enabled), tachogenerator polarity must be indicated here.

Figure 5-13 Connecting the Tachogenerator to 50 to 125 hp Controllers

Adjustments – 50 to 125 hp Controllers



NON-ISOLATED CIRCUIT.


- Speed regulation circuits are at line voltage potential.
- External devices connected to speed regulation circuits must be insulated for line voltage with respect to ground.
- Do not adjust ASP potentiometer with power applied.

Failure to observe these precautions will cause shock or burn, resulting in severe personal injury or death!

To adjust the tachogenerator circuit:

1. Remove all power and refer to Danger statement above.
2. Connect a voltmeter to the tachogenerator terminals.
3. Adjust potentiometer ASP to its minimum setting, fully counter-clockwise.
4. Adjust external potentiometer to its minimum setting, fully counter-clockwise.
5. Apply power to the drive controller and start motor. Verify tachogenerator polarity is correct.
6. Set the maximum speed using the speed reference potentiometer.
7. Turn external potentiometer clockwise until the corresponding voltage (calculated from example on page 93) is obtained.

Figure 5-14 shows the location of the adjustable speed potentiometer.

 **DANGER**

HAZARDOUS VOLTAGE.

- Do not adjust ASP potentiometer with power applied.

Failure to observe these precautions will cause shock or burn, resulting in severe personal injury or death!

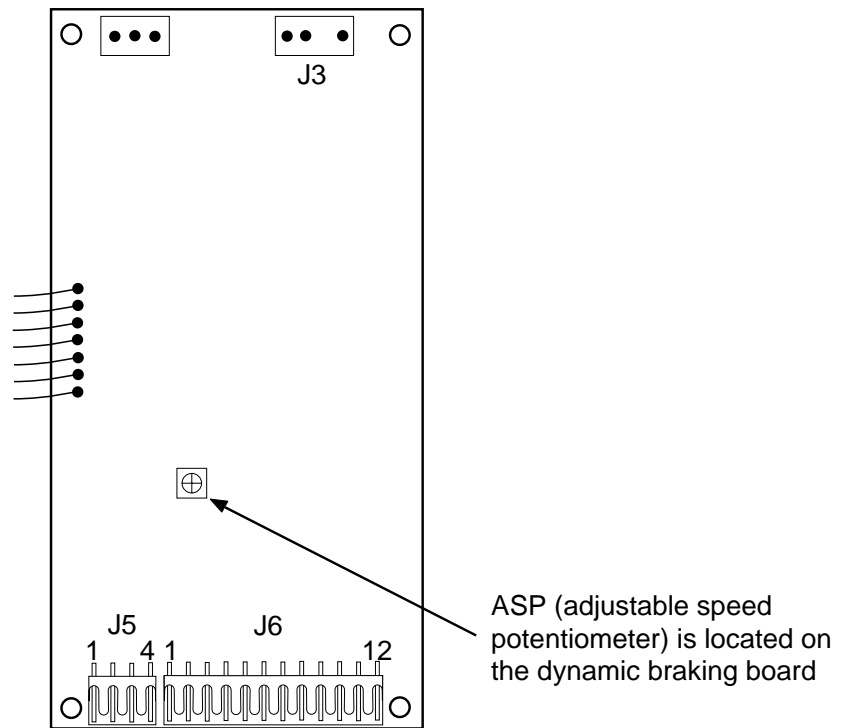


Figure 5-14 Location of Adjustable Speed Potentiometer (ASP) – 50 to 125 hp Controllers

**MOUNTING IN DUST-
AND DAMP-PROOF
METAL ENCLOSURE**
(1 to 40 hp drives)

To reduce power dissipated in the enclosure, the drive controller can be recess mounted in the back of the enclosure, with the heat sink on the outside. Follow the mounting instructions given in "Mounting in Dust- and Damp-Proof Metal Enclosure" on page 22.

Figure 5-15 shows the dimensions of the cut out to be made in the enclosure and the spacing of the mounting holes.

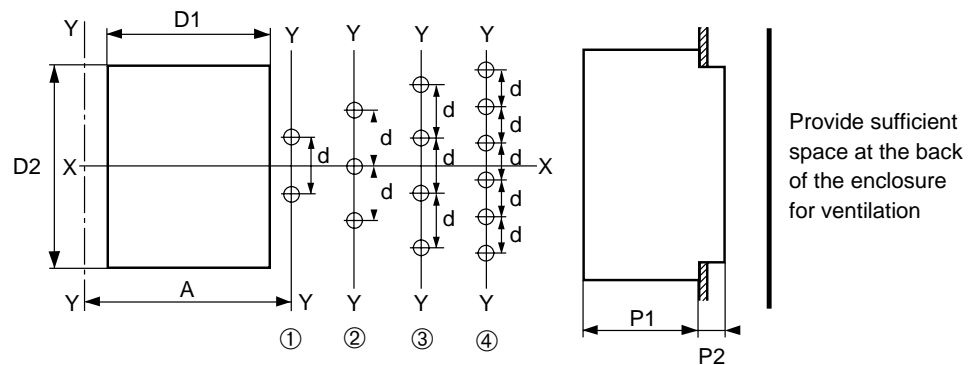


Figure 5-15 Cut Out for Recess Mounting

NOTE

- For P00CO2G, _H, _J, _K, 4L, 4M and 4N, the fan is located outside the enclosure.
- Gasket kit does not maintain dust- and damp-proof integrity of interior of 30-40 hp controller enclosures (bus capacitors protrude through heat sink).

Table 5-6 Dimensions for Recess Mounting Cutout

Drive Ratings		D1 in (mm)	D2 in (mm)	A in (mm)	P1 in (mm)	P2 in (mm)	Drilling			Gasket Kit Part No.
hp	V						Dwg	d in (mm)	Ø in (mm)	
1 1 to 2	230 460	7.6 (194)	10.9 (278)	8.35 (212)	6.3 (160)	0	①	6.3 (160)	0.276 (7)	VY1-A451U1501
3 to 5	230,460	6.7 (172)	13.5 (342)	8.35 (212)	6.5 (165)	0.98 (25)	②	5.91 (150)	0.276 (7)	VY1-A451U4001
7.5	460	6.7 (172)	15.0 (382)	8.35 (212)	6.5 (165)	0.98 (25)	②	5.91 (150)	0.276 (7)	VY1-A451U7501
7.5 10	230 230,460	6.7 (172)	15.0 (382)	8.35 (212)	6.5 (165)	4.09 (104)	②	5.91 (150)	0.276 (7)	
15	230,460	6.7 (172)	20.9 (532)	8.35 (212)	6.5 (165)	4.09 (104)	③	5.91 (150)	0.276 (7)	VY1-A451D1101
20 20 to 30	230 460	6.7 (172)	22.5 (572)	8.35 (212)	6.5 (165)	4.09 (104)	③	5.91 (150)	0.276 (7)	VY1-A451D1501
40	460	6.7 (172)	30.4 (772)	8.35 (212)	6.5 (165)	4.09 (104)	④	5.91 (140)	0.276 (7)	VY1-A451D3001

Hardware supplied with the dust- and damp-proof kits:

- Self-adhesive flat gasket and mounting instructions (all kits)
- Dust- and damp-proof plates, screws and accessories (②, ③ and ④ only)

VENTILATION KIT (1 to 40 hp drives)

The ventilation kit, part no. VY1-A05107, is comprised of a single phase stirring fan and mounting accessories. It is attached to the upper part of the drive controller. This arrangement reduces hot spots, allowing the controller to be used in an enclosure with a maximum internal temperature of 140 °F (60 °C).

The ventilation kit, shown in Figure 5-16, has the following characteristics:

- ❑ Attached to upper part of drive controller with 0.79 in (20 mm) standoffs, leaving an area free for wiring
- ❑ Overall height: 2.95 in (75 mm) + 0.79 in (20 mm) = 3.74 in (95 mm)

At least 2 in (50 mm) clearance must be provided above the fan for air flow.

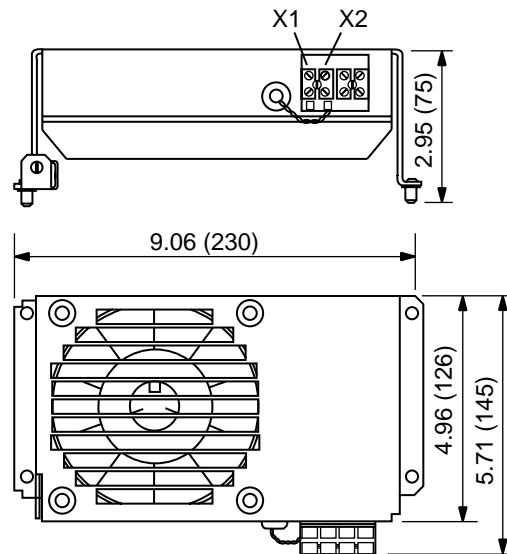


Figure 5-16 Ventilation Kit

The fan has the following characteristics:

- ❑ Flow: 100 CFM (44 dm³/s)
- ❑ Power supply (terminals X1-X2): 208 to 240 V, 50/60 Hz
- ❑ Current consumption: 125/105 mA

To access the top of the drive controller once the fan is installed, remove the two screws on the right hand side of the kit and pivot the kit away from the controller.

SERIAL
COMMUNICATION
BOARD



CAUTION

LOSS OF CONTROL.

- Designer of any control scheme must consider potential failure modes of control paths and, for certain critical control functions (such as emergency stop and over-travel stop), provide a means of achieving a safe state during and after a path failure. Separate or redundant control paths must be provided for critical control functions.
- Control paths of a system may include communication links. Consideration must be given to implications of unanticipated transmission delays or failures of the link. Failure to observe these precautions could result in personal injury, product damage or property damage.¹

1. For additional information, refer to NEMA ICS 1.1-1984, "Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control" and NEMA ICS 3.1-1983 (R 1988), "Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable-Speed Drive Systems."

Designed for incorporation in modern automated system architectures, Omegapak Type P AC drives can be connected to an RS-485 standard multidrop bus. This option board (part no. 8803 PS01) is required for each drive on the bus.

The serial communication board is supplied with mounting accessories, for clipping it on to the control board of the drive controller, and an instruction bulletin.

This option enables data exchange, according to the following protocols:

- UNI-TELWAY®
- MODBUS® / J BUS®
- SY/MAX® PNIM

Via a single asynchronous serial link, a programmable controller or a computer can control and monitor up to 28 Omegapak Type P drive controllers.

The following data may be transmitted over the serial link:

- Operating mode (read and write): LOCAL or LINE
- Drive controller configuration and settings (read and write): ramp times, speed limits, voltage/frequency ratio, thermal (overload) protection, etc.
- Commands (read and write): run, frequency reference, braking, etc.
- Signalling (read only): state and fault recording, motor current, thermal state, etc.

For further information, refer to the Serial Communication Board Instruction Bulletin, part no. 50006-378-05.


200 Hz SOFTWARE
(Software for High Speed Motors)

Optional software (part no. 8803 PE01) that enables control of special, high speed motors (by replacing the standard drive controller memory) is available for Ome-gapak Type P drive controllers. This software is useful for the following applications:


- High speed spindles: textile machines, machine-tools, wood working machines, etc.
- High frequency vibrators: metallurgy, buildings, public works, etc.
- Screw compressors

For further information, refer to the 200 Hz Software Instruction Bulletin, part no. 50006-378-06.

COMMISSIONING
TERMINAL

 WARNING
<p>UNINTENDED EQUIPMENT ACTION.</p> <ul style="list-style-type: none">• Parameter changes affect controller operation.• Read and understand this section before using commissioning terminal. <p>Failure to observe these precautions may result in severe personal injury or equipment damage.</p>

The commissioning terminal enables clear display and modification of the various operation and adjustment parameters. It also extends the drive controller's functions. The terminal is connected to J4 on the control board (Sub D, 9-pin connector).

 DANGER
<p>HAZARDOUS VOLTAGE.</p> <ul style="list-style-type: none">• Hazardous voltage present on control and power terminals adjacent to J4 connector.• Type P controllers are open style devices that have exposed power and control connections.• If commissioning terminal must be connected or disconnected from J4 connector with power present on controller, avoid contact with the following points on the controller:<ul style="list-style-type: none">• All power terminals• J3 control terminals• J5 and J6 control terminals on 50-125 hp controllers. <p>Failure to observe these precautions will cause shock or burn, resulting in severe personal injury or death!</p>

Some features and characteristics of the commissioning terminal are:

- 2-line, 16-character liquid crystal display
- 6 keys for displaying and adjusting various values
- 1 key (STP) for initiating a freewheel stop when controlled by the terminal (terminal control mode)

- ❑ Display in 6 languages
- ❑ 4.9 ft (1.5 m) cable with Sub D, 9-pin connector
- ❑ Dimensions (H x W x D):
7.28 in (185 mm) x 3.54 in (90 mm) x 1.38 in (35 mm)
- ❑ Weight: 1.43 lb (650 g)
- ❑ Operating temperature range: +32 to +104 °F (0 to +40 °C)
- ❑ Storage temperature range: -13 to +158 °F (-25 to +70 °C)

The commissioning terminal is illustrated in Figure 5-17.

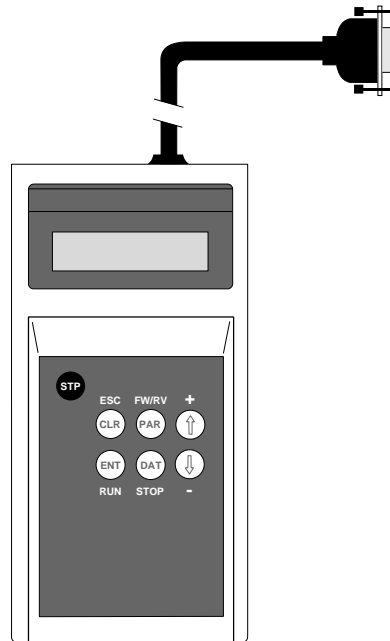


Figure 5-17 Class 8803 Type PP01 Commissioning Terminal

Preliminary Operations

NOTE

- Before applying power to controller, be sure dialog unit CONFIG switch is set to 1 and AUTOTEST switch is OFF.
- When commissioning terminal is connected to the controller, the dialog unit, located on the control board, is disabled. Modification of a variable or parameter can only be carried out from the terminal.

Controller Identification

When power is applied or the terminal is connected, the controller's identification appears on the screen as shown in Figure 5-18 below.

```
OMEGAPAK P00C04D  
460V 2HP U2.1
```

Identification, Rating
Input supply, Software version

Figure 5-18 Controller Identification Screen

Autotest Diagnostics

If the controller is running self-diagnostics and the commissioning terminal is connected, the controller identification is followed by the messages shown in Figure 5-19. For information on fault diagnostics, see Instruction Bulletin 50006-378-04.

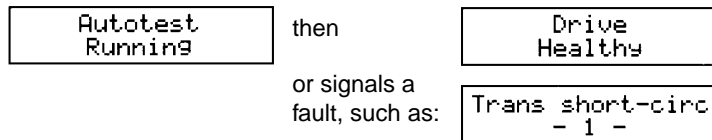


Figure 5-19 Autotest Display Sequence

Selecting the Language

To select the language displayed:

1. Connect the commissioning terminal.
2. Press (CLR) (clear) after identification of the controller is displayed.
3. Press ↑ or ↓ until the desired language (English, French, Italian, German, Portuguese or Spanish) is displayed.
4. Press (ENT) (enter) to select the language.

Normal Operation

Immediately after identification of the drive controller (or after choosing the language), access to the commissioning terminal's normal operation is obtained by pressing (ENT). When the terminal is in the normal mode, its keys operate as defined in Table 5-7.

Table 5-7 Operating Commissioning Terminal Keys in Normal Mode

Key	Operation
(ENT)	Step forward through main menus.
(DAT)	Access parameters to make changes.
↑ and ↓	Scroll through sub-menus or modify parameter settings.
(PAR)	Save parameter changes to memory (EEPROM).
(CLR)	Step backward through main menus or abort parameter modification.
(STP)	Not used.

The various messages that appear on the screen have four hierarchical levels:

1. Electrical quantities
2. Choice of control or adjustment modes
3. Choice of the variables to be modified
4. Modification of a variable or a parameter

Figure 5-20 is a simplified diagram of the commissioning terminal's operation.

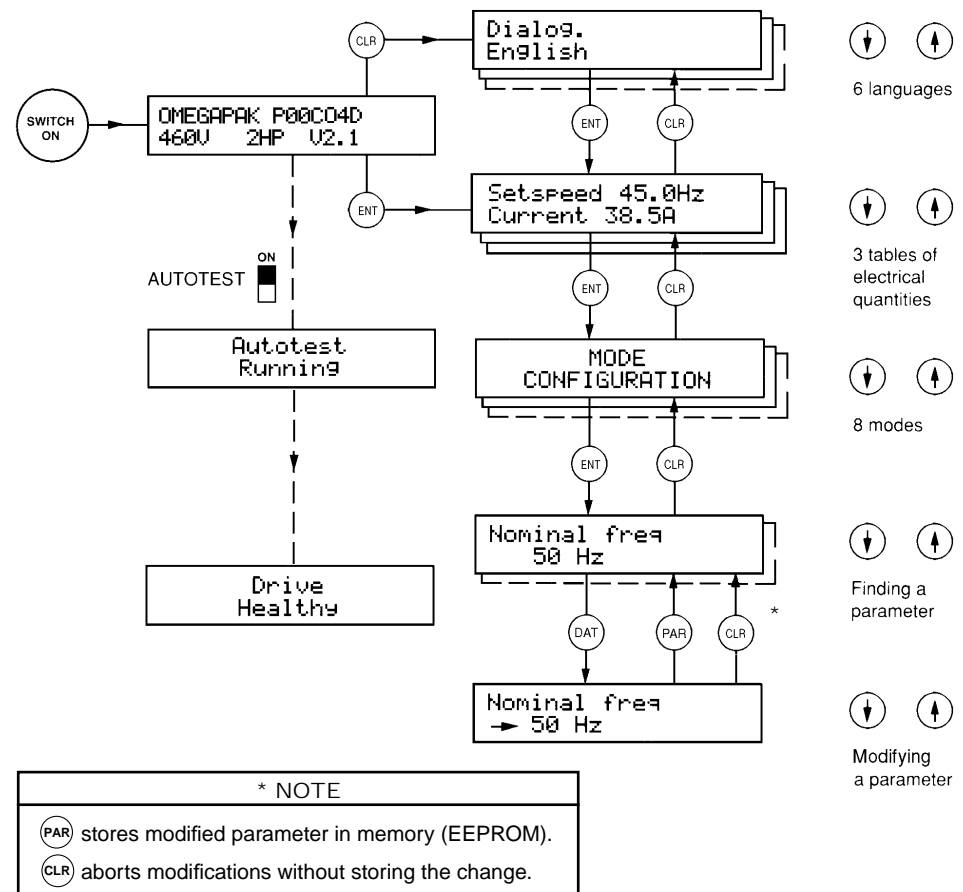


Figure 5-20 Operating the Commissioning Terminal

If a connection fault occurs between the drive controller and commissioning terminal, `Liaison Failure` is displayed. To cancel the fault:

1. Switch off the drive controller's power and control circuits.
2. Check the connection cables.
3. Reapply power.

Electrical Quantities

Electrical quantities appear in pairs, in three tables. Movement from one table to another is achieved by pressing \uparrow or \downarrow . The electrical quantities are:

- Setspeed and motor current
- Thermal state of the motor and voltage on the input line
- Motor load and motor frequency

For example, the setspeed and motor current displayed is: `Setspeed 38.3Hz Current 15.9A`.

Choosing Control or Adjustment Modes

This choice is accessible from the previous level by pressing **(ENT)**. There are eight of these modes, accessible by scrolling with the \uparrow or \downarrow keys:

- CONFIGURATION
 - INPUTS-OUTPUTS
 - SPEC. FUNCTIONS
 - ADJUSTMENTS
 - PAST FAULTS
 - FACTORY SETTINGS
 - CUST. SETTINGS
 - TERMINAL CONTROL
- } Configuration

Press **(CLR)** to go back to the previous level.

If the serial communication option board is being used, an additional mode exists: SERIAL LINK. Refer to the instruction bulletin supplied with the option.

For a detailed description of these parameters, see Chapter 6, Configuration and Adjustments.

Choosing Variables to be Modified

Once a control or adjustment mode is chosen, press **(ENT)** to access the list of variables. Scroll through the variables by pressing \uparrow or \downarrow .

Press **(CLR)** to go back to the previous level.

Modifying a Variable or Parameter

Press **(DAT)** (data) for access to parameter or variable adjustments. An arrow appears at the start of the second line. For example, the acceleration variable is displayed as:

Acceleration
→ 12.3 s

. To modify the variable, press \uparrow or \downarrow .

When in the adjustment mode, pressing \uparrow or \downarrow immediately affects drive operation.

Press **(PAR)** to store the new value and go back to the list of variables.

Press **(CLR)** to go back to the list of variables without storing the modified value.

Fault Displays

If the drive controller faults, the nature of the fault appears on the screen. However, the display of electrical quantities remains possible by pressing ↑ or ↓. Figure 5-21 lists the fault displays, their corresponding codes on the dialog unit and describes the faults. For additional information, refer to Table 4-1 on page 68.

Faults	Dialog Unit Code	Description
Phase failure	PHF	Input phase failure
Undervoltage	USF	Input supply too low
Overvoltage	OSF	Input supply too high
Overtemperat.	OHF	Drive controller (or brake resistor, if used) overheated
Motor overload	OLF	Motor overload, thermal protection tripped
Motor phase	OLF.	Current loss in a motor phase
Overbraking U	ObF	Overbraking (overvoltage)
Overbraking I	ObF.	Overbraking (overcurrent)
Overcurrent 1	OCF	Transient overcurrent or short circuit (anti-sat)
Overcurrent 2	OCF.	Transient overcurrent or short circuit (bus sensor)
Cap. relay	CRF	Capacitor charge relay closure command fault
Overspeed	SPF	Speed regulation fault, incorrect setting or overspeed
Tacho failure	SPF.	No tachogenerator feedback signal
Serial link	SLF	Serial link communication fault
Intern	INF	Internal connection fault
Store fault	INF	EEPROM storage fault: recall factory settings (page 110) or customer settings (page 110)
Autotest inval	INF.	Autotest invalid: AUTOTEST switch moved to the ON position during drive controller operation

Figure 5-21 Fault Displays

Description of Control and Adjustment Modes

1 - CONFIGURATION

The Configuration mode enables display and adjustment of the configuration parameters. The parameters can only be modified when the controller is stopped. Figure 5-22 lists the configuration parameter displays, their corresponding codes on the dialog unit and describes the parameters.

NOTE

All parameter value changes are stored in EEPROM if run command is issued while changes are being made. These parameters will affect drive controller performance. Do NOT enable run command while parameters are being changed.

Parameters	Dialog Unit Code	Description
Nominal freq	[FrS]	Nominal motor frequency
Current input	[rE]	Current input setting
Volts/Freq	[UF]	Voltage/frequency
Max frequency	[Fr]	Maximum frequency
Slip comp.	[SLP]	Slip compensation
Preset speeds		Preset speeds
+speed/-speed		Faster/slower
Reduce volts FW		Reduction of voltage (forward)
Reduce volts RV		Reduction of voltage (reverse)
Reduce I lim.		Reduction of current limit
Accel. torque		Disables reduced current limit during acceleration (accessible only if "Reduce I lim." is set to Local or Remote)

Figure 5-22 Configuration Displays

For a detailed description of these parameters, see Chapter 6, Configuration and Adjustments.

2 - INPUTS-OUTPUTS

The Inputs/Outputs mode allows a user to assign the drive controller's logic inputs and outputs to functions other than the ones to which they are assigned. Input and output assignments can only be modified when the controller is stopped. Figure 5-23 lists and describes the Input/Output parameter displays.

Parameters	Description
Function LI1 I/P	Assignment of logic input LI1
Function LI2 I/P	Assignment of logic input LI2
Function DCB I/P	Assignment of logic input DCB
Analog outputs	Selection of 0-20 mA / 4-20 mA analog outputs
Function A01 O/P	Assignment of analog output A01
Function A02 O/P	Assignment of analog output A02

Figure 5-23 Input/Output Displays

For a detailed description of these parameters, see Chapter 6, Configuration and Adjustments.

3 - SPECIAL FUNCTION

The Special Function mode allows the use of some functions specifically adapted to special applications. These functions can only be enabled and disabled when the controller is stopped. Figure 5-24 lists and describes the Special Function parameter displays.

Parameters	Description
Volt-freq law	Selection of the V/f ratio
Nom. motor volt.	Selection of the nominal motor voltage
Motor therm prot	Tripping of the motor thermal protection
Frequency loop	Frequency regulation loop (disable function available only on 1 to 3 hp drive controllers)
RAMPs	Acceleration-deceleration ramp shapes
Dec ramp adapt.	Adaptation of the deceleration ramp
Skip frequencies	Frequency skipping
DC brake to stop	Injection of DC at standstill
Fr. wheel < LSP	Freewheel stop for frequency below low speed
Catching a load	Automatic catching of a load while running
Auto restart	Automatic restarting after a fault
Phase fail. val.	Enables/disables fault relay function for input line failure at L1, L2 and L3 with line power at H1 and H2
Tacho Feedback	Enables/disables the speed regulation fault function (accessible only when cable is connected from J3 of the drive controller to the speed regulation module)


Figure 5-24 Spec. Function Displays

For a detailed description of these parameters, see Chapter 6, Configuration and Adjustments.

4 - ADJUSTMENTS

The Adjustments mode allows a user to display and adjust all the drive controller's setting parameters. Any parameter can be adjusted at any moment, whether the controller is stopped or running.

Depending on selections made in Configuration, Inputs/Outputs and Special Functions modes, some parameters in the list below may not appear on the terminal screen. Parameters always present are marked with an asterisk (*). Figure 5-25 lists and describes the Adjustment parameter displays.

 WARNING
<p>UNINTENDED EQUIPMENT ACTION.</p> <ul style="list-style-type: none"> Parameter changes affect controller operation. Read and understand this section before using commissioning terminal. <p>Failure to observe these precautions may cause severe personal injury or equipment damage.</p>








Parameters	Dialog Unit Code	Description
*Acceleration		Acceleration time
*Deceleration		Deceleration time
*Low speed		Low speed
*High speed		High speed
*U/F adjustment		Adjustment of the V/f ratio
*I thermal		Motor thermal current
*Stability		Stability
Slip comp.		Slip compensation
Preset speed 1		Preset speed # 1
Preset speed 2		Preset speed # 2
Preset speed 3		Preset speed # 3
Preset speed 4		Preset speed # 4
Preset speed 5		Preset speed # 5
Preset speed 6		Preset speed # 6
Reduce volts		Reduction of motor voltage
Reduce I lim		Reduction of current limit
Acceleration 2		Acceleration time, ramp 2
Deceleration 2		Deceleration time, ramp 2
Freq loop gain		Frequency loop gain
Skip freq. 1		Skip frequency # 1
Skip freq. 2		Skip frequency # 2
DC brake current		DC brake current value

Figure 5-25 Adjustment Displays

Parameters	Description
DC stop current	DC standstill current value
DC stop time	DC current injection time on stop
Brake release I	Current threshold for mechanical brake control
Brake release F	Frequency threshold for mechanical brake release
Brake engage F	Frequency threshold for mechanical brake engage
Brake rel. delay	Time delay for mechanical brake release

Figure 5-22 Adjustment Displays (Cont'd)

For a detailed description of these parameters, see Chapter 6, Configuration and Adjustments.

5 - PAST FAULTS

The Past Faults mode enables display at any time of the eight latest faults to appear during drive controller operation. “Phase Failure” and “Undervoltage” (faults that appear when the power of the controller is switched off) are not included in this list.

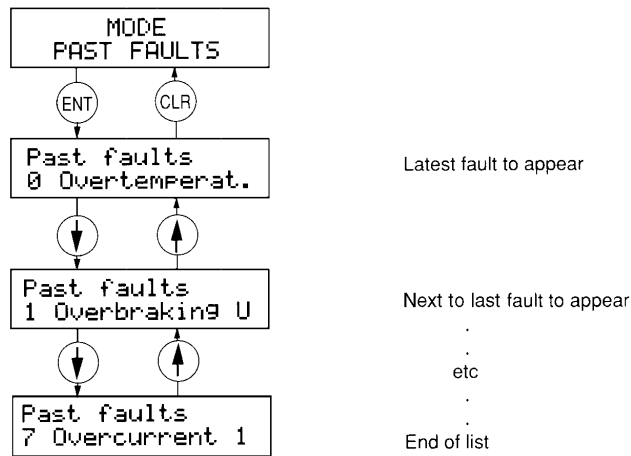


Figure 5-26 Displaying Past Faults

For a detailed description of these faults, refer to the Troubleshooting Manual, part no. 50006-378-04.

6 - FACTORY SETTINGS

The Factory Settings mode allows a user to recall the drive controller's factory settings. This mode is available only when the drive controller is stopped.

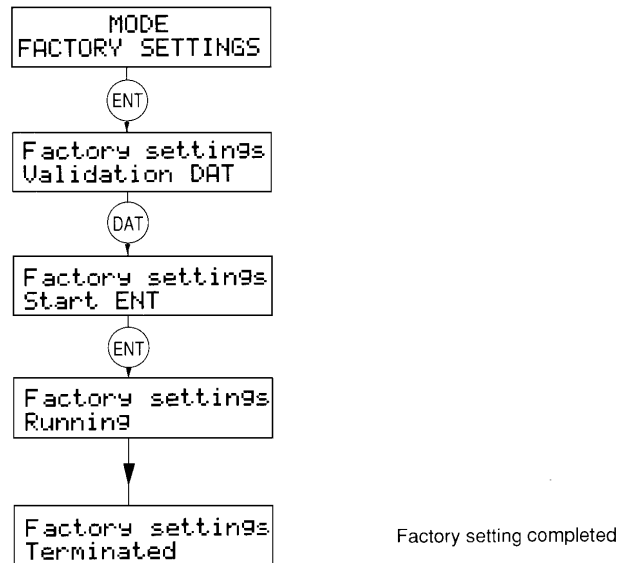


Figure 5-27 Recalling Factory Settings

7 - CUST. SETTINGS

The Cust. Settings (customer settings) mode is a function that allows a user to save all drive controller settings to a separate location in memory. This mode might be used to store a set up for a particular machine or application.

Three separate memory tables are used for storing settings:

- Factory settings, stored in the drive controller (see “Factory Settings” above)
- Adj. ATV, stored in the drive controller
- Adj. term., stored in the commissioning terminal

The displays used in this mode are shown in Figure 5-28. This mode is available only when the drive controller is stopped.

Store adj. ATV	This command stores all drive controller settings in a memory location in the drive controller.
Recall adj. ATV	This command recalls all drive controller settings saved with the command “Store adj. ATV” and stores them in the drive controller EEPROM.
Store adj. term.	This command stores all drive controller settings in a memory location in the commissioning terminal.
Recall adj. term.	This command recalls all drive controller settings saved with the command “Store adj. term.” and stores them in the commissioning terminal EEPROM.
Lock	When set to “YES”, the drive controller dialog unit and commissioning terminal do not allow any drive controller settings to be modified. To unlock the settings, set this parameter back to “NO”.

Figure 5-28 Customer Settings Mode

NOTE

The lock function only locks out commissioning terminal and dialog unit. Changes are still accepted from commissioning software.

Figure 5-29 shows how to store and recall customer settings.

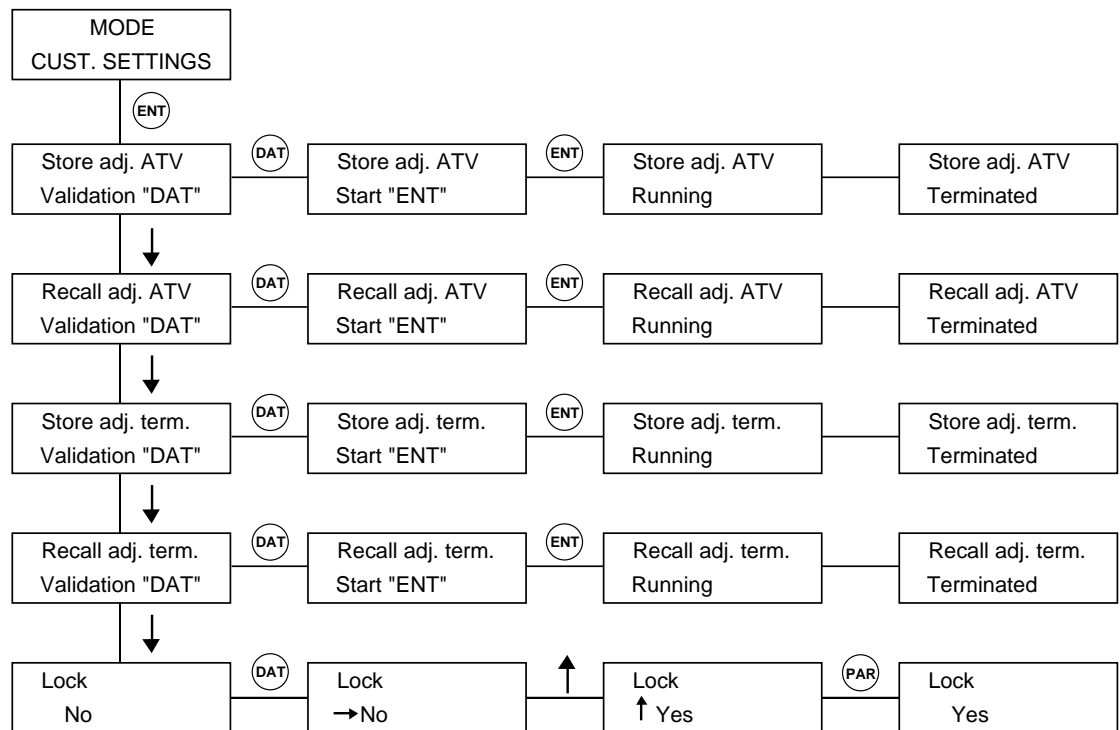


Figure 5-29 Storing and Recalling Customer Settings

8 - TERMINAL CONTROL


The Terminal Control mode allows the drive controller to operate independently from its logic or analog inputs. The drive controller must be stopped for the terminal control to be enabled. Table 5-8 shows which control input terminal functions of the drive controller are valid or disabled when operated in this mode.

Table 5-8 Commissioning Terminal Drive Control Hierarchy

Valid Functions	Disabled Functions
Fast stop (logic input)	Freewheel stop (logic input)
Reduce volts forward (logic input)	DC braking (logic input)
Reduce volts reverse (logic input)	Preset speeds (logic input)
Reduce current limit (logic input)	Run/stop (logic input)
Switch to ramp 2 (logic input)	Store setspeed (logic input)
Remote PBU (logic input)	Local control (logic input)
Remote Reset (logic input)	Forward input
	Reverse input
	Speed reference input (unless set for current limit remote)

NOTE

If communication link is broken between the commissioning terminal and drive controller, the controller reverts to terminal block control (external). No fault is indicated.

 **WARNING**

HAZARD OF SEVERE PERSONAL INJURY OR EQUIPMENT DAMAGE.
Check that motor presents no danger for personnel, as drive controller does not take into account the driven machine's safety devices.
Failure to observe this precaution can result in severe personal injury or death as well as equipment damage!

Figure 5-30 shows how to control the drive controller from the commissioning terminal.

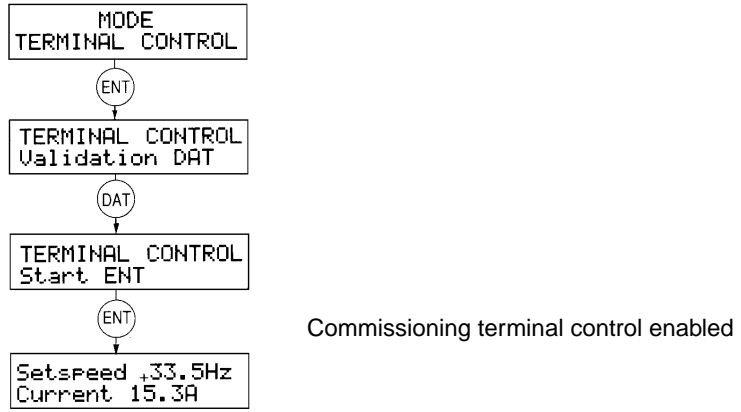


Figure 5-30 Enabling Terminal Control

When terminal control is enabled, its keys are reassigned as shown in Figure 5-31:

⊙ ENT	→	Run command
⊙ PAR	→	Change rotation direction
⊙ DAT	→	Stop with deceleration ramp
⊙ ↑	→	Increase the setspeed
⊙ ↓	→	Decrease the setspeed
⊙ STP		Disable the drive controller, freewheel stop
⊙ CLR	→	Escape. Cancels terminal control when the drive controller is stopped. Displays electrical quantities (setspeed, current, thermal state, frequency, load, input supply) when the drive controller is operating.

Figure 5-31 Terminal Key Control Assignments

SERIAL LINK

Incorporated in the Omegapak Type P drive controller is a point-to-point serial link operating either via a 20 mA current loop or RS-232C link. This function allows connection of the drive controller to a programmable controller or a computer with a single link. When the serial link is enabled, it can:

- Adjust drive controller setting parameters
- Control the drive controller
- Access all control and signalling data

The serial link has the following characteristics:

- Asynchronous serial link
- Isolated transmission interfaces: 20 mA current loop, RS-232C
- Speed: 9600 baud
- Character format (these parameters are fixed):
 - 1 start bit
 - 8 data bits
 - 1 odd parity bit
 - 1 stop bit
- The link is the master-slave type, the drive controller being the slave, and operating in half-duplex (a single station transmits at any given moment).
- Drive controller response time: $10 \text{ ms} \leq T_r \leq 50 \text{ ms}$

 **CAUTION**

LOSS OF CONTROL.

- Designer of any control scheme must consider potential failure modes of control paths and, for certain critical control functions (such as emergency stop and over-travel stop), provide a means of achieving a safe state during and after a path failure. Separate or redundant control paths must be provided for critical control functions.
 - Control paths of a system may include communication links. Consideration must be given to implications of unanticipated transmission delays or failures of the link.
- Failure to observe this precaution could result in personal injury, product damage or property damage.¹

1. For additional information, refer to NEMA ICS 1.1-1984, "Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control" and NEMA ICS 3.1-1983 (R 1988), "Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable-Speed Drive Systems."

Connections

Use of the 20 mA current loop is strongly recommended in industrial applications in environments with high levels of interference or long distances. Use a shielded cable with two twisted pairs, with conductor cross sections at least AWG 20 (0.5 mm²), maximum length = 1640 ft (500 m).

Although isolated from the controller, the RS-232C link, because of its electrical characteristics, is much more sensitive to interference and should not be used over distances longer than 33 ft (10 m).

Transmission interfaces:

- Available on connector J4 of drive controller: a Sub D, 9-pin female connector, located in the lower part of controller.
- Only one of these interfaces should be used for any given application.
- No jumpers or switches need to be set.

The serial link connector pins are illustrated in Figure 5-32 below.

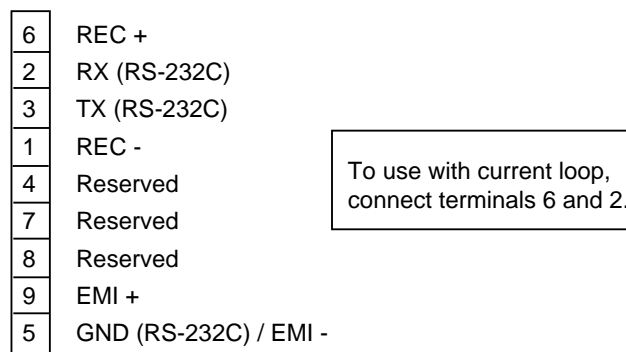


Figure 5-32 Serial Link Connector Pins

Figure 5-33 shows a 20 mA current loop connection between a Telemecanique TSX7 programmable controller and TSX-SCM2022 communication module. This configuration requires the use of UNI-TELWAY protocol.

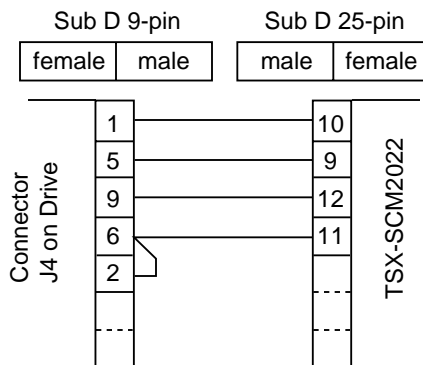


Figure 5-33 Serial Link Current Loop Connection

Figure 5-34 shows an RS-232C connection to a DOS-compatible computer.

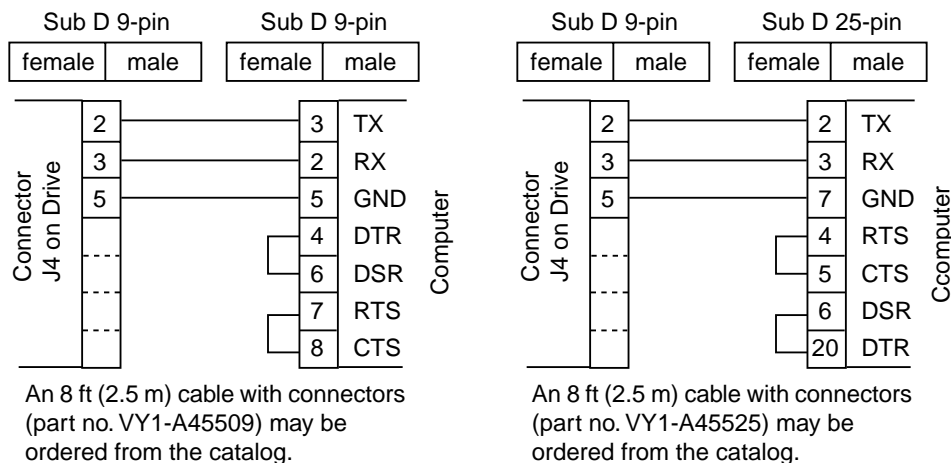


Figure 5-34 Serial Link Connection to a Computer

Data Structure and Access

Adjustments, commands, control and monitoring of the drive controller by serial link is carried out via the exchange of data. Essentially, the data is comprised of:

- ❑ Bits, called Bi (i = bit number) enabling the carrying out of logic commands (2 possible states: 0 or 1). For example, B7 = braking command bit.
- ❑ Words (16 bits), called Wi (i = word number) used to exchange complete numerical values (-2768 to +32,767), or, where necessary, a group of 16 independent logic states (referred to as registers). For example, W19 = frequency reference, W21 = fault register (16 bits). Notation: W21,2 assigns the row 2 bit of register 21.

Some data (such as settings, references and commands) is accessible by the read and write commands. As a general rule, this data is used by the drive. On the other hand, data initiated by the drive (such as signalling data, faults) is only accessible by the read command. Writing of this data is prohibited and will be refused.

Protocol

The protocol is based on the exchange of data comprised of ASCII characters, exclusively. For the rest of this document, all characters are considered to be encoded in ASCII (see ASCII codes table, page 122).

Data exchanges are of the question-answer type. The master (programmable controller or computer) sends a question to the drive controller and waits for its answer, which should arrive within 50 ms, maximum. If this time is exceeded, the master must repeat the question.

Failure to respond by the drive controller occurs in the following cases:

- Incorrect question format
- Parity error detected in the characters
- Faulty or interrupted link

Message Format

Messages are delimited by a start character (? for a question, > for an answer) and two end characters (LF followed by CR).

Questions are formatted as follows:

Start	Question code	Data 1	Separator *	Data 2 *	End
?	see table	number of word or bit	1 or 2 characters <SP> or <@>	value	<LF> <CR>

* These 2 symbols only exist to carry out writing. They are empty if a read request is made

Answers are formatted as follows:

Start	Answer code	Data 3 **	End
>	see table	value	<LF> <CR>

** This value only exists in answer to a read request. It is empty if a write request is made.

- Data 1: bit or word number between 0 and +32767, the + is optional, as are the leading zeros. For example: for word W19, either 19 or +00019.
- Data 2: value of word or bit to be written. For 1 word, it is a whole number between -32768 and +32767, the + is optional, as are the leading zeros. For example: 25 or +00025, -168 or -00168. For 1 bit, this value is 0 or 1.
- Data 3: value of word or bit to be read. For 1 word, it is 6 characters, fixed format. For example: +00034, -21254. For 1 bit this value is 0 or 1.

Table 5-9 Question and Answer Code Table

Function	Question Code	Positive Answer Code	Negative Answer Code
Read bit	A	A	N
Write bit	B	V	N
Read word	C	C	N
Write word	D	Y	N
Read table of 10 consecutive words	E	E	N
Mirror	M	M	N

A negative answer is caused by:

- Bit or word number not present in the drive controller
- Non-existent question code
- Incorrect question format (but first character = ?)

To read B6 (frequency reference signal):

- Question: ? A6 <LF> <CR> or ? A +00006 <LF> <CR>
- Answer: > A0 <LF> <CR> si B6 = 0 (positive reference)
> A1 <LF> <CR> si B6 = 1 (negative reference)

To write to bit B5 (drive controller run/stop command):

- Question: ? B5 <SP> 1 <LF> <CR> for run
? B5 <SP> 0 <LF> <CR> for stop
- Answer: > Y <LF> <CR>

To read W22 (motor current):

- Question: ? C22 <LF> <CR>
- Answer: ? C + 00128 <LF> <CR> (motor current 12.8 A)

To write to word W19 (frequency reference):

- Question: ? D19 <SP> 385 <LF> <CR> (reference: 38.5 Hz)
- Answer: > Y <LF> <CR>

To read 10 consecutive words starting at W5:

- Question: ? E 5 <LF> <CR>
- Answer: > E +00002 <SP> +00007 <SP> +00128..... <LF> <CR>
word W5 = +00002
word W6 = +00007
word W7 = +00128
etc... up to W14 inclusive

The mirror function can be used for the communication test. It sends back the succession of characters sent (from 1 to 16 numbers). To perform the mirror function:

- Question: ? M12345 <LF> <CR>
- Answer: > M12345 <LF> <CR>

**Drive Controller
Variables**

Table 5-10 Bit Definitions

Bit	Name	Description
B0	TST	Tripping of fault relay
B1	RST ^[1]	Resetting of drive controller
B2	CLO ^[1]	Assigning of LOCAL commands
B3	CLI ^[1]	Assigning of LINE commands
B4	NTO	Disable serial link fault protection
Commands (read and write)		
B5	RUN	Run command
B6	REV	Frequency reference sign
B7	DCB	DC braking command
B8	CAL	Freewheel stop command
B9	CAR	Fast stop command
B10	RTM	Reduce motor volts

^[1]These bits are transitionals. When set to 1, stated action occurs and drive controller then sets the bit to 0. Writing the bit to 0 has no effect.

- TST (B0): Causes the drive controller fault relay contacts to open, and as a result, removes line power from the controller if the relay contact is used to maintain the line contactor.
- RST (B1): Acknowledges the fault and resets the drive controller fault relay only if the fault has been corrected.
- CLO (B2): Puts the drive controller in Local mode. This can only be controlled from its terminal (logic and analog inputs).
- CLI (B3): Puts the drive controller in Line mode and waits for its commands from the serial link.
- NTO (B4): The serial link is monitored continuously when the drive controller is in Line mode. If the controller does not receive at least one character every second, SLF fault is issued. Set this bit to 1 to disable this function.

 **WARNING**

LOSS OF CONTROL.

Setting NTO (B4) to 1 disables serial link fault protection. Disabling the serial link fault protection can result in loss of control and may cause severe personal injury or equipment damage.

- RUN (B5): 1 = run, 0 = stop.
- REV (B6): Frequency reference signal: 0 = positive, 1 = negative. To reverse the rotation direction, change this bit state or supply an opposite frequency reference sign in word W19.
- DCB (B7): Brake control by setting the bit at 1. Has priority over RUN bit.
- CAL (B8): Freewheel stop control as soon as the bit is set to 1. Has priority over RUN bit.
- CAR (B9): Fast stop control (deceleration ramp divided by 4). Has priority over RUN and CAL bit.

- ❑ RTM (B10): At state 1, reduces the voltage taken by the motor in normal operating mode. This bit is only active if the drive controller was configured with this function. The reduction factor can be adjusted in word W5.

NOTE

Drive controller is in Local mode when power is first applied. To control it by serial link (enable Line mode), set bit B3 to 1.

Table 5-11 Word Definitions

Word	Name	Unit	Description
Adjustments and commands (read and write)			
W0	–	–	Reserved
W1	–	–	Reserved
W2	CGL	0.1%	Slip compensation ^[1]
W3	STA	0-1000	Stability
W4	RLI	0.1%	Reduce I limit ^[1]
W5	FTM	0.1%	Reduce motor volts ^[1]
W6	IBR	0.1 A	DC braking level current
W7	IAR	0.1 A	DC stop level current ^[1]
W8	TAR	0.1 s	DC stop time ^[1]
W9	UFR	0-99	Voltage/frequency ratio
W10	ITH	0.1 A	I thermal
W11	GBF	0-1000	Frequency loop gain
W12	FR1	0.1 Hz	Skip frequency 1 ^[1]
W13	FR2	0.1 Hz	Skip frequency 2 ^[1]
W14	LSP	0.1 Hz	Low speed
W15	HSP	0.1 Hz	High speed
W16	ACC	0.1 s	Acceleration
W17	DEC	0.1 s	Deceleration
W18	COM	–	Command register
W19	FRH	0.1 Hz	Frequency reference
Signalling (read only)			
W20	STR	–	State register
W21	FLT	–	Fault register
W22	LCR	0.1 A	Motor current
W23	RFR	0.1 Hz	Rotation frequency
W24	THR	0.1%	Thermal state
W25	ULN	0.1 V	Line voltage
W26	CHM	% of rated value	Motor load

^[1]These parameters are not active unless corresponding function has been configured in drive controller.

Registers

Table 5-12 Command Register COM (W18) – Read and Write

Bit	Name	Description
W18,0	RST	Resetting of drive controller
W18,1	DLI	Assigning of logic commands in Line mode
W18,2	FLI	Assigning of frequency reference in Line mode
W18,3	–	Reserved
W18,4	NTO	Disable serial link fault protection
W18,5	RUN	Run command
W18,6	DCB	DC injection braking command
W18,7	–	Reserved
W18,8	CAL	Freewheel stop command
W18,9	CAR	Fast stop command
W18,A	RTM	Reduce motor volts
W18,B	–	Reserved
W18,C	–	Reserved
W18,D	–	Reserved
W18,E	–	Reserved
W18,F	–	Reserved

Bits listed above are active when set to 1, and have same function as bits described in "Drive Controller Variables" on page 118.

Bits DLI and FLI provide the possibility of partially assigning the drive controller commands:

- DLI (W18,1): when set to 1, the logic commands (such as run, stop, brake) can be carried out in Line mode. When set to 0, the logic commands are only controlled by the drive controller logic inputs.
- FLI (W18,2): when set to 1, the frequency reference is read in word W19. When set to 0, the frequency reference is provided by the drive controller analog input.

NOTE

DLI and FLI must be in correct state each time COM register is written. In application where controller is completely controlled by serial link, they should always be at state 1. Writing value of 1 in bit B3 (CL1) causes DLI and FLI to be set to 1. Writing value of 1 in bit B2 (CL0) sets DLI and FLI to 0.

Table 5-13 State register STR (W20) – Read Only

Bit	Name	Description
W20,0	LOC	All commands assigned in Local
W20,1	RDY	Drive controller ready (RDY or SLC)
W20,2	FAI	Fault present
W20,3	REN	Resetting authorized
W20,4	BCR	Brake engage relay closed
W20,5	FLO	Local control enabled
W20,6	NTO	Serial link fault protection disabled
W20,7	CFA	Fault present, can be corrected
W20,8	RNG	Controller running
W20,9	RVE	Direction (0 = forward, 1 = reverse)
W20,A	BRE	DC injection braking
W20,B	SST	Normal operating mode
W20,C	OVL	Thermal overload alarm
W20,D	OBR	Overbraking alarm
W20,E	LIM	In current limitation
W20,F	PWD	Power voltage failure

The states listed above are active when set to 1.

Table 5-14 Fault Register FLT (W21) – Read Only

Bit	Name	Description
W21,0	INF	Internal drive controller fault ^[1]
W21,1	SLF	Serial link fault
W21,2	–	Reserved
W21,3	SRF	Fault following a TST command
W21,4	USF	Undervoltage
W21,5	OSF	Overvoltage
W21,6	PHF	Phase fault
W21,7	OHF	Overtemperature
W21,8	SPF	Speed fault (tachogenerator)
W21,9	OCF	Overcurrent ^[1]
W21,A	OBF	Overbraking
W21,B	OBF	Overhauling load current
W21,C	OLF	Motor overload
W21,D	OLF	Current too low or motor phase failure ^[1]
W21,E	–	Reserved
W21,F	CRF	Charge relay fault (models ≥ 50 hp)

^[1]These faults cannot be reset through the serial link.


ASCII Characters

Table 5-15 ASCII Characters Used

Dec	Hex	Character
10	0A	LF (line feed)
13	0D	CR (carriage return)
32	20	SP (space)
43	2B	+
45	2D	-
48	30	0
49	31	1
50	32	2
51	33	3
52	34	4
53	35	5
54	36	6
55	37	7
56	38	8
57	39	9
62	3E	>
63	3F	?
64	40	@
65	41	A
66	42	B
67	43	C
68	44	D
69	45	E
77	4D	M
78	4E	N
89	59	Y

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INTRODUCTION

 WARNING
<p style="text-align: center; margin: 0;">PARAMETER CHANGES AFFECT DRIVE CONTROLLER OPERATION.</p> <p style="margin: 0;">Read and understand this section before operating controller or changing controller parameters.</p> <p style="margin: 0;">Failure to observe this precaution can result in severe personal injury, product damage or property damage.</p>

The aim of this chapter is to specify the significance of each configuration and adjustment parameter and to provide detailed information about the special functions. These special functions are only available via the software, the commissioning terminal or via the serial link.

CONFIGURATION PARAMETERS

Table 6-1 lists and describes the configuration parameters.

Table 6-1 Configuration Parameters

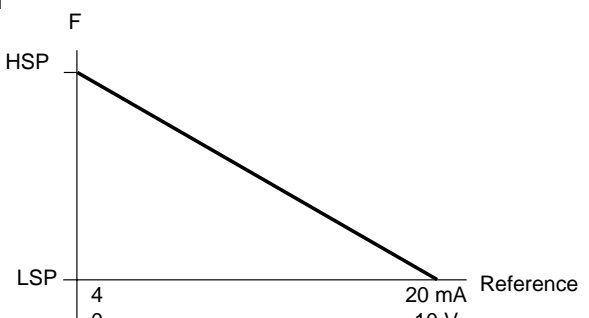
Parameters	Selection	Factory Setting	Description
Rated frequency	50/60 Hz	P00C02_: 50 Hz P00C04_: 60 Hz	(Dialog unit $\boxed{FR5}$) Output frequency selection at rated motor voltage (see Table 3-1 on page 60).
Current input	0-20/4-20 mA 20-4 mA ^[1]	0-20 mA	(Dialog unit \boxed{RE}) Speed reference input selection at terminal EC. <div style="display: flex; align-items: center;"> <div style="flex: 1;"> <p>^[1] Special case: current input = 20-4 mA. Inputs E1 and E2 become 10-0 V inputs (high speed HSP obtained for 4 mA or 0 V reference).</p> </div> <div style="flex: 2;">  </div> </div> <p style="text-align: center;">Figure 6-1 Curve for 20-4 mA Reference</p>
Voltage/frequency	Connection 1 (high) Connection 2 (low)	Connection 1	(Dialog unit \boxed{UF}) Voltage/frequency selection (see Table 3-1 on page 60).
Maximum frequency	67 / 87 / 110 Hz 80.4 / 132 Hz 104 / 120 / 132 Hz	P00C02_: 67 Hz P00C04_: 80.4 Hz	(Dialog unit \boxed{FR}) Frequency range selection (see Table 3-1 on page 60).
Slip compensation	YES/NO	YES	(Dialog unit \boxed{SLP}) Allows user to disable/enable automatic slip compensation.
Preset speeds	NO	NO	Initial set up of this function causes inputs LI1, LI2 and DCB to be assigned to the selection of 2, 4 or 8 preset frequency values. Determined by the state of the logic inputs, these frequency values are listed below.

Table 6-1 Configuration Parameters (Cont'd)

Parameters	Selection	Factory Setting	Description			
Preset speeds (cont'd)	2		LI1	LI2	DCB	Frequency value
			0	0	0	Reference
			1	0	0	Preset speed 1
	4		0	1	0	Preset speed 2
			1	1	0	High speed
			0	0	1	Preset speed 3
	8		1	0	1	Preset speed 4
			0	1	1	Preset speed 5
			1	1	1	Preset speed 6

Adjustments: see “High speed” and “Preset speeds 1 to 6” in Table 6-7 on page 134.

Special case: jog function. Selection of 2 preset speed levels corresponds to jog function operation. LI1 = 0: standard operation at the speed reference. LI1 = 1: operation at preset speed 1.

Acceleration and deceleration ramp times are equal to “Acceleration 2” and “Deceleration 2” on page 134. Time delay between stopping and the next start of operation = 500 ms.

+Speed/-Speed
 (motorized potentiometer)

NO/YES

NO

With +Speed/-Speed operation, the logic inputs are assigned to the following functions:
LI1: “+Speed” (frequency increases according to acceleration ramp, maximum frequency limited by the reference).
LI2: “-Speed” (frequency decreases according to deceleration ramp).
Operation: drive controller is enabled and rotation direction is controlled by FW and RV inputs (see Figure 6-2).

NOTE

+Speed/-Speed function may not be used simultaneously with selection of preset speeds (2, 4 or 8 levels).

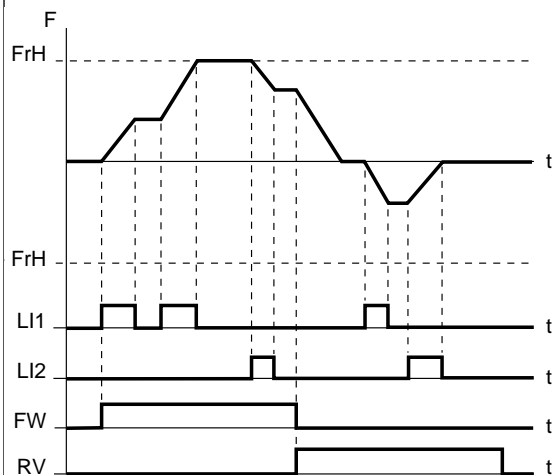


Figure 6-2 +Speed/-Speed Operation

Figure 6-3 shows the terminal connections for the +Speed/-Speed function.

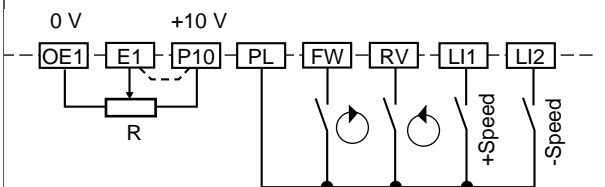
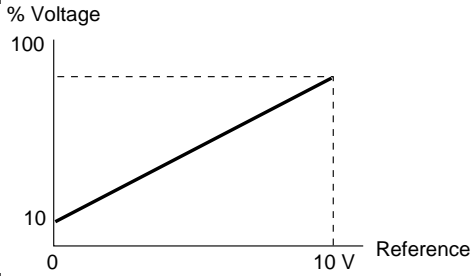
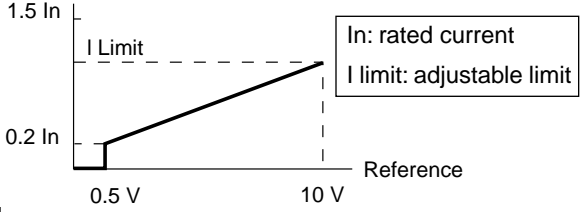


Figure 6-3 +Speed/-Speed Connections

Table 6-1 Configuration Parameters (Cont'd)

Parameters	Selection	Factory Setting	Description
Reduce volts FW	NO/YES LOGIC INPUT REMOTE	NO	<p>Allows user to reduce voltage supplied to motor. YES: Motor voltage reduced in steady state operating mode. For acceleration and deceleration, voltage remains normal. LOGIC INPUT: Motor voltage is reduced for forward operation when one of the logic inputs assigned to the function is enabled. The rate of reduction can be adjusted: see “Reduce motor volts” on page 134.</p> <ul style="list-style-type: none"> • 100% = full voltage applied • 10% = 10% of voltage applied  <p>Figure 6-4 Reduced Voltage Operation</p> <p>REMOTE: Motor voltage is reduced in forward or reverse direction to a value determined by the reference input assigned to this function. Speed reference is selected by the preset speeds, HSP or +Speed/-Speed. This function may not be used in conjunction with Reduce volts RV or Reduce I limit (remote).</p>
Reduce volts RV	NO/YES LOGIC INPUT	NO	<p>Identical to FW (see above). LOGIC INPUT: Motor voltage is reduced for reverse operation when one of the logic inputs assigned to the function is enabled. Rate of reduction can be adjusted: see “Reduce motor volts” on page 134.</p>
Reduce I limit	NO LOCAL REMOTE	NO	<p>Initial set up of this function allows a user to adjust the current limit value. Disabled when frequency loop is set to “No.” LOCAL: Value is altered when one of the logic inputs assigned to the function is enabled. Value is fixed by an “I limitation” parameter. REMOTE: Current limit is systematically altered to a value fixed by an input reference, reassigned to this function. Speed reference is therefore equal to “high speed.”</p>  <p>Figure 6-5 Reducing Current Limit</p>
Acceleration torque	NO/YES	–	<p>When current limitation reduction is enabled (in Local or Remote), acceleration torque can be maintained by selecting YES. In this case, current limit stays at its maximum value during acceleration.</p>

INPUT/OUTPUT
 ASSIGNMENTS

Table 6-2 shows the input assignments.

Table 6-2 Input Assignments

Configuration Parameter	Assignments
Preset speed ^[1]	8 speeds: LI1, LI2 and DCB are assigned to this function. 4 speeds: LI1 and LI2 are assigned to this function. 2 speeds: LI1 is assigned to this function.
+Speed/-Speed ^[1]	LI1 is assigned to +Speed. LI2 is assigned to -Speed.
DC Braking Freewheel stop Fast stop	Reduce volts ^[2] Reduce I lim ^[2] Sw. to ramp 2 Store setspeed ^[2]
Local control Remote PBU Remote Reset	Any of the three logic inputs can be assigned to these functions, except where they are assigned to one of the previous functions.

^[1] These functions have priority over logic inputs.
^[2] These functions may not be present, depending on settings in Configuration menu.

Table 6-3 shows the possible logic input assignments for each function enabled in configuration. For each configuration choice, the default assignments of the logic inputs are highlighted in grey.

Table 6-3 Logic Input Defaults

Configuration Selection	Possible Assignments		
	LI1	LI2	DCB
8 Preset speeds	Preset speeds	Preset speeds	Preset speeds
4 Preset speeds	Preset speeds	Preset speeds	DC braking
			Freewheel stop Fast stop Reduce FW or RV volts Reduce I lim Sw. to ramp 2 Store setspeed Local control Remote PBU Remote Reset Motor selection 2
2 Preset speeds	Preset speeds	DC braking	DC braking
		Freewheel stop Fast Stop Reduce FW or RV volts Reduce I lim Sw. to ramp 2 Store setspeed Local control Remote PBU Remote Reset Motor selection 2	Freewheel stop Fast stop Reduce FW or RV volts Reduce I lim Sw. to ramp 2 Store setspeed Local control Remote PBU Remote Reset Motor selection 2
+Speed/-Speed	+Speed	-Speed	DC braking
			Freewheel stop Fast stop Reduce FW or RV volts Reduce I lim Sw. to ramp 2 Store setspeed Local control Remote PBU Remote Reset Motor selection 2

Table 6-3 Logic Input Defaults (Cont'd)

Configuration Selection	Possible Assignments		
	LI1	LI2	DCB
Reduce FW or RV volts (logic input)	DC braking	DC braking	DC braking
	Freewheel stop	Freewheel stop	Freewheel stop
	Fast stop	Fast stop	Fast stop
	Reduce FW or RV volts	Reduce FW or RV volts	Reduce FW or RV volts
	Reduce I lim	Reduce I lim	Reduce I lim
	Sw. to ramp 2	Sw. to ramp 2	Sw. to ramp 2
	Store setspeed	Store setspeed	Store setspeed
	Local control	Local control	Local control
	Remote PBU	Remote PBU	Remote PBU
	Remote Reset	Remote Reset	Remote Reset
Motor selection 2 +Speed	Motor selection 2 -Speed	Motor selection 2	
Reduce I limit (local)	DC braking	DC braking	DC braking
	Freewheel stop	Freewheel stop	Freewheel stop
	Fast stop	Fast stop	Fast stop
	Reduce FW or RV volts	Reduce FW or RV volts	Reduce FW or RV volts
	Reduce I lim	Reduce I lim	Reduce I lim
	Sw. to ramp 2	Sw. to ramp 2	Sw. to ramp 2
	Store setspeed	Store setspeed	Store setspeed
	Local control	Local control	Local control
	Remote PBU	Remote PBU	Remote PBU
	Remote Reset	Remote Reset	Remote Reset
Motor selection 2 +Speed	Motor selection 2 -Speed	Motor selection 2	
Factory setting	Freewheel stop	Fast stop	DC braking

Table 6-4 describes the functions that may be assigned to the logic inputs.

Table 6-4 Function Descriptions

Function	Description
Preset speeds +Speed/-Speed	Reduce volts Reduce I lim

Sw. to ramp 2
When logic input assigned to this function is enabled, acceleration and deceleration ramp values are equal to Acceleration 2 and Deceleration 2 (page 134). The shape of the ramp remains the same. Figure 6-6 is a sample timing diagram.

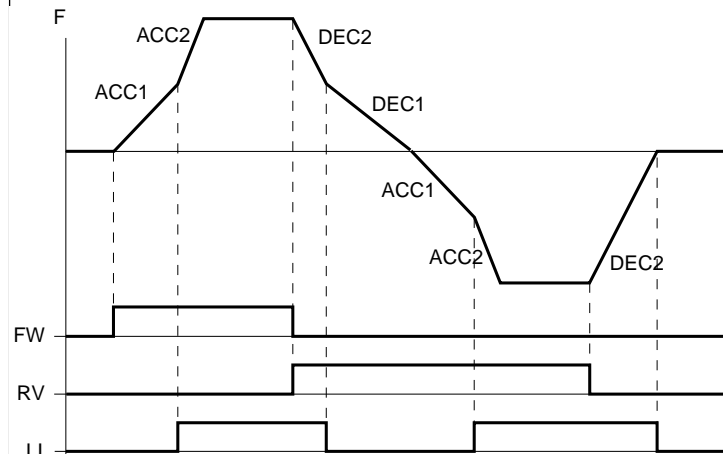
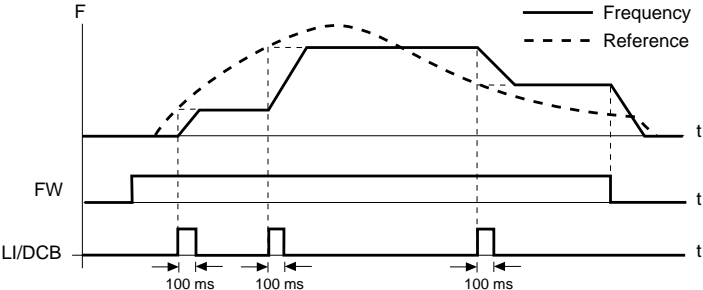
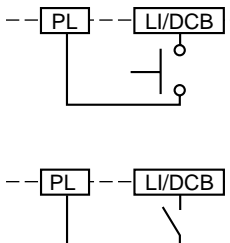
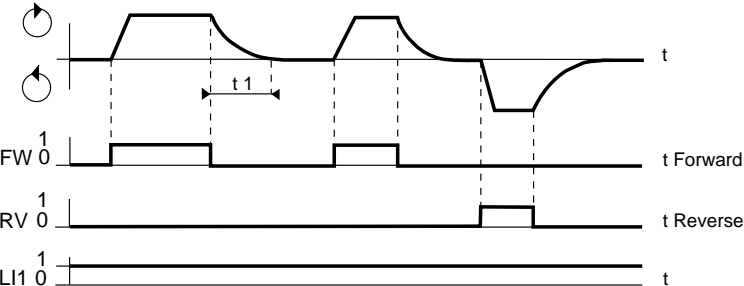
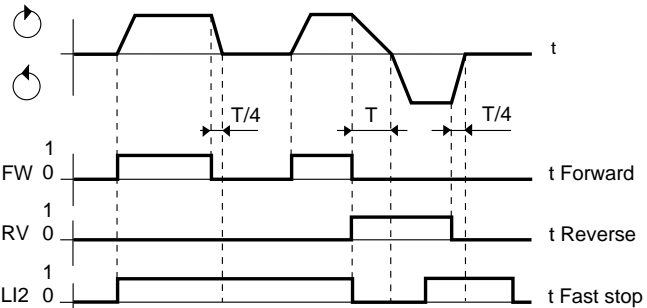


Figure 6-6 Switching to Ramp 2

Table 6-4 Function Descriptions (Cont'd)

Function	Description
<p>Store setspeed</p>	<p>When logic input assigned to this function is enabled (by a pulse of at least 100 ms), frequency reference is stored and is independent of the signals present at the reference inputs. Frequency reference is maintained until the next pulse or until run input (FW or RV) is disabled.</p>  <p>Figure 6-7 Storing the Setspeed</p>
<p>Remote PBU</p> <p>Remote Reset</p> <p>Select Motor 2</p> 	<p>This function is the same as the push button on the dialog unit (see page 54). Long pulse on input assigned to this function causes parameters on dialog unit to scroll. Short pulse causes parameter name and value to be displayed.</p> <p>When logic input assigned to this function is enabled, any stored faults (see list below) are cleared and drive controller is reset if cause of fault has been corrected. Faults that may be cleared are: OSF, OLF, OLF•, OBF, OBF•, OHF, SPF, SPF•, and SLF•. Note that faults PHF and USF are not stored.</p> <p>When logic input assigned to this function is enabled, a second value for I thermal is selected. Value may range between 0.2 and 1.05 times the rated current. Factory setting is 0.9 times the rated current. The selection may not be changed if drive controller has tripped and input PL is enabled.</p>
<p>Local control</p>	<p>When logic input assigned to this function is enabled, drive controller will not accept any commands or parameter changes via the commissioning software, serial link or serial communication board. Controller will accept commands and parameter changes from the commissioning terminal.</p>
<p>Freewheel stop</p>	<p>When logic input assigned to this function is enabled, drive controller output will be disabled when run input (FW or RV) is disabled. Controller will decelerate with no power applied to the motor (see Figure 6-8). Deceleration time, T1, depends on motor speed, machine inertia and resistive torque.</p>  <p>Figure 6-8 Freewheel Stop</p>
<p>Fast stop</p>	<p>Fast stop modifies deceleration ramp setting. When logic input assigned to this function is enabled and run input (FW or RV) is disabled, drive deceleration time is divided by 4 (to a minimum of 0.2 s), depending on motor/controller load conditions (see Figure 6-9). Freewheel stop has priority over fast stop.</p>  <p>Figure 6-9 Fast Stop</p>

Analog outputs A01 and A02 can be modified and assigned according to the data listed in Table 6-5.

Table 6-5 Analog Output Assignments

		Factory Setting	Description
Analog Output Value	0-20 mA 4-20 mA	0-20 mA	Output signals A01 and A02 varying from 0 to 20 mA or from 4 to 20 mA according to selection.
Assignment of output A01 or A02	Motor frequency	A01	Analog output A01 assigned to motor frequency signal. Scale factor: 20 mA = high speed.
	Motor current	A02	Analog output A02 assigned to motor current signal. Scale factor: 20 mA = maximum drive controller transient current (see Table 1-1 on page 10).
	Motor thermal state		Analog output A01 or A02 assigned to motor thermal state signal. Scale factor: 20 mA = 150%.
	Motor load		Analog output A01 or A02 assigned to motor load signal. Scale factor: 20 mA = 200%.
	HSP attained ^[1]		Analog output A01 or A02 assigned to "HSP attained" logic function.
	LSP attained ^[1]		Analog output A01 or A02 assigned to "LSP attained" logic function.
	Reference attained ^[1]		Analog output A01 or A02 assigned to "Reference attained" logic function.
	I limit ^[1]		Analog output A01 or A02 assigned to "I limit" logic function.
	Motor thermal state ≥ 100% ^[1]		Analog output A01 or A02 assigned to motor thermal state logic function. ≥ 100% (thermal pre-alarm).
Motor thermal state ≥ 118% ^[1]		Analog output A01 or A02 assigned to motor thermal state logic function. ≥ 118% (thermal alarm).	

^[1] Logic level 0 = 0 or 4 mA. Logic level 1 = 20 mA.

SPECIAL APPLICATIONS

The functions listed in Table 6-6 enable adaptation of the drive controller to certain special applications.

Table 6-6 Special Functions

Function	Selection	Factory Setting	Description
Volt/freq. law	Linear N Quadratic P Linear F Linear L	Linear N	Selection of voltage/frequency ratio. Linear: Ratio adapted to loads at constant torque with self-adaptation to the motor load. N: Typical applications. F: Machines with fast cycles, machines with stop positioning, machines with high inertia. L: Special motors, such as tapered rotor motors, pole change motors, high torque motors. Quadratic: Ratio adapted to quadratic torque loads (fans or centrifugal pumps). Enables reduction of current and motor noise.
Nominal motor voltage	Automatic 220/240 V 440/460/500 V	Automatic, according to input line supply	Selection of rated motor voltage at 50 or 60 Hz. P00C02_: 220 V or 240 V P00C04_: 440 V, 460 V or 500 V
Motor thermal (overload) protection	Yes/No Force cooled motor	Yes	Function enabled: Normal operation of thermal protection. Function disabled: Tripping of thermal protection is cancelled, thermal state calculation is maintained. Force cooled motor: Thermal protection is enabled and, depending on the speed, does not take the derating into account. Note: Thermal (overload) protection memory is non-retentive during loss of controller power.

⚠	CAUTION
<p>MOTOR OVERHEATING AND DAMAGE.</p> <p>This drive controller does not provide direct thermal protection for the motor. Use of a thermal sensor in the motor may be required for protection at all speeds or loading conditions. Consult motor manufacturer for thermal capability of motor when operated over desired speed range.</p> <p>Failure to observe this precaution could result in personal injury, product or property damage.</p>	

Frequency loop	Yes/No	Yes	Frequency loop enabled. Possible only with 1 to 3 hp drive controllers, enables reduction of time constants during transient phases and improvement of torque performance.
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⚠	CAUTION
<p>MOTOR MAY STALL.</p> <p>Inhibiting this function can cause motor to stall if required torque is too high.</p> <p>Failure to observe this precaution could result in product or property damage.</p>	


Table 6-6 Special Functions (Cont'd)

Function	Selection	Factory Setting	Description
Ramps	Linear S Parabolic	Linear	Determines the type of acceleration and deceleration ramps (see Figure 6-10). Use of S ramps (rounded ramps) or parabolic ramps increases the real acceleration and deceleration times.
<p>Figure 6-10 Ramp Types</p> <p>Adjustments: See acceleration and deceleration parameters on page 134.</p>			
Deceleration ramp adaptation	Yes/No No braking module	Yes	Deceleration ramp adaptation automatically increases deceleration time, if the latter was set too low, taking load inertia into account. To obtain maximum braking performance, this function can be disabled if a braking option is used. If there is no braking option, selection of “No braking module” avoids, in most cases, drive controller faulting due to overbraking ($[D b F]$), even if deceleration ramp is not adapted to the load.
Skip Frequency Bandwidth	No 2 Hz/5 Hz	No	It is possible to skip two 2 or 5 Hz frequency bands. The purpose is to stop the motor from operating steady state at machine or installation resonant frequencies. Positioning of the two frequency bands: see “Skip frequencies 1 and 2” on page 135.
DC stop	Yes/No	Yes	DC injection braking when output frequency drops below 1 Hz. Current and duration are adjustable (page 135). When set to “No,” motor coasts to stop below 1 Hz.
Low speed freewheel	No/Yes	No	Enabling this function inhibits drive controller output if frequency drops below low speed value. Applications: Supply of tapered rotor motors.

Table 6-6 Special Functions (Cont'd)

Function	Selection	Factory Setting	Description
Catching a spinning load (see precautions below)	No/Yes	No	In the event of a short input line undervoltage, this function avoids a break in the motor speed. Function off: When restarted, the frequency increases from zero to the reference value. Function on: When restarted, the output frequency is immediately equal to the reference frequency. Voltage increases progressively to avoid causing an overcurrent fault.
Automatic restart (see precautions below)	No/Yes	No	Activation of this function enables automatic restarting of the drive controller, following an overbraking fault or a motor overload fault. If drive controller faults following filter capacitor overvoltage , controller remains disabled for 1 minute with OBF displayed (overbraking), and automatically restarts if fault has disappeared and if the other operating conditions allow. Fault relay (terminals SA-SB) remains closed. If overvoltage occurs again , sequence above is repeated 4 times (a maximum of 5 sequences) before drive controller faults and has to be reset. If drive controller faults following motor overcurrent, drive controller remains disabled for as long as thermal state stays above 100% (approximately 7 minutes). Fault relay (terminals SA-SB) remains closed. Restarting is possible if the other operating conditions allow. Applications: HVAC systems or high inertia applications.

Precautions To ensure drive controller is restarted when power returns, install a special line contactor control sequence (2-wire control). Fault relay contact (terminals SA-SB) should only be used to indicate controller faults.

	WARNING
<p>UNINTENDED EQUIPMENT ACTION.</p> <ul style="list-style-type: none"> • Automatic restart and catching a spinning load can only be used for machines or installations that present no danger in the event of automatic restarting, either for personnel or equipment. • Equipment operation must conform with national and local safety regulations. <p>Failure to observe these precautions may cause severe personal injury or equipment damage.</p>	

Phase Failure Enable	Yes/No	Yes	Disabling the input fault allows fault relay to remain closed (SA-SB terminal contact) when drive controller is stopped and line power is off (control power remains).
Tachogenerator feedback	Regulation Regulation+Fault Fault	Regulation	Enabling the safety function disables drive controller in the event of a speed regulation fault (incorrect setting, overspeed, no tachogenerator feedback signal). Do not use safety function until after adjustments are made.

ADJUSTMENTS

Adjustable parameters are listed in Table 6-7. Depending on the selections made during configuration, inputs-outputs, or special functions, some parameters are not always available. For example, "Acceleration 2" only appears if a logic input has been assigned to "Sw. to ramp 2."

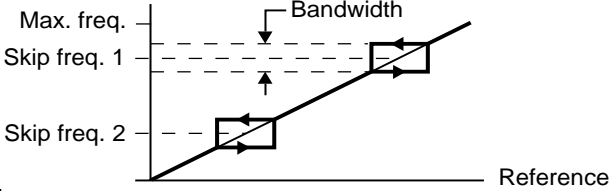
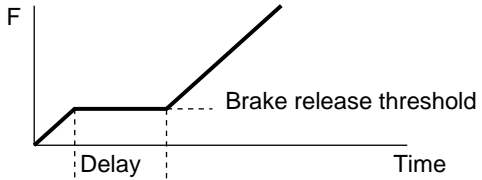
Table 6-7 Description of Adjustments

Parameter	Value	Factory Setting	Description
Acceleration	0.2 to 990 s	5 s	(Dialog unit \overline{ACC}) Acceleration time may be increased automatically when current limit threshold is reached (ACC flashes).
Deceleration	0.2 to 990 s	10 s	(Dialog unit \overline{DEC}) Deceleration time may be increased automatically in the event of overbraking (\overline{OBR} flashes).
Low speed	0 to high speed	0	(Dialog unit \overline{LSP}) When LSP is set to minimum, the absolute minimum controller speed is 1 Hz. Controller will not run with references less than 1 Hz (see page 62).
High speed	From low speed to max. frequency	P00C02_: 50 Hz P00C04_: 60 Hz	(Dialog unit \overline{HSP}) Maximum frequency adjustment (see page 62).
U/F adjustment	N00 to N99 P00 to P99 F00 to F99 L00 to L99	N00	(Dialog unit \overline{UFR}) Allows V/f ratio to be tailored to the motor load. If torque supplied by motor at low speed is inadequate, increase the setting gradually.
I thermal ^[1]	0.45 to 1.05 In No protection	0.9 In	(Dialog unit \overline{IEH}) Motor thermal (overload) protection. Adjustment of electronic thermal protection. Value in amps to be adjusted to the full load current value shown on motor nameplate.
I thermal 2 ^[1]	0.2 to 1.05 In No protection	0.9 In	Motor thermal (overload) protection for motor 2. Adjustment of electronic thermal protection. Value in amps to be adjusted to the full load current value shown on motor nameplate.
Stability	0 to 100	0	(Dialog unit \overline{SEB}) Adjustment of motor stability. In the event of instability, increase value of parameter until stable operation is obtained.
Slip compensation	0 to 5 Hz	According to drive controller rating	Adjust to compensate for motor slip as motor approaches rated load. Precaution: Overcompensation can lead to unstable operation.
Preset speed 1 to 6	From low speed to high speed	Low speed	Preset speed levels in Hz. 6 different levels possible.
Reduce motor volts	100% to 10%	100%	Reduction of motor voltage when operating at steady state. 100% = full voltage applied. 25% = 25% of voltage applied.
Reduce I limit	150% to 5%	150%	Current limit adjustment factor as % of drive controller's rated current.
Acceleration 2	0.2 to 990 s	5 s	Same as acceleration above.
Deceleration 2	0.2 to 990 s	10 s	Same as deceleration above.

^[1] In = drive controller rated current (Table 1-1 on page 10). Extended operation of DC injection above 0.5 In could result in motor overheating.

^[2] See "DC Injection Braking" on page 35.

Table 6-7 Description of Adjustments (Cont'd)

Parameter	Value	Factory Setting	Description
Frequency loop gain	0 to 100%	33%	<p>Used only with V/f ratio set to Linear F or L. Allows a user to adjust drive controller's response time.</p> <p>0 to 33: Longer response time. 33: Factory setting. 33 to 100: Shorter response time.</p> <p>Applications: Machines with high resistive torque or high inertia: adjust frequency loop gain in the 0 to 33 zone. Machines with fast cycles, low resistive torque or low inertia: adjust gain in the 33 to 100 zone.</p> <p>Precaution: Overcompensation can lead to unstable operation.</p>
Skip frequency 1 Skip frequency 2	0 to high speed	High speed	<p>Adjustment: Affects speed reference in order to determine the one or two critical frequencies (noise or mechanical vibrations). Adjust skip frequencies 1 (and 2) on the value (or values) read. If resonance persists, widen the skip frequency band from 2 to 5 Hz (see "Skip frequency bandwidth" on page 132).</p>  <p>Figure 6-11 Skip Frequencies</p>
DC braking level current ^[1]	0.2 I _n to 1.5 I _n	0.5 I _n	DC injected when DCB input is activated (after impulse of 1.5 I _n for 3 seconds). Value in amps, variable according to controller rating. ^[2]
DC stop level current ^[1]	0.5 I _n to 1.5 I _n	I _n	DC injected when frequency drops below 1 Hz. Value in amps, variable according to controller rating. ^[2]
DC stop time	0.5 to 4 s	0.5 s	DC injection time when frequency drops below 1 Hz. ^[2]
Brake release I	0 to I _n	0 I _n	Current threshold initiates closing of brake control relay (on dynamic braking and speed regulation option). Value in amps, variable according to controller rating.
Brake release threshold	From 0 to LSP	0 Hz	Frequency threshold initiates closing of brake control relay (on dynamic braking and speed regulation option).
Brake engage threshold	From 0 to LSP	0 Hz	Frequency threshold initiates opening of brake control relay (on dynamic braking and speed regulation option).
Brake release time delay	0 to 4 s	0 s	<p>Time delay for brake release. Causes delay in acceleration ramp.</p>  <p>Figure 6-12 Brake Release Time Delay</p>

^[1] I_n = drive controller rated current (Table 1-1 on page 10). Extended operation of DC injection above 0.5 I_n could result in motor overheating.

^[2] See "DC Injection Braking" on page 35.

Table 6-8 Summary of Configurations and Adjustments

CONFIGURATION	INPUTS-OUTPUTS	SPECIAL FUNCTIONS	SETTINGS
Nominal freq * 50 Hz, ** 60 Hz	Function LI1 I/P Freewheel stop Fast stop DC braking Preset speeds Reduce volts Reduce I limit Sw. to ramp 2 Store setspeed Local control Remote PBU Remote Reset Motor Selection 2	U/F law Linear N, quadratic P, linear F, linear L	Acceleration 0.2 to 990 s (5 s)
Current input 0 - 20 mA, 4 - 20 mA, 20 - 4 mA		Nominal motor voltage Automatic, 220/240 V, 380/415 V, 440/460/500 V, 525/575 V	Deceleration 0.2 to 990 s (10 s)
Volts/freq Connection 1 (high), connection 2 (low)	Function LI2 I/P Freewheel stop Fast stop DC braking Preset speeds Reduce volts Reduce I limit Sw. to ramp 2 Store setspeed Local control Remote PBU Remote Reset Motor Selection 2	Motor thermal (overload) protection Yes, no, force cool mot	LSP 0 to HSP (0)
Max frequency * 67, 87, 110 Hz ** 80.4, 104, 120, 132 Hz		Frequency loop Yes, no (models ≤ 2.2 kW)	HSP LSP to Max. frequency (* 50 Hz, ** 60 Hz)
Slip compensation Yes, no	Function DCB I/P Freewheel stop Fast stop DC braking Preset speeds Reduce volts Reduce I limit Sw. to ramp 2 Store setspeed Local control Remote PBU Remote Reset Motor Selection 2	Ramps Linear, S, parabolic	U/F adjustment N/P/F/L from 00 to 99 (N00)
Preset speeds No, 2, 4, 8		Deceleration ramp adaptation Yes, no, No brak. mod.	I thermal 0.45 to 1.05 In (0.9 In)
+ Speed / - Speed No, yes	Analog outputs 0 - 20 mA, 4 - 20 mA	Skip frequency bandwidth No, 2 Hz, 5 Hz	Stability 0 to 100 (0)
Reduce volts FW No, yes, logic input, remote		DC stop Yes, no	Slip compensation 0 to 5 Hz (according to rating)
Reduce volts RV No, yes, logic input	Function A01 O/P Motor frequency Mot. current Mot. thermal state Mot. load HSP attained LSP attained Ref attained I limit Mot therm ≥ 100% Mot therm ≥ 118%	Low speed freewheel No, yes	Preset speeds 1 to 6 LSP to HSP (LSP)
Reduce I limit No, local, remote		Catching a load No, yes	Reduce motor volts 100% to 10% (100%)
Accel. torque No, yes	Function A02 O/P Motor frequency Mot. current Mot. thermal state Mot. load HSP attained LSP attained Ref attained I limit Mot therm ≥ 100% Mot therm ≥ 118%	Automatic restart No, yes	Reduce I limit 150% to 5% (150%)
		Input fault validation Yes, no	Acceleration 2 0.2 to 990 s (5 s)
		Tacho Feedback Regulation, Regulation+Fault, Fault	Deceleration 2 0.2 to 990 s (10 s)
			Freq loop gain 0 to 100 (33)
			Skip frequency 1 0 to HSP (* 50 Hz, ** 60 Hz)
			Skip frequency 2 0 to HSP (* 50 Hz, ** 60 Hz)
			I thermal 2 0.2 to 1.05 In (0.9 In)
			DC brake current 0.2 In to 1.5 In (0.5 In)
			DC stoplevel current 0.5 In to 1.5 In (In)
			DC brake time 0.5 to 4 s (0.5 s)
			Brake release I 0 to In (0 In)
			Brake release threshold 0 to LSP (0 Hz)
			Brake engage I 0 to LSP (0 Hz)
			Brake release time delay 0 to 4 s (0)

* P00C02_ (230 V)
** P00C04_ (460 V)

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INTRODUCTION

The commissioning software is DOS-compatible computer software, supplied with Omegapak Type P drive controllers. It provides all variable drive controller configuration, adjustment and control functions that can be carried out with the commissioning terminal. In addition, it allows a user to:

- Prepare a job in the design office without connecting the drive controller to the computer.
- Save configurations and adjustments on floppy disk or hard disk and download them into the drive controller.
- Provide a printout of documents that can be included in a contract file.

The software can be run on any computer with the following features:

- 3-1/2" disk drive
- 256 K bytes RAM minimum
- COM serial communication port
- DOS operating system, version 3.1 minimum

NOTE

The commissioning software is intended for controller setup and diagnostics - not real time control. If real time control is needed, use of the Serial Communication Board option is recommended.

INITIAL SETUP



DANGER

HAZARDOUS VOLTAGE.

- Read and understand this manual in its entirety before installing or operating Omegapak AC drive controllers. Installation, adjustment, repair and maintenance of these controllers must be performed by qualified personnel.
- Disconnect all power before servicing drive controller. WAIT TEN MINUTES until bus capacitors discharge, then measure bus capacitor voltage between + and - terminals to verify DC voltage is zero (see page 15).
- DO NOT short across capacitors or touch unshielded components or terminal strip screw connections with voltage present.
- Install all covers and close door before applying power or starting and stopping the controller.
- User is responsible for conforming to all applicable code requirements with respect to grounding all equipment. See Figure 2-10 on page 26 and Figure 2-11 on page 27 for drive controller grounding points.
- Many parts in this drive controller, including printed wiring boards, operate at line voltage. DO NOT TOUCH. Use only electrically insulated tools while making adjustments.

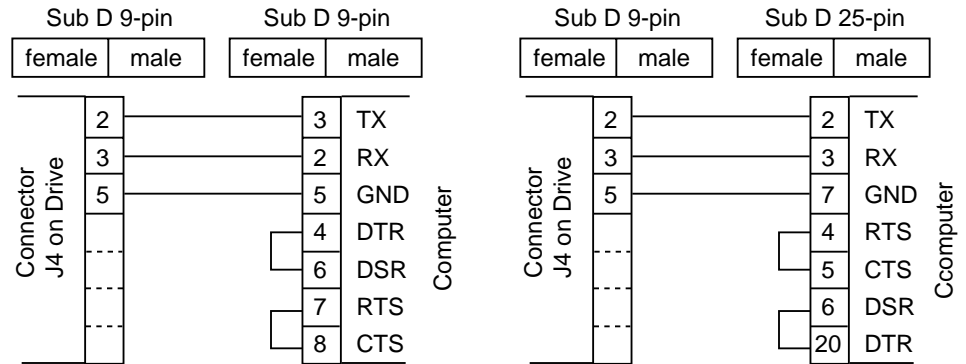
Before installing controller:

- Disconnect all power.
- Place a "DO NOT TURN ON" label on the controller disconnect.
- Lock disconnect in open position.

Failure to observe these precautions can cause shock or burn, resulting in severe personal injury or death!

The drive controller must be connected to the computer COM port by RS-232C serial link, using a cable no longer than 33 feet (10 meters).

Follow one of the connection diagrams shown below. The COM port is on a Sub D 25-pin or Sub D 9-pin connector, depending on the computer model.



An 8 ft (2.5 m) cable with connectors (part no. VY1-A45509) may be ordered from the catalog.

An 8 ft (2.5 m) cable with connectors (part no. VY1-A45525) may be ordered from the catalog.

Figure 7-1 RS-232C Connections to Computer

Table 7-1 shows which control input terminal functions of the drive controller are valid or disabled when operated from the commissioning software in the control mode.

Table 7-1 Commissioning Software Drive Control Hierarchy

Valid Functions	Disabled Functions
Local override	Freewheel stop (logic input)
Reduce volts (if set to YES)	Fast stop
Remote PBU (logic input)	DC braking (logic input)
Remote Reset (logic input)	Preset speeds (logic input)
	Start/stop (logic input)
	Reduce volts (if assigned to logic input)
	Reduce current limit (logic input)
	Switch to ramp 2 (logic input)
	Store setspeed (logic input)
	Forward input
	Reverse input
	Speed reference input

NOTE

If communication link is broken between commissioning software and drive controller, controller faults after approximately 2 seconds. An SLF fault (serial link failure) is indicated.

INSTALLING THE SOFTWARE

To install the software on the floppy disk supplied with the drive controller:

1. Turn on the computer.
2. Insert the floppy disk in drive A.
3. Type “C:” and press <Enter>.
4. Copy all files from the floppy disk to the hard disk by typing “COPY A:*.* C:” and press <Enter>.
5. (In order to protect the floppy disk, installation and use of the software on a hard disk is recommended.)
6. Start the software from drive C by typing “Omegap” and press <Enter>.
7. Wait for presentation page to be displayed, then press any key to continue.

SELECTING THE LANGUAGE

To choose one of the six available languages:

1. Start the software by typing “Omegap/L” and press <Enter>.
2. Wait for presentation page to be displayed, then press any key to continue.
3. Using the ↑ or ↓ keys, select the language then press <Enter>.

Selection of the language is recorded, and this operation is no longer necessary on any future occasion the software is used.

ADAPTING FOR THE COMPUTER

The commissioning software can be adapted to the type of screen and to the COM port to which the drive controller is connected. To store this information:

1. Start the software by typing “Omegap/C” and press <Enter>.
2. Wait for presentation page to be displayed, then press any key to continue.
3. Select the type of screen and press <Enter>.
4. Select the page setup and file destination and press <Enter>.
5. Select the COM port used and press <Enter> to continue.

All selections made are recorded and this operation is no longer necessary on any future occasion the software is used.

KEYS USED

Only a few keys are required to use the commissioning software:


- Help window: appears when <F1> is pressed, disappears when <F1> is pressed a second time.
- To select a menu: simultaneously press <ALT> and the corresponding letter, shown in the required menu in a different shade.
- To select a sub-menu: using ↑ or ↓, place the cursor on the sub-menu required, then press <Enter> or key in the letter of the sub-menu.
- To cancel or to revert to the previous menu: press <Esc>.
- To modify a value in configuration: place the cursor, using ↑ or ↓, on the required value, then press <Enter>.
- To modify a numerical value: place the cursor, using <Tab>, in the value to be modified, using ↑ or ↓, press <Enter>, enter the new numerical value, activate by pressing <Enter>.

MENUS

The five main menus (FILE, MODE, CONFIGURATION/ATV, MONITORING and SYSTEM) always appear in the upper band of the computer screen. Each of them is subdivided into sub-menus, listed below:

- ❑ **FILE:** Creates, modifies, records and prints drive controller configuration and adjustments.
 - ➔ **NEW:** Creates a new configuration.
 - ➔ **OPEN:** Calls up and modifies a configuration already stored in memory.
 - ➔ **SAVE:** Saves the modified configuration on the open file.
 - ➔ **SAVE AS:** Saves the modified configuration on another file, or saves a new configuration.
 - ➔ **PRINT:** Prints the file.
 - ➔ **ABOUT OMEGAP:** Gives the revision number of the software.
 - ➔ **EXIT:** Exits the software and reverts to the operating system.

Names of files do not have to be entered with an extension. The software automatically adds “.CFV” to configuration files, “.DOC” to document files.

 WARNING
<p>UNINTENDED EQUIPMENT ACTION.</p> <ul style="list-style-type: none">• Parameter changes affect controller operation.• Read and understand this section before using commissioning software. <p>Failure to observe these precautions may cause severe personal injury or equipment damage.</p>

- ❑ **MODE:** Enables and disables the serial link from the computer to the drive controller.
 - ➔ **OFF-LINE:** When the commissioning software is Off-Line, a user can make changes to drive controller settings and save them to a file. This file can be loaded into the drive controller at a later time. The computer is not communicating with the controller. The serial link to the controller is not required for this type of operation.
 - ➔ **ON-LINE:** When the commissioning software is On-Line, any changes made to the drive controller settings immediately affect controller operation. Changes made to the drive controller settings are not saved in EEPROM. To save in EEPROM, see “EEPROM SAVING” in the CONFIGURATION/ATV menu below.

 **WARNING**

UNINTENDED EQUIPMENT ACTION.

- Parameter changes affect controller operation.
- Read and understand this section before using commissioning software.

Failure to observe these precautions may cause severe personal injury or equipment damage.

NOTE

If computer is correctly connected to drive controller serial link, commissioning software defaults to ON-LINE mode when it is started up. If computer is not connected to controller, the software defaults to OFF-LINE mode.

CONFIGURATION/ATV: Defines the configuration and settings of the drive controller.

- **CONFIGURATION:** Basic drive controller configuration.
- **SPECIAL FUNCTIONS:** Additions to the configuration.
- **INPUTS/OUTPUTS:** Assigns all speed controller inputs/outputs to the available functions.
- **ADJUSTMENTS:** Enters all the required setting values.
- **OPTION CARD:** Select option module.
- **EEPROM SAVING:** Saves the configuration and the settings in the drive controller.

NOTE

This is the only option that stores the configuration in the drive controller's permanent memory (EEPROM).

❑ **MONITORING:** Control and monitor the Omegapak Type P drive controller.

- ➔ **MONITORING:** This screen may be accessed when the drive controller is in the “Mode On-Line” configuration. The monitor function allows a user to monitor signals and the drive controller state from the computer. It also allows changes to be made to some adjustment parameters and allows a user to control the drive controller from the computer.
- ➔ **OFF-LINE Command:** Releases control of the drive controller when the computer has been in control. When this command is issued, control of the drive controller is immediately returned to the terminal block inputs of the controller.
- ➔ **ON-LINE Command:** Places computer in control of the drive controller. When this command is issued, control is removed from the terminal block inputs of the drive controller. To run the drive controller, a user must issue the motor run command then input a reference frequency.
- ➔ **PAST FAULTS:** Allows a user to obtain a chronological list of the eight most recent past faults.

❑ **SYSTEM:**

- ➔ **PC SERIAL PORT:** Select COM port to which the drive controller is connected.
- ➔ **PRINTER:** Select type of printer used.
- ➔ **SCREEN:** Adapt the software to the type of screen used.
- ➔ **SAVE:** Record the two previous selections made.

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NOTES:

PLEASE NOTE:

Electrical equipment should be serviced only by qualified electrical maintenance personnel, and this document should not be viewed as sufficient instruction for those who are not otherwise qualified to operate, service or maintain the equipment discussed. Although reasonable care has been taken to provide accurate and authoritative information in this document, no responsibility is assumed by Square D for any consequences arising out of the use of this material.