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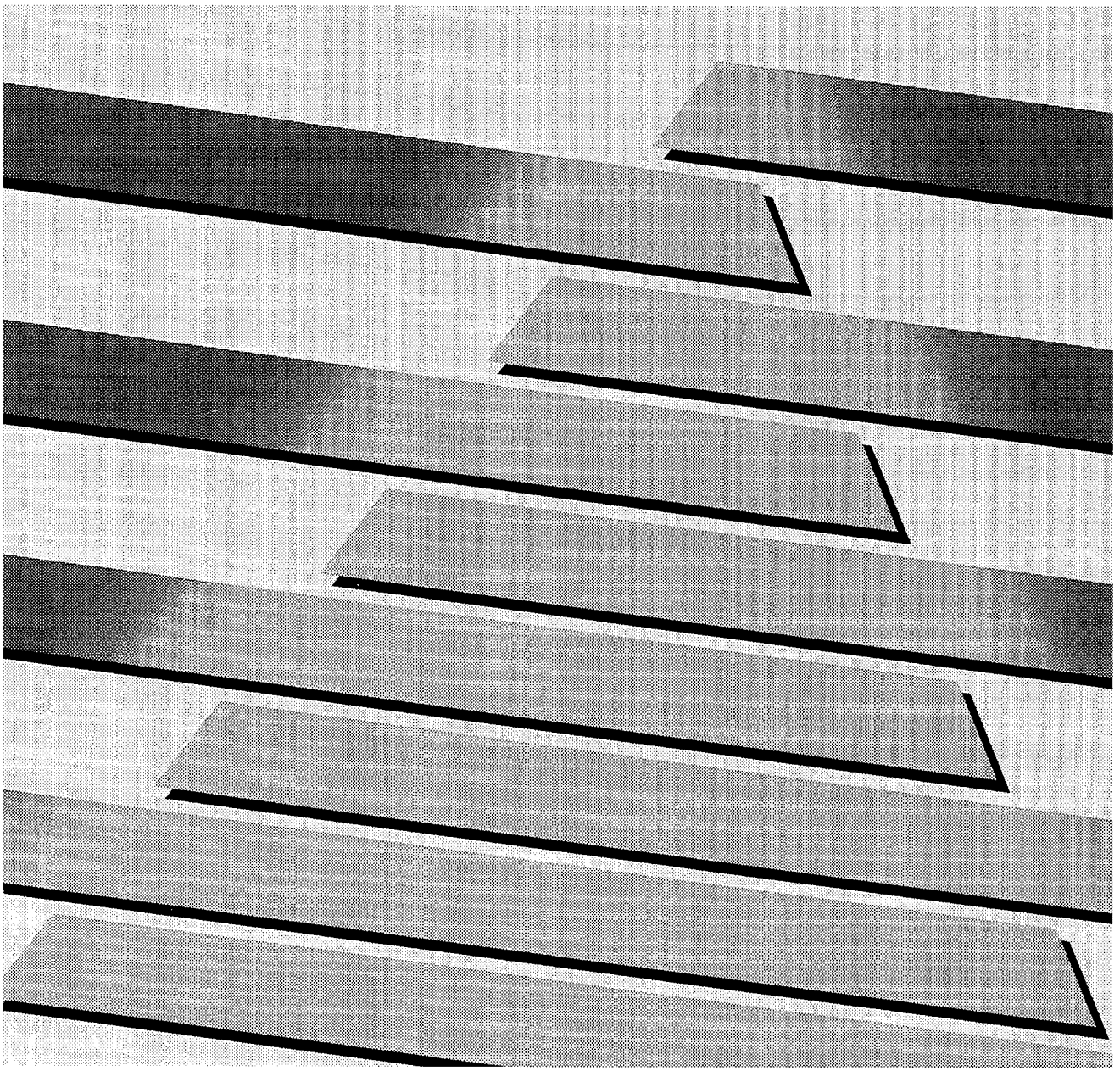
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ALLEN-BRADLEY

Bulletin 1333
Adjustable Frequency AC Drives
(Series B/C)

User Manual



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Important User Information

Because of the variety of uses for this equipment and because of the differences between this solid state equipment and electromechanical equipment, the user of and those responsible for applying this equipment must satisfy themselves as to the acceptability of each application and use of the equipment. **In no event** will Allen-Bradley Company be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The illustrations shown in this manual are intended solely to illustrate the text of this manual. Because of the many variables and requirements associated with any particular installation, the Allen-Bradley Company **cannot** assume responsibility or liability for actual use based upon the illustrative uses and applications.

No patent liability is assumed by Allen-Bradley Company with respect to use of information, circuits or equipment described in this text.

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WARNINGs tell readers where people may be hurt if procedures are not followed properly.



CAUTIONs tell readers where machinery may be damaged or economic loss can occur if procedures are not followed properly.

Both of these Reader Alerts:

- Identify possible trouble spots.
- Tell what causes the trouble.
- Give the result of improper actions.
- Tell the reader how to avoid trouble.

Additionally:



SHOCK HAZARD labels may be located on or inside the Drive to alert people of hazards if service procedures are not followed properly.

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Repair or Repair/Exchange Procedure

For your convenience, the Allen-Bradley Drives Division, and the Allen-Bradley Support Services Division, provide an efficient and convenient method of returning equipment eligible for repair or repair/exchange.

A **Product Service Report** (**P.S.R.**) number is required to return any equipment for repair. This may be obtained from your local Allen-Bradley Area Support Center, Drives Distributor, or Sales Office.

Return any equipment to be repaired to the Area Support Center nearest you. Be sure to reference the P.S.R. number on the carton and packing slip. Include your company name and address, your repair purchase order number, and a brief description of the problem. This will facilitate quick return of your equipment.

A listing of Area Support Centers may be obtained by calling your local Allen-Bradley Drives Distributor or Sales Office.

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Manual Objective

This Instruction Manual defines the installation, startup, operation and troubleshooting procedures for the Allen-Bradley Bulletin 1333 Series B Adjustable Frequency AC Drive and is intended for use by personnel familiar with the functions of solid state Drive equipment. Specifications, installation and operation instructions for Bulletin 1333 Modifications are also provided in this manual.



CAUTION

This assembly may contain ESD (Electrostatic Discharge) sensitive parts and assemblies. Static control precautions are required when testing, servicing or repairing this assembly. Component damage may result if ESD control procedures are not followed when testing, servicing or repairing this assembly. If you are not familiar with static control procedures, before servicing, reference U.S. Department of Defense, DOD-HDBK-263, Electrostatic Discharge Control Handbook for Protection of Electronic Parts, Assemblies and Equipment or any other applicable ESD Protection Handbook.

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Chapter

1

Pre-Installation Care

1.0 Pre-Installation

Before installing and operating your Bulletin 1333, carefully read this manual and observe all precautions. The catalog number of your Drive as explained in **Chapter 2 – Nameplate Data**, lists the Drive rating, type of enclosure, nominal line voltage, phase, and frequency. Specifications including standard controls, adjustment range, diagnostics, and environmental qualifications are listed in **Chapter 3 – Specifications**.

1.1 Receiving

Once you have received your Bulletin 1333 Drive, careful inspection for shipping damage should be made. Damage to the shipping carton is usually a good indication that it has received rough handling. Any and all damage should be immediately reported to the freight carrier and your nearest Allen-Bradley Area Sales/Support Center, Drives Distributor or Sales Office.

Carefully unpack the Drive taking care to save the shipping carton and any packing material should return be necessary. Verify that the items on the packing list or bill of lading agree with your order.

1.2 Storage

If the Drive will not immediately be installed, it should be stored in a clean, dry area where the ambient temperature is not less than -25°C nor more than +65°C. The Drive should not be stored in a corrosive environment or subject to conditions in excess of the storage environment parameters stated in **Chapter 3 – Specifications**.

1.3 Handling

Proper safety precautions and practices should be observed whenever the Drive is being moved from one location to another.

1.4 Shipping

The carton and materials that came with your Drive have been designed to provide reasonable protection against damage during transit. Should shipment of the Drive to another location be required, it is recommended that the original shipping carton and packing material be used to protect the Drive from damage during transit.

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1.5 ESD Precautions

CAUTION

This assembly may contain ESD (Electrostatic Discharge) sensitive parts and assemblies. Static control precautions are required when testing, servicing, or repairing this assembly. Component damage may result if ESD control procedures are not followed testing, servicing, or repairing this assembly. If you are not familiar with static control procedures, before servicing, reference U.S. Department of Defense, DOD-HDBK-263, Electrostatic Discharge Control Handbook for Protection of Electronic Parts, Assemblies and Equipment or any other applicable ESD Protection Handbook.

ESD (Electrostatic Discharge) generated by static electricity can damage the CMOS devices on various Drive boards. To guard against this type of damage from accidental contact with these devices during installation , set-up, repair, or cleaning, it is recommended that the following minimum precautions be observed.

- *Wear a wrist type grounding strap that is grounded to the Drive chassis.*
- *DO NOT remove the new circuit board from its conductive wrapper unless a ground strap is worn.*
- *When removing any circuit board from the Drive, immediately place it in conductive packing material.*

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2.0 Catalog Number Explanation

The following is an explanation of the catalog numbering system for Bulletin 1333 Series B Adjustable Frequency AC Drives. The catalog number for your drive can be found on the controller nameplate.

1333 – E A A

First Position — Model Number

Number	Description
1333	PWM, Adjustable Frequency

Second Position — Drive Ratings

Letter	Nominal HP	Input Volts	Maximum Continuous Amps	kVA Rating	Input Volts	Maximum Continuous Amps	kVA Rating	Input Volts	Maximum Continuous Amps	kVA Rating
Z	¾	230	3.0	1.2	—	—	—	—	—	—
A	1	230	5.0	2.0	460	2.1	1.7	575	1.4	1.4
Y	2	230	8.0	3.2	460	4.0	3.2	575	2.7	2.7
B	3	230	11.0	4.4	460	6.0	4.8	575	3.9	3.9
C	5	230	17.0	6.8	460	9.4	7.5	575	6.1	6.1
D	7½	230	24.0	9.6	—	—	—	575	9.0	9.0
E	10	230	33.0	13.1	—	—	—	575	11.0	11.0
F	15	230	45.0	17.9	—	—	—	575	17.0	17.0
G	20	230	61.0	24.3	—	—	—	—	—	—
R	25	230	75.0	30.0	—	—	—	—	—	—
H	30	230	87.0	35.0	—	—	—	—	—	—
J	40	230	117.0	47.0	—	—	—	—	—	—
K	50	230	140.0	56.0	—	—	—	—	—	—

Third Position — Type of Enclosure

Letter	Enclosure
A	NEMA Type 1

Fourth Position — Input Line Voltage Phase and Frequency

Letter	Volts	Phase	Hz
A	230	3	50/60
B	460	3	50/60
C	575	3	60

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Specifications

3.0 230V Specifications

The following table lists specification data for Bulletin 1333 230V Series B Adjustable Frequency AC Drives.

230V Drive Specifications

NOMINAL HP	$\frac{3}{4}$, 1, 2, 3, 5, $7\frac{1}{2}$, 10, 15, 20, 25, 30, 40 and 50 HP
INPUT VOLTAGE	**STANDARD** – 230 or 208V AC, 3Ø, 48-62 Hz **DERATED** – 230 or 208V AC, 1Ø, 48-62 Hz
OUTPUT VOLTS-PER-HERTZ	230V Input Produces 3.83 V/Hz Modified by Auto Torque Boost Circuit Programmable to Reach Nominal Input Voltage at 50, 60, 100 or 120 Hz by Using One of The (7) Optional Constant Torque/DC Boost Patterns or (2) Variable Torque Patterns
OVERVOLTAGE TRIP	Bus Voltage Above 430V DC (Input AC Line Voltage 10% Above 230V AC)
UNDERVOLTAGE TRIP	Bus Voltage Below 160V DC (Input AC Line Voltage 10% Below 208V AC)
DECEL STALL PROTECTION	Stops Decel Ramp If Bus Voltage Rises Above 380V DC

	Model	HP	Input Amps	Input kVA (230V AC)	Input kVA (208V AC)	Output Amps	Output kVA (230V AC)	Output kVA (208V AC)	Maximum Heat ① Dissipated (WATTS)
STANDARD INPUT VOLTAGE 230/208V AC 3Ø 50/60 Hz	ZAA	$\frac{3}{4}$	4.1	1.6	1.5	3.0	1.2	1.1	80
	AAA	1	6.5	2.6	2.4	5.0	2.0	1.8	100
	YAA	2	9.0	3.6	3.2	8.0	3.2	2.9	170
	BAA	3	14.0	5.6	5.0	11.0	4.4	4.0	250
	CAA	5	22.0	8.8	7.9	17.0	6.8	6.1	360
	DAA	$7\frac{1}{2}$	27.0	10.8	9.7	24.0	9.6	8.7	425
	EAA	10	37.0	14.7	13.3	33.0	13.1	11.9	480
	FAA	15	47.0	18.7	16.9	45.0	17.9	16.2	565
	GAA	20	62.0	24.7	22.3	61.0	24.3	22.0	610
	RAA	25	77.0	31.0	28.0	75.0	30.0	27.0	1,090
	HAA	30	90.0	36.0	32.0	87.0	35.0	31.0	1,280
	JAA	40	120.0	48.0	43.0	117.0	47.0	42.0	1,710
	KAA	50	144.0	57.0	52.0	140.0	56.0	50.0	2,110

IMPORTANT: ① Heat dissipation is estimated and based on operation at the maximum output current rating of the controller.

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3.0 230V Specifications (continued)

230V Drive Specifications

STANDARD INPUT VOLTAGE 230/208V AC 1∅ 60 Hz

Model	HP	Input Amps	Input kVA (230V AC)	Input kVA (208V AC)	Output Amps	Output kVA (230V AC)	Output kVA (208V AC)	Maximum Heat ① Dissipated (WATTS)
ZAA	½	6.2	1.4	1.3	2.6	1.0	0.9	80
AAA	¾	8.6	2.0	1.8	3.8	1.5	1.4	100
YAA	1	9.5	2.2	2.0	4.9	2.0	1.8	170
BAA	1½	13.0	3.0	2.7	5.9	2.4	2.1	250
CAA	2	18.8	4.3	3.9	8.4	3.3	3.0	360
DAA	3	23.4	5.8	4.9	12.0	4.8	4.3	425
EAA	5	31.1	7.1	6.5	16.0	6.4	5.8	480
FAA	7½	41.6	9.6	8.7	23.0	9.2	8.3	565
GAA	10	54.6	12.6	11.4	31.0	12.3	11.2	610

DERATED INPUT VOLTAGE 230/208V AC 1∅ 50 Hz

Model	HP	Input Amps	Input kVA (230V AC)	Input kVA (208V AC)	Output Amps	Output kVA (230V AC)	Output kVA (208V AC)	Maximum Heat ① Dissipated (WATTS)
ZAA	½	5.7	1.3	1.2	2.4	1.0	0.9	80
AAA	¾	7.7	1.8	1.6	3.4	1.4	1.2	100
YAA	1	8.8	2.0	1.8	4.5	1.8	1.6	170
BAA	1½	11.9	2.7	2.5	5.4	2.2	1.9	250
CAA	2	17.3	4.0	3.6	7.7	3.1	2.8	360
DAA	3	21.4	4.9	4.5	11.0	4.4	4.0	425
EAA	5	29.1	6.7	6.1	15.0	6.0	5.4	480
FAA	7½	38.0	8.7	7.9	21.0	8.4	7.6	565
GAA	10	49.3	11.3	10.3	28.0	11.2	10.1	610

RECOMMENDED DRIVE INPUT FUSE SIZES

Model	Fuse Size ②③	Model	Fuse Size ②③
ZAA	15A	EAA	80A
AAA	15A	FAA	100A
YAA	15A	GAA	125A
BAA	30A	RAA	175A
CAA	40A	HAA	200A
DAA	70A	JAA	250A
—	—	KAA	300A

IMPORTANT: ① Heat dissipation is estimated and based on operation at the maximum output current rating of the controller.
② Recommended fuses are intended to satisfy NEC requirements for branch circuit protection.
③ Use 600V Class K5 U.L. Listed fuses and fuse holders.

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3.1 460V Specifications

The following table lists specification data for Bulletin 1333 460V Series B Adjustable Frequency AC Drives.

460V Drive Specifications

NOMINAL HP	1, 2, 3, and 5 HP
INPUT VOLTAGE	STANDARD – 460, 415 or 380V AC, 3∅, 48-62 Hz
OUTPUT VOLTS-PER-HERTZ	460V Input Produces 7.6 V/Hz Modified by Auto Torque Boost Circuit Programmable to Reach Nominal Input Voltage at 50, 60, 100, or 120 Hz by Using One of The (7) Optional Constant Torque/DC Boost Patterns or (2) Variable Torque Patterns
OVERVOLTAGE TRIP	Bus Voltage Above 820V DC (Input AC Line Voltage 10% Above 460V AC)
UNDERVOLTAGE TRIP	Bus Voltage Below 310V DC (Input AC Line Voltage 10% Below 380V AC)
DECEL STALL PROTECTION	Stops Decel Ramp If Bus Voltage Rises Above 760V DC

STANDARD INPUT VOLTAGE 460V AC 3∅ 50/60 Hz

Model	HP	Input Amps	Input kVA	Output Amps	Output kVA	Maximum Heat ① Dissipated (WATTS)
AAB	1	3.3	2.6	2.1	1.7	100
YAB	2	4.5	3.6	4.0	3.2	170
BAB	3	8.0	6.4	6.0	4.8	250
CAB	5	13.0	10.4	9.4	7.5	370

STANDARD INPUT VOLTAGE 415V AC 3∅ 50/60 Hz

Model	HP	Input Amps	Input kVA	Output Amps	Output kVA	Maximum Heat ① Dissipated (WATTS)
AAB	1	3.3	2.4	2.1	1.5	100
YAB	2	4.5	3.2	4.0	2.9	170
BAB	3	8.0	5.8	6.0	4.3	250
CAB	5	13.0	9.3	9.4	6.8	370

STANDARD INPUT VOLTAGE 380V AC 3∅ 50/60 Hz

Model	HP	Input Amps	Input kVA	Output Amps	Output kVA	Maximum Heat ① Dissipated (WATTS)
AAB	1	3.3	2.2	2.1	1.4	100
YAB	2	4.5	3.0	4.0	2.6	170
BAB	3	8.0	5.3	6.0	3.9	250
CAB	5	13.0	8.6	9.4	6.2	370

RECOMMENDED DRIVE INPUT FUSE SIZES

HP	Fuse Size ② ③
1	15A
2	15A
3	15A
5	20A

IMPORTANT : ① Heat dissipation is estimated and based on operation at the maximum output current rating of the controller.
② Recommended fuses are intended to satisfy NEC requirements for branch circuit protection.
③ Use 600V Class K5 U. L. Listed fuses and fuse holders.

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3.2 575V Specifications

The following table lists specification data for Bulletin 1333 575V Series B Adjustable Frequency AC Drives.

575V Drive Specifications

NOMINAL HP	1, 2, 3, 5, 7½, 10 and 15 HP
INPUT VOLTAGE	575V AC, 3Ø, 57-63 Hz
OUTPUT VOLTS-PER-HERTZ	575V Input Produces 9.58 V/Hz Modified by Auto Torque Boost Circuit Customer Programmable to Reach Nominal Input Voltage at 50, 60, 100, or 120 Hz by Using One of The (7) Optional Constant Torque/DC Boost Patterns or (2) Variable Torque Patterns
OVERVOLTAGE TRIP	Bus Voltage Above 975V DC (Input AC Line Voltage 10% Above 575V AC)
UNDERVOLTAGE TRIP	Bus Voltage Below 570V DC (Input AC Line Voltage 10% Below 575V AC)
DECEL STALL PROTECTION	Stops Decel Ramp If Bus Voltage Rises Above 920V DC

STANDARD INPUT VOLTAGE 575V AC 3Ø 60 Hz

Model	HP	Input Amps	Input kVA	Output Amps	Output kVA	Maximum Heat ① Dissipated (WATTS)
AAC	1	1.9	1.9	1.4	1.4	200
YAC	2	3.8	3.8	2.7	2.7	350
BAC	3	5.5	5.5	3.9	3.9	350
CAC	5	9.3	9.3	6.1	6.1	500
DAC	7½	12.5	12.5	9.0	9.0	300
EAC	10	15.3	15.3	11.0	11.0	375
FAC	15	24.0	24.0	17.0	17.0	450

RECOMMENDED DRIVE INPUT FUSE SIZES

HP	Fuse Size ② ③
1	3.2A
2	5A
3	8A
5	12A
7½	15A
10	20A
15	30A

IMPORTANT: ① Heat dissipation is estimated and based on operation at the maximum output current rating of the controller.
② Recommended fuses are intended to satisfy NEC requirements for branch circuit protection.
③ Use 600V Class K5 U. L. Listed fuses and fuse holders.

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3.3 General Specifications

The following table lists specification data for all Bulletin 1333 Series B Adjustable Frequency AC Drives.

230, 460 and 575V Drive Specifications

INPUT SPECIFICATIONS	Rectifier Type	Full Wave Diode Bridge
	Voltage	Allowable Line Variations of ± 10% of Nominal Input Voltage
	Frequency	230 and 460V Input — 48-62 Hz 575V Input — 57-63 Hz
	Ride-Thru	Minimum Power Loss Ride-Thru of 15mS
OUTPUT SPECIFICATIONS	Waveform	Sine Weighted Pulse Width Modulated (PWM)
	Switching Device	Darlington Power Transistors
	Voltage	0 to Nominal Input Voltage Programmable to Reach Maximum Voltage at 50, 60, 100, or 120 Hz
	DC Boost	Auto Torque Boost or (9) Selectable Manual Patterns
	Frequency Range	Programmable Maximum Frequencies of 50, 60, 100, 120, 200, or 240 Hz Programmable Lower and Upper Limits Within Selected Range Programmable Minimum Frequency of 0.5 Hz
	Regulation	± 0.5% of Selected Maximum Frequency
	Current	**Continuous** – 0 to 100% of Drive Nameplate Rating **Intermittent** – Up to 150% of Nameplate Rating for (1) Minute
	Overload Current	Programmable ON/OFF Current Limit with a Selectable Decel Rate When ON Limits Output Current to 140% of Rated Output Current Depending Upon V/Hz Pattern Selected, Activated When the Drive Senses an Overload While Operating Above 25 or 50 Hz
	Accel/Decel Rates	Independently Programmable from 0.1 to 1600 Seconds
	DC Brake	Programmable from 0 to 3 Seconds in Ten Levels
	Stop Mode	Programmable Coast-to-Stop or Ramp-to-Stop
	Accel Stall Protection	Can be Programmed to Modify Drive Accel Ramp Should Output Current Reach 140% of Nameplate Rating
	Decel Stall Protection	Can be Programmed to Modify Decel Ramp Should the DC Bus to Rise Above Set Limit
CONTROLS	Start/Stop	**Local** – Start/Stop Switch **External** – Accepts Separately Supplied RUN/STOP Selector Switch or START & STOP Pushbuttons
	Direction	**Local** – Forward/Reverse Switch **External** – Accepts Separately Supplied Forward/Reverse Switch or Contact Closure Input
	Frequency (SPEED)	**Local** – Speed Pot **External** – Accepts Separately Supplied 10kΩ Speed Pot, 0-10V DC, or 4-20mA Input
	Drive Programming	**Local** – Mode Select, Data Select, and Data Set Pushbuttons **External** – Not Available
	Jog	**Local** – Not Available **External** – Accepts Separately Supplied Jog Pushbutton or Contact Closure Input
	Preset Speeds	**Local** – Not Available **External** – May be Programmed to Accept (2) Separately Supplied Selector Switch or Contact Closure Inputs
	Alternate Accel/Decel Rates	**Local** – Not Available **External** – May be Programmed to Accept (2) Separately Supplied Selector Switch or Contact Closure Inputs
	External Interlock	**Local** – Not Available **External** – Allows Separately Supplied N.O. Contacts to Disable Drive When Open
DISPLAYS	Frequency	(3) Digit Drive Display of Output Frequency, Fault Codes, or Mode Data
	Mode	(2) Digit Drive Display of Operating or Programming Mode

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3.3 General Specifications (continued)

230, 460 and 575V Drive Specifications

CONTROL OUTPUTS	**Frequency** (SPEED)	0 to 1mA Analog Output Signal Proportional to Drive Frequency Available for Customer Use (Maximum Load Impedance 300Ω)
	At Speed	(1) N.O. Contact Closes When Drive Is Within 2 Hz of Commanded Speed (Contact Rating – 120V AC, 1A Resistive, 0.8A Inductive – 30V DC, 2A Resistive)
	Run	(1) N.O. Contact Closes When Drive Is Running (Contact Rating – 120V AC, 1A Resistive, 0.8A Inductive – 30V DC, 2A Resistive)
	Fault	(1) Set of N.O./N.C. Contacts Changes State On Drive Fault (Contact Rating – 120V AC, 1A Resistive, 0.8A Inductive – 30V DC, 2A Resistive)
DIAGNOSTICS	**Overcurrent LED Display** (*OC*)	LED Display Indicates a Drive Fault Due to Output Current Exceeding Either 200% of Drive Nameplate Rating for 230 and 460V Ratings or 165% of Drive Nameplate Rating for 575V Ratings
	Overvoltage LED Display (*OU*)	LED Display Indicates a Drive Fault Due to DC Bus Voltage Above Overvoltage Trip Value
	Undervoltage LED Display (*LU*)	LED Display Indicates a Drive Fault Due to DC Bus Voltage Below Undervoltage Trip Value
	Overtemperature LED Display (*OH*)	LED Display Indicates a Drive Fault Due to Drive Heatsink Temperature Above 100°C
	External Interlock LED Display (*AU*)	LED Display Indicates a Drive Fault Due to Open External Interlock(s)
	Overload LED Display (*OL*)	LED Display Indicates a Drive Fault Due to Overload Current Above 140% of Rated Output Current for (1) Minute
	Operating Error LED Display (*OP*)	LED Display Indicates a Drive Fault Due to Improper Operating Sequence
OPERATING ENVIRONMENT	**Ambient Temperature**	-10°C to +50°C
	Relative Humidity	5 to 95% Non-Condensing
	Elevation	To 3,000 Feet (1,000 Meters) Without Derating
	Noise	Showering Arc Transients from 350 to 2,000 Volts
	Shock	16G Peak for 11mS Duration
	Vibration	Below 0.5G, 0.8mM P-P Amplitude, X-Y-Z Direction
STORAGE ENVIRONMENT	**Ambient Temperature**	-25°C to +65°C
	Relative Humidity	5 to 95% Non-Condensing
ENCLOSURE RATING	**Enclosure Rating**	NEMA Type 1

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Chapter

4

Installation

4.0 General Installation Requirements

The Bulletin 1333 should be installed in an area where the following installation and environmental guidelines can be met.

- *Cabinet mounting is upright, leaving room for a minimum clearance of (4) inches on the top and bottom, (2) inches on the sides for proper ventilation.*
- *The Drive is easily accessible for maintenance and troubleshooting.*
- *The rated altitude does not exceed 3,000 feet (1,000 meters).*
- *Vibration will be kept to a minimum as outlined in* **Chapter 3 – Specifications.**
- *The ambient atmosphere is free of corrosive gases.*
- *The relative humidity is kept to within 95% for all Drive ratings.*
- *The rated ambient temperature is between -10°C and 50°C.*

An input transformer, in general, is not required for normal drive operation. However, if the use of an input transformer is desired, only an isolation type transformer should be used.

Before actual installation, remove all packing material, wedges or braces from within and around the drive. For $7\frac{1}{2}$ to 50 HP drives, remove all packing material from the heat sink and cooling fans.

IMPORTANT

The Bulletin 1333 local control/programming panel is not intended to replace or be considered a suitable alternative for the operator control station for all applications. Refer to codes and standards applicable to your particular system for specific requirements and additional information.

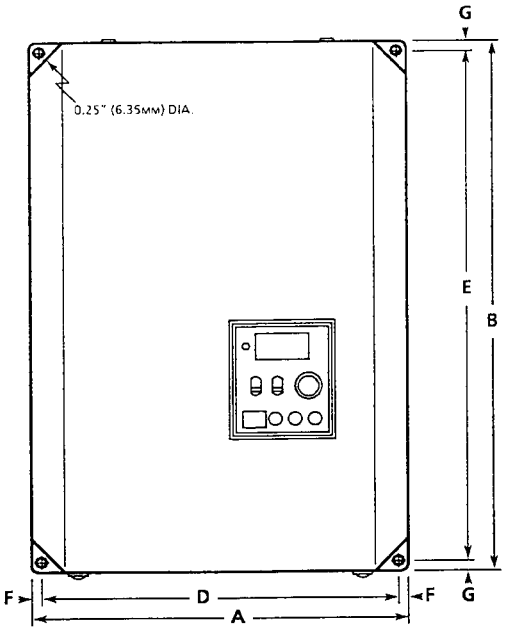
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4.1 Dimensions, Weights & Conduit Entry Locations

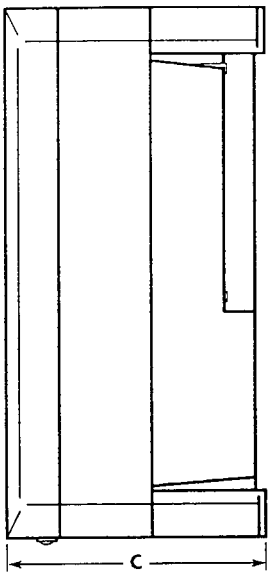
230V Drives ¾ to 5 HP

NOMINAL DIMENSIONS & WEIGHTS
IN INCHES (MILLIMETERS) & POUNDS (KILOGRAMS)

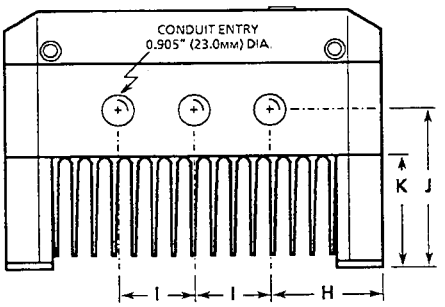
MODEL	HP	A	B	C	D	E	F	G	H	I	J	K	WEIGHT
ZAA	¾	8.90 (226)	10.04 (255)	4.72 (120)	8.27 (210)	9.45 (240)	0.30 (8)	0.30 (8)	2.48 (63)	1.97 (50)	2.24 (57)	1.26 (32)	6.0 (2.7)
AAA	1	8.90 (226)	10.04 (255)	4.72 (120)	8.27 (210)	9.45 (240)	0.30 (8)	0.30 (8)	2.48 (63)	1.97 (50)	2.24 (57)	1.26 (32)	6.0 (2.7)
YAA	2	8.90 (226)	11.26 (286)	5.31 (135)	8.27 (210)	10.63 (270)	0.30 (8)	0.30 (8)	2.48 (63)	1.97 (50)	2.83 (72)	1.85 (47)	8.0 (3.6)
BAA	3	10.20 (259)	13.54 (344)	6.90 (175)	9.45 (240)	12.80 (325)	0.30 (8)	0.30 (8)	3.13 (80)	1.97 (50)	4.13 (105)	2.80 (71)	20.0 (9.1)
CAA	5	10.20 (259)	13.54 (344)	6.90 (175)	9.45 (240)	12.80 (325)	0.30 (8)	0.30 (8)	3.13 (80)	1.97 (50)	4.13 (105)	2.80 (71)	20.0 (9.1)



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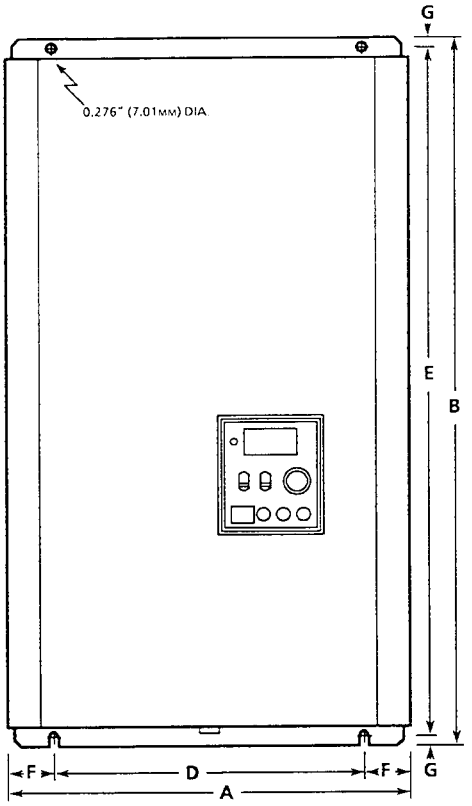
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4.1 Dimensions, Weights & Conduit Entry Locations (continued)

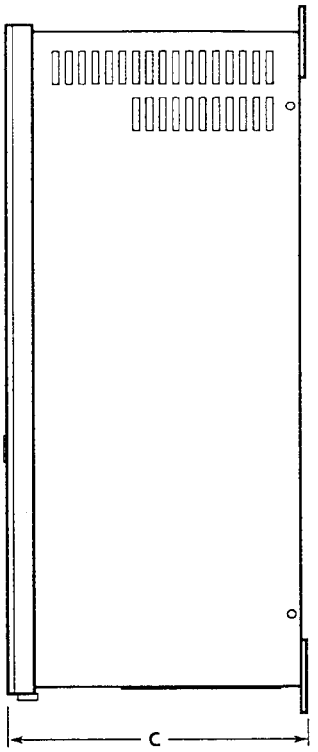
230V Drives
$7\frac{1}{2}$ to 20 HP

NOMINAL DIMENSIONS & WEIGHTS
IN INCHES (MILLIMETERS) & POUNDS (KILOGRAMS)

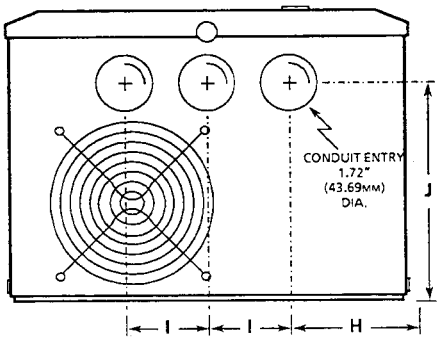
MODEL	HP	A	B	C	D	E	F	G	H	I	J	WEIGHT
DAA	$7\frac{1}{2}$	10.63 (270)	17.72 (450)	8.27 (210)	7.87 (200)	17.13 (435)	1.38 (35)	0.295 (8)	1.57 (40)	2.56 (65)	6.31 (160)	30.0 (13.6)
EAA	10	10.63 (270)	17.72 (450)	8.27 (210)	7.87 (200)	17.13 (435)	1.38 (35)	0.295 (8)	1.57 (40)	2.56 (65)	6.31 (160)	30.0 (13.6)
FAA	15	10.63 (270)	21.65 (550)	8.27 (210)	7.87 (200)	21.06 (535)	1.38 (35)	0.295 (8)	1.57 (40)	2.56 (65)	6.31 (160)	43.0 (19.5)
GAA	20	10.63 (270)	21.65 (550)	8.27 (210)	7.87 (200)	21.06 (535)	1.38 (35)	0.295 (8)	1.57 (40)	2.56 (65)	6.31 (160)	43.0 (19.5)



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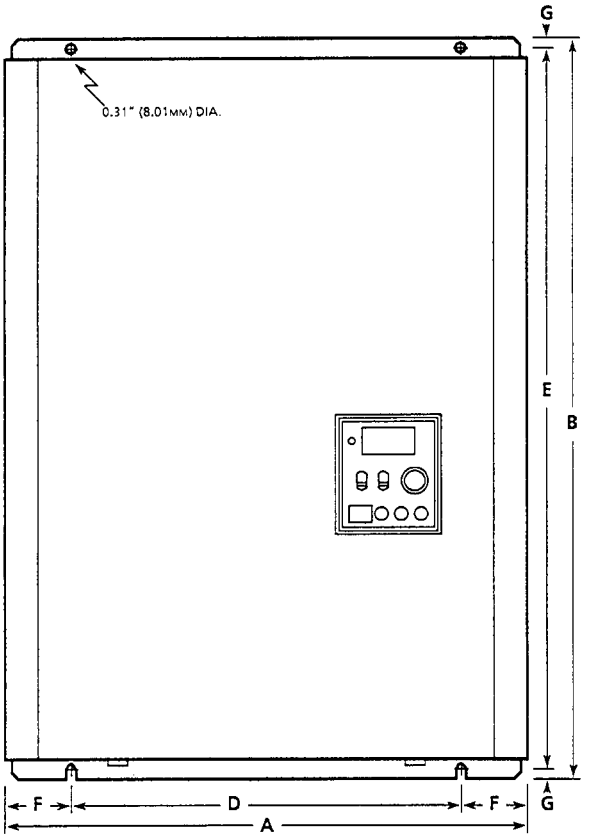
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4.1 Dimensions, Weights & Conduit Entry Locations (continued)

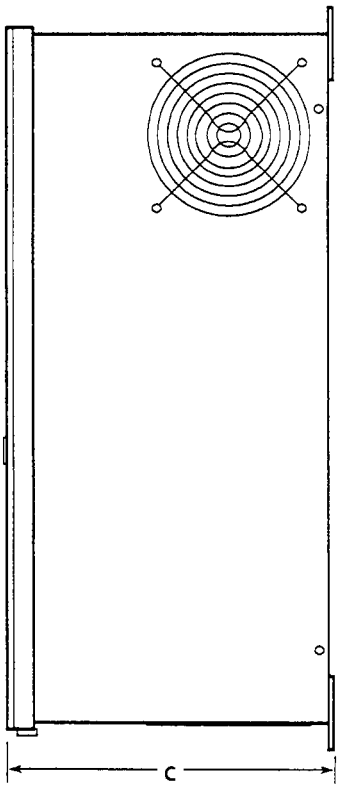
230V Drives 25 and 30 HP

NOMINAL DIMENSIONS & WEIGHTS
IN INCHES (MILLIMETERS) & POUNDS (KILOGRAMS)

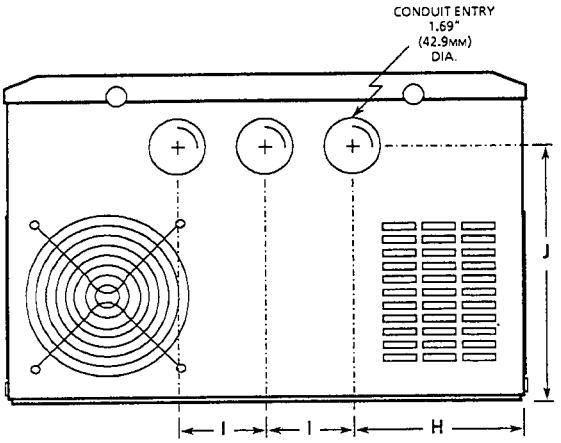
MODEL	HP	A	B	C	D	E	F	G	H	I	J	WEIGHT
RAA	25	13.82 (351)	22.83 (580)	9.15 (232)	9.84 (250)	21.65 (550)	2.00 (51)	0.60 (15)	3.75 (96)	3.15 (80)	6.78 (172)	60.0 (27.2)
HAA	30	13.82 (351)	22.83 (580)	9.15 (232)	9.84 (250)	21.65 (550)	2.00 (51)	0.60 (15)	3.75 (96)	3.15 (80)	6.78 (172)	60.0 (27.2)



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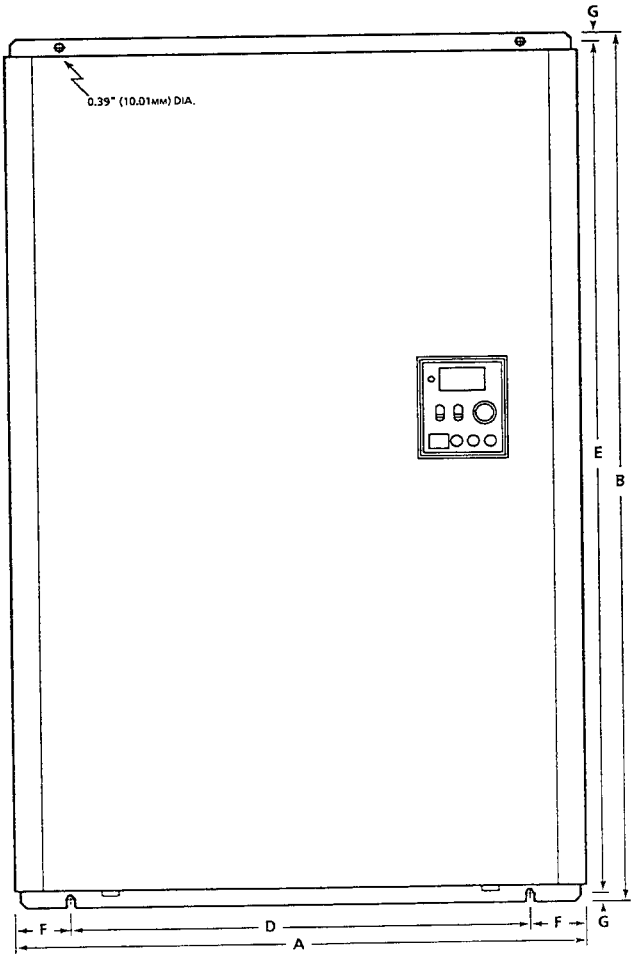
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4.1 Dimensions, Weights & Conduit Entry Locations (continued)

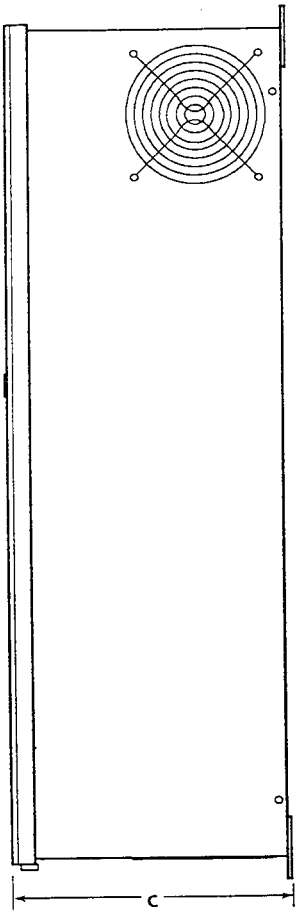
230V Drives 40 and 50 HP

NOMINAL DIMENSIONS & WEIGHTS
IN INCHES (MILLIMETERS) & POUNDS (KILOGRAMS)

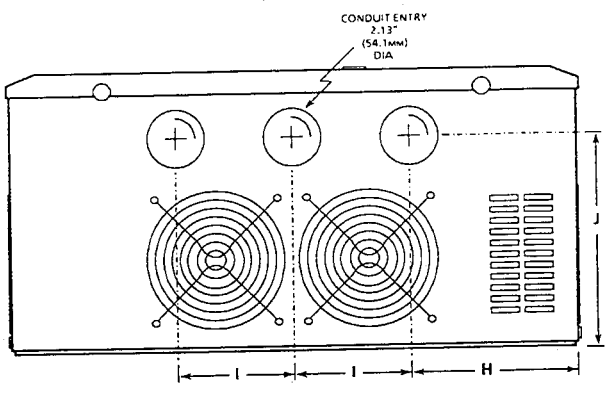
MODEL	HP	A	B	C	D	E	F	G	H	I	J	WEIGHT
JAA	40	17.75 (451)	31.50 (800)	9.18 (233)	13.78 (350)	30.31 (770)	2.00 (51)	0.60 (15)	4.15 (105)	4.72 (120)	6.62 (168)	106.0 (48.0)
KAA	50	17.75 (451)	31.50 (800)	9.18 (233)	13.78 (350)	30.31 (770)	2.00 (51)	0.60 (15)	4.15 (105)	4.72 (120)	6.62 (168)	106.0 (48.0)



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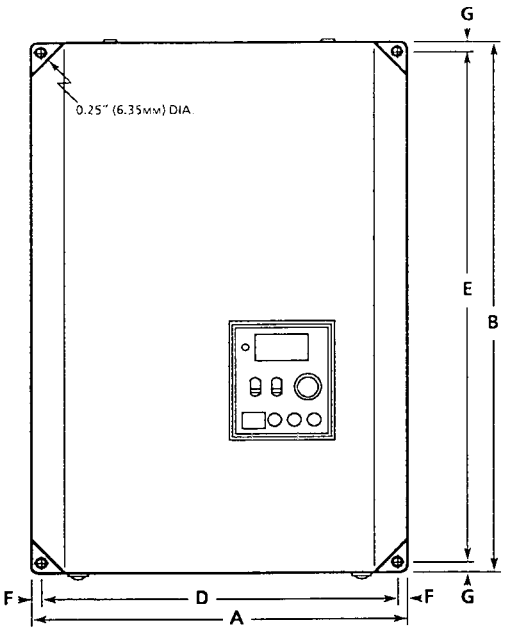
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4.1 Dimensions, Weights & Conduit Entry Locations (continued)

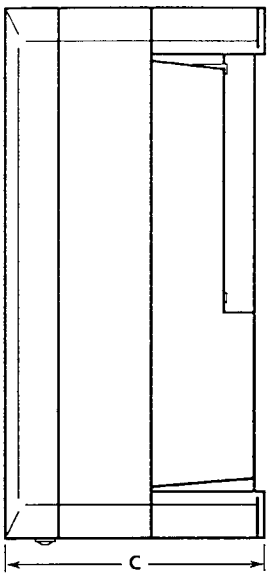
460V Drives 1 to 5 HP

NOMINAL DIMENSIONS & WEIGHTS
IN INCHES (MILLIMETERS) & POUNDS (KILOGRAMS)

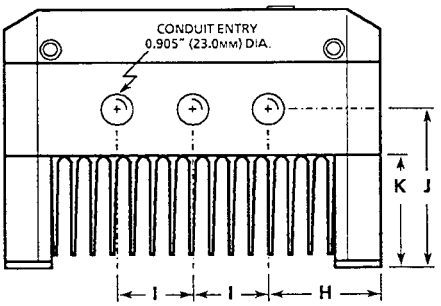
MODEL	HP	A	B	C	D	E	F	G	H	I	J	K	WEIGHT
AAB	1	8.9 (226)	11.26 (286)	5.31 (135)	8.27 (210)	10.63 (270)	0.30 (8)	0.30 (8)	2.48 (63)	1.97 (50)	2.83 (72)	1.85 (47)	9.0 (4.1)
YAB	2	8.9 (226)	11.26 (286)	5.31 (135)	8.27 (210)	10.63 (270)	0.30 (8)	0.30 (8)	2.48 (63)	1.97 (50)	2.83 (72)	1.85 (47)	9.0 (4.1)
BAB	3	10.20 (259)	13.54 (344)	6.90 (175)	9.45 (240)	12.80 (325)	0.30 (8)	0.30 (8)	3.13 (80)	1.97 (50)	4.13 (105)	2.80 (71)	20.0 (9.1)
CAB	5	10.20 (259)	13.54 (344)	6.90 (175)	9.45 (240)	12.80 (325)	0.30 (8)	0.30 (8)	3.13 (80)	1.97 (50)	4.13 (105)	2.80 (71)	20.0 (9.1)



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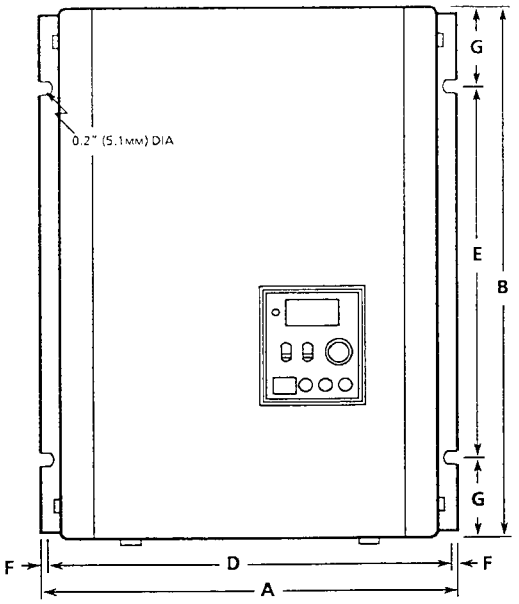
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4.1 Dimensions, Weights & Conduit Entry Locations (continued)

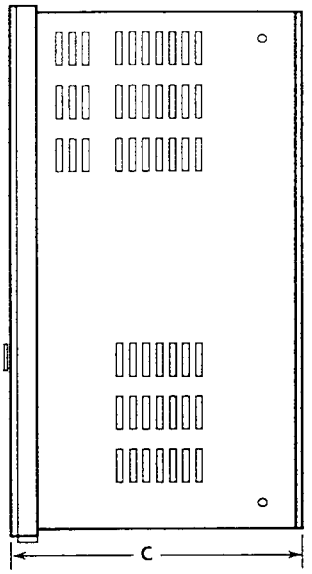
575V Drives 1 to 5 HP

NOMINAL DIMENSIONS & WEIGHTS
IN INCHES (MILLIMETERS) & POUNDS (KILOGRAMS)

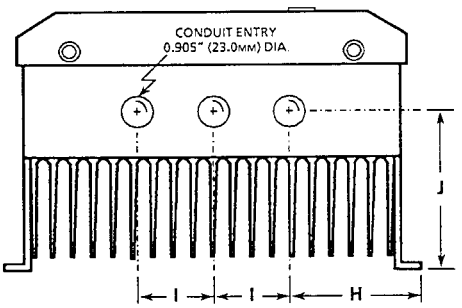
MODEL	HP	A	B	C	D	E	F	G	H	I	J	WEIGHT
AAC	1	10.63 (270)	13.19 (335)	6.89 (175)	10.16 (258)	9.84 (250)	0.23 (6)	1.67 (42)	3.34 (85)	1.97 (50)	4.66 (118)	17.6 (8.0)
YAC	2	10.63 (270)	13.19 (335)	6.89 (175)	10.16 (258)	9.84 (250)	0.23 (6)	1.67 (42)	3.34 (85)	1.97 (50)	4.66 (118)	17.6 (8.0)
BAC	3	10.63 (270)	13.19 (335)	6.89 (175)	10.16 (258)	9.84 (250)	0.23 (6)	1.67 (42)	3.34 (85)	1.97 (50)	4.66 (118)	19.0 (8.6)
CAC	5	10.63 (270)	13.19 (335)	6.89 (175)	10.16 (258)	9.84 (250)	0.23 (6)	1.67 (42)	3.34 (85)	1.97 (50)	4.66 (118)	19.0 (8.6)



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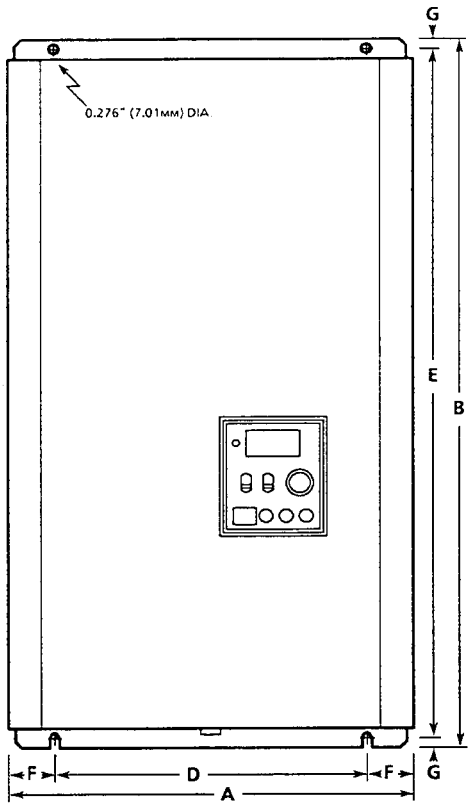
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4.1 Dimensions, Weights & Conduit Entry Locations (continued)

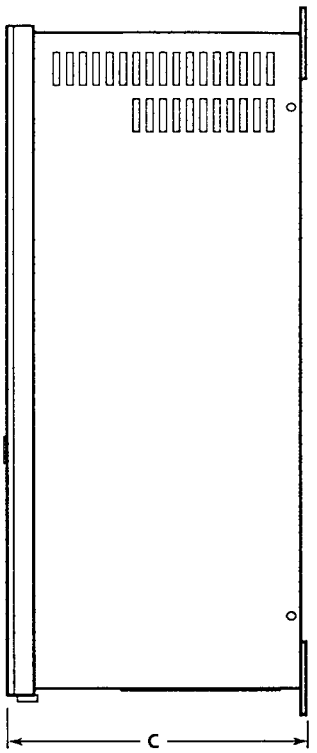
575V Drives
7½ to 15 HP

NOMINAL DIMENSIONS & WEIGHTS
IN INCHES (MILLIMETERS) & POUNDS (KILOGRAMS)

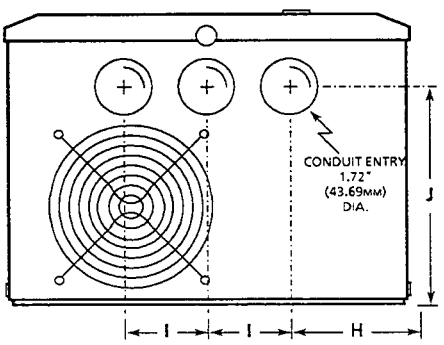
MODEL	HP	A	B	C	D	E	F	G	H	I	J	WEIGHT
DAC	7½	10.63 (270)	17.72 (450)	8.27 (210)	7.87 (200)	17.13 (435)	1.38 (35)	0.30 (7)	2.75 (70)	2.56 (65)	6.31 (160)	34.0 (15.5)
EAC	10	10.63 (270)	17.72 (450)	8.27 (210)	7.87 (200)	17.13 (435)	1.38 (35)	0.30 (7)	2.75 (70)	2.56 (65)	6.31 (160)	34.0 (15.5)
FAC	15	10.63 (270)	17.72 (450)	8.27 (210)	7.87 (200)	17.13 (435)	1.38 (35)	0.30 (7)	2.75 (70)	2.56 (65)	6.31 (160)	34.0 (15.5)



(FRONT)



(SIDE)



(BOTTOM)

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4.2 General Wiring Procedures

CAUTION

Do not proceed without reading the information on this page. Failure to understand procedures and hazards may result in personal injury or equipment damage.

1. The National Electrical Code requires that a circuit breaker or fusible disconnect switch be provided in the drive branch circuit. Providing drive input fusing alone is not sufficient to meet NEC guidelines. The 1333 does not provide this requirement. Selection of a branch circuit or fusible disconnect should be based on the drive input current rating. Refer to Chapter 3 for mandatory AC input fusing recommendations for drive short circuit protection

2. The National Electrical Code (NEC) requires that motor overload protection be provided in the motor branch circuit. The standard Bulletin 1333 Drive does not provide this requirement. Eutectic Alloy or bi-metal overload relays can be utilized to provide running overcurrent protection. Due to the reduced cooling capacity of motors running at low speed (full load), overload relays typically can not provide accurate protection against overheating below 50% of base speed.

3. The National Electrical Code and local regulations govern the installation and wiring of the Bulletin 1333 Adjustable Frequency AC drive. All Input and output power wire, control wire, and conduit should be brought through the the drive conduit entry holes at the bottom of the enclosure. Connections to the drive should be made as shown in the following sections and in accordance with the drive nameplate data, NEC requirements, and any additional interconnection diagrams packed with the drive.

4. All signal wiring must be run separate from power wiring. Verify that shielded cable and/or conduit is used if indicated on any interconnection diagrams. If multiple drives are used, do not use common cabling for AC input or output leads. If shielded cable is required , shields must be grounded at the drive end only at the drive ground lug. The other end must be insulated and left floating. Nearby relays, solenoids, or brake coils can produce electrical noise transients and cause erratic drive behavior. Transient suppression networks must be added across the coils of these devices. Since most start-up difficulties result from incorrect wiring, every precaution should be taken to assure that the wiring is as shown on the diagrams.

4.3 Power Circuit Terminals & Input Fusing

The power circuit terminals are located at an (8) position terminal block situated on the lower front portion of the drive under the enclosure cover. The following explanation indicates the function of each terminal. The plastic guard over the terminal block should be replaced once field installed control wiring is complete.

The Bulletin 1333 does not provide input power short circuit protection. Refer to **Chapter 3 – Specifications**, for the recommended fuse size to provide drive input power protection against short circuits.

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4.3 Power Circuit Terminals & Input Fusing (continued)

CAUTION

1) Power factor correction capacitors connected to the drive output cannot be used. The switching of power factor correction capacitors on the input AC line of the drive may cause damage to the drive.
2) The use of contactors between the output of the Bulletin 1333 and the motor may cause damage to the drive and is not recommended.

If your application requires the use of power factor correction capacitors or output contactors, consult your nearest Allen-Bradley Area Sales/Support Center.

IMPORTANT

1) Verify that the induction motor windings are properly connected to match the drive output rating.
2) For multimotor operation the combined total of motor kVA cannot exceed the kVA output of the drive.

L1, L2, & L3 Connect these terminals to a fused 3Ø AC input. Verify that the incoming line voltage matches the voltage listed on the drive nameplate.

M1, M2 & M3 Connect the motor leads to these terminals – (**M1** to **T1**, **M2** to **T2** and **M3** to **T3**).

(GND) This terminal is connected to earth ground or the ground of the building electrical system. Additionally, the motor frame should also be connected to earth ground. Refer to the motor manufacturer's guidelines for specific details.

① CUSTOMER SUPPLIED COMPONENTS

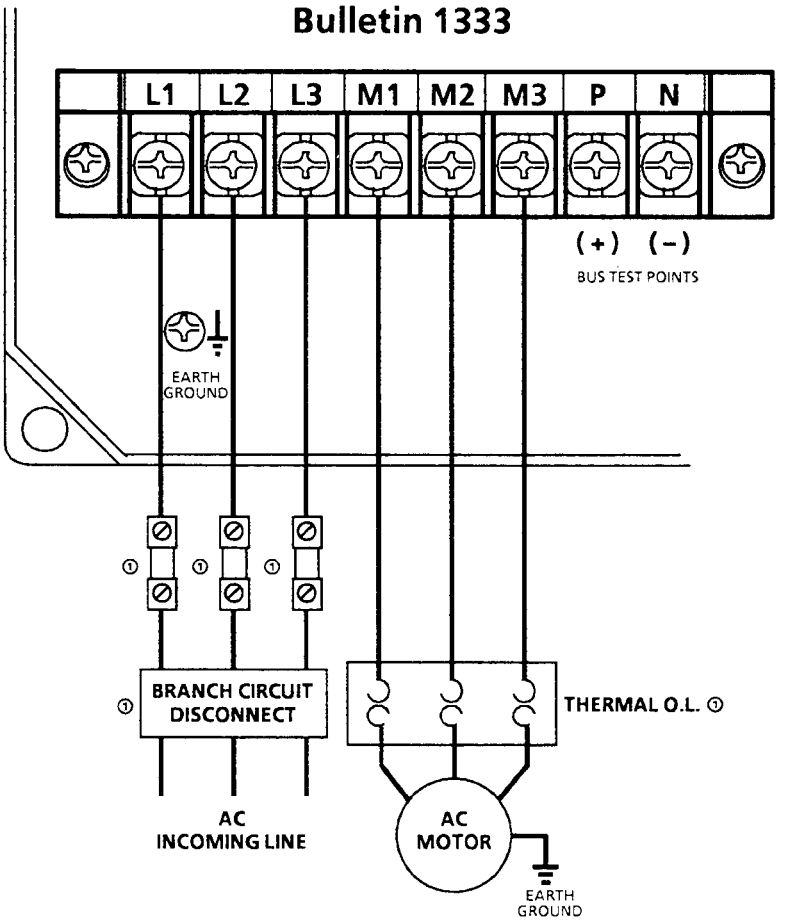


Figure 4.3a – 3Ø Connections for 230/460/575V Drives – Plastic Guard on Terminal Block Removed

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4.3 Power Circuit Terminals & Input Fusing (continued)

WARNING

1) Any disconnecting means wired to the output of the drive must be capable of shutting down the drive if opened during drive operation. The drive will continue to run into an open motor circuit causing a potential shock hazard. Opening the motor circuit while the drive is running will also cause equipment damage. A hard wired, normally closed, stop interlock contact must be wired between terminals **16** & **17**.
2) The start/stop control circuitry in the Bulletin 1333 drive includes solid state components. If hazards due to accidental contact with moving machinery or unintentional flow of liquid, gas, or solids exist, an additional hard wired emergency stop circuit may be required. Refer to codes and standards applicable to your particular system for specific requirements and additional information. A device that removes AC input power when an emergency stop is initiated can be used. When AC input power is removed however, there will be a loss of inherent regenerative braking effect and the motor will coast to a stop. An auxiliary braking method may be required.

L2 & L3 Connect these terminals to a fused 1Ø AC input. Verify that the incoming line voltage matches the voltage listed on the drive nameplate.

M1, M2 & M3 Connect the motor leads to these terminals – (**M1** to **T1**, **M2** to **T2** and **M3** to **T3**).

(GND) This terminal is connected to earth ground or the ground of the building electrical system. Additionally, the motor frame should also be connected to earth ground. Refer to the motor manufacturer's guidelines for specific details.

① CUSTOMER SUPPLIED COMPONENTS

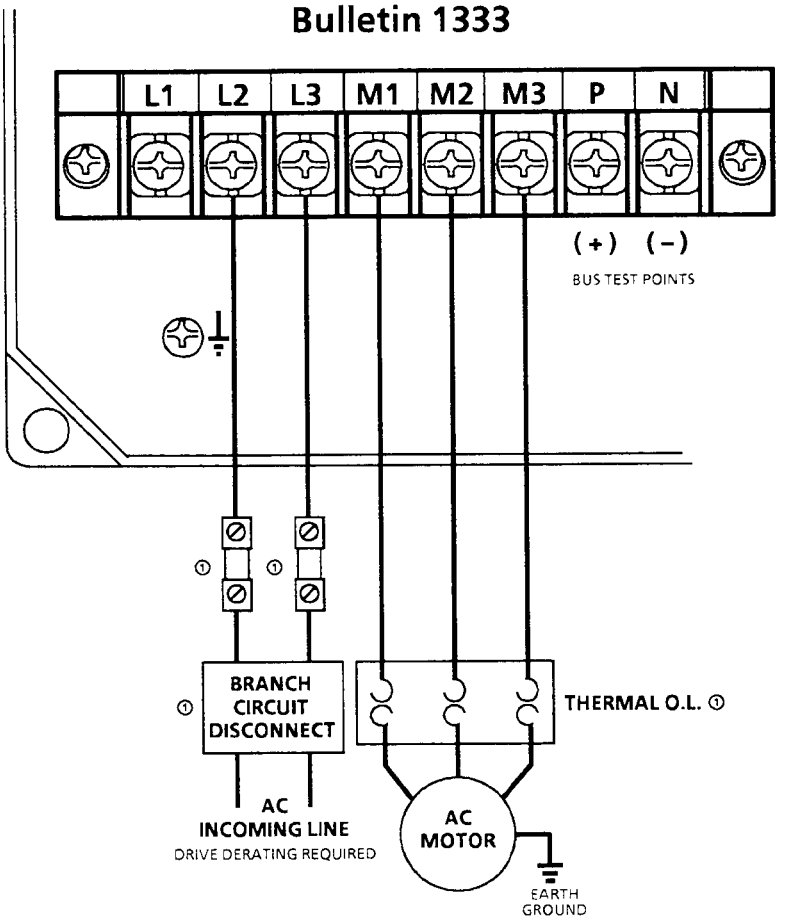


Figure 4.3b – 1Ø Connections for 230V Drives – Plastic Guard on Terminal Block Removed

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4.4 Control Terminals

The drive is capable of operating from the built-in control panel without any connections to the customer terminal block. When required, external (remote) operator elements may be connected to the control terminal block to provide remote control of the drive. There are also several additional drive control functions and status outputs available for customer use at the control terminal block.

The control terminal block is a (24) position terminal block located on the lower front portion of the drive under the enclosure cover. The following is an explanation of the function of each of the terminals.

All signal wiring must be run separate from power wiring. Verify that shielded cable and/or conduit is used if indicated on any interconnection diagrams. If shielded cable is required , shields must be grounded at the drive end only at the drive ground lug. The other end must be insulated and left floating. Nearby relays, solenoids, or brake coils can produce electrical noise transients and cause erratic drive behavior. Transient suppression networks must be added across the coils of these devices. Since most start-up difficulties result from incorrect wiring, every precaution should be taken to assure that the wiring is as shown on the diagrams.

IMPORTANT

Many of the control functions located on the control terminal block are affected by drive MODE programming and selection. Refer to **sections 5.3, 5.3.1, & 5.3.2** in **Chapter 5 – Operation & Programming** to verify that the drive is programmed for the desired operation.

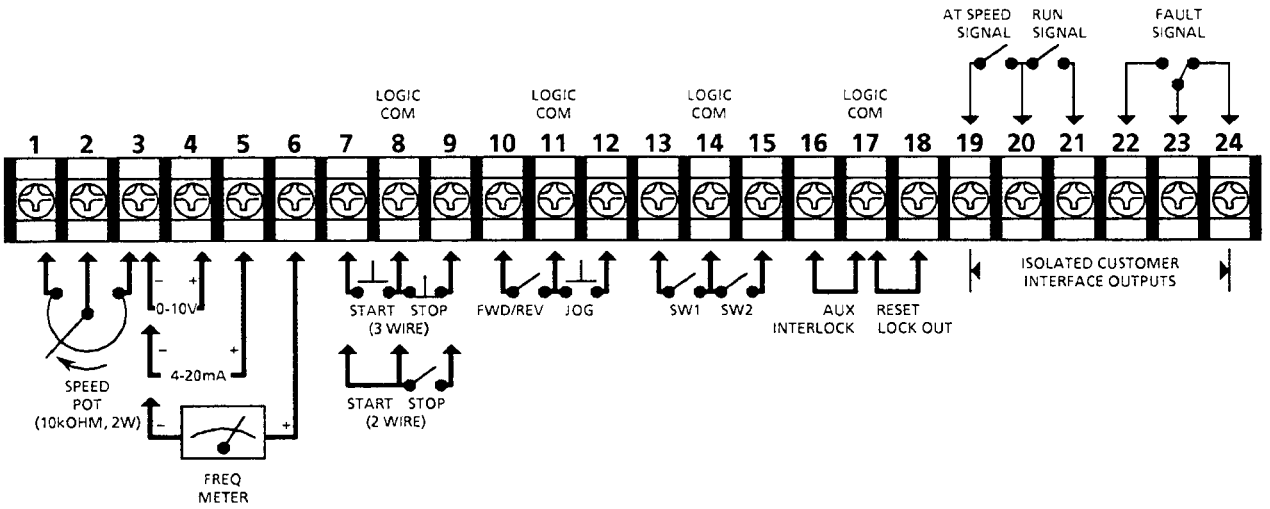


Figure 4.4 – Control Terminal Block with Optional Customer Connections

1, 2 & 3 These terminals are available for connection to a 10kΩ, 2W remote potentiometer. When a pot is connected to these terminals, no connections should be made to terminals **4** or **5**. The status of **MODE 10** affects the drive response to this signal.

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4.4 Control Terminals (continued)

CAUTION

Unexpected machine acceleration can cause injury or death.

If Mode 10 is set to a value other than 0, a loss of the potentiometer low reference signal at terminal 3 of the control terminal block will allow the drive to immediately accelerate to maximum frequency if the drive is running or a start command has been received.

Ensure that remote potentiometer connection integrity is maintained and inspected in accordance with NFPA 70B standards for maintenance of electrical equipment.

CAUTION

Terminals 4, 5 and 6 are internally protected from reverse polarity signals or input signals rising above 120% of the maximum input signal. If reverse polarity or levels are maintained above 120%, signals may be degraded and component damage may result.

3 & 4 These terminals are used when a 0 to +10V DC signal is the external source for speed control. When these terminals are used, normally no connections are made to terminals **1**, **2**, or **5**. The status of both **MODE**s **10** & **11** will affect the drive response to this signal. These terminals present a load impedance of 40kΩ to external circuits.

3 & 5 These terminals are used when a 4 to 20mA signal is the external source for speed control. When these terminals are used, normally no connections should be made to terminals **1**, **2**, or **4**. The status of both **MODE**s **10** & **11** will affect the drive response to this signal. These terminals present a load impedance of 340Ω to external circuits.

IMPORTANT

Speed input wiring must be twisted (2) or (3) conductor shielded wired having (2) to (3) twists per inch. The shield must be grounded at the drive end only at the drive ground lug. The other end must be insulated and left floating. For distances less than 150 ft., use a minimum wire size of 22AWG. For distances between 150 and 300 ft., use a minimum wire size of 16AWG.

3 & 6 These terminals may be used to connect an external analog speed (frequency) meter. The output from these terminals is a 0 to 1mA signal proportional to drive output frequency. Full scale (1mA at terminal **6**), is reached when the drive reaches its maximum frequency, selected by **MODE 6**. The connected load to these terminals must be less than 300Ω.

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4.4 Control Terminals (continued)

7, 8 & 9 These terminals may be used to connect external start/stop pushbuttons or switches as shown in **Figure 4.4**. Controls connected to these terminals are affected by the programming of **MODEs 9 & 12**.

If pushbuttons are used, connect a N.O. start pushbutton between terminals **7 & 8** and a N.C. stop pushbutton between terminals **8 & 9**.

If a two position selector switch or isolated relay contact is used, connect the contact between terminals **8 & 9** and place a jumper between terminals **7 & 8**.

IMPORTANT

If **MODE 16** Decel Stall Prevention is set to 1 (on), an overhauling load may cause the decel ramp to hold at one frequency for an extended period, causing ramp-to-stop commands to appear to be non-functional.

10 & 11 These terminals may be used to connect an external single pole forward/reverse switch. Controls connected to these terminals are affected by **MODE 12** programming.

11 & 12 These terminals are used to connect a jog pushbutton. For the Bulletin 1333, jog is a mode of operation that allows the drive to start and run at a speed programmed by **MODE 19** only as long as the pushbutton is held in. Once the pushbutton is released, the drive will stop.

IMPORTANT

The jog command can operate the drive independent of either the local or external start/stop controls.

13, 14 & 15 These terminals are used to connect external switches to perform functions in one of two ways.

1) To Provide One of Four Preset Speeds

MODE	SPEED	SW1	SW2
NONE	MANUAL	OPEN	OPEN
20	2nd PRESET SPEED	CLOSED	OPEN
21	3rd PRESET SPEED	OPEN	CLOSED
22	4th PRESET SPEED	CLOSED	CLOSED

2) To Alternate Accel or Decel Rates as Programmed by MODES 28 & 29

ACCEL RATE	DECEL RATE	SW1	SW2
1st	1st	OPEN	OPEN
2nd	1st	CLOSED	OPEN
1st	2nd	OPEN	CLOSED
2nd	2nd	CLOSED	CLOSED

MODE 27 is then programmed to perform the functions in either **1)** or **2)** above, but not both.

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4.4
Control Terminals
(continued)

16 & 17 These factory jumpered terminals are used to connect a customer supplied motor overload trip interlock. Typically, the N.C. pilot contacts would be wired to these terminals by the customer. An open contact indicates an ***AU*** (auxiliary fault) condition at the main display and stops the drive on a fault trip. Additional N.C. fault interlocks can be wired in series with the overload contact.

IMPORTANT

1) If the factory installed jumper is removed from terminals **16** & **17** the drive will not run.
2) The Bulletin 1333 requires that contacts installed between terminals **16** & **17** to be open for 100mS or longer to sense the auxiliary fault.

17 & 18 These terminals are jumpered or not jumpered to determine how the Bulletin 1333 is reset after a fault condition.

When the terminals are jumpered, a drive fault trip may only be reset by removing and reapplying incoming line voltage to the drive.

When the terminals are not jumpered, a drive fault trip can be reset by either a local or remote stop command or by removing AC line voltage to the drive.

19 & 20 These terminals allow a drive supplied "*at speed*" contact to be used in external circuits. The N.O. drive contact closes when the drive output frequency is within 2 Hz of the commanded speed reference after accel or decel is complete. The contact is rated for 120V AC, 1A resistive & 30V DC, 2A resistive.

20 & 21 These terminals allow a drive supplied run contact to be used in external circuits. The N.O. drive contact closes when the drive is running. The contact is rated for 120V AC, 1A resistive & 30V DC, 2A resistive.

22, 23 & 24 These terminals allow a set of drive supplied fault contacts to be used in external circuits. The contacts are rated for 120V AC, 1A resistive & 30V DC, 2A resistive.

CONTROLLER STATE	TERMINALS 22 & 23	TERMINALS 23 & 24
NO POWER	OPEN	CLOSED
POWER ON, NO FAULT	CLOSED	OPEN
POWER ON, DRIVE FAULT	OPEN	CLOSED

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5.0 General Application

The Bulletin 1333 is an AC adjustable frequency Drive designed for use with a standard, three phase induction motor. The standard control is designed as a constant torque, soft start speed control with 150% overload capability and is adaptable through programming to handle a wide variety of applications.

The Bulletin 1333 provides an exceptional quality output voltage and current waveform. However, special considerations must be taken when applying an inverter to an existing motor. At slower speeds, cooling is not as effective due to reduced fan RPM. Extended operation at full load torque at slow speeds may damage the motor due to overheating.

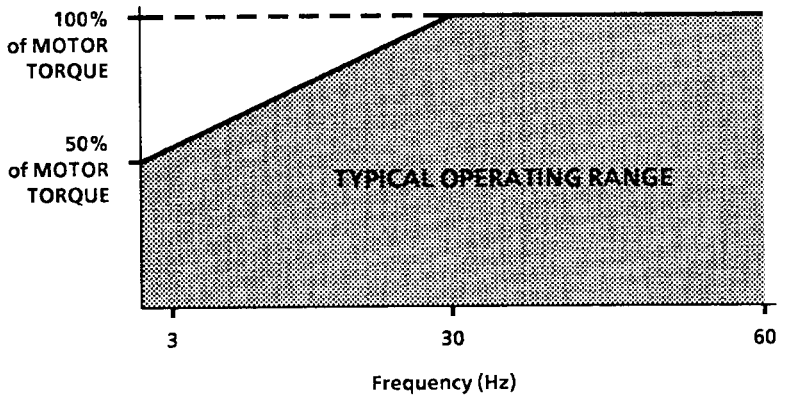


Figure 5.0 – Torque vs. Frequency

Figure 5.0 shows a typical curve, plotting torque vs. speed. At slow speeds, if torque requirements continuously exceed levels shown in **figure 5.0** (10 minutes or longer), a motor rated for the required speed and torque operation should be substituted. Additionally, in order to guard against mechanical problems, it is recommended that the entire drive train machinery be checked for various limitations due to the adjustable frequency range of the Bulletin 1333.

CAUTION

Motors may overheat when operated at rated torque for long periods of time below 50% base speed due to the decreased air flow of the motor fan. Motors may require special balancing if operated at more than 125% of base speed. Refer to the motor manufacturer for proper sizing of the motor for the intended application.

5.1 Description of Operation

An adjustable frequency Drive must be capable of generating a 3Ø adjustable voltage and frequency waveform to control the speed of a 3Ø motor. As shown in **figure 5.1a**, the Bulletin 1333 uses the following circuits to accomplish this.

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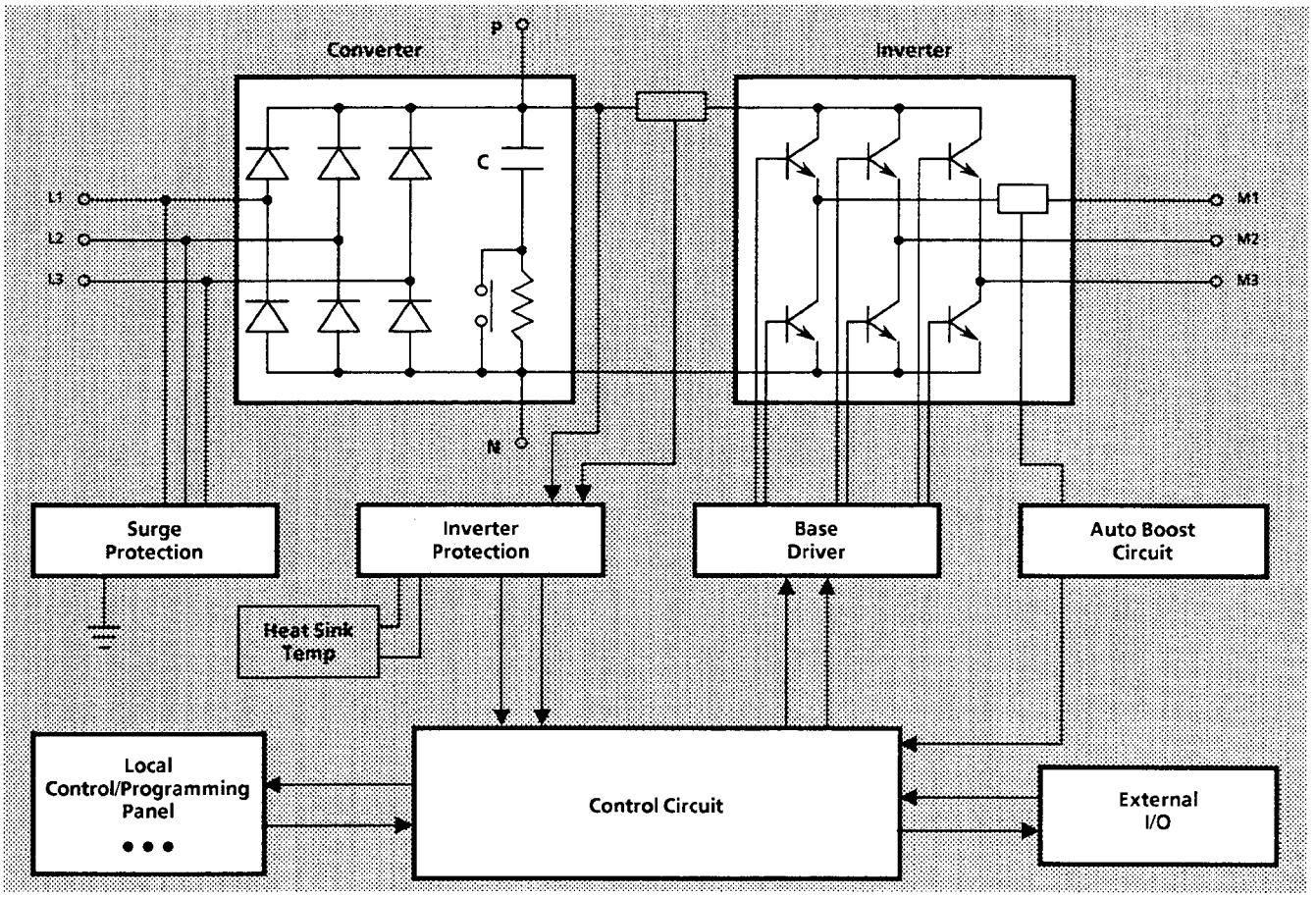


Figure 5.1a – Bulletin 1333 Block Diagram

5.1 Description of Operation (continued)

Converter Section – The six diode Converter Section of the Bulletin 1333 converts or rectifies the incoming three phase AC line. The resultant DC is smoothed by capacitor **C** and used as in input to the **Inverter Section**.

Inverter Section – In the Inverter Section, the rectified DC is converted into three phase AC. The transistors repeat many switching operations to generate one cycle forming a sine weighted PWM. This output allows current flowing through the motor to approximate a sine wave.

1) and **2)** in **figure 5.1b** shows the output waveforms for output phases **M1** and **M2**. The pulses generated in the **Control Circuit** are fed to the base of the inverter transistors by means of the **Base Driver**. These pulse signals then cause the transistor to perform a switching operation according to the base driver signal. Waveform **3)** in **figure 5.1b** is the logical summation of phase outputs **M1** and **M2**. The output mean voltage now becomes sinusoidal, and motor current that approximates a sinusoidal value flows through the motor.

Surge Protection – These protection devices are designed to absorb power source transients that are superimposed on the three phase input lines.

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5.1 Description of Operation (continued)

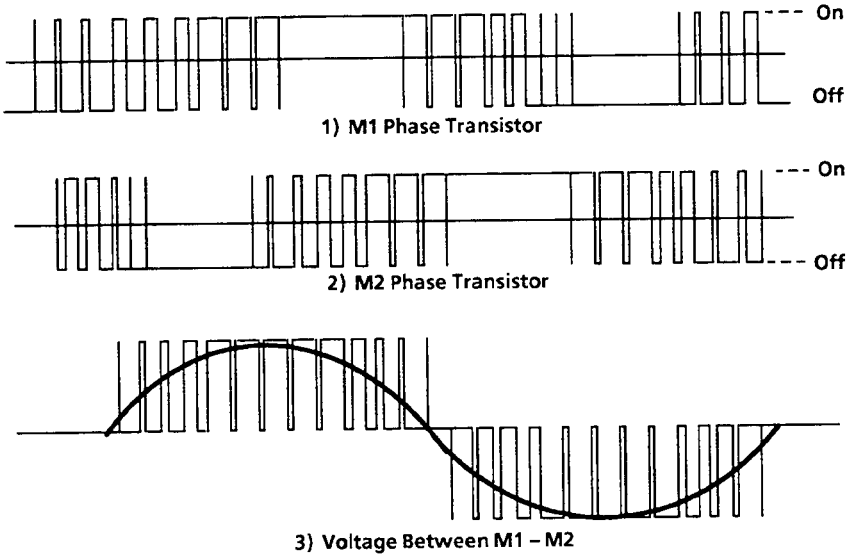


Figure 5.1b – Inverter Section Output Waveforms

Inverter Protection – This circuit monitors the current and voltage conditions of the **Converter** and **Inverter**. If current or voltage values reach a predetermined level, signals are sent to the **Control Circuit** which responds by protecting Drive circuitry against damage and indicating the condition.

Base Driver – This section amplifies and isolates signals from the **Control Circuit** and makes the inverter transistors operate in an appropriate switching scheme.

Auto Boost Circuit – This circuit detects load conditions of the motor. Once load conditions are determined, the circuit determines the optimum output voltage level that will allow the motor to effectively handle the required load.

Local Control/Programming Panel – This panel provides a means of local control and programming of Drive operation. In addition to control functions, it also displays operating conditions of the Drive and indicates fault conditions. Indicated fault conditions are followed by a programmable Drive shutdown sequence.

Control Circuit – The **Control Circuit** serves several functions.

1. It receives speed reference and operating commands from the **Local Control/Programming Panel** or **External I/O**. These commands are used to determine the frequency output voltage and phase rotational direction of the motor.
2. It generates commands (pulses) which are fed to the **Base Driver** which in turn generates the required output frequency and voltage as shown in **figure 5.1b**.
3. It generates outputs for the **Local Control/Programming Panel** and **External I/O** block to indicate Drive speed, operating status and fault conditions.
4. It responds to abnormal conditions sensed by the **Inverter Protection** circuits and performs an orderly shutdown of the Drive when required.

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5.1 Description of Operation (continued)

External I /O – This provides a means for the Drive to accept external commands instead of using the **Local Control/Programming Panel** as well as to send external commands.

5.2 Local Control/Programming Panel

The local control/programming panel shown below, provides a convenient means to locally control the common operating functions of the Drive including start/stop, forward/reverse, and frequency. In addition, the local control/programming panel also contains two digital displays – a Main Display to show output frequency, fault codes, and Drive MODE values – and a MODE Display to show the Drive MODE codes and control source. Finally, the local control/programming panel includes the controls necessary to program the various MODES that can control the Drive.

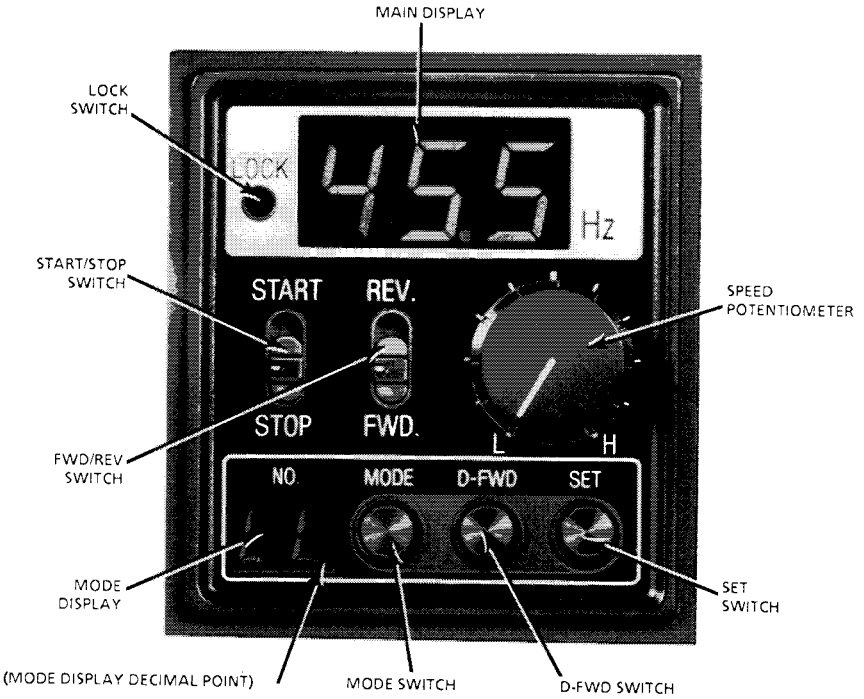


Figure 5.2 – Local Control/Programming Panel

5.2.1 Panel Switches & Displays

DISPLAYS

Main Display

This is a large, three digit display that normally displays the Drive output frequency. It is also used to display the fault code when a Drive fault occurs and to display MODE values when in the set-up mode.

MODE Display

These two smaller seven segment displays show the current MODE selected when in the set-up mode. When not in the set-up mode, these displays are used to indicate the source of Drive control and frequency. The right-most decimal point of this display is used to indicate that the Drive is in the operating mode.

PROGRAMMING SWITCHES

MODE Switch

The MODE Switch is used to select a desired MODE (shown at the MODE Display), for viewing the present value (shown at the Main Display), or to make programmed changes to Drive control functions.

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5.2.1
Panel Switches & Displays
(continued)

D-FWD Switch
The D-FWD Switch is used to display alternate values for the selected set-up mode.

SET Switch
The SET Switch is used to load (store) the displayed value of the selected set-up mode.

LOCK Switch
The LOCK switch cycles the Drive between the operating mode and the set-up mode.

In the operating mode, the Drive program values can not be changed. The D-FWD and SET Switch will be disabled. The MODE Switch may still be used to view MODE settings, but changes cannot be made. In the operating mode, the MODE Display Decimal Point will be illuminated.

The set-up mode permits MODE programming changes using the MODE, D-FWD, and SET Switches. Drive operation is disabled in this mode, and the Drive can not run. Neither the local or external Start/Stop function nor the external jog function will start the Drive. In the set-up mode, the MODE Display Decimal Point will not be illuminated.

LOCAL CONTROLS

IMPORTANT

To Allow Local Control

- The local Start/Stop selector switch requires that **MODE 12** be set to ***0*** as explained in **section 5.3.3 – MODE Description**.
- The local forward/reverse selector switch requires that both **MODE 12** & **MODE 13** be set to ***0*** as explained in **section 5.3.3 – MODE Description**.
- The local speed potentiometer requires that **MODE 10** be set to ***0*** as explained in **section 5.3.3 – MODE Description.**

The Bulletin 1333 local control/programming panel is not intended to replace or be considered a suitable alternative for the operator control station for all applications. Refer to codes and standards applicable to your particular system for specific requirements and additional information.

Speed Potentiometer
This potentiometer is used to control the Drive output speed only in the local mode. Local Control will be indicated by an ***L*** in the control display as shown in **section 5.2.2 – Table B – Control Display**.

START/STOP Selector Switch
This switch is used to start and stop the Drive only in the local mode. Local Control will be indicated by an ***L*** in the control display as shown in **section 5.2.2 – Table B – Control Display**.

FWD/REV Selector Switch
This switch is used to control or change the direction of motor rotation only in the local mode. Local Control will be indicated by an ***L*** in the control display as shown in **section 5.2.2 – Table B – Control Display**.

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5.2.1 Panel Switches & Displays (continued)

In addition to the controls on the local control/programming panel, there is one additional adjustment that is available. For users that connect a remote analog speed meter, there is a scaling adjustment. This adjustment, **VR2**, (shown in **Chapter 6 – figure 6.0**) is located on the control board just to the left of the local control/programming panel.

5.2.2 Control & Fault Displays

Table A shows the Bulletin 1333 fault displays that will appear at the Main Display in the event of a Drive fault and their explanation.

Fault Display	Fault Explanation
OC	OVERCURRENT
OL	OVERLOAD
OU	OVERVOLTAGE
LU	LOW VOLTAGE
OH	OVER TEMPERATURE
AU	AUX. INTERLOCK
OP	OPERATING ERROR

Table A – Fault Display

Table B shows the Bulletin 1333 local /external control displays that will appear at the MODE Display under normal operating conditions and their explanation.

Mode Display	Control Explanation			
LL	L	START/STOP & FWD/REV CONTROL AT THE CONTROL PANEL (*LOCAL CONTROL*)	1	FREQUENCY CONTROL AT THE CONTROL PANEL (*LOCAL CONTROL*)
LE	L	START/STOP & FWD/REV CONTROL AT THE CONTROL PANEL (*LOCAL CONTROL*)	E	FREQUENCY CONTROL AT THE CONTROL TERMINAL BLOCK (*EXTERNAL CONTROL*)
EL	E	START/STOP & FWD/REV CONTROL AT THE CONTROL TERMINAL BLOCK (*EXTERNAL CONTROL*)	1	FREQUENCY CONTROL AT THE CONTROL PANEL (*LOCAL CONTROL*)
EE	E	START/STOP & FWD/REV CONTROL AT THE CONTROL TERMINAL BLOCK (*EXTERNAL CONTROL*)	E	FREQUENCY CONTROL AT THE CONTROL TERMINAL BLOCK (*EXTERNAL CONTROL*)

Table B – Control Display

5.3 Introduction to MODE Programming

Table C lists the (31) Bulletin 1333 MODEs available for user programming and selection. The remainder of this chapter describes how to change MODE values and what the function and alternatives are for each of the set-up MODEs.

IMPORTANT

1) Before attempting any MODE programming, read the remainder of this chapter and perform **STEPS 1 – 4** in **Chapter 6, section 6.1 – Verification of AC Line Power & Drive Settings**.
2) Set-up MODE values are stored in nonvolatile memory. Removing power to the Drive will not change or lose the present values. The Drive does not require reprogramming after loss or removal of power.

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MODE Display	MODE Name	SETTINGS															
01	ACCELERATION TIME (SECONDS)	0.1	0.2	0.5	1	2	5	10	20	50	100						
02	ACCELERATION TIME MULTIPLIER	×1	×2	×3	×4	×5	×6	×7	×8	×9	×10	×11	×12	×13	×14	×15	×16
03	DECELERATION TIME (SECONDS)	0.1	0.2	0.5	1	2	5	10	20	50	100						
04	DECELERATION TIME MULTIPLIER	×1	×2	×3	×4	×5	×6	×7	×8	×9	×10	×11	×12	×13	×14	×15	×16
05	BOOST LEVEL	0	1	2	3	4	5	6	7	8	A (AUTO)						
06	MAXIMUM FREQUENCY & VOLTS/HERTZ	50	60	100	120	200	240	10H	12H	20H	24H						
07	DC BRAKE TIME (SECONDS)	0	0.2	0.4	0.6	0.8	1	1.2	1.4	1.6	1.8	2	2.2	2.4	2.6	2.8	3
08	DC BRAKE LEVEL (%)	0	1	2	3	4	5	6	7	8	9	10					
09	RESTART MODE AUTO RESTART (0) / NONRESTART (1)	0	1														
10	FREQUENCY CONTROL LOCAL (0) / EXTERNAL (1)	0	1														
11	EXTERNAL FREQ SIGNAL TYPE 0-10V (0) / 4-20mA (1)	0	1														
12	START/STOP; FWD/REV CONTROL	0	1														
13	LOCAL REVERSE LOCKOUT UNLOCK (0) / LOCK (1)	0	1														
14	STOP MODE RAMP (0) / COAST (1)	0	1														
15	ACCEL STALL PREVENTION OFF (0) / ON (1)	0	1														
16	DECEL STALL PREVENTION OFF (0) / ON (1)	0	1														
17	MINIMUM FREQUENCY (HERTZ)	Lowest operating frequency														0.5 Hz	
18	MAXIMUM FREQUENCY (HERTZ)	Highest operating frequency														60 Hz	
19	JOG FREQUENCY (HERTZ)	Frequency can be set up to 20 Hz in 0.5 Hz increments.														10 Hz	
20	2nd PRESET FREQUENCY (HERTZ)	Frequency can be set between maximum frequency and minimum frequency.														20 Hz	
21	3rd PRESET FREQUENCY (HERTZ)	Frequency can be set between maximum frequency and minimum frequency.														30 Hz	
22	4th PRESET FREQUENCY (HERTZ)	Frequency can be set between maximum frequency and minimum frequency.														40 Hz	
23	1st SKIP FREQUENCY (HERTZ)	Frequency can be set between maximum frequency and minimum frequency. NO SKIP FUNCTION (0)														0 Hz	
24	2nd SKIP FREQUENCY (HERTZ)	Frequency can be set between maximum frequency and minimum frequency. NO SKIP FUNCTION (0)														0 Hz	
25	3rd SKIP FREQUENCY (HERTZ)	Frequency can be set between maximum frequency and minimum frequency. NO SKIP FUNCTION (0)														0 Hz	
26	SKIP FREQUENCY RANGE	0	1	2	3	4	5	NO SKIP FUNCTION (0)									
27	PRESET FREQ / 2nd ACCEL/DECEL PRESET FREQ (0) / 2nd ACCEL/DECEL (1)	0	1														
28	2nd ACCEL TIME MULTIPLIER	×1	×2	×3	×4	×5	×6	×7	×8	×9	×10	×11	×12	×13	×14	×15	×16
29	2nd DECEL TIME MULTIPLIER	×1	×2	×3	×4	×5	×6	×7	×8	×9	×10	×11	×12	×13	×14	×15	×16
30	LAST FAULT INFORMATION	No Setting Required															
31	CURRENT LIMIT	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Table C – MODE Programming ▨ Factory Settings

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5.3.1 MODE Viewing

MODE values may be viewed in the operating mode while the Drive is running. Press the MODE switch until the desired MODE number is reached. The present value will appear in the main display. To return to the operating display, continue pressing the MODE switch until mode number 31 is reached, then press the switch one more time — or — simply wait 30 seconds. When the Drive is in the viewing mode and running, the operating frequency display will automatically reappear after 30 seconds.

5.3.2 MODE Programming

Set-up MODE programming is accomplished in a four step procedure using the **LOCK**, **MODE**, **D-FWD**, and **SET** switches located on the local control panel.



WARNING

Drive MODE Programming Requires That Power be Applied to the Drive

Hazard of unintentional machine motion and personal injury may exist due to previous MODE programming and external control inputs when power is applied to the Drive.

Before Applying Power

1) Set the local Start/Stop switch to STOP.
2) De-energize any remote Start/Stop circuits connected to terminals **7**, **8** & **9** or any Jog circuits connected to terminals **11** & **12**.

If a decimal point is shown in the MODE Display, Drive data is locked, and the Drive is in the Operating Mode. Set-up data may be viewed but not changed. In order to enter or change data the Drive must be in the Programming Mode.

STEP 1 STOP THE DRIVE & UNLOCK DATA

Once the Drive is stopped, press the **LOCK** switch. The decimal point in the MODE Display will go out. You are now in the programming mode.

STEP 2 SELECT MODE

Use the **MODE** switch to select the desired **MODE** to be changed. Each time the **MODE** switch is depressed, the MODE Display will be incremented by one number and the current value for that MODE will be shown on the Main Display.

STEP 3 SELECT VALUE

Use the **D-FWD** switch to select the desired data or value for the displayed MODE. Each time the **D-FWD** switch is depressed, the Main Display will increment to the next highest value. After increased to the highest value, the data will start over at its lowest value.

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5.3.2 MODE Programming (continued)

STEP 4 SET VALUE

Once the desired MODE and data is selected, use the **SET** switch to store the data in Drive memory. Once set, the display value will disappear, then reappear.

Programming is now complete for the displayed MODE. If other MODE programming is required, repeat **STEPS 1**, **2** ,**3**, and **4** for the other required MODEs.

It is strongly suggested that any mode data changes be recorded for future reference. A set-up mode chart has been provided in the Reference Guide, at the back of this manual, and in the Drive with space to record customer settings. This data should be transferred to the set-up mode chart in the Drive only after programming is complete and power has been removed from the Drive.

5.3.3 MODE Description

The following information describes the 31 MODEs available for user programming and selection. The initial values for each mode have been preset at the factory as shown in **Table C** in **section 5.3**. Any interaction or preconditions required for individual MODEs is included with each description.

MODE 1 Acceleration Time
MODE 2 Acceleration Time Multiplier

These two modes together determine the time it takes the Drive to accelerate over a change in frequency of 60 Hz.

MODE 1 permits the selection of a time base in seconds.

MODE 2 permits the selection of a multiplier from ***1*** to ***16***, which when multiplied by the value selected in MODE 1, determines the actual time.

EXAMPLE MODE 1 = ***10*** MODE 2 = ***5***

The result = ***10*** x ***5*** = 50. It will take the Drive (50) seconds to accelerate from 0 to 60 Hz. If the maximum frequency were 120 Hz, it would take the Drive (100) seconds to accelerate from 0 to 120 Hz.

MODE 3 Deceleration Time
MODE 4 Deceleration Time Multiplier

These two modes work in conjunction to determine the time the Drive takes to decelerate over a frequency change of 60 Hz.

MODE 3 permits the selection of the time base in seconds.

MODE 4 permits the selection of the multiplier, which when multiplied by the value selected in MODE 3, determines the actual time.

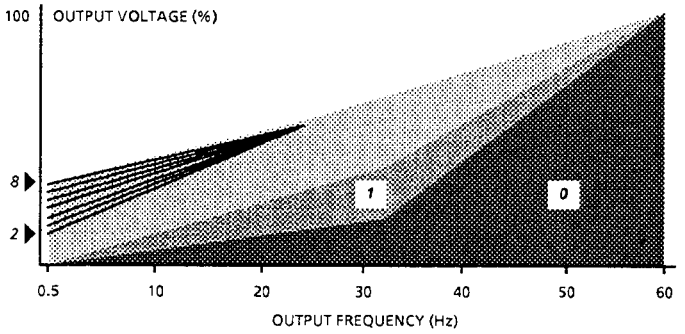
EXAMPLE **Refer to MODES 1 & 2**

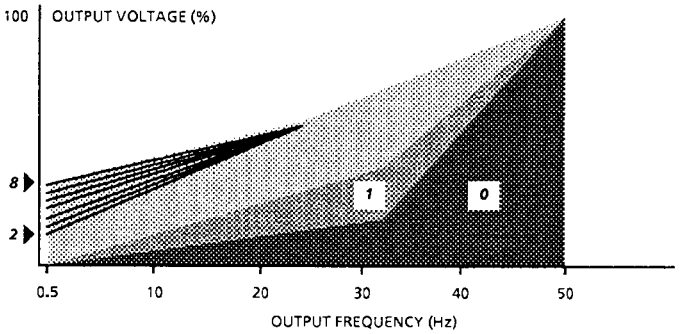
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5.3.3
MODE Description
(continued)

MODE 5 Boost Level

The boost selection provides a means for selecting one of several special volts-per-hertz patterns that mainly affect the available starting torque. Generally constant volts-per-hertz is considered desirable, however some load conditions permit more efficient operation at reduced volts-per-hertz. Other applications may require an increased voltage (boost) at the starting frequency to generate the required starting torque.





Boost Settings – *0 – 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – A*

A (auto) is the factory selected setting. In this setting the Drive is nominally programmed for constant volts-per-hertz. At this setting, the Drive will actually sense the motor load, boosting the voltage automatically at low frequencies and high load. This setting adds only the boost necessary as determined by the load.

0 is a reduced volts-per-hertz setting that is recommended for centrifugal loads, where the load torque is quite low at low speeds. These loads will occur mainly with fan applications, but may also occur with some centrifugal pump applications.

1 is also a reduced volts-per-hertz setting, but is not as drastic a setting as zero. This setting is used by most centrifugal pump applications and by some fan applications.

2 to ***8*** are constant volts-per-hertz or "higher" settings than ***0*** or ***1***. Setting ***2*** is constant volts-per-hertz. Each higher setting has a proportionately higher starting voltage, allowing higher starting torque. Setting ***7*** & ***8*** may produce higher starting torques than is obtained by using the ***A*** setting.

IMPORTANT

Immediate overcurrent trips on Drive start commands may indicate too high of a setting. Stalled motors or overcurrent trips after start and some acceleration has occurred may indicate too low of a setting.

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5.3.3 MODE Description (continued)

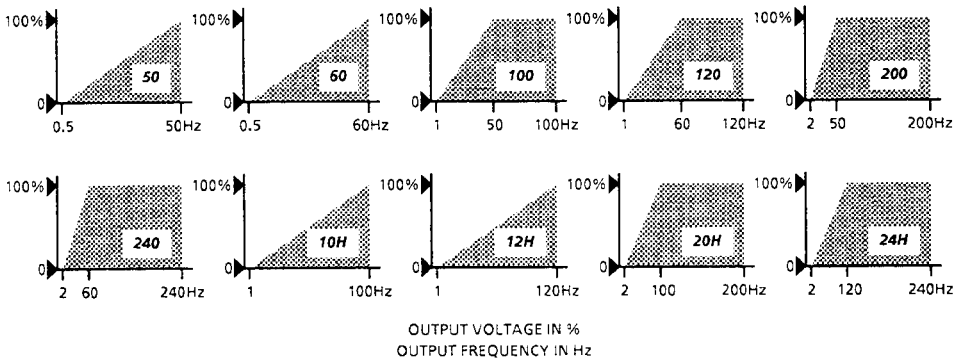
MODE 6 Maximum Frequency & Volts-Per-Hertz

This mode permits the selection of (1) of (10) different maximum frequency and volts-per-hertz patterns. The selection may be broken down into three decisions.

One is to determine the maximum frequency desired. The selectable maximum frequencies and settings are ***50***, ***60***, ***100***, ***120***, ***200***, or ***240*** Hz. These frequencies are absolute values and will override any other maximum frequency setting. During Drive operation, once the frequency set by MODE 6 has been reached, the Drive will not respond to any further increase in command speed from either the local potentiometer or remote speed input. When programming other MODEs, if an attempt is made to program in a frequency value higher then that set by MODE 6, the Drive will default and display the MODE 6 value.

The second decision is to determine the absolute minimum frequency that may be required. As shown below, each selection has a corresponding minimum frequency that the Drive will produce. Once this frequency has been reached, the Drive will not respond to any further decrease in command speed from either the local potentiometer or remote speed input. When programming other MODEs, if an attempt is made to program in a frequency value lower then that set by MODE 6, the Drive will accept and display the value, but default to the MODE 6 value during operation.

The third selection is to determine the volts-per-hertz pattern desired.



V/Hz Patterns – *50 – 60 – 100 – 120 – 200 – 240 – 10H – 12H – 20H – 24H*

Standard volts-per-hertz patterns reach the maximum Drive output voltage at either:

- 50 Hz for maximum frequency settings of ***50***, ***100***, or ***200*** Hz.
- 60 Hz for maximum frequency settings of ***60***, ***120***, or ***240*** Hz.

10H and ***20H*** permit the selection of 100 or 200 Hz respectively, with the volts-per-hertz output modified to reach the maximum Drive output voltage at 100 Hz instead of 50 Hz.

12H and ***24H*** permit the selection of 120 or 240 Hz respectively, with the volts-per-hertz output modified to reach the maximum Drive output voltage at 120 Hz instead of 60 Hz.

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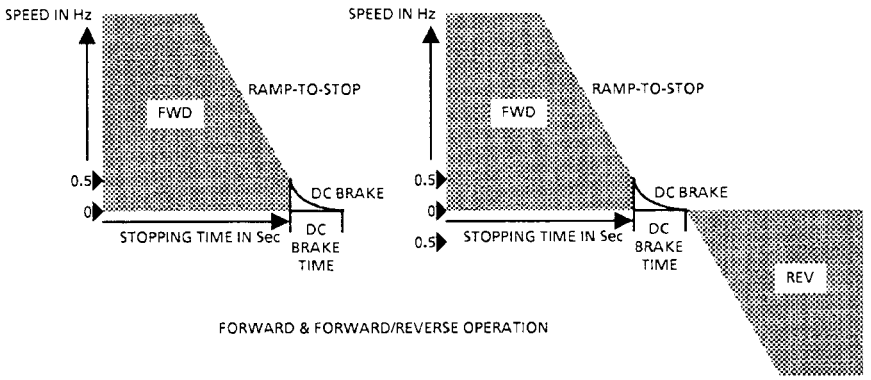
5.3.3
MODE Description
(continued)

IMPORTANT

Applications where the volts-per-hertz patterns are required to reach full voltage at 100 or 120 Hz are primarily provisions for operating custom motors. For application assistance in these special ranges, contact your nearest Allen-Bradley Area Sales/Support Service Center.

MODE 7 DC Brake Time
MODE 8 DC Brake Level

These two modes permit the selection of a DC braking action that will occur when the Drive is ramped-to-stop or programmed to change direction while operating.



DC Brake Time – *0 – 0.2 – 0.4 – 0.6 – 0.8 – 1 – 1.2 – 1.4 – 1.6 – 1.8 – 2 – 2.2 – 2.4 – 2.6 – 2.8 – 3*
DC Brake Level – *0 – 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 – 10*

MODE 7 sets the duration time of the braking action in the ramp-to-stop MODE once the Drive output frequency is below 0.5 Hz. The time is selectable from 0.0 seconds (***0***) to 3.0 seconds (***3***) in increments of 0.2 seconds. If a time of 0.0 seconds is selected or if MODE 14 is set to ***1*** (coast-to-stop), no braking effect will be produced.

MODE 8 permits control of the level or strength of the braking that occurs. The level can be varied from ***0*** to ***10***, with ***10*** being the strongest braking action available.

MODE 9 Restart Mode

This mode permits the selection of the restart action that will occur if Drive power is lost and then restored.

0 permits auto restart. Should power to the Drive be lost, once power is restored, operation will resume without having to recycle power or manually restart the Drive if the local start/stop switch was left in the start position. If the drive were programmed for remote start/stop control (MODE 12 set to ***1***), auto restart only occurs when using a maintained contact on control terminals **8** & **9** with a jumper on **7** & **8**. Auto restart will not occur when using the momentary start and stop connections on these terminals.

1 requires the opening and reclosing of the Drive start or run contacts once power is restored. The Drive will not restart on return of power unless this is done.

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5.3.3
MODE Description
(continued)

WARNING

This operation may only be used as outlined in NFPA79, paragraph 6-14 (Exceptions 1, 2, & 3) for specialized applications. Equipment damage and/or personal injury may result if MODE 9 settings are used in an inappropriate application.

MODE 10 Frequency Control

This mode permits the selection of the source for controlling the Drive output frequency (speed).

0 uses the speed potentiometer on the local control panel as the only source for run speed setting. A ***0*** setting still allows jog and preset speeds to be selected.

1 programs the Drive to ignore the local control panel speed pot and use the speed signal present at the control terminal block as the run speed. A ***1*** setting also allows jog and preset speeds to be selected.

As explained previously in **section 5.2.2 – Control & Fault Displays**, under normal operating conditions the MODE Display provides a (2) position LED indication of Drive control sources. The 2nd illuminated LED will indicate whether local or remote frequency control is being used.

L An ***L*** indicates local control.

E An ***E*** indicates external (remote) control, however an ***E*** will also be displayed whenever jog or preset speeds are selected. This is to indicate that some other source, (such as the jog pushbutton or preset speed switches), control the speed source and not the local speed pot.

MODE 11 External Frequency Signal Type

If MODE 10 is programmed for remote (***1***), MODE 11 can program the Drive for the type of external signal to be used. One of two types of signals may be used as remote inputs. Only one signal may be connected to the control terminal block at a time. Listed below are the permissible signal inputs, the signal type, and the MODE 11 value for that type.

Signal	Type	MODE 11 Value
Potentiometer	Voltage	***0/1***
0 to 10V DC	Voltage	***0***
4 to 20mA DC	Current	***1***

IMPORTANT

If an external potentiometer is connected to the control terminal block, it will override a 0 -10V or 4-20mA DC signal sent to the drive. Refer to Appendix C for alternate switching logic recommendations.

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5.3.3
MODE Description
(continued)

MODE 12 Start/Stop; Forward/Reverse Control

This mode determines the source that the drive monitors for Start/Stop and Forward/Reverse commands.

If ***0*** is entered, the Drive monitors the elements on the local control panel for these commands.

If ***1*** is entered, the Drive will monitor the appropriate terminal at the control terminal block for these commands, and the local control Start/Stop and Forward/Reverse switches will no longer be operative. As explained previously in **section 5.2.2 – Control & Fault Displays**, under normal operating conditions the MODE Display provides a (2) position LED indication of Drive control.

 The 1st illuminated LED will indicate an ***L*** if ***0*** has been entered in MODE 12,

 or an ***E*** if ***1*** has been entered in MODE 12.

IMPORTANT

The Bulletin 1333 local control/programming panel is not intended to replace or be considered a suitable alternative for the operator control station for all applications. Refer to codes and standards applicable to your particular system for specific requirements and additional information.

IMPORTANT

If ramp-to-stop is selected, refer to Mode 16 if the drive will be subject to an overhauling load. If Mode 16 Decel Stall Prevention is on, an overhauling load may cause the decel ramp to hold at one frequency for an extended period, causing ramp-to-stop commands to appear to be non-functional.

MODE 13 Local Reverse Lockout

This mode permits the disabling or lockout of the Forward/Reverse selector switch on the local control panel.

For those cases where reversing is not desired, changing this mode value to ***1*** will disable the local Forward/Reverse selector switch.

Selecting the value ***0*** will permit the switch to function again.

This mode only affects the local forward/reverse command. It does not disable the Forward/Reverse command that may be connected to the control terminal block which has control when MODE 12 is set to ***1*** (remote).

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5.3.3
MODE Description
(continued)

MODE 14 Stop Mode

The Drive can respond in one of two ways when a Stop command is initiated. This MODE selects which response is used.

If ***0*** is selected, the motor will ramp-to-stop. On a Stop command, the Drive will begin to decelerate to minimum speed at the selected decel rate. The motor to follow the decrease in frequency or ramp down to minimum speed and Stop.

If ***1*** is selected, the motor will coast-to-stop. This value will cause the Drive to immediately shut off output power when a stop command is received. The motors response is that it will coast to a stop instead of linearly decelerating as with the ramp-to-stop selection (***0***).

WARNING

The user has the ultimate responsibility to determine which stopping mode is best suited to the application and will meet applicable standards for operator safety on a particular machine.

MODE 15 Accel Stall Protection

When ***1*** is selected, the Drive monitors the output current to the motor. If the current rises above 140% of rated nameplate current, the Drive will hold the accel ramp until the current drops below 140% for a maximum of 60 seconds. This action helps guard against nuisance current trips during acceleration when a high inertia load or too fast of an accel ramp has been set.

When ***0*** is selected, accel stall protection is turned off. The accel ramp will not be held if the current rises above 140%.

In either case, when the load exceeds 140% of the Drive rating for 60 seconds, the Drive will trip and display an ***OL*** fault. This timing circuit is independent of accel stall protection selection and will occur whenever the load exceeds 140% for 60 seconds.

MODE 16 Decel Stall Protection

When ***1*** is selected, the Drive monitors the DC Bus voltage. If the bus voltage approaches the overvoltage trip level, the decel stall prevention will hold the decel ramp. This action helps guard against nuisance overvoltage trips during deceleration of high inertial loads or too fast of a decel rate.

When ***0*** is selected, decel stall prevention is turned off. The overvoltage trip will still be active in the drive, but additional nuisance trips may also occur.

IMPORTANT

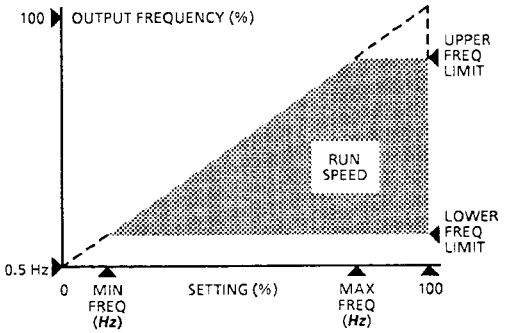
If Mode 16 Decel Stall Prevention is on, an overhauling load may cause the decel ramp to hold at one frequency for an extended period, causing ramp-to-stop commands to appear to be non-functional.

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5.3.3
MODE Description
(continued)

MODE 17 Minimum Frequency

The minimum frequency or lower limit frequency programmed by this mode sets the lowest frequency the Drive will produce while running. The minimum frequency set by MODE 17 is an absolute setting and will override any other minimum frequency setting. Once this frequency has been reached, the Drive will not respond to any further decrease in command speed from the local potentiometer, remote speed input, or any other MODE settings. **The frequency set by MODE 17 must be at or between the minimum and maximum frequencies defined by MODE 6.**



Minimum & Maximum Frequency Settings

MODE 18 Maximum Frequency

The maximum or upper limit frequency programmed in this mode sets the highest frequency that the Drive will produce while running. The maximum frequency set by MODE 18 is an absolute setting and will override any other maximum frequency setting. The Drive will not respond to any further increase in command speed from either the local potentiometer, remote speed input, or any other MODE settings. **The frequency set by MODE 17 must be at or between the minimum and maximum frequencies defined by MODE 6.**

MODE 19 Jog Frequency

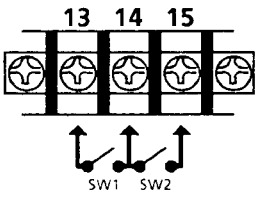
This mode sets the frequency the Drive will produce when the jog function is given (control terminals **11** & **12**). The frequency may be set up to ***20*** Hz in ***0.5*** Hz increments, and should always be set at or larger than the minimum frequency selected by MODE 17. If the jog frequency is less, the Drive will default to the minimum frequency set by MODE 17 when a jog command is given.

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5.3.3
MODE Description
(continued)

MODE 20 2nd Preset Frequency
MODE 21 3rd Preset Frequency
MODE 22 4th Preset Frequency

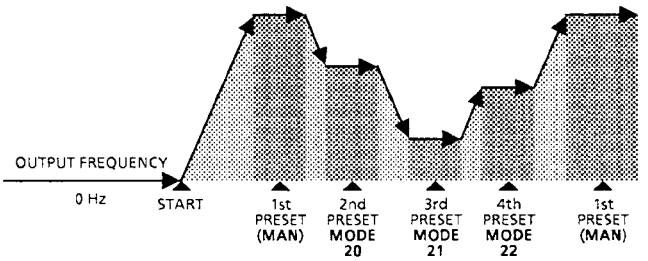
Each of these modes store the corresponding frequency the drive will produce when the appropriate preset speed function is selected via switches SW1 and SW2.



Control Terminal Block

MODE	SPEED	SW1	SW2
NONE	MANUAL	OPEN	OPEN
20	2nd PRESET SPEED	CLOSED	OPEN
21	3rd PRESET SPEED	OPEN	CLOSED
22	4th PRESET SPEED	CLOSED	CLOSED

For each of the three modes, the frequency can be set between the minimum frequency set by MODE 17, and maximum frequency set by MODE 18, in (1) ***Hz*** increments. If the frequency is out of this range, the Drive will default to the frequencies set by MODEs 17 or 18 when a preset speed command is given. Additionally, MODE 27 is used to enable or disable the frequencies set by MODEs 20, 21, and 22.



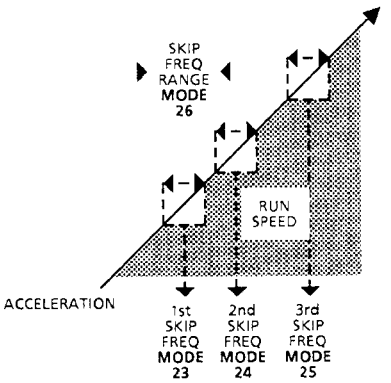
Preset Speeds

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5.3.3
MODE Description
(continued)

MODE 23 1st Skip Frequency
MODE 24 2nd Skip Frequency
MODE 25 3rd Skip Frequency

These modes prohibit the Drive from running at one, two or three selected frequencies. By setting MODE 26, these (3) frequencies may be expanded to include (3) band ranges of skip frequencies. Although the Drive will pass through the selected frequencies or frequency bands during acceleration or deceleration, the Drive will stay slightly above or slightly below these frequencies when running. This operation may be desirable when there is a machine resonance within the running frequency range of the Drive.



Skip Frequency and Range Settings

MODE 26 Skip Frequency Range

This mode sets the frequency band range that is skipped by the frequencies selected in MODEs 23, 24, and 25. The skip frequency range width may be set to ***0***, ***1***, ***2***, ***3***, ***4***, or ***5*** Hz. Selecting ***0*** will deactivate any skip frequencies set by MODEs 23, 24, or 25.

EXAMPLE If MODE 23 = ***30***
MODE 24 = ***0***
MODE 25 = ***45***
MODE 26 = ***2***
Drive skip frequencies will be set at 29-31 Hz and 44-46 Hz.

IMPORTANT

The skip frequencies and range should not be set to overlap to provide a wider range than that set by MODE 26. Overlapping the skip frequencies may allow the Drive to settle at a frequency within one of the ranges rather than skip over it.

EXAMPLE If MODE 23 = 30
MODE 24 = 33
MODE 26 = 4

The 1st skip frequency range is 30 ±2 = 28-32 Hz.

The 2nd skip frequency range is 33 ±2 = 31-35 Hz.

The Drive may operate at 32 Hz which is the upper limit of the 1st skip frequency range even though it is part of the 2nd skip frequency range — or — the Drive may operate at 31 Hz which is the lower limit of the 2nd skip frequency range even though it is part of the 1st skip frequency range.

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5.3.3 MODE Description (continued)

MODE 27 Select - Preset Frequencies or 2nd Accel/Decel Rate

The external contacts connected to terminals **13**, **14**, and **15** of the control terminal block can perform one of two functions. The data set in MODE 27 determines which function is preformed.

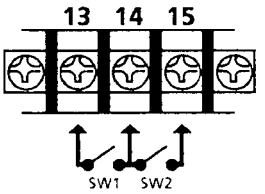
If MODE 27 data is set to ***0***, the terminals will select one of the preset speeds set by MODES 20, 21, and 22.

If MODE 27 is set to ***1***, the terminals select alternate accel and decel rates as set by MODEs 28 and 29.

MODE 28 2nd Acceleration Time Multiplier

A second acceleration rate may be programmed by entering a multiplier from ***1*** to ***16*** in increments of 1. This multiplier times the acceleration time set by MODE 1 will be the 2nd acceleration rate.

This rate is in effect when MODE 27 is set to ***1*** and switch SW1 is closed as listed below.



Control Terminal Block

ACCEL RATE	DECEL RATE	SW1	SW2
1st	1st	OPEN	OPEN
2nd	1st	CLOSED	OPEN
1st	2nd	OPEN	CLOSED
2nd	2nd	CLOSED	CLOSED

MODE 29 2nd Deceleration Time Multiplier

A second deceleration rate may be programmed by entering a multiplier from ***1*** to ***16*** in increments of 1. This multiplier times the deceleration time set by MODE 3 will be the 2nd deceleration rate.

This rate is in effect when MODE 27 is set to ***1*** and switch SW2 is closed as listed above.

MODE 30 Last Fault Information

This mode will display the last fault that occurred in the Drive at the Main Display. No programming is required.

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5.3.3
MODE Description
(continued)

MODE 31 Current Limit

This mode may be programmed to cause the Drive to respond to an overcurrent condition above 140% of rated output current by reducing its output voltage and frequency.

The current limit circuit responds to an overload condition only when the Drive frequency is above 25 Hz and the load has reached 140% of the Drive output current rating. If MODE 6 is set for 10H, 12H, 20H, or 24H V/Hz, the Drive frequency must be above 50 Hz. The Drive will reduce frequency at a selectable rate to either the current limit frequency or to the programmable minimum frequency set by MODE 17, whichever is greater. If the overload lasts for 60 seconds, the Drive will trip off with an ***OL*** fault displayed.

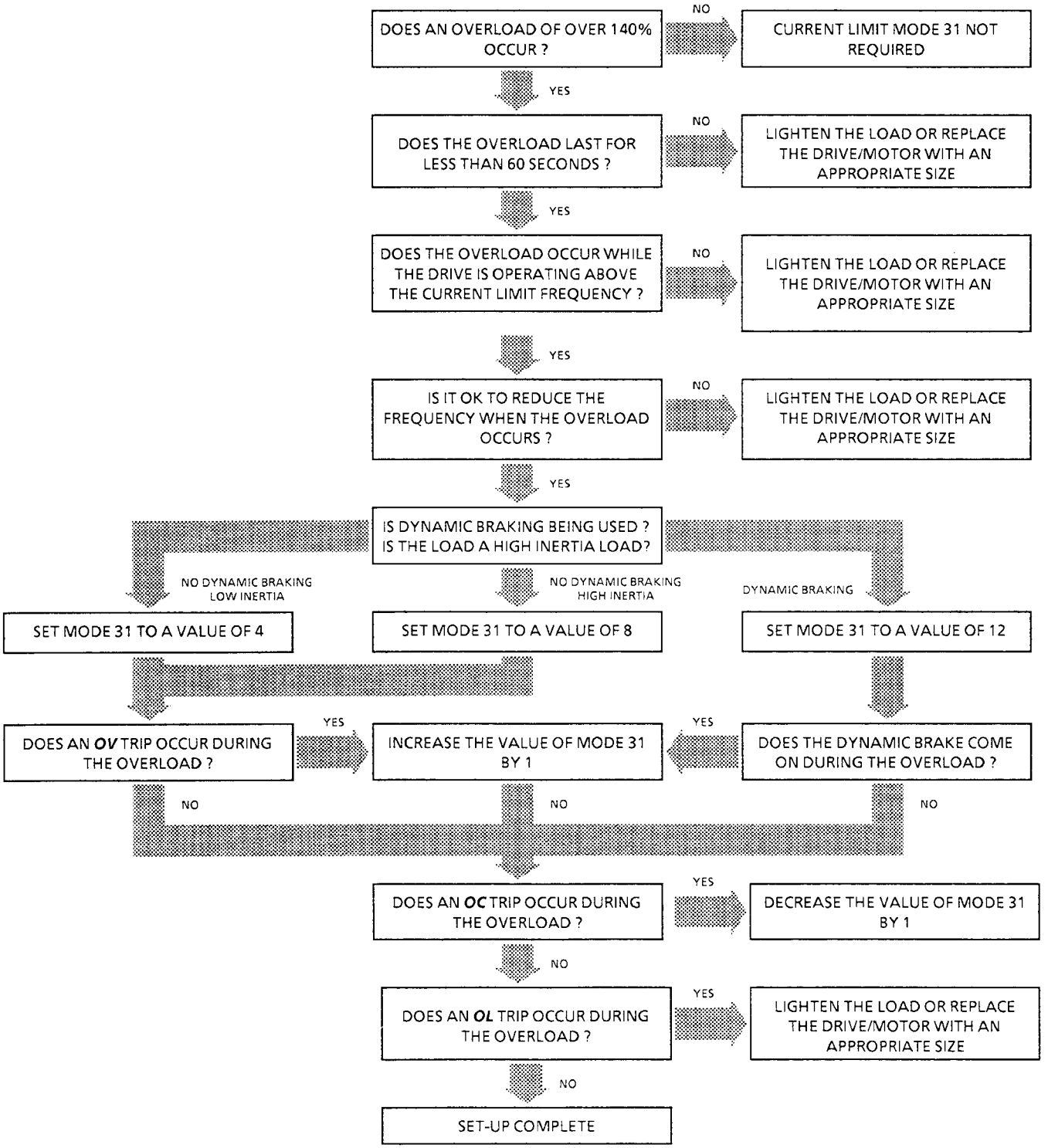
Selectable rates of from ***1*** to ***15*** may be used to set the deceleration rate. Each value corresponds to a decel ramp with a 0.1 multiplier. A value of ***1*** therefore provides a 0.1 second decel ramp, while a value of ***15*** provides a 1.5 second decel ramp. A value of ***0*** will disable the current limit circuit completely.

The selection of an optimum current limit setting is a function of the overload and load inertia. The optimum setting can only be determined by the customer. The factory setting of ***4*** is recommended for initial operation. If overcurrent trips occur before the Drive ramps down to its minimum frequency, a lower value for MODE 31 should be used. For high inertia loads or if overvoltage trips occur while decelerating, a higher value should be used.

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5.3.3
MODE Description
(continued)

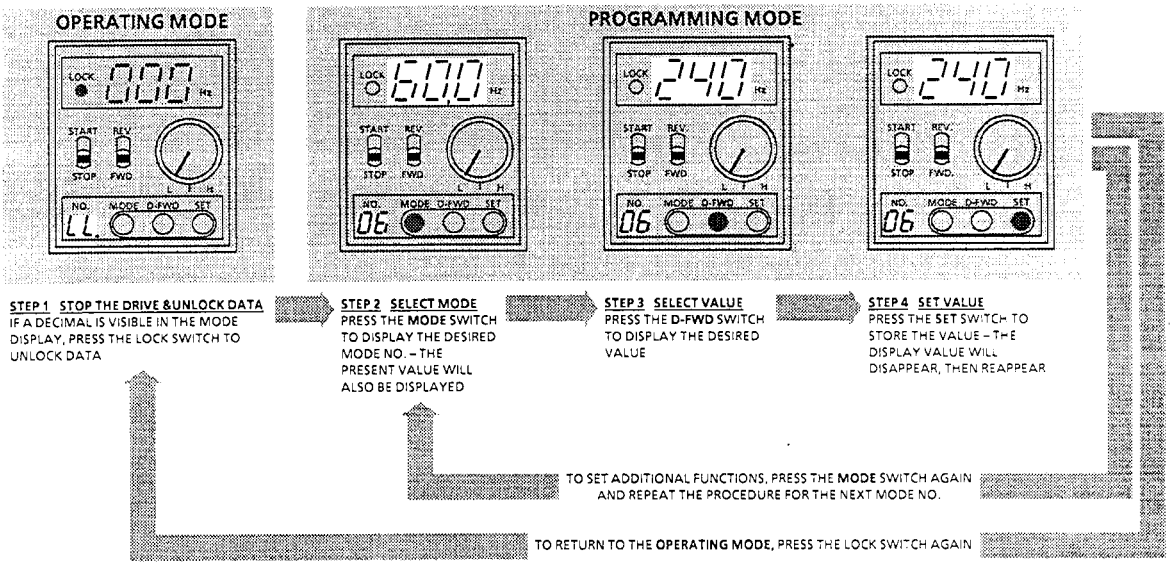
Current Limit Set-Up Procedure



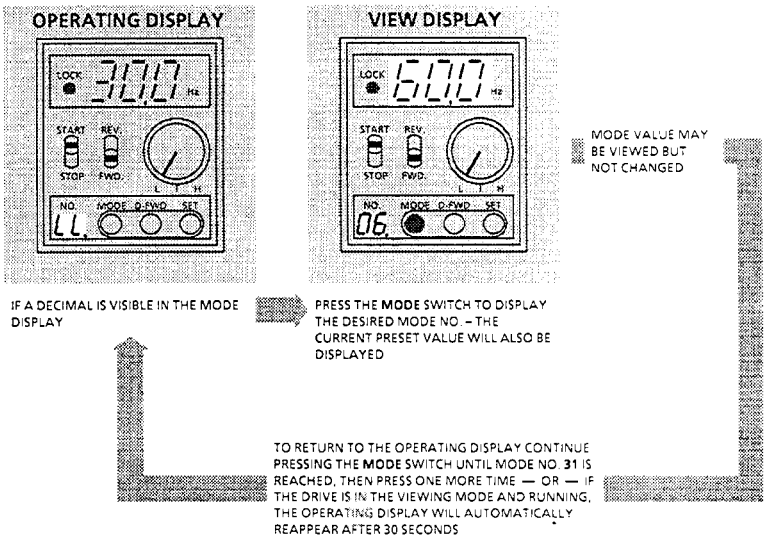
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5.3.4
Quick Reference

Programming



Viewing



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Chapter

6

Start-Up

6.0 Preliminary Checks & Adjustments

WARNING

Exercise extreme care when performing any task on the Drive control. Failure to do so may result in equipment damage or personal injury.

Become familiar with the equipment, installation, and start-up procedures before attempting to interconnect the Drive equipment and perform this start-up. Many of the functional adjustments must be made to meet specific machine characteristics or operator preferences.

WARNING

Power must be applied to the Drive and the Drive cover removed to perform certain adjustments specified in the following sections. Voltages on many components are at incoming line potential or bus voltage. To avoid injury to personnel and/or damage to equipment, take all necessary precautions to guard against accidental contact with Drive components when making the following adjustments.

REMOVE DRIVE POWER prior to making specified connections. If an event does not occur while performing the start-up procedures, *do not proceed.* **REMOVE DRIVE POWER** by opening the branch circuit disconnect device and correct the condition *before* continuing.

WARNING

Before proceeding with any maintenance or troubleshooting activity, allow at least one minute after input power has been removed to allow for bus circuit discharge. A **Bus Charge LED** is incorporated on the Drive to provide visual indication of the presence of bus voltage. The bus voltage may be verified by using a voltmeter to measure the voltage between terminals **P** (+) and **N** (−) on the Power Terminal Block. Do not attempt any servicing until the LED has extinguished or the bus voltage has diminished to (0). Refer to **figure 6.0** for LED location.

Hazards of electrical shock exist if accidental contact is made with parts carrying bus voltage.

With all power to the Drive removed, remove the Drive cover. Verify that the incoming AC power and motor connections are in accordance with **section 4.3, Power Circuit Terminals**. Verify that all control logic interconnections are made in accordance with **Chapter 3, Installation**. **Figure 6.0** indicates the locations of adjustments, switches and the LED displays used in start–up and operation of the Bulletin 1333.

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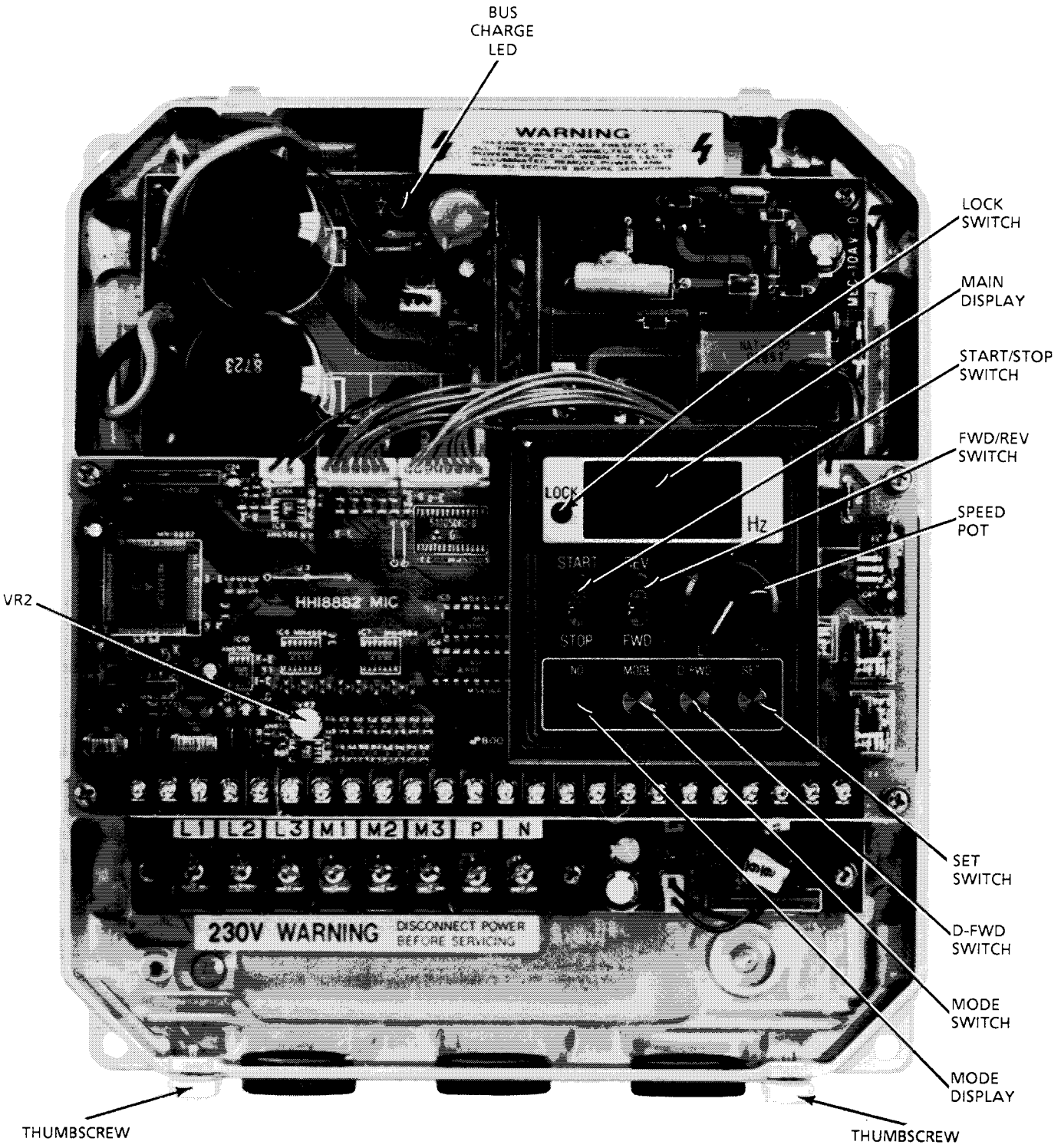


Figure 6.0 – Bulletin 1333 Components

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6.1
Initial Operation

Verification of AC Line Power & Drive Settings – Motor Disconnected –

Step 1 Verify that the AC line power at the disconnect device is within the rated value of the Drive. Drive nameplate and alternate voltage ratings are listed in **Chapter 2**.

Step 2 With all incoming power to the Drive removed, remove the Drive cover and disconnect the motor leads from terminals **M1**, **M2** & **M3** at the Drive.

IMPORTANT

Control Terminal Block Connections

1) Verification or changes to Drive MODEs require that power be applied to the Drive. Previous programming may effect the Drive status when power is applied. If remote start circuits are connected to terminals **7**, **8**, & **9**, confirm that they are in a de-energized state before applying power.
2) Terminals **19** through **24** are provided for use in external circuits. Customer supplied voltages may exist at these terminals even when power is not applied to the Drive.

Step 3 Replace the Drive cover and ensure that all thumbscrews are tightened. Set initial settings at the local control/programming panel.
Speed Potentiometer – Full CCW
START/STOP Selector Switch – Stop
FWD/REV Selector Switch – Forward

Before entering or changing any mode values, refer to **section 5.3.2 – MODE Programming** and **section 5.3.3 – MODE Description** to determine the required values for **MODEs 1** through **31**. For initial operation, set both **MODE 10** and **12** to local (***0***) to permit operation of the Drive from the local control/programming panel.

Step 4 Apply input power to the Drive and verify that the Drive accepts power with no faults displayed.

- The DC **Bus Charge LED** should be illuminated.
- Both the **MAIN** and **MODE Displays** should be illuminated.

The **MAIN Display** should read ***000***. If the **MAIN Display** indicates ***OU*** or ***LU***, an incorrect voltage is being applied to the Drive. Remove power immediately and correct the condition.

The **MODE Display** should read ***LL.*** to allow control of the Drive from the local control/programming panel. Use the programming procedures described in **section 5.3.2 – MODE Programming** to verify or change MODE values as required.

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6.1 Initial Operation (continued)

Drive Operation – Motor Disconnected –

Step 1 Start the Drive using the local START/STOP selector switch. Verify that the desired minimum speed (**MODE 17**) is displayed at the **MAIN Display**. Turn the local Speed Pot fully CW (100%). Verify that the maximum frequency (**MODE 18**) is displayed at the **MAIN Display**.

Step 2 Stop the Drive using the local START/STOP selector switch. Verify that the Drive immediately stops or ramps to a stop as selected by **MODE 14**. The **MAIN Display** should read ***000***.

Step 3 Restart the Drive and observe the time for acceleration to full speed at the **MAIN Display**. Verify that it matches the desired acceleration ramp set by **MODE**s **1** and **2**.

Step 4 Quickly turn the speed pot fully CCW and observe the time for deceleration to minimum speed at the **MAIN Display**. Verify that the deceleration time matches the desired deceleration ramp set by **MODE**s **3** and **4**.

Step 5 If skip frequencies have been programmed by **MODE**s **23**, **24**, **25**, and **26**, perform the following.

Slowly increase the speed pot and monitor the **MAIN Display**. Verify that the Drive skips over the selected frequencies.

Step 6 With the Drive running and the speed pot set fully CW (100%) switch the local FWD/REV selector switch to reverse.

If **MODE 13** is set to ***0***, the **MAIN Display** should show the frequency decreasing at the set decel rate to ***000***, then increasing back to the maximum speed indicating a correct reversing function.

If **MODE 13** is set to ***1*** (reverse lockout), the **MAIN Display** should not change, indicating no response to the reverse command.

Step 7 If the preset speed feature is being used, perform the following.

With the Drive running, select preset speed (2) – Closed contact between Control Terminals **13** & **14**. The **MAIN Display** should show a change in speed as programmed by **MODE 20**.

Select preset speed (3) – Closed contact between Control Terminals **14** & **15**. The **MAIN Display** should show a change in speed as programmed by **MODE 21**.

Select preset speed (4) – Closed contact between Control Terminals **13**, **14** & **15**. The **MAIN Display** should show a change in speed as programmed by **MODE 22**.

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6.1
Initial Operation
(continued)

Step 8 If the second accel/decel time feature is being used, perform the following.
Stop the Drive and turn the speed pot fully CW (100%).

Select the second accel/decel time – Closed contacts between control terminal **13**, **14** & **15**.

Restart the Drive and observe the time for acceleration to full speed at the **MAIN Display**. Verify that the acceleration time matches the desired acceleration ramp set by **MODEs 1** & **28**.

Quickly turn the speed pot fully CCW. Observe the time for deceleration to minimum speed at the **MAIN Display**. Verify that the deceleration time matches the desired deceleration ramp set by **MODEs 3** & **29**.

Step 9 Stop the Drive by setting the START/STOP switch to stop. The **MAIN Display** should read ***000***.

Step 10 If the jog feature is being used, perform the following.

Select the jog mode – Closed contact at Control Terminals **11** & **12**.

The Drive should immediately start and the jog speed set by **MODE 19** should be shown at the **MAIN Display**.

Release the jog contact. The Drive should immediately stop and the **MAIN Display** should read ***000***.

Step 11 Remove power from the Drive at the disconnect device. Within (1) minute, the **MAIN Display**, the **MODE Display**, and the **Bus Charge LED** will go out.

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6.1
Initial Operation
(continued)

Motor Rotation Check

Step 1 With input power removed from the Drive at the disconnect device, reconnect the motor to the Drive at output terminals **M1**, **M2**, & **M3**.

CAUTION

The following steps may cause motor rotation in an unknown direction. To guard against equipment damage, disconnect the motor from the load before proceeding.

Step 2 Verify that the local START/STOP switch is set to stop, the local FWD/REV switch is set to forward, and the local speed pot is fully CCW.

Step 3 Apply power to the Drive and set the minimum frequency (**MODE 17**) to ***0.5*** Hz.

Start the Drive and slowly increase the speed pot setting until the motor rotates.

If the motor runs in the wrong direction, stop the Drive and go to **Step 4** below.

Step 4 Remove all incoming power to the Drive.

Interchange any two motor leads at terminals **M1**, **M2**, or **M3** and repeat **STEPs 2** and **3** above .

Step 5 Once correct rotation is verified, stop the Drive and reset the minimum frequency (**MODE 17**) to the desired application value.

Remote Frequency Meter Calibration

Step 1 With all input power to the Drive removed, remove the Drive cover. Verify that a 0-1mA movement meter is correctly connected to control terminals **3** (**–**) and **6** (**+**).

Step 2 Locate **Remote Meter Adjustment VR2** on the Control Board as shown in **figure 6.0**.

Step 3 Apply power to the Drive and give the Drive a start command in the forward direction at approximate 20% of maximum speed.

Observe the remote frequency meter needle deflection.

If the needle does not move upscale, stop the Drive, remove all power to the Drive, and interchange the wires at terminals **3** and **6**.

Reapply power and start the Drive in the forward direction. Turn the speed reference pot fully CW (100%) to allow the motor to run at base speed. With the motor at base speed, turn **Remote Meter Adjustment VR2** until the needle corresponds to the frequency indication shown at the **MAIN Display**.

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6.1
Initial Operation
(continued)

Stop-Time Check

If DC braking (**MODEs 7 & 8**) is to be used, perform the following steps with the Drive connected to the motor and the motor under normal load conditions.

Step 1 Verify that the local START/STOP switch is set to stop, the local FWD/REV switch is set to forward, and the local speed pot is fully CCW.

Step 2 With power applied to the Drive and the Drive in the programming mode, set the DC Brake Time (**MODE 7**) to the desired value, then set the Stop Mode (**MODE 14**) to ***1***, ramp-to-stop.

Step 3 Return to the operating mode and start the Drive. Increase the Drive frequency until the motor, under normal load condition, reaches operating speed.

Step 4 Stop the Drive and observe the motor stopping sequence.

The motor will decelerate at the set decel ramp. Once the Drive reaches 0.5 Hz, the DC brake will come on.

If the motor does not come to a stop before the brake time is complete, increase the DC brake level (**MODE 8**). If the DC brake level is at its maximum — ***10*** — set **MODE 7** to a longer brake time.

If the motor stops before the brake time is complete, reduce the DC brake level (**MODE 8**).

Repeat the above procedure until the desired DC brake action is achieved.

Operation Check

After all start-up procedures have been completed, reprogram the Drive to the desired application requirements. Confirm all mode settings and record them on the charts provided both inside the Drive cover and on the rear inside cover of this manual.

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Maintenance & Troubleshooting

Maintenance

The Bulletin 1333 is convection or fan cooled by air flowing through the heat sink slots. The slots must never be allowed to become obstructed with dirt or foreign matter. Periodically check and clean with compressed air or vacuum the heat sink slots. Air flow must never be restricted in any way.

Troubleshooting Prechecks

The following descriptions indicate the operation of protective circuitry in the Bulletin 1333. What is thought to be an operational problem with the Drive, may in reality be normal operation of the Drive protective circuitry. Refer to the following descriptions before attempting to troubleshoot what may seem to be a Drive related malfunction.

Acceleration Stall Protection

No Fault Display

FUNCTION — During motor acceleration, if overcurrent which is 140% of rated Drive current flows in the Drive, the overcurrent stall protection circuit operates. In order to guard against currents in excess of 140% and an overcurrent trip, this circuit temporarily stops the rise in frequency. When load current falls below 140%, the circuit lets the frequency rise again and continue to accelerate to set frequency.

REMARKS — If this function is not appropriate for the application, it can be deactivated by setting **MODE 15** to ***0***.

Deceleration Stall Protection

No Fault Display

FUNCTION — During motor deceleration, if DC bus voltage rises above a preset bus level due to regenerative energy, the overvoltage stall protection circuit temporarily stops the decrease in frequency in order to guard against an overvoltage trip. When regenerative energy decreases and bus voltage falls below the preset level, this circuit lets the frequency fall again and continue to decelerate to set frequency. Refer to **Chapter 3 – Specifications** for voltage levels.

REMARKS — If this function is not appropriate for the application, it can be deactivated by setting **MODE 16** to ***0***.

Momentary Power Failure Protection

LU Fault Display

FUNCTION — When an incoming line power failure exceeds 15mS, this protective circuit stops transistor operation to guard against incorrect Drive operation. If the momentary power failure is less than 15mS, operation is not interrupted.

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Overcurrent Protection
OC Fault Display

FUNCTION — If overcurrent exceeding 200% of rated Drive current flows in the Drive, this protective circuit will shut off the transistors and annunciate the condition as shown.

REMARKS
1. Inertia of the load is excessively large and acceleration time is extremely short. Setting **MODE 15** to ***1*** (Accel Stall Prevention) or increasing acceleration time (**MODEs 1** & **2**) will guard against ***OC*** nuisance trips.
2. The motor experienced an excessive overload condition while operating.
3. A short circuit exists in the output leads or motor windings.
4. A device in the Drive output inverter section has shorted.

Overvoltage Protection
OU Fault Display

FUNCTION — When bus voltage rises above a preset level due to a high line or regenerative energy, this protective circuit stops transistor operation and annunciates the condition as shown. Refer to **Chapter 3 – Specifications** for actual voltage levels.

REMARKS — Extremely short deceleration time is the main cause. Setting **MODE 16** to ***1*** (Decel Stall Protection) or increasing deceleration time (**MODEs 3** & **4**) will guard against ***OU*** nuisance trips.

Undervoltage Protection
LU Fault Display

FUNCTION — When incoming line voltage falls below 90%, this protective circuit stops transistor operation to guard against incorrect Drive operation and annunciates the condition as shown.

REMARKS — After incoming line voltage is restored, if automatic restart of the Drive without recycling power is required set **MODE 9** to ***0*** as outlined in **section 5.3.3 – MODE Description**.

Overtemperature Protection
OH Fault Display

FUNCTION — When heat sink temperature rises and the transistor cooling effect is reduced, this protective circuit stops transistor operation and annunciates the condition as shown.

REMARKS — Check specifications and ambient temperature around the Drive and the cooling fan ($7\frac{1}{2}$ - 20 HP units).

Fault Trip
AU Fault Display

FUNCTION — It is possible that the Drive was stopped by means of an external interlock. The interlocks (thermal overload relay, external sequence circuit for example), are connected to terminals **16** and **17**. ***AU*** will be shown when an external fault has occurred. Refer to **section 4.4 – Control Terminals** for connection information.

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Overload Protection
OL Fault Display

FUNCTION

If the Drive output current exceeds 140% of the rated nameplate current for 60 seconds, this protective circuit will shut off the transistors and annunciate the condition as shown.

REMARKS

1. The starting load is above 140%. The Drive is attempting to start the load, but is in Accel Stall Prevention (**MODE 15** set to ***1***) for one minute.
2. The running load has been above 140% for one minute. The Drive may be in Accel Stall Prevention if below the current limit frequency, or in Current Limit if at the current limit frequency — either 25 or 50 Hz, depending on the V/Hz setting. If neither Accel Stall Prevention nor Current Limit is selected, the Drive is between 140% and 180% of rated current for one minute.

Operating Error
OP Fault Display

FUNCTION

If an attempt is made to return the Drive to the operating mode from the programming mode with a START or JOG command present, this fault will be displayed and the Drive will not start.

REMARKS

The Drive must not receive a maintained START or JOG command while in the programming mode. If a START command is present when the Drive is returned to the operating mode, an ***OP*** fault will appear.

1. If the Drive was in local control, the START/STOP selector switch was left in the START position while switching from the programming mode to the operating mode.
2. If the Drive was in remote control, a START command was present while switching from the programming mode to the operating mode.
3. If a JOG command was present while switching from the programming mode to the operating mode.

When the command is removed, the ***OP*** fault will be cleared.

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Troubleshooting Guide

The following charts indicate several Drive malfunctions and the approved procedure for correcting these malfunctions.

WARNING

Voltages behind the enclosure door are at bus voltage or incoming line potential. Hazards of electrical shock exist if accidental contact is made with voltage carrying components during troubleshooting procedures where power must be applied.

WARNING

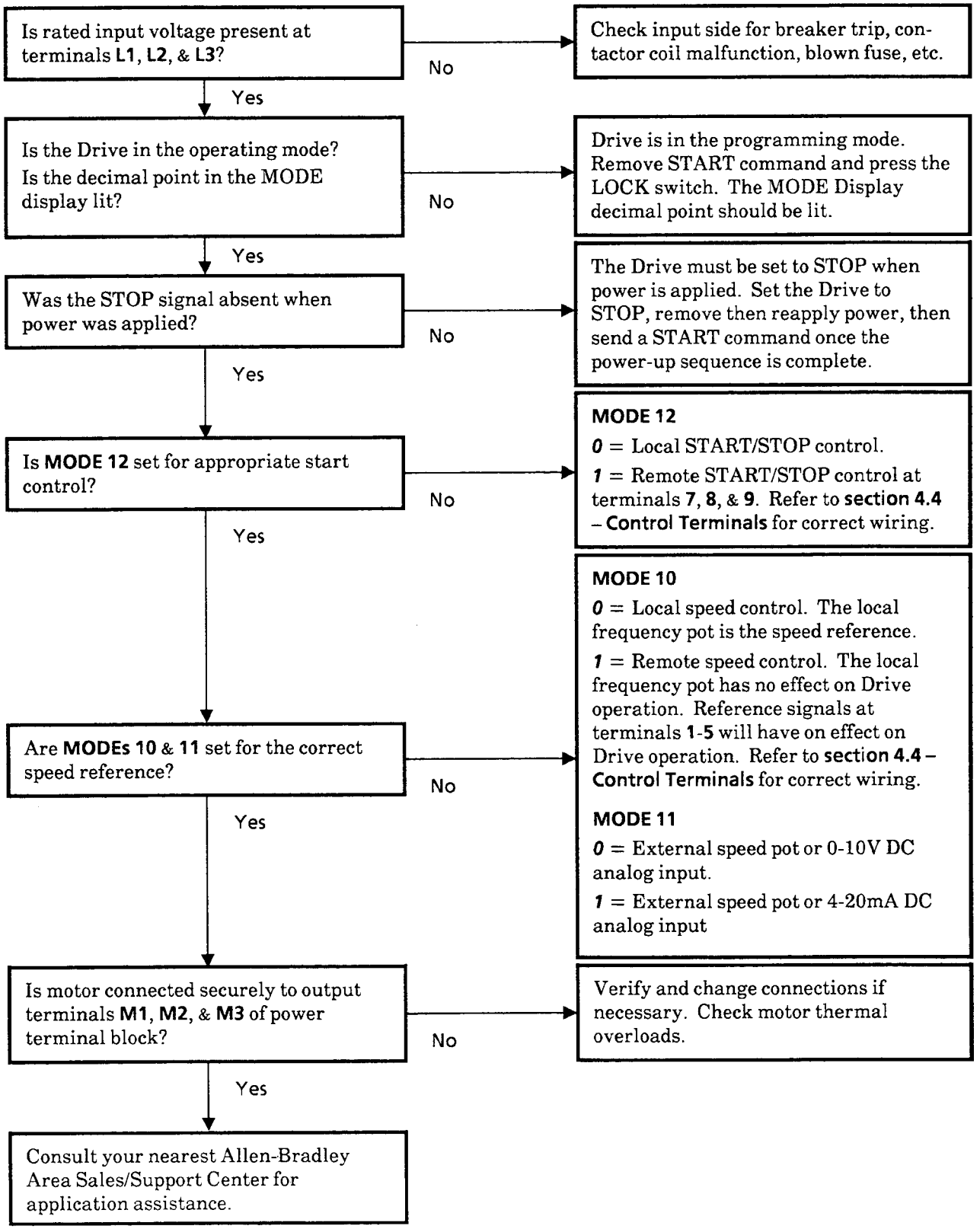
Before proceeding with any maintenance or troubleshooting activity, allow at least one minute after input power has been removed to allow for bus circuit discharge. A **Bus Charge LED** is incorporated on the Drive to provide visual indication of the presence of bus voltage. The bus voltage should be verified by using a voltmeter to measure the voltage between terminals **P** (+) and **N** (−) on the Power Terminal Block. Do not attempt any servicing until the LED has extinguished or the bus voltage has diminished to (0). Refer to **figure 6.0** in **Chapter 6** for LED location.

Hazards of electrical shock exist if accidental contact is made with parts carrying bus voltage.

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1. Motor Does Not Run

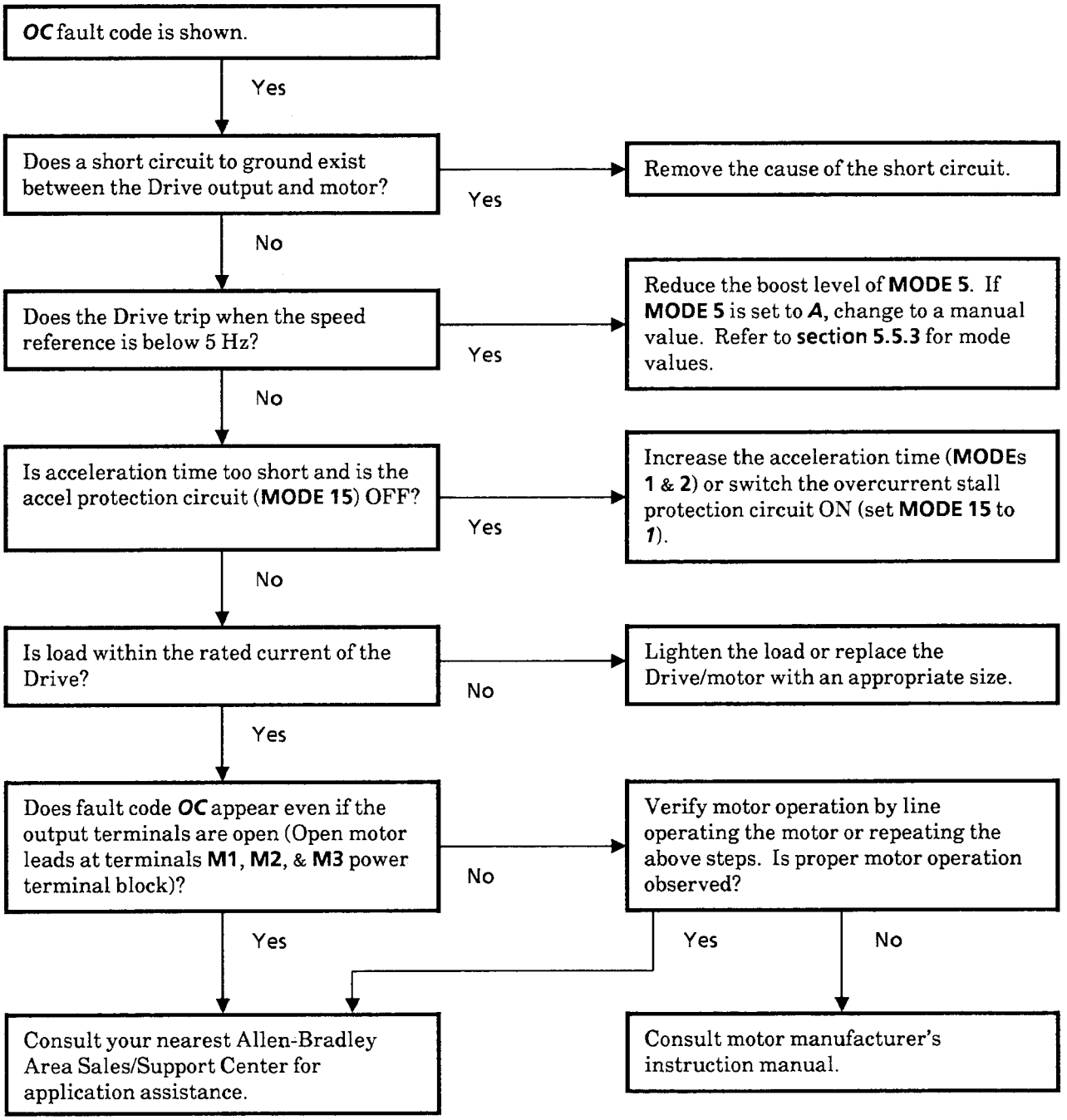
No Fault Displays Are Shown



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2A. Motor Does Not Run Continuously

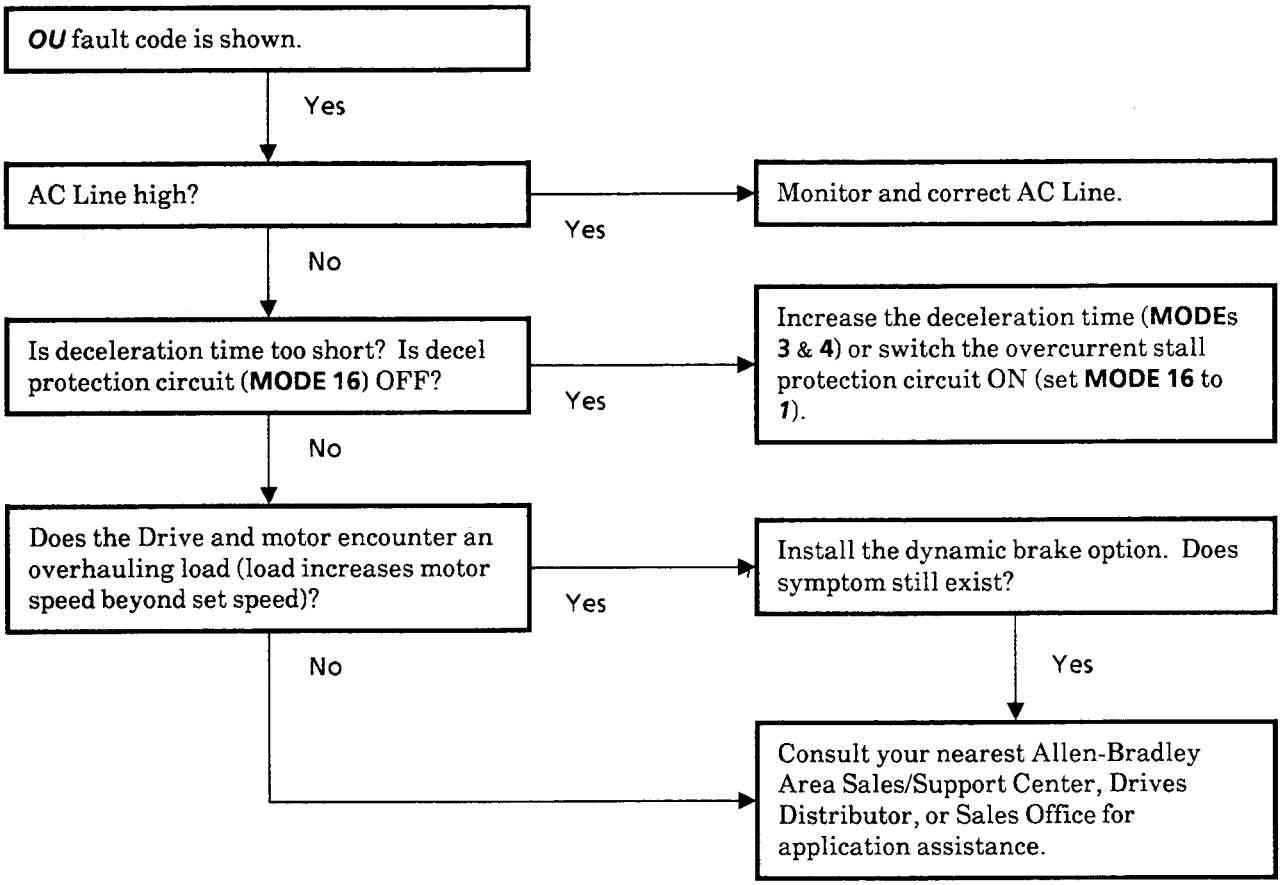
OC (overcurrent) Fault Display Is Shown



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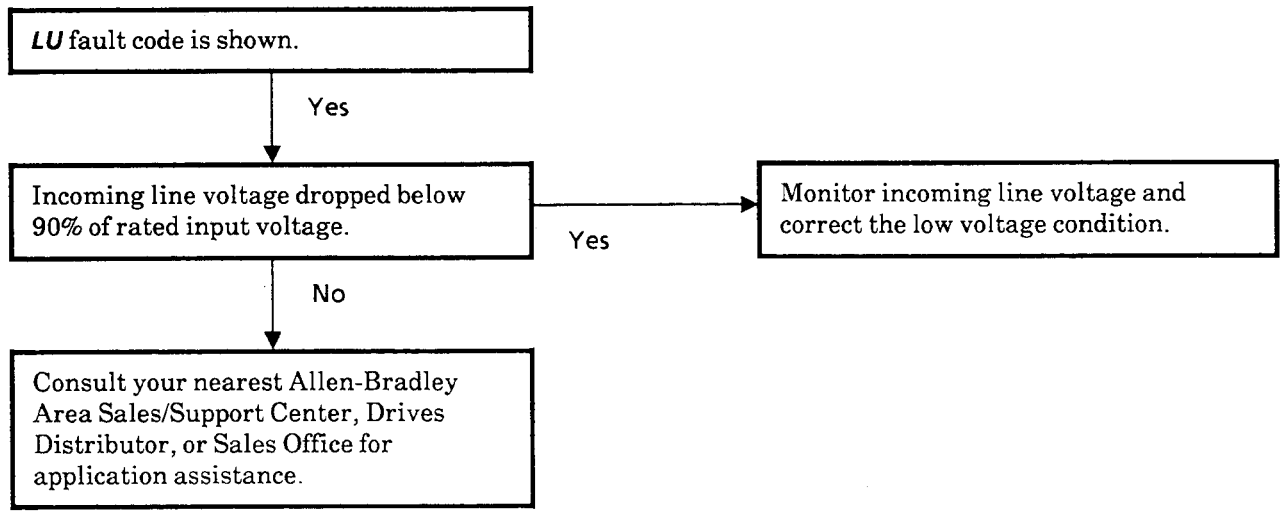
2B. Motor Does Not Run Continuously

OU (overvoltage) Fault Display Is Shown



2C. Motor Does Not Run Continuously

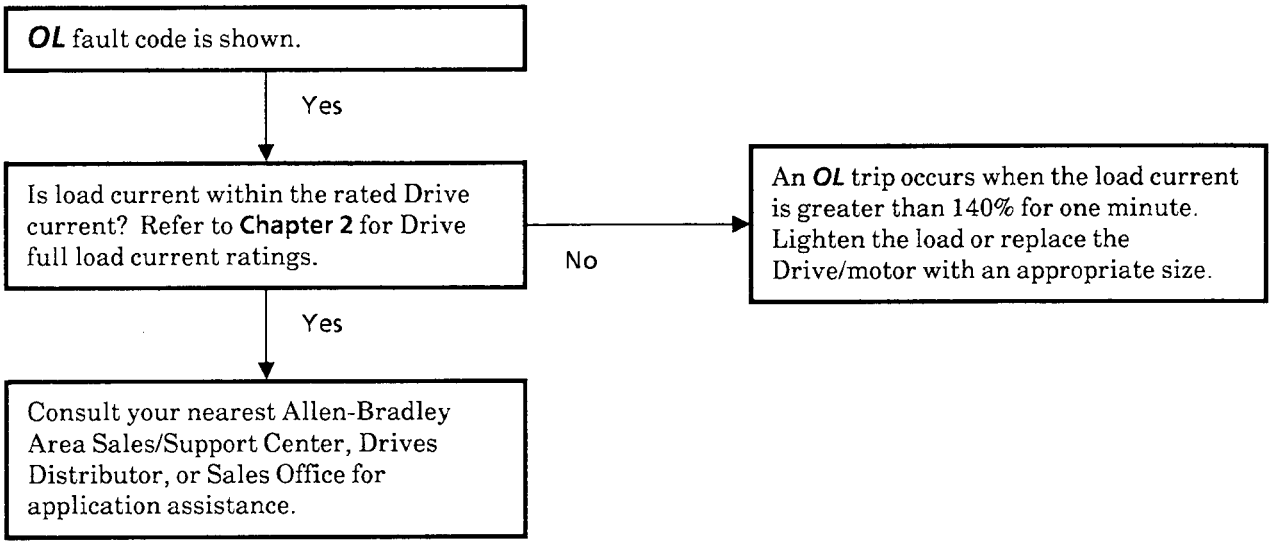
LU (low voltage) Fault Display Is Shown



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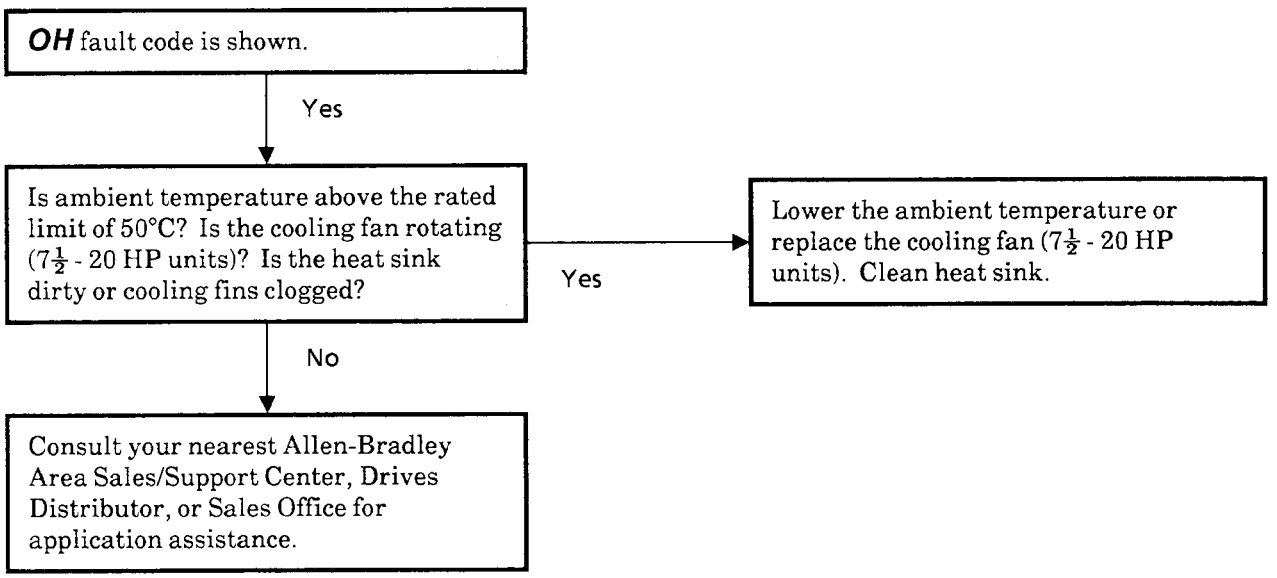
2D. Motor Does Not Run Continuously

OL (overload) Fault Display Is Shown



3A. Motor Does Not Run

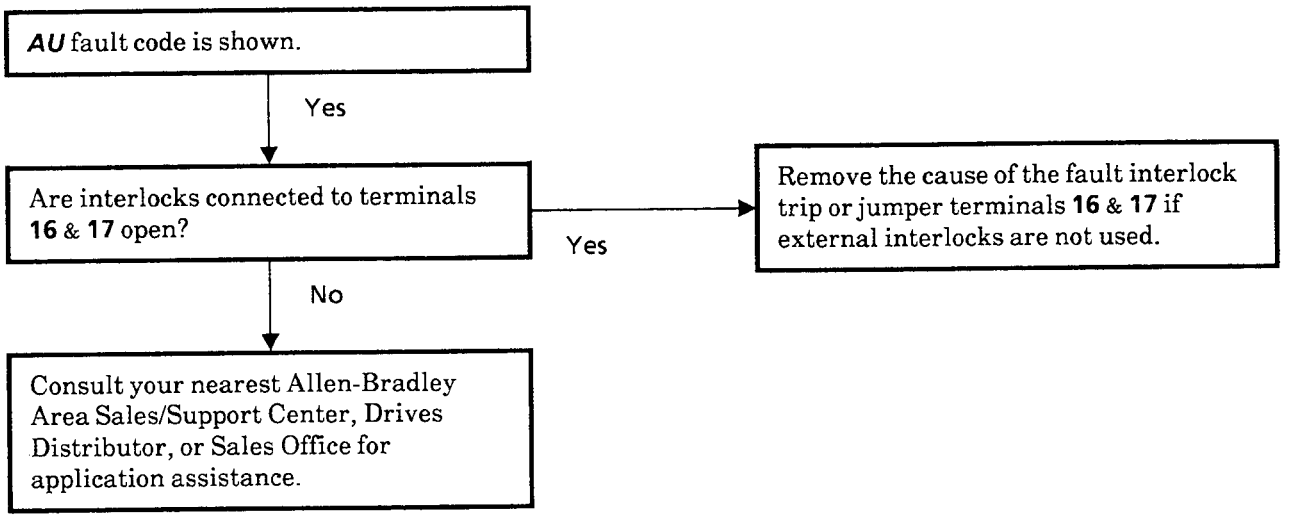
OH (over temperature) Fault Display Is Shown



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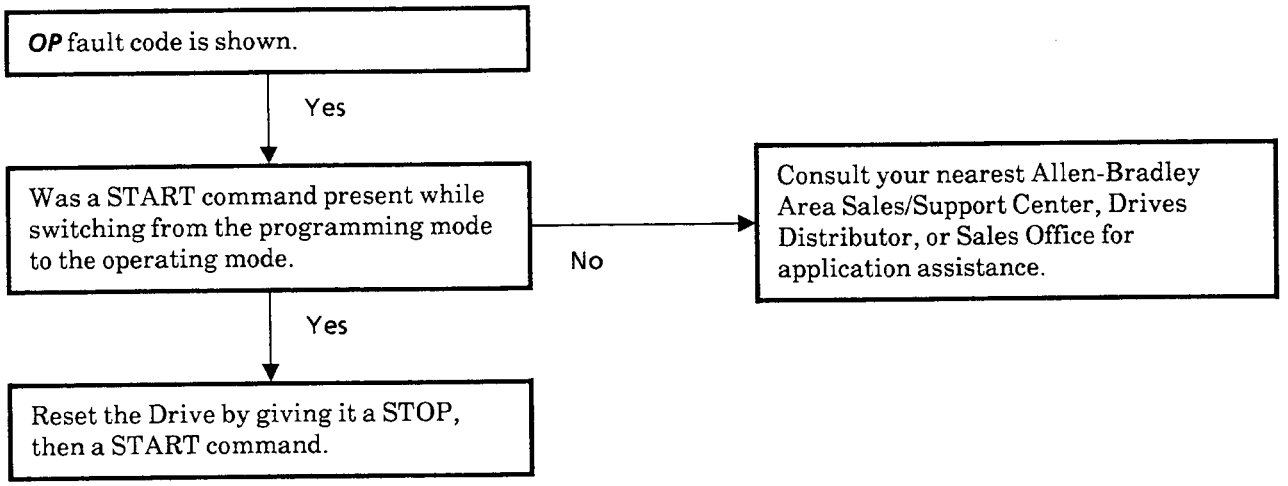
3B. Motor Does Not Run

AU (auxiliary interlock) Fault Display Is Shown



3C. Motor Does Not Run

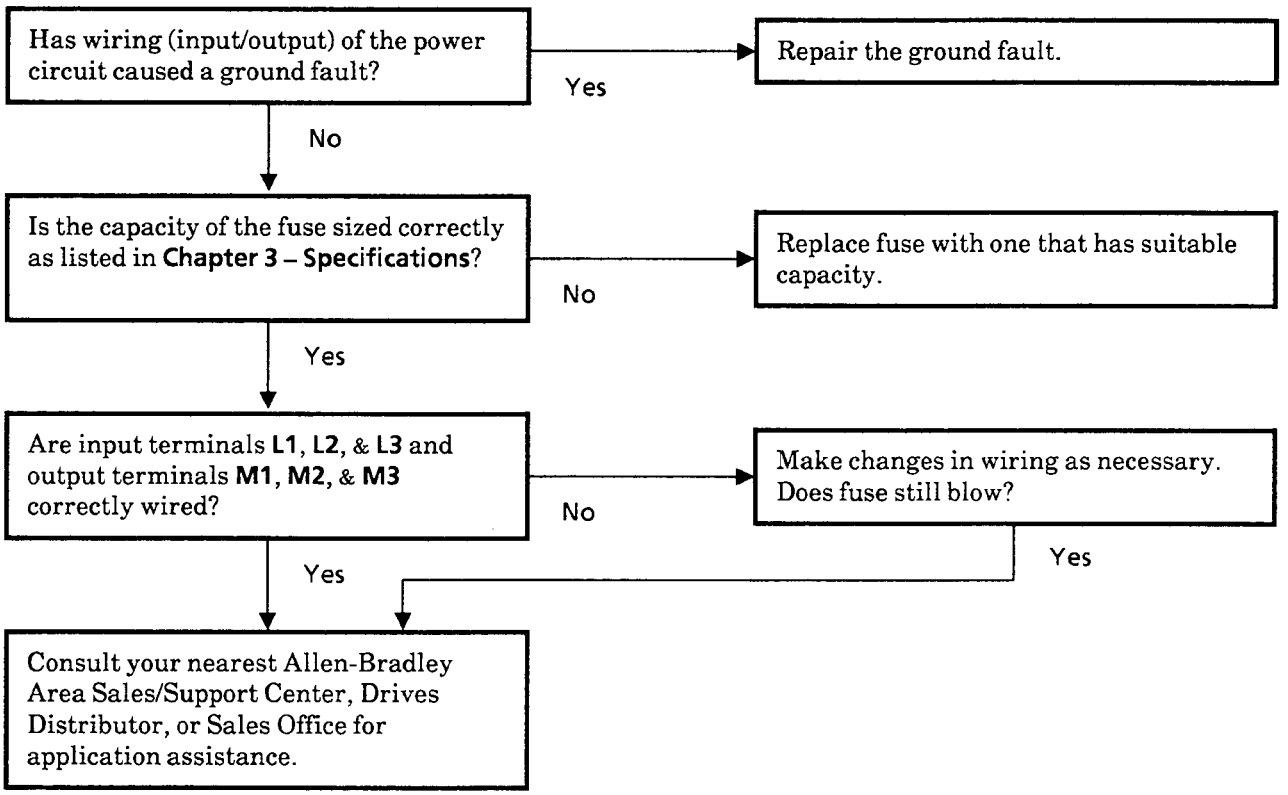
OP (operating error) Fault Display Is Shown



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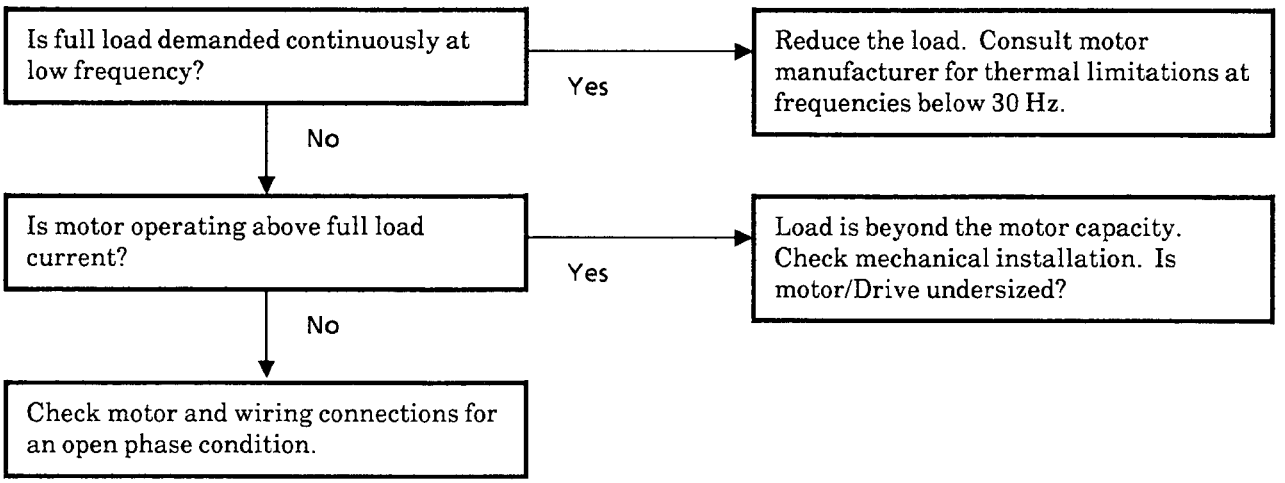
4. Fuse Blown

No Fault Displays Are Shown



5. Motor Generates an Excessive Amount of Heat

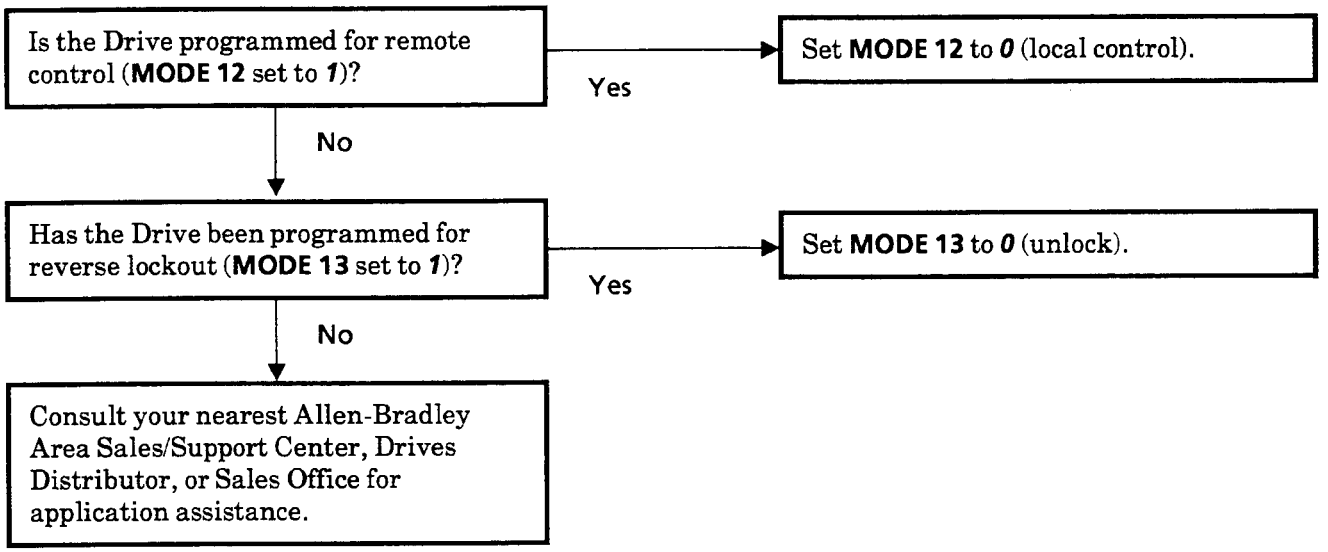
No Fault Displays Are Shown



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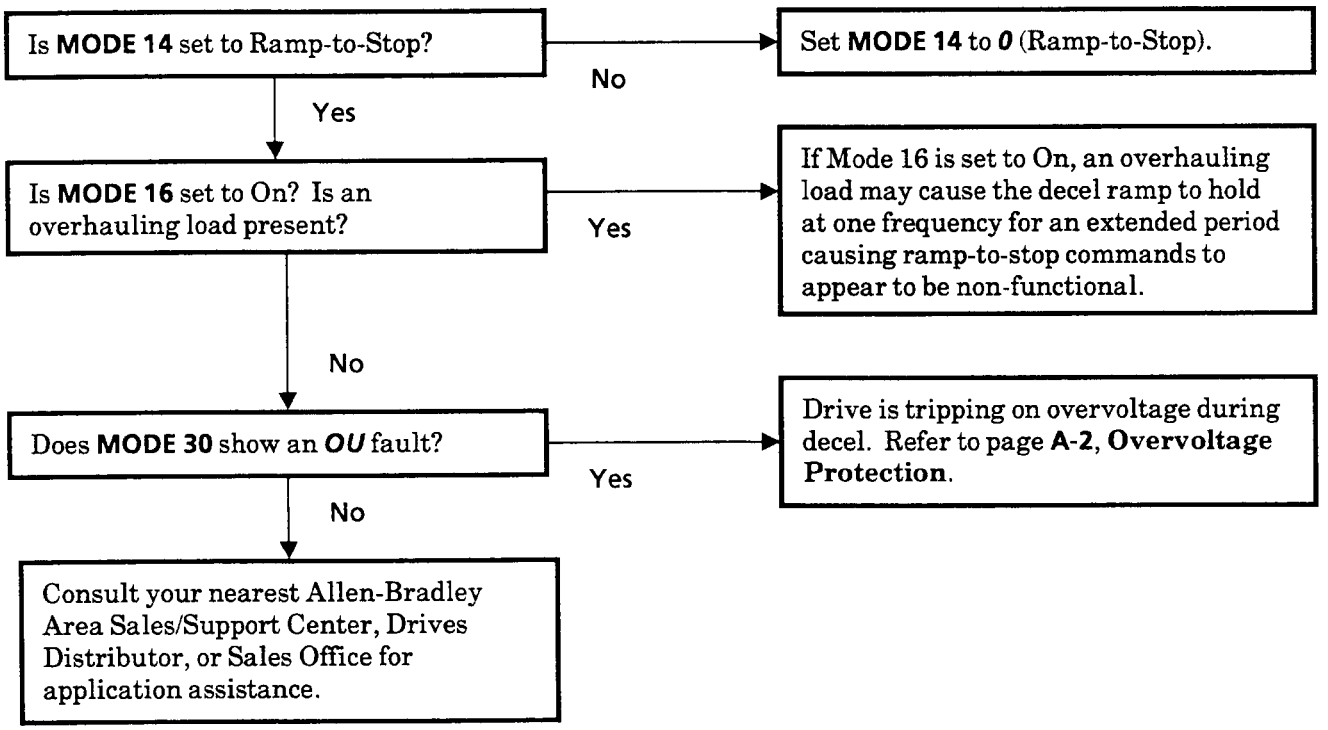
6. Drive Will Not Reverse In Local Control

No Fault Displays Are Shown



7. Drive Does Not Ramp-to-Stop

No Fault Displays Are Shown



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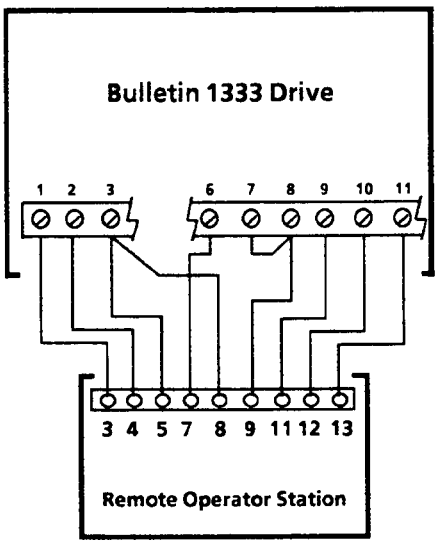
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Bulletin 1332 MOD Kits

Bulletin 1332 MOD Kits may be used with Bulletin 1333 Drives however some interconnection wiring changes will be required. Additionally, the Bulletin 1333 is a programmable Drive. The **MODE**s outlined below must be programmed to allow MOD Kit operation. Refer to the individual MOD Kit Instructions for complete installation procedures and any additional information required.

1332-MOD-F
Pub. 1332-5.0.1

Remote Operators Station



MODE 10 Frequency Control

To allow the Bulletin 1333 Drive to accept the 1332-MOD-F speed potentiometers as their speed reference, **MODE 10** must be set to ***1*** (external).

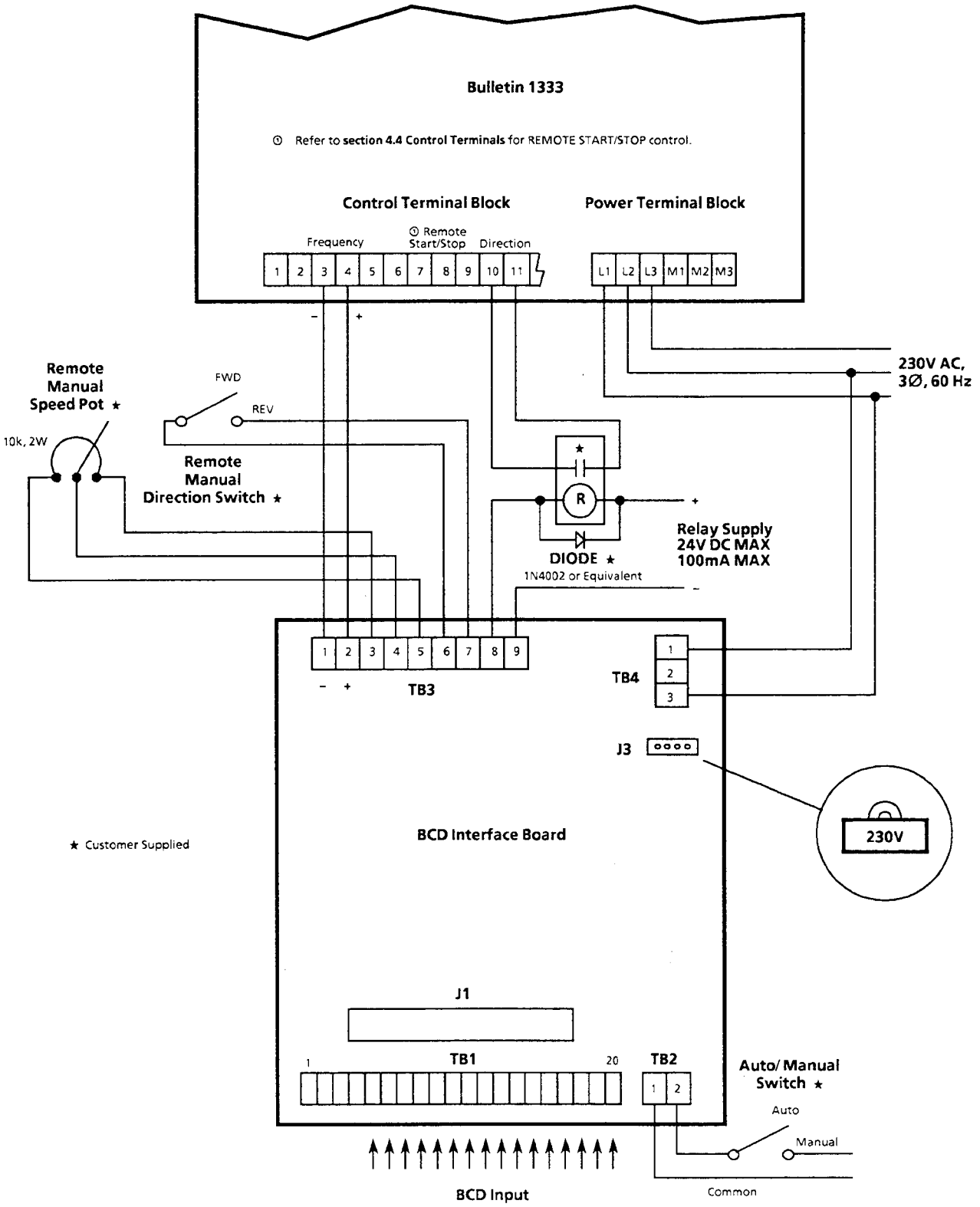
MODE 12 Start/Stop; Forward/Reverse Control

To allow the Bulletin 1333 Drive to accept the 1332-MOD-F speed start/stop and forward/reverse control commands, **MODE 12** must be set to ***1*** (external).

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1332-MOD-G4
Pub. 1332-5.1.4

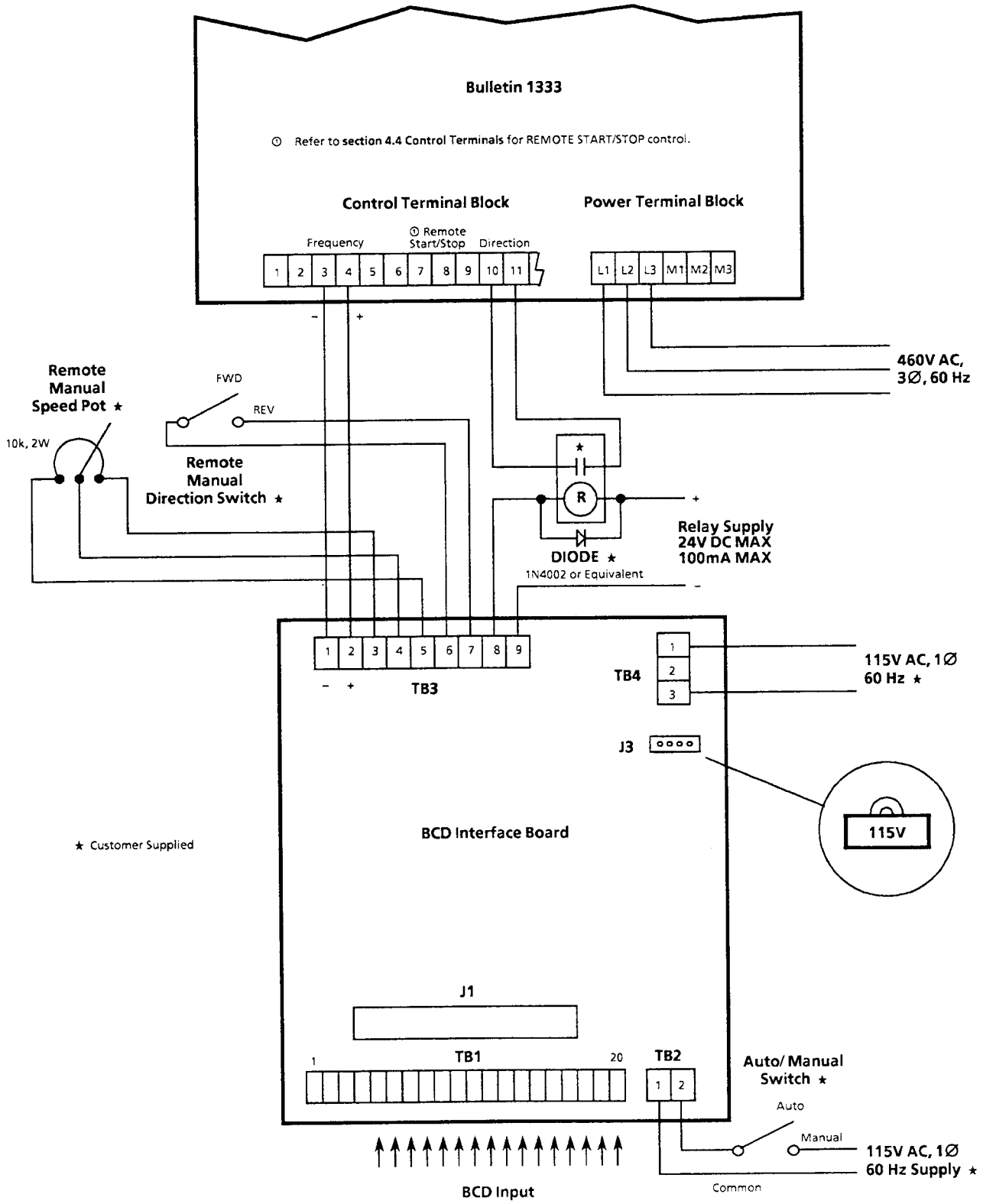
BCD Interface (230V Drives)



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1332-MOD-G4
Pub. 1332-5.1.4
(continued)

BCD Interface (460V Drives)



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1332-MOD-G4
Pub. 1332-5.1.4
(continued)

BCD Interface

MODE 6 Maximum Frequency & Volts-Per-Hertz

The frequency range of the 1332-MOD-G4 BCD Interface Board and the Bulletin 1333 Drive must be matched. Once the required position of the scaling jumper on the BCD Interface Board has been selected, **MODE 6** must be programmed to the corresponding frequency range as shown below.

Scaling Jumper Set To	Enter in MODE 6
60 Hz	***60***
120 Hz	***120*** or ***12H***
200 Hz	***240*** or ***24H***

IMPORTANT

12H and ***24H*** permit the selection of 120 or 240 Hz respectively, with the volts-per-hertz output modified to reach the maximum Drive output voltage at 120 Hz instead of 60 Hz. Applications where the volts-per-hertz patterns are required to reach full voltage at 100 or 120 Hz are primarily provisions for operating custom motors. For application assistance in these special ranges, contact your nearest Allen-Bradley Area Sales/Support Service Center, Drives Distributor, or Sales Office.

MODE 10 Frequency Control

To allow the Bulletin 1333 Drive to accept 1332-MOD-G4 speed signals, **MODE 10** must be set to ***1*** (external).

MODE 11 External Frequency Signal Type

To allow the Bulletin 1333 Drive to accept the type of signal generated by 1332-MOD-G4, **MODE 11** must be set to ***0*** (0-10V).

MODE 12 Start/Stop; Forward/Reverse Control

If the Bulletin 1333 is to have its Forward/Reverse operation controlled from the local control/programming panel on the Drive, MODE 12 must be set to ***0*** (local).

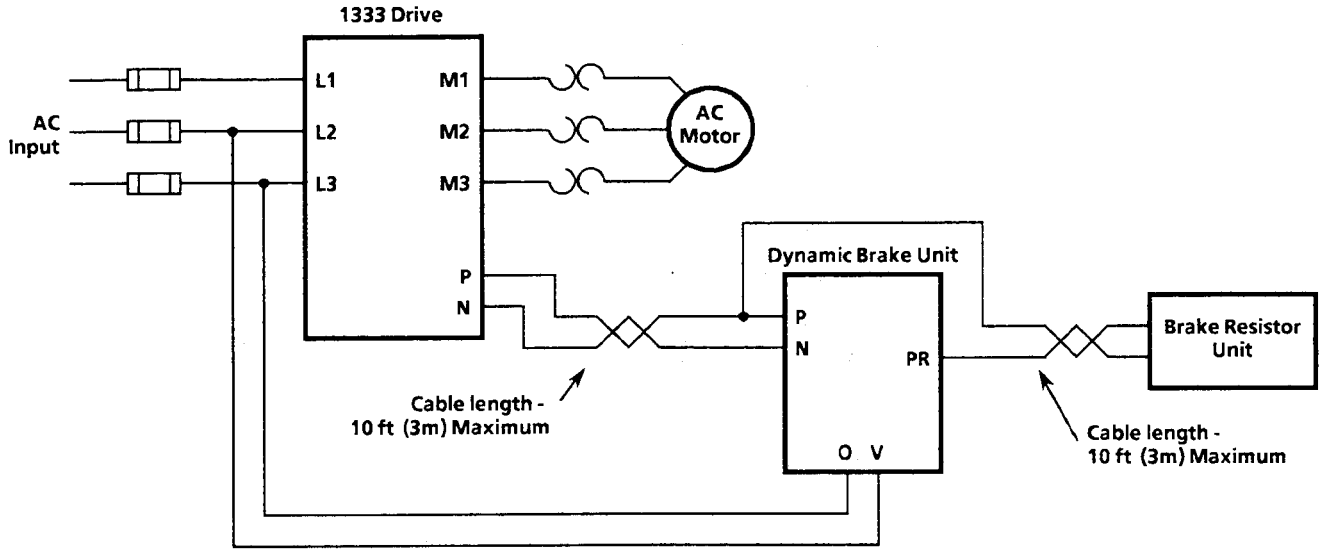
If the Bulletin 1333 is to have its Forward/Reverse operation controlled by the BCD Interface Board, **MODE 12** must be set to ***1*** (external).

IMPORTANT

If ***1*** is selected an external means of Start/Stop control will also be required. Refer to **section 4.4 – Control Terminals** for additional information.

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1332-MOD-K, K2, K3, K4, K5 **Heavy Duty Dynamic Braking**
Pub. 1332-5.0.6



MODE 14 Stop Mode

If braking is required when the Drive is stopped, set **MODE 14** to ***0*** (ramp-to-stop).

If braking is required only on speed changes and not when the Drive is stopped, set MODE 14 to ***1*** (coast-to-stop).

MODE 16 Decel Stall Protection

To prevent this feature from interfering with dynamic braking action, set **MODE 16** to ***0*** (decel stall prevention OFF).

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Application Data

IMPORTANT

Because of the variety of uses for this equipment and because of the differences between this solid state equipment and electromechanical equipment, the user of and those responsible for applying this equipment must satisfy themselves as to the acceptability of each application and use of the equipment. **In no event** will Allen-Bradley Company e responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The illustrations shown are intended solely to illustrate the accompanying text. Because of the many variables and requirements associated with any particular installation, the Allen-Bradley Company **cannot** assume responsibility or liability for actual use based upon the illustrative uses and applications.

Application

The Bulletin 1333 Adjustable Frequency Drive may use a speed potentiometer located on the front panel of the Drive or an external source as its speed reference. The method of speed control that is used is determined by Drive MODE programming during initial set up procedures. Once a particular MODE is set, it cannot be changed without stopping the Drive and reprogramming it.

(3) types of signals may be used as the external speed reference.

1) A 10kΩ Potentiometer.

2) A 0-10V DC Reference Signal.

3) A 4-20mA DC Reference Signal.

Section 4.4 in the Bulletin 1333 Instruction Manual states that only one of these signals should be connected to the Drive Control Terminals at any time.

There are times when a user may want the option of switching between an automatic speed reference and a manual speed reference. The automatic speed reference may be either a 4-20mA or 0-10V DC signal. The manual speed reference must be a 10kΩ potentiometer. The Bulletin 1333 Drive normally requires initial programming and signal wire connection, then reprogramming and reconnection to accomplish this. This application sheet describes an alternate method of external speed selection. The user must satisfy himself that this alternate method is safe in his particular application and that its use complies with applicable codes and standards.

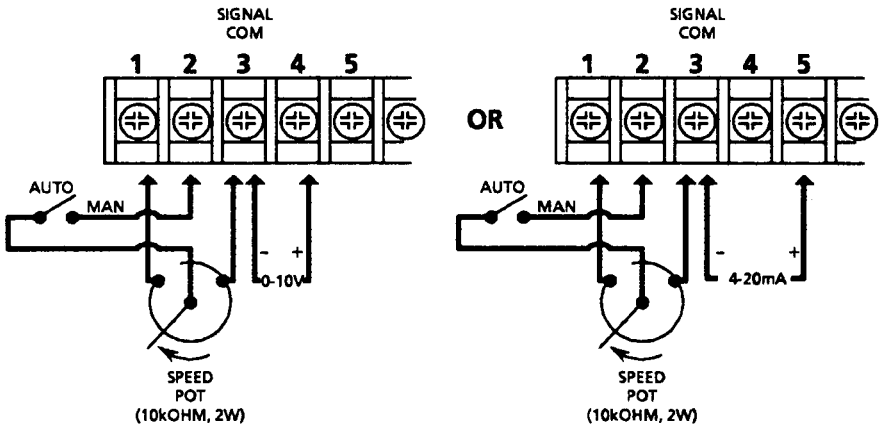
Alternate Connection

The Bulletin 1333 does have the capability to allow a 10kΩ potentiometer and one other reference signal to be connected to the Drive at the same time. Additionally the Drive may be switched from the 10kΩ potentiometer to the reference signal by means of a selector switch. The Drive logic will default to the potentiometer setting when the potentiometer is selected, and to the reference signal set by MODE 11 when the potentiometer is not selected.

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Alternate Connection
(continued)

Shown below is a method of switching between an external speed pot and an external reference signal. With this arrangement, the user must make sure that it will be safe to switch between these settings in his application, otherwise this alternate method should not be used.



0-10V / SPEED POT **4-20mA / SPEED POT**

The Bulletin 1333 must be programmed for external speed control by setting MODE 10 to 1 (external), and MODE 11 for the type of reference signal being used – Either 0 for 0-10V DC or 1 for 4-20mA.

When the selector switch is series with the potentiometer is open (AUTO position), the Drive will use the 4-20mA or 0-10V DC signal as the speed reference.

When the selector switch is closed (MAN position), the Drive will use only the potentiometer signal as the speed reference.

If the selector switch is toggled while the Drive is running, the Drive will accelerate or decelerate to the new speed reference at the set ACCEL or DECEL rate.

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