RELIANCE ELECTRIC

Installing, Operating, and Maintaining the Three-Phase Input Three-Phase Output General Purpose GP2000 AC V*S Drives

15 to 20 HP at 230/208 VAC
25 to 40 HP at 460 VAC
30 to 40 HP at 575 VAC
22kW/30 HP at 380/415 VAC

Instruction Manual D2-3182-5

Rockwell Automation

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DANGER

ONLY QUALIFIED ELECTRICAL PERSONNEL FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF THIS EQUIPMENT AND THE HAZARDS INVOLVED SHOULD INSTALL, ADJUST, OPERATE, AND/OR SERVICE IT. READ AND UNDERSTAND THIS MANUAL IN ITS ENTIRETY BEFORE PROCEEDING. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

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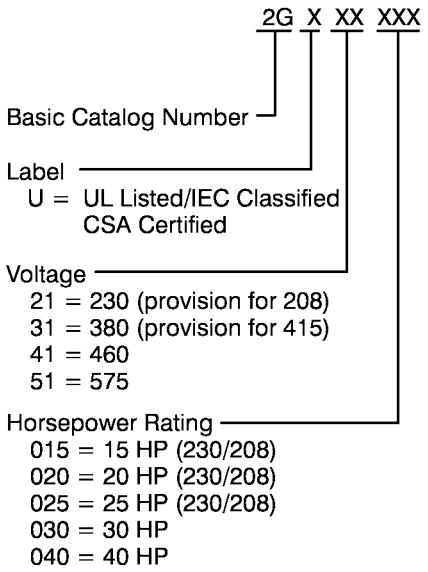
1: Receive and Accept the Controller

The products described in this instruction manual are manufactured by Reliance Electric Industrial Company.

Identify the Controller

Each Reliance Electric GP2000 A-C V★S® Controller can be positively identified by its model number (standard controller) or sales order number (customer specified controller). This number appears on the shipping label and is stamped on the controller nameplate. Refer to this number whenever discussing the equipment with Reliance Electric personnel.

The standard model number describes the controller as follows:



Receive and Accept the Shipment

Reliance Electric's terms of sale, in all instances, are F.O.B. point of origin. The user is responsible for thoroughly inspecting the equipment before accepting shipment from the transportation company.

If all the items called for on the bill of lading or on the express receipt are not included or if any items are obviously damaged, do not accept the shipment until the freight or express agent makes an appropriate notation on your freight bill or express receipt.

If any concealed loss or damage is discovered later, notify your freight or express agent within 15 days of receipt and request that he make an inspection of the shipment. Keep the entire shipment intact in its original shipping container.

The user is responsible for making claim against the Carrier for any shortage or damage occurring in transit. Claims for loss or damage in shipment must not be deducted from the Reliance Electric invoice, nor should payment of the Reliance® invoice be withheld while awaiting adjustment of such claims since the Carrier guarantees safe delivery.

If considerable damage has been incurred and the situation is urgent, contact the nearest Reliance Electric Sales Office for assistance.

File a Return Request

1. To return equipment, send a written request to Reliance Electric within ten days of receipt.
2. Do not return equipment without a numbered Equipment Return Authorization (ERA) from Reliance Electric.
3. Reliance Electric reserves the right to inspect the equipment on site.

Store the Controller until Installation

After receipt inspection, repack the GP2000 A-C V★S Controller in its shipping container until installation. If a period of storage is expected, store in the original shipping container with its internal packing.

To ensure satisfactory drive operation at startup and to maintain warranty coverage, store the equipment

- in its original shipping container in a clean, dry, safe place.
- within an ambient temperature range of −40°C to 65°C (−40°F to 149°F).
- within a relative humidity range of 5 to 95% without condensation.
- away from a highly corrosive atmosphere. In harsh environments, cover the shipping/storage container.
- away from construction areas.

If storage will be longer than 5 months, contact Reliance for long-term storage instructions.

2: Know the Controller

Introduction to the Controller

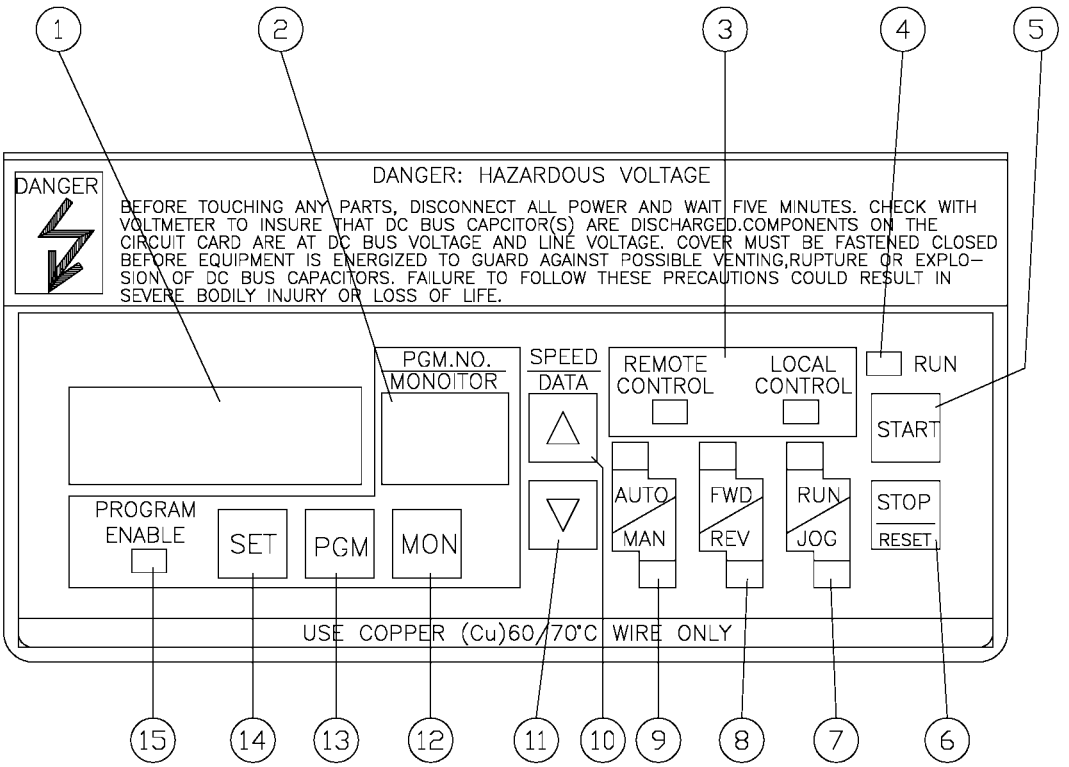
The GP2000 controller is a general purpose, variable speed, A-C controller. It utilizes state-of-the-art microprocessor digital technology. Many diagnostic capabilities are standard. Because of the many configuration adjustments handled in software through the standard keypad/display, this controller is ideal for many industrial applications.

Configuration adjustments are handled in software through the standard keypad/display. Lower motor noise operation on PWM power is achieved through Full Spectrum Switching techniques, resulting in a controller uniquely suited for constant or variable torque applications.

Keypad and Display

Controller operation and configuration is easily performed through a convenient keypad/display panel (Figure 2-1). The keypad allows easy selection of START, STOP, RUN/JOG, FORWARD/REVERSE, and AUTOMATIC/MANUAL. Each of the three dual selection keys (RUN/JOG, for example) has a small red LED above and below it that indicates which condition is selected. Also included on the keypad are an increment ▲ key and a decrement ▼ key that are used to increase or decrease the speed of the motor. The increment and decrement keys can also be used with the PGM key and the SET key to configure the GP2000 controller to many application requirements.

Also located on the keypad are a 4-digit LED display and a 2-digit LED display that show controller running information (output frequency, voltage, and percent of full-load amps and Motor RPM) and error function codes. In addition, these displays are used in configuring the controller.



1. 4-DIGIT DISPLAY OF FUNCTION VALUES/IET CODES
2. 2-DIGIT DISPLAY OF MONITOR SELECTION/FUNCTION NUMBER
3. OPERATOR'S CONTROL LEDS
4. RUN MODE LED (GREEN)
5. START KEY
6. STOP/RESET KEY
7. RUN/JOG KEY WITH INDICATING LEDS
8. FORWARD/REVERSE KEY WITH INDICATING LEDS
9. AUTOMATIC/MANUAL KEY WITH INDICATING LEDS
10. SPEED/DATA INCREMENT KEY
11. SPEED/DATA DECREMENT KEY
12. MONITOR KEY
13. PROGRAM KEY
14. SET KEY
15. PROGRAM ENABLE KEY

Figure 2-1. Keypad Layout.

Each key and LED has its own function in configuring the controller. See Figure 2-1 for location of the keys, displays and LEDs.

1. **4 Digit Display**: Displays function values in volts, frequency, percentage of full load amps, or RPM.
2. **2-Digit Display**: Displays what monitor type is selected (U for volts, H for frequency, PA for percentage of full load amps, or SP for RPM monitor), or the function number selected by scrolling through the display with the PGM key.
3. **REMOTE CONTROL and LOCAL CONTROL LED's**: When in Local Mode this indicates whether the controller is receiving a speed reference from a remote location, or locally by the keypad.
4. **RUN Mode LED**: Illuminates green when the controller is in the RUN mode.
5. **START key**: Starts controller and places it in the RUN mode. The Run mode LED will illuminate.
6. **STOP /RESET key**: Stops the controller activity and resets the controller after an IET fault.
7. **RUN/JOG key and LED's**: Activates and indicates RUN or JOG mode.
8. **FORWARD/REVERSE key and LED's**: Actvates and indicates FORWARD and REVERSE mode. (**Note**: Reverse Key is disabled from the factory: see Function 36)
9. **AUTO/MAN keys and LED's**: If the AUTO key is selected, the controller follows speed reference commands from an external process control signal. If MAN key is selected, the controller follows speed reference commands from the ▲ and ▼ keys on the keypad.
10. **SPEED/DATA ▲ key**: Increses the value of a function in increments based on what MON is set to.
11. **SPEED/DATA ▼ key**: Decreases the value the setting of a function in increments based on what MON is set to.
12. **MON key**: Activates 2-digit display to indicate which output is being monitored (H, U, PA, or SP), and activates the 4-digit display to indicate the actual value (frequency, volts, percentage of full load amps, or RPM) of the output being monitored.
13. **PGM key**: When pressed, allows the program to be changed. The program jumper must be in the J5 position to allow changes to the configuration. See Figure 5-4.
14. **SET key**: Locks in the new value entered for a particular function.
15. **PROGRAM ENABLE LED**: Indicates that the PGM key is activated and that a function's value can be changed.

Terminology Used in This Manual

Definitions and Abbreviations

AUTO: See "Speed Reference."

CEC: The abbreviation for the Canadian Electrical Code.

Chassis: The open style of controller.

Configure: The process by which the user selects and adjusts one of the standard 57 programmable functions listed in Table 8-2.

Controller: The term substituted throughout this manual for "GP2000 A-C V*S Drive Controller."

Drive: The reference to the controller and the motor combined as one system.

GP2000 A-C V★S Drive Controller: See "controller."

Hz: The abbreviation for hertz.

IET: The abbreviation for instantaneous electronic trip.

MAN: See "Speed Reference."

NEC: The abbreviation for the National Electrical Code.

NEMA: The abbreviation for the USA National Electrical Manufacturers Association.

NEMA 1: The type 1 enclosure defined in NEMA standards which provides protection against accidental or inadvertent bodily contact with live parts.

Process Control: See "Speed Reference."

Program: See "Configure."

PWM: The abbreviation for Pulse Width Modulation.

Run Mode: The condition when output frequency (Hz) and voltage are applied to the A-C motor. The green RUN MODE LED will be lit in this mode.

Set Frequency: The speed setting stored in memory to which the controller will accelerate when the Run mode is initiated. When not monitoring frequency, voltage, or current from the keypad, the 4-digit display shows the set frequency and the 2-digit display is blank.

Speed Pot: The shortened term for speed potentiometer. The speed pot on this controller is in the form of increment ▲ and decrement ▼ keys on the controller keypad: use the increment ▲ key to increase the speed of the motor (like turning a speed pot CW) and the decrement ▼ key to decrease the speed of the motor (like turning a speed pot CCW).

Speed Reference: The MAN (manual) key or the AUTO (automatic) key on the controller keypad determines whether the controller follows speed reference commands from the keypad ▲ and ▼ keys (MAN selected) or from an external process control signal (AUTO selected). Note: If no process control signal is present when AUTO is selected, the controller will run at minimum Hz. See Figure 3-5 for process control configurations.

Static MOP: An electronic MOP (Motor Operated Potentiometer). The speed can be adjusted remotely by the external contacts.

Stop Mode: The condition when output frequency (Hz) and voltage are ramped down to zero. This condition can be caused by pressing the STOP key, by an external function loss signal, or an internal IET. When an IET occurs, the STOP key also acts as an IET reset.

Dangers, Warnings, and Cautions

Dangers, warnings, and cautions point out potential hazards. All three of these precautions are enclosed in a box to call attention to them.

- A **danger** alerts a person that high voltage is present which could result in severe bodily injury or loss of life.
- A **warning** alerts a person of potential bodily injury if procedures are not followed.
- A **caution** alerts a person that, if procedures are not followed, damage to, or destruction of, equipment could result.

Standard Features

- PWM control with dedicated microprocessor to optimize motor flux
- Microprocessor based regulator
- Full spectrum switching for reduced motor noise
- Surface mount technology
- Large scale integration
- UL/CSA electronic motor overload which meets NEC/CEC requirements
- 57 controller configuration adjustments including
  - Minimum and maximum frequency settings
  - Separate acceleration and deceleration ramps
  - Current limit
  - Automatic flux control
  - Torque boost
  - Three preset speed selections
  - Frequency Avoidance and bandwidth selections
  - D-C braking
  - Slip compensation
  - Frequency and current level detection
  - Static MOP

  - Settable electronic overload
  - Output Voltage Regulation
  - Linear S-Curve acceleration and deceleration
- Keypad and display
  - Start/Stop
  - Speed adjustment
  - Automatic or manual speed reference
  - Run/Jog
  - Complete drive adjustments
  - Monitor and display of either output frequency, voltage, percent current, or RPM
  - Diagnostic fault monitoring
- Ability to follow a 0−20 mA, 4−20 mA, 0−10 VDC, or frequency pulse input signal for automatic speed control
- 0−400 Hz frequency range
- Signal Buffer Board for industry standard control interface
- UL Listed
- Integral Input Line Reactor
- D-C Bus Fuse
- D-C Bus Contactor
- Line-to-line and line-to-ground output short circuit protection
- Motoring current limit and regenerative voltage limit
- NEMA 1 enclosure

Optional Kits and Modifications

The following kits and modifications are available with select controllers. See Table 2-1 for the complete kit listing. Contact a Reliance Electric Sales Office or authorized distributor for more information regarding these kits or modifications.

Kits

- Remote Meter Interface Card
- Remote Digital Meter
- Pressure-to-Electrical Transducer
- Main Input Circuit Breaker
- Output Contactor
- Dynamic Braking
- Input Line Fuses
- Reference Trim Pot
- Remote Operator Station

Modifications

- Complete Magnetic Bypass
- 115 VAC Control Interface
- RPM A-C Blower Motor Protection

Table 2-1. Controller Kits(1).

Description	Model Number	Instruction Sheet
Rail Interface Card	1SC4000	D2-3170
GPI-2 Regulator Upgrade Kit(4)	1RG2002	D2-3269
Remote Meter Interface Card (All Drives)	1MI4000	D2-3168
Remote Digital Meter (1)(2) (All Drives)	3DM4000	D2-3169
Pressure-to-Electrical Transducer (25−50 HP) 460/575	1PE4050	D2-3175
Pressure-to-Electrical Transducer 380/415 (22−30 kw)	1PE3040	D2-3175
Pressure-to-Electrical Transducer 230/208 (15−25 HP)	1PE2025	D2-3175
Main Input Circuit Breaker (All Drives)	1CB4050 2CB4050(3)	D2-3223 D2-3235(3)
Motor Overload (All Drives)	1ML4050	D2-3222
Output Contactor (25−50 HP) 460/575	1CN4050	D2-3177
Dynamic Braking (2) 460/380/416 V 25 thru 50 HP (UL) 460/380/416 V 25 thru 50 HP (CSA) 230/208 V 10 HP (UL) 230/208 V 10 HP (CSA) 575 V 20 HP (UL) 575 V 20 HP (CSA)	 2DB4020 2DC4020 2DB2010 2DC2010 2DB5020 2DC5020	 D2-3179 D2-3179 D2-3179 D2-3179 D2-3179 D2-3179
Inverter Fuse Kit (All Drives)	2FU4050	D2-3211
Reference Trim Pot	1TP3000	D2-3213
Remote Operator Station	1RS3000	D2-3214

(1) Some kits subject to availability. Contact your local Reliance Electric Sales office or authorized distributor.
(2) These kits mount remote to the main control cabinet.
(3) Order this Model Number for drives shipped after June, 1992.
(4) Upgrade Kit is needed for 1SC4000.

Controller Specifications

Controller Ratings

The controller is intended to operate from a three-phase A-C power source at the rated voltage listed on the controller nameplate. It can operate on 50 or 60 Hz line frequency. The controller provides three-phase variable voltage and variable frequency to the motor. Controller current ratings are listed in Table 2-2.

Table 2-2. Controller Ratings with Three-Phase Input Power.(1)

Controller Model Number	Nominal Horsepower Range	Controller 3-Phase Input Volts	Controller Input KVA	Input Amps at Rated Output Amps	Maximum Controller Output Amp
2GU41025	25	460	29.5	37	34.0
2GU41030	30	460	35.1	44	40.0
2GU41040	40	460	45.4	57	52.0
2GU21015	15	230/208(1)	17.5	44.0	40.0
2GU21020	20	230/208(1)	22.7	57.0	52.0
2GU31022	30/22 kw	380/415	31.7	48.0	44.0
2GU51030	30	575	34.0	35.0	32.0
2GU51040	40	575	45.4	44.0	41.0

(1) For 208 Voltage Input Power, derate to the lower horsepower rating.

Service Conditions

- Ambient temperature: −10°C to 40°C (14°F to 104°F) for enclosed controllers
- Storage temperature: −40°C to 65°C (−40°F to 149°F)
- Atmosphere: 5 to 95% non-condensing relative humidity
- Elevation: To 3300 feet (1000 meters) above sea level without derating. For every 300 feet (91.4 meters) above 3300 feet, derate the current rating by 1%. Consult your Reliance Electric Sales Office for operation above 10,000 feet.
- Line frequency: 50±2 Hz or 60±2 Hz
- Line voltage variation: −10% to +10%
- A-C line distribution system capacity (maximum): 1,000 KVA for 460 VAC, three-phase with 25,000 amps symmetrical fault current capacity.

Controller Application Data

- Pulse Width Modulation (PWM)
- Service Factor: 1.0
- Displacement Power Factor: 0.96
- Maximum Load: 150% for one minute (based on controller nameplate rating)
- Overcurrent IET: 200% load (based on controller nameplate rating)
- Current Limit Adjustment: 50 to 150% (based on controller nameplate rating)
- Linearity (Speed reference to output frequency): ±1%

WARNING

THIS DRIVE IS INTENDED TO OPERATE AT A PREDETERMINED MINIMUM SPEED UNLESS DISCONNECTED FROM THE POWER SOURCE. IF THE APPLICATION REQUIRES ZERO SPEED OPERATION WITHOUT SUCH DISCONNECTION, THE USER IS RESPONSIBLE FOR ASSURING SAFE CONDITIONS FOR OPERATING PERSONNEL BY PROVIDING SUITABLE GUARDS, AUDIBLE OR VISUAL ALARMS, OR OTHER DEVICES. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

- Minimum Frequency: 5 to 60 Hz (or 0.5 to 60 Hz programmed with a password)

WARNING

THE USER IS RESPONSIBLE FOR ENSURING THAT DRIVEN MACHINERY, ALL DRIVE-TRAIN MECHANISMS, AND PROCESS LINE MATERIAL ARE CAPABLE OF SAFE OPERATION AT A SPEED EQUIVALENT TO AT LEAST THAT WHICH WOULD RESULT FROM AN APPLIED FREQUENCY OF 20% ABOVE THE OVERFREQUENCY LIMIT (FUNCTION 38/FACTORY PRESET 90 HZ; MAXIMUM VALUE 405 HZ). FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

- Maximum Frequency: 15 Hz to overfrequency limit
- Base Frequency (V/Hz): 30 to 400 Hz
- Frequency Stability Long Term: 0.01% of base speed with digital keypad; 0.5% of base speed with optional analog speed pot
- Acceleration Adjustment: 0.1 to 360 seconds (within the capability of current limit)
- Deceleration Adjustment: 0.1 to 360 seconds (within the energy absorbing capability of the controller)
- Torque Boost: 0 to 10% of input voltage

Single-Motor Applications

The controller and motor must be sized for the load and speed requirements of the specific application. Refer to "Selection and Application of A-C V★S Drives" (D-9084) for assistance.

If the motor is overframed, the motor operating current must not exceed the controller's rated output current and the motor horsepower must not be more than one standard rating larger than the controller's horsepower rating.

Multi-Motor Applications

One controller can run one, two, or more motors. Adhere to the following requirements to assure correct drive operation:

1. When all the motors connected to the output of the controller are to start and stop simultaneously, the sum of the full-load currents of all the motors must be less than the maximum output current rating of the controller.
2. When one or more of the motors connected to the output of the controller are to start and stop independently:
   - Any motor that starts or stops while the controller is running must have a full-load current rating less than 10% of the maximum controller output current rating.
   - The sum of the sine wave currents of all the motors connected to the output of the controller and the locked rotor current of any motor which is to start and stop individually must be less than the maximum controller output current rating.

3: Install the Drive

DANGER

ONLY QUALIFIED ELECTRICAL PERSONNEL FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF THIS EQUIPMENT AND THE HAZARDS INVOLVED SHOULD INSTALL IT. READ AND UNDERSTAND THIS MANUAL IN ITS ENTIRETY BEFORE PROCEEDING. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

DANGER

THE USER IS RESPONSIBLE FOR CONFORMING TO THE NEC/CEC AND ALL OTHER APPLICABLE LOCAL CODES. WIRING PRACTICES, GROUNDING, DISCONNECTS, AND OVERCURRENT PROTECTION ARE OF PARTICULAR IMPORTANCE. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

Plan the Installation

Read and understand this section in its entirety before beginning the actual installation. Follow these guidelines and procedures to minimize both installation and operating problems.

Select Controller Location

1. Verify that the controller can be kept clean, cool, and dry.
2. Check that the controller is away from oil, coolant, and other airborne contaminants.

CAUTION: Salt, chlorine, other corrosive gases and/or liquids must be avoided. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

3. Check that temperatures in the controller vicinity are between −10°C to 40°C (14°F to 104°F).
4. Check that relative humidity is between 5 and 95% (noncondensing).
5. Do not install above 3300 feet (1000 meters) without derating. For every 300 feet (91.4 meters) above 3300 feet, derate the current rating 1%. Consult your Reliance Electric Sales Office for operation above 10,000 feet.

Mount the Controller

Mount the Standard NEMA 1 Controller

1. In the location selected, using the provided lifting holes, mount the enclosed controller vertically. See Figure 3-1.
2. Make sure surrounding components do not hinder service access. Service clearance for front and right side entry is 10−12 inches. See Figure 3-1 for mounting dimensions.
3. Provide adequate clearance for air ventilation:
   - At least 2 inches from the sides and 4 inches from the top and bottom of the controller to adjacent non-heat producing equipment.
   - At least 4 inches from the sides and 10 inches from the top and bottom of adjacent controllers. For the best air movement with three or more controllers, do not mount the controllers in a vertical stack; offset the controllers.

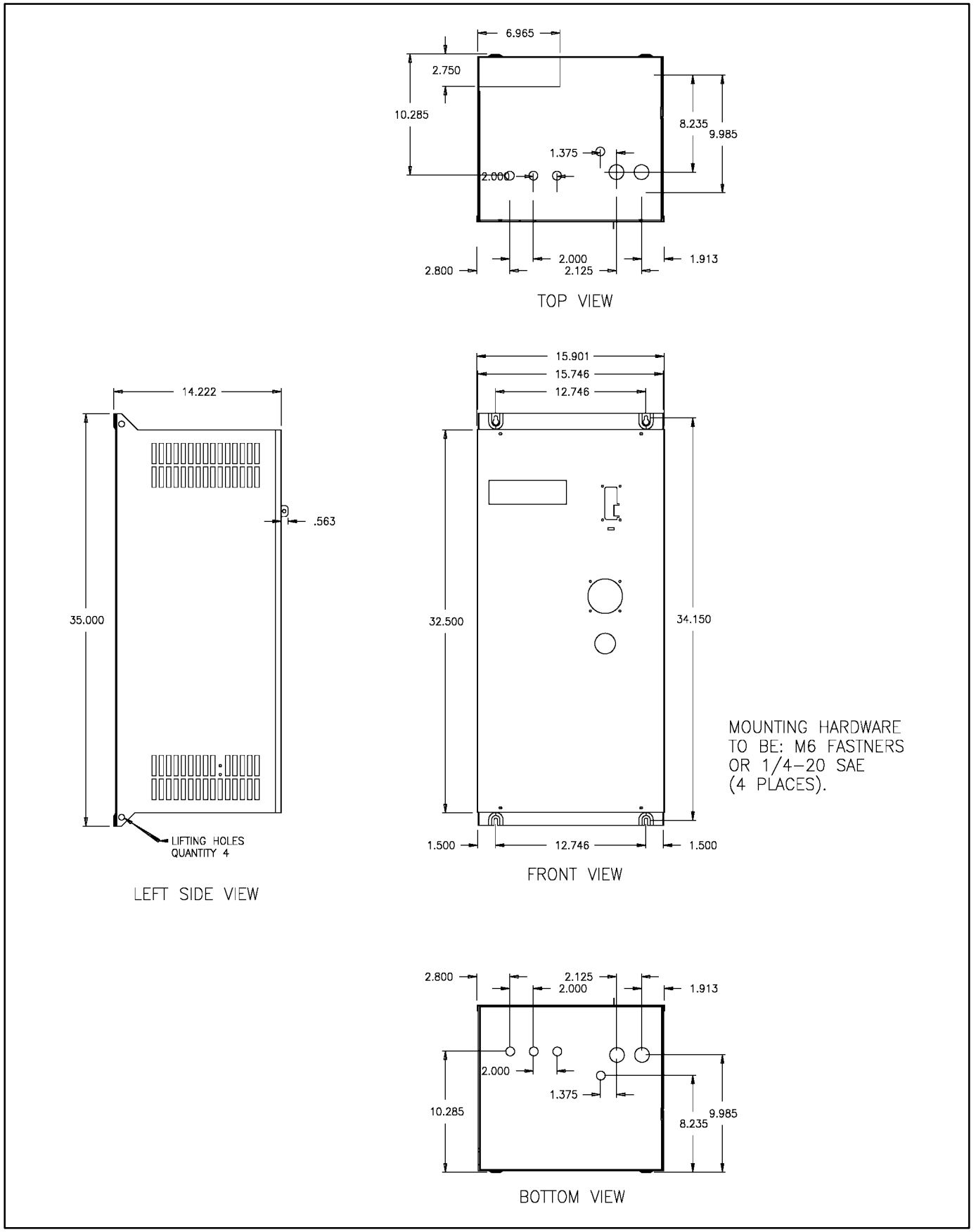


Figure 3-1. Physical Dimensions.

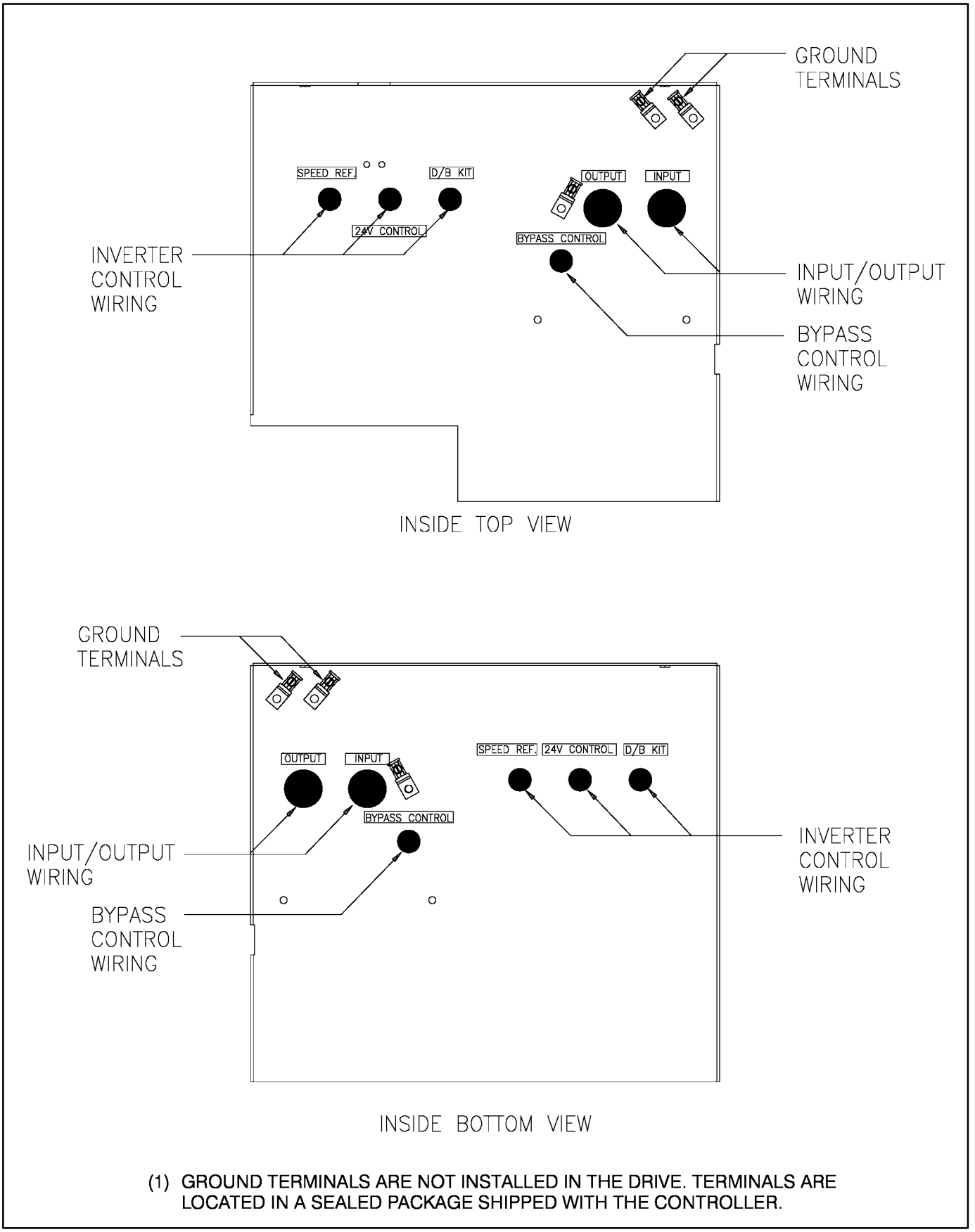


Figure 3-2. Controller Wiring Entrance Locations and Ground Terminals.

Mounting the GP2000 Controller in User-Supplied Enclosure

CAUTION: Complete all drilling, cutting, welding, etc., before mounting the controller in a user-supplied metal enclosure. During installation protect the controller from metal chips, weld splatters, and other debris. Failure to observe these precautions could result in damage to, or destruction of, the equipment.

1. Mount the controller in a vertical position directly to the enclosure mounting panel. Stand-off hardware is not necessary. See Figure 3-1 for mounting dimensions.
2. Provide adequate clearance for air ventilation and servicing within the enclosure:
   - At least 2 inches from the sides and 4 inches from the top and bottom of the controller to adjacent non-heat producing equipment, such as a cabinet wall.
   - At least 4 inches from the side and 10 inches from the top and bottom of adjacent controllers. For the best air movement with three or more controllers, do not mount the controllers in a vertical stack; offset the controllers.

Table 3-1. Heat Generated By GP2000 Power Modules (without kits).

230/208, 380/415, 460, 575 V Volts	
HP	**Power Loss (watts)**
15	625
20	625
25	650
30	775
40	900

Install the Motor

Note: For multi-motor application requirements, refer to "MultiMotor Applications" in Section 2.

1. Verify the motor is the appropriate size to use with the controller.

   Derate the A-C motor to compensate for additional heating in the motor caused by harmonics.
2. Install the A-C motor according to its instruction manual.

   If the motor is overframed, verify that the motor operating current does not exceed the controller's output current and the motor horsepower is not more than one size larger than the controller's horsepower rating. Select the proper heater coil to protect the motor. See Table 4-1 for heater selection.

   If the motor will be operated at speeds below one-half the motor's base speed, use the thermal responsive type of protection device because it monitors the actual temperature of the motor windings. The motor overload relay may not protect the motor because of the reduction in motor cooling action due to the reduced speed.
4. Make sure the motor is properly aligned with the driven machine to minimize unnecessary motor loading from shaft misalignment.
5. If the motor is accessible while it is running, install a protective guard around all exposed rotating parts.

Install an Input Disconnect (Inside the Controller Cabinet)

DANGER

THE NEC/CEC REQUIRES THAT AN INPUT DISCONNECT BE PROVIDED IN THE INCOMING POWER LINE. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

1. Install an input disconnect in the incoming power line according to the NEC.
2. Size the disconnect, considering any additional loads the disconnect may supply.
3. Wire this disconnect in the secondary circuit of the controller isolation transformer (if used) when the disconnect is installed in the controller. If the Main Input Circuit Breaker Kit is used, see Instruction Sheet D2-3173.

Install an Input Disconnect (External to the Controller)

DANGER

THE NEC/CEC REQUIRES THAT AN INPUT DISCONNECT BE PROVIDED IN THE INCOMING POWER LINE. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

1. Install an input disconnect in the incoming power line according to the NEC/CEC.
2. Size the disconnect, considering the transformer inrush current as well as any additional loads the disconnect may supply.
3. Wire this disconnect in the controller isolation transformer primary circuit (if used).

Install A-C Input Branch Circuit Protection (External to the Controller)

DANGER

THE NEC/CEC REQUIRES THAT UPSTREAM BRANCH CIRCUIT PROTECTION BE PROVIDED TO PROTECT INPUT POWER WIRING. INSTALL THE RATING RECOMMENDED IN TABLE 3-2. IF THE FUSE RATING IS INCREASED DUE TO LOADS REQUIRING HIGH STARTING CURRENTS, DO NOT EXCEED THE MAX ALLOWABLE RATINGS IN TABLE 3-2. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

CAUTION: The input Fuse Ratings listed in Table 3-2 are applicable for one drive per branch circuit. No other load can be applied to that fused branch circuit. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

1. Install user-supplied branch circuit protection according to the NEC/CEC.
2. Size the branch circuit according to Table 3-2.
3. If the Main Input Circuit Breaker Kit is used, see Instruction Sheet D2-3173.

Table 3-2. A-C Input Line Branch Circuit Protection with Three-Phase Input.

Controller Horsepower	Controller 3-Phase Input Volts	Input Current (Amps) at Rated Output Amps	Recommended Input Fuse Rating		Max Allowable Input Fuse Rating	
			UL Class	Rating (Amps)	UL Class	Rating (Amps)
15	230/208	44	RK5	60	RK5	100
20	230/208	57	RK5	70	RK5	100
25	460	37	RK5	50	RK5	100
30	460	44	RK5	60	RK5	100
30	575	35	RK5	60	RK5	80
40	460	57	RK5	70	RK5	100
40	575	44	RK5	60	RK5	80
22 kw/30 HP	380/415	48	RK5	60	RK5	100

Install a Transformer (if needed)

In all applications requiring the use of an output transformer, contact your Reliance Electric Sales Office for assistance.

Input transformers step up or step down input voltage and can be either auto-transformers or isolation transformers. Isolation transformers help eliminate

- Damaging A-C line voltage transients from reaching the controller.
- Line noise from the controller back to the incoming power.
- Damaging currents, which could develop if a point inside the controller becomes grounded.

If an input transformer is installed ahead of the controller, a power disconnecting device must be installed between the power line and the primary of the transformer. If this power disconnecting device is a circuit breaker, the circuit breaker trip rating must be coordinated with the inrush current (10 to 12 times full-load current) of the input transformer. An input transformer rated at more than 1000 KVA (500 KVA for 230/208 V, 1250 KVA for 575 V), 5% impedance for 460 VAC should NOT be used directly ahead of the controller without additional impedance between the controller reactor and the transformer.

CAUTION: Distribution system capacity above 1000 KVA, 5% impedance for 460 VAC (500 KVA for 230/208 V, 1250 KVA for 575 V) requires an isolation transformer, line reactors, or other means of adding line impedance. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

Wire the Drive

Ground the Drive

DANGER

THE USER IS RESPONSIBLE FOR MEETING ALL CODE REQUIREMENTS WITH RESPECT TO GROUNDING ALL EQUIPMENT. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

1. Remove the controller cover.
2. Run a suitable equipment grounding conductor unbroken from the controller ground terminal (Figure 3-2 to the grounding electrode conductor (earth ground). See Table 3-3 for wire size.
3. Connect a suitable equipment grounding conductor to the motor frame, the remote control station (if used), the transformer (if required), and the controller enclosure. Run each conductor **unbroken** to the grounding electrode conductor (earth ground).
4. The 24 VDC Start/Stop circuit is factory grounded.

Table 3-3. Recommended Wire Sizes.

Description	Terminal Designation	Wire Size
Input power	R', S', T'	2–12 AWG
Output power	U', V', W'	2–12 AWG
460 VAC control	R1, S1, T1/R2, S3, T2	12–26 AWG (normally no customer wiring required)
DB power	147, 45	4–10
DB control	113, 114	12–22 AWG
Function Loss, O/L, 24 VDC control	11A, 12A, 12B	12–22 AWG
24 VDC control signal buffer PC Board	TB11 (1–19)	14–22 AWG
GND terminal	GND input/output/control	6–14 AWG
Bypass control	201–206, 188, 189	12–26 AWG
Main input circuit breaker	L1, L2, L3	4–14 AWG
Bypass contactor interlocks	207–210	12–26 AWG

Note: Table 3-3 presents a range of acceptable wire sizes for the GP2000. For actual sizes, the user is responsible for following the National Electrical Code/Canadian Electrical Code and all applicable local codes with respect to wire sizes.

Install Power Wiring

DANGER

EXTERNAL POWER WIRING MAY REMAIN ELECTRICALLY HOT WHEN THE MAIN A-C POWER IS DISCONNECTED. IDENTIFY ALL SUCH EXTERNAL WIRING. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

1. Verify that input power to the controller corresponds to the controller nameplate voltage and frequency and that the plant supply is of sufficient capacity to support the input current requirements of the controller.
2. Provide a transformer between the plant power supply and the controller if the correct input line voltage is not available. Refer to "Install a Transformer (if needed)" in this section.
3. Size upstream branch circuit protection (fuses) according to Table 3-2.
4. Size input and output power wiring, according to applicable codes, to handle the rated maximum controller current listed in Table 2-2. See Table 3-3 for recommended wire sizes.
5. Use only copper wire with a minimum temperature rating of 60/75°C.
6. Use the appropriate tightening torque listed in Table 3-4 for wire connections to input terminals and output terminals in the controller.
7. Refer to Figure 3-2 for the wiring entrance locations.
8. Install the power wiring. Use Figure 3-3.
9. Route A-C input leads through the bottom right opening of the controller to terminals R', S', and T'.
10. Route motor leads through the bottom left opening of the controller to terminals U', V', and W'.

Table 3-4. Terminal Tightening Torques (lb-in).

Input Terminals R', S', T' R1, S1	Output Terminals U', V', W' 147, 45
35–44	35–44

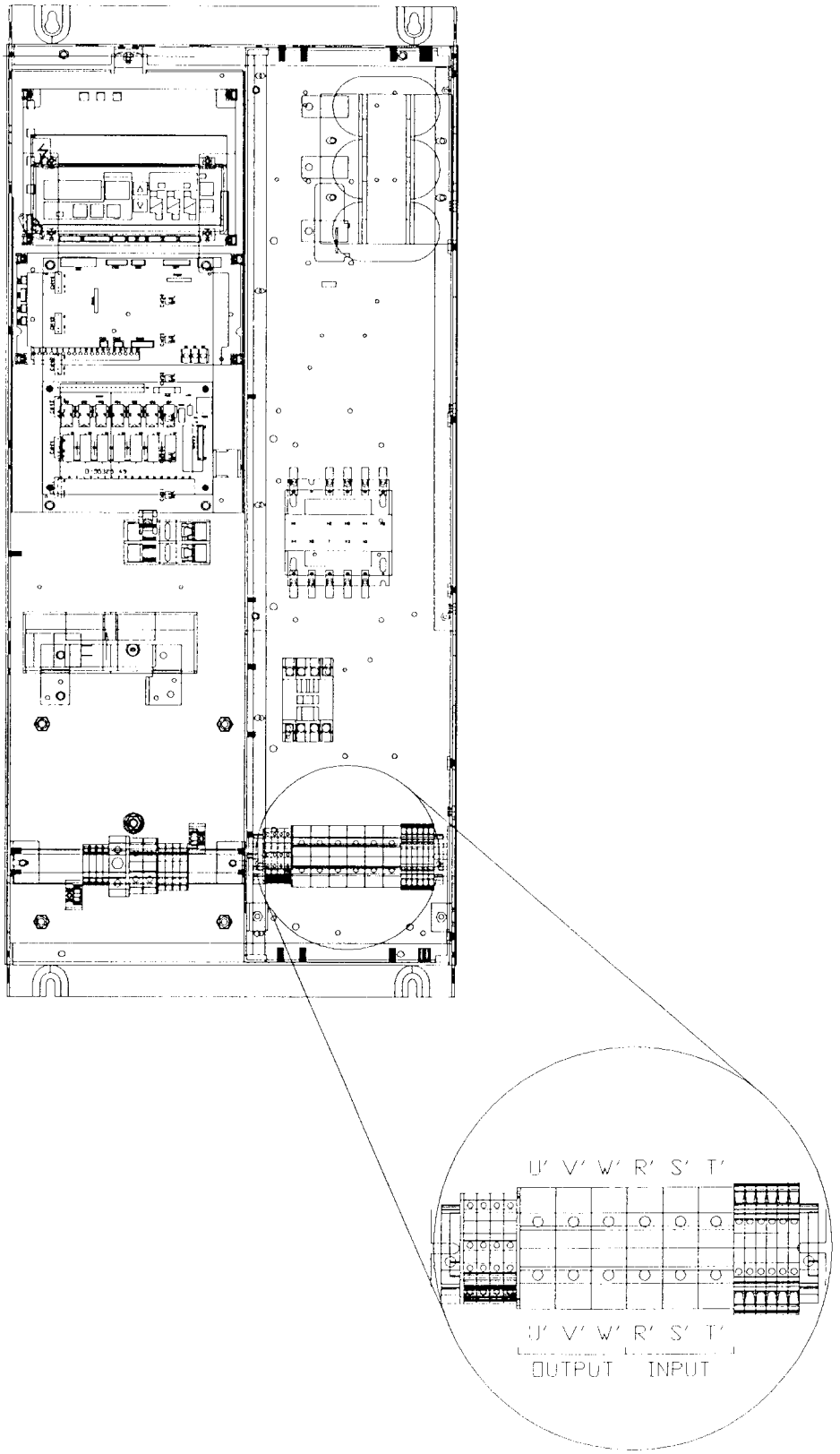


Figure 3-3. Typical Input/Output Power Wiring Locations.

Install Control and Signal Wiring (if used)

Size and install all wiring in conformance with the NEC/CEC and all other applicable local codes. See Table 3-3 for recommended wire sizes.

1. For 24 VDC control and signal wiring, use twisted wire having two to three twists per inch. If you use shielded twisted pair wire rather than twisted wire, the shields should not attach to any ground point; they should "float."

   Note: All customer interlocks shall be suitable for operation with 24-volt, 2 milliamp signals (standard contacts).

2. For distances of less than 150 feet, use a minimum of #22 AWG. For distances of more than 150 feet and less than 300 feet, use a minimum of #16 AWG. For distances of more than 300 feet, contact your Reliance Electric Sales Office.

WARNING

THE FACTORY-INSTALLED JUMPER ACROSS TERMINALS 11A AND 12A MUST BE REMOVED WHEN FUNCTION LOSS INPUT, COAST-STOP PUSHBUTTON, OR INTERLOCKS ARE USED SO THESE CONTACTS WILL OPEN TO STOP THE CONTROLLER. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

3. Route user-supplied interlock and function loss input wiring (if used) through the conduit opening labelled 24 VDC in the bottom of the controller. Remove the factory-installed jumper across terminals 11A and 12A. Refer to Figure 3-8.

WARNING

GP2000 CONTROLLERS WITHOUT THE OPTIONAL BYPASS MODIFICATION ARE NOT EQUIPPED WITH A COAST-STOP PUSHBUTTON. THE USER MUST INSTALL A HARDWIRED, OPERATOR - ACCESSIBLE PUSHBUTTON THAT PROVIDES A POSITIVE INTERRUPT AND SHUTS DOWN THE DRIVE. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

4. On GP2000 controllers without the optional Bypass modification, install a normally closed maintained pushbutton. A mushroom head type is recommended. Wire the pushbutton between terminals 11A and 12A on the terminal board. (Refer to Figure 3-9 for detail.) Route the wiring through the conduit opening labelled 24 VDC in the bottom of the controller. Remove the factory-installed jumper across terminals 11A and 12A.

5. Route external control wiring (if used) through openings indicated on Figure 3-2 in the bottom or top of the controller in separate steel conduit to eliminate electrical noise pick-up. The conduit can be rigid or flexible armored steel.

6. Do not route any signal wire through junction or terminal boxes that contain power or control wire.

7. Do not route any signal wire in close proximity to devices producing external magnetic fields.

8. The controller can be operated in one of four modes. See Table 3-5.

   Remote Auto Mode: Install the process signal wiring (if used) as indicated in Figure 3-5.

   Remote Manual Mode: Install the control signal wiring (if used) as indicated in Figure 3-6 or 3-7.

Table 3-5. GP2000 Operating Modes.

Mode	Control Interface	Speed Reference Means
Local Manual*	Keypad	Speed increment/decrement keys
Local Auto	Keypad	Process signal
Remote Manual	Terminal board	Speed pot connected to terminal board
Remote Auto	Terminal board	Process signal

* The controller is shipped with keypad functions selected to operate in Local Manual mode. In the startup procedure, the controller should be tested in this mode first before changing to other modes.

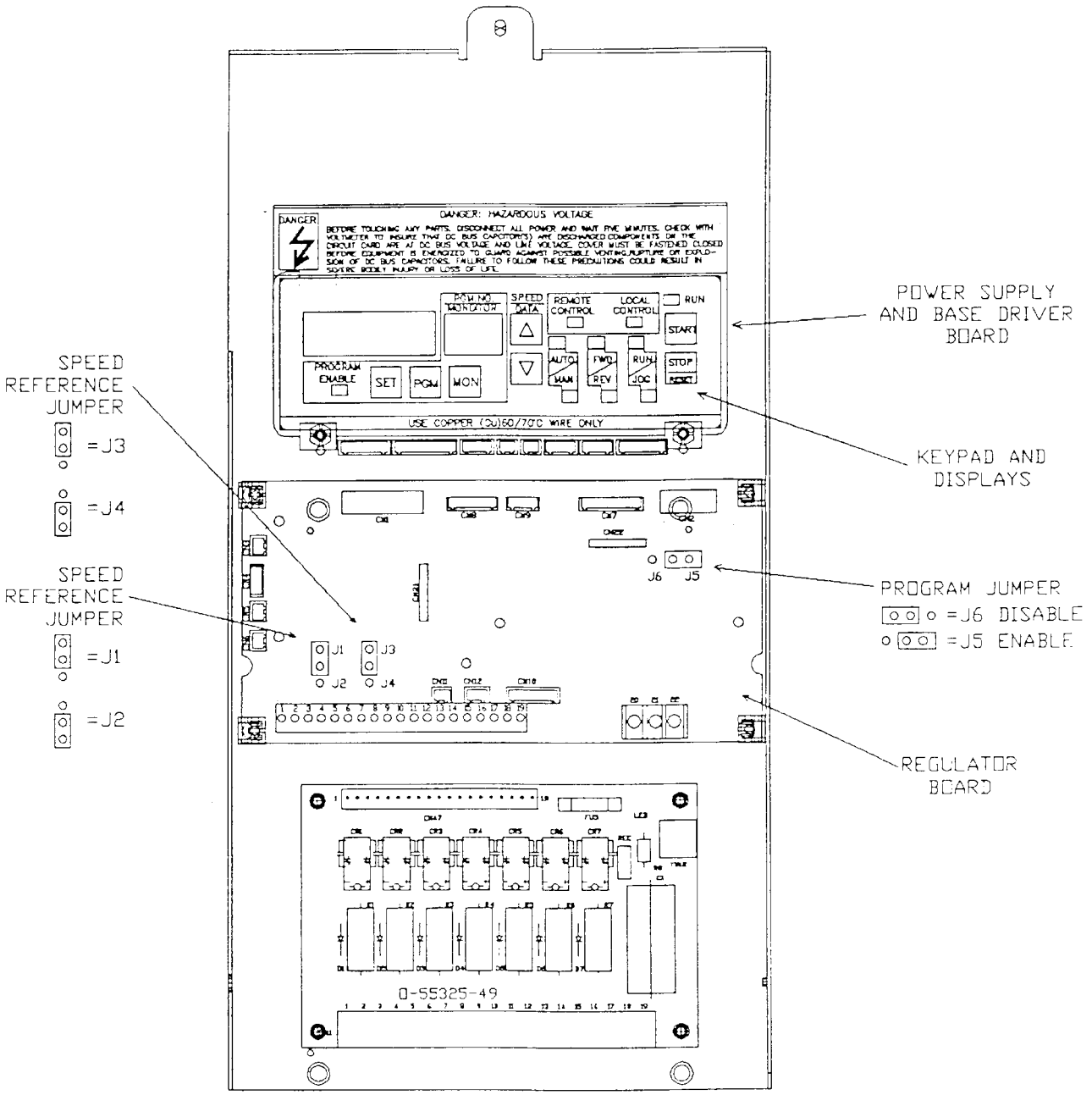
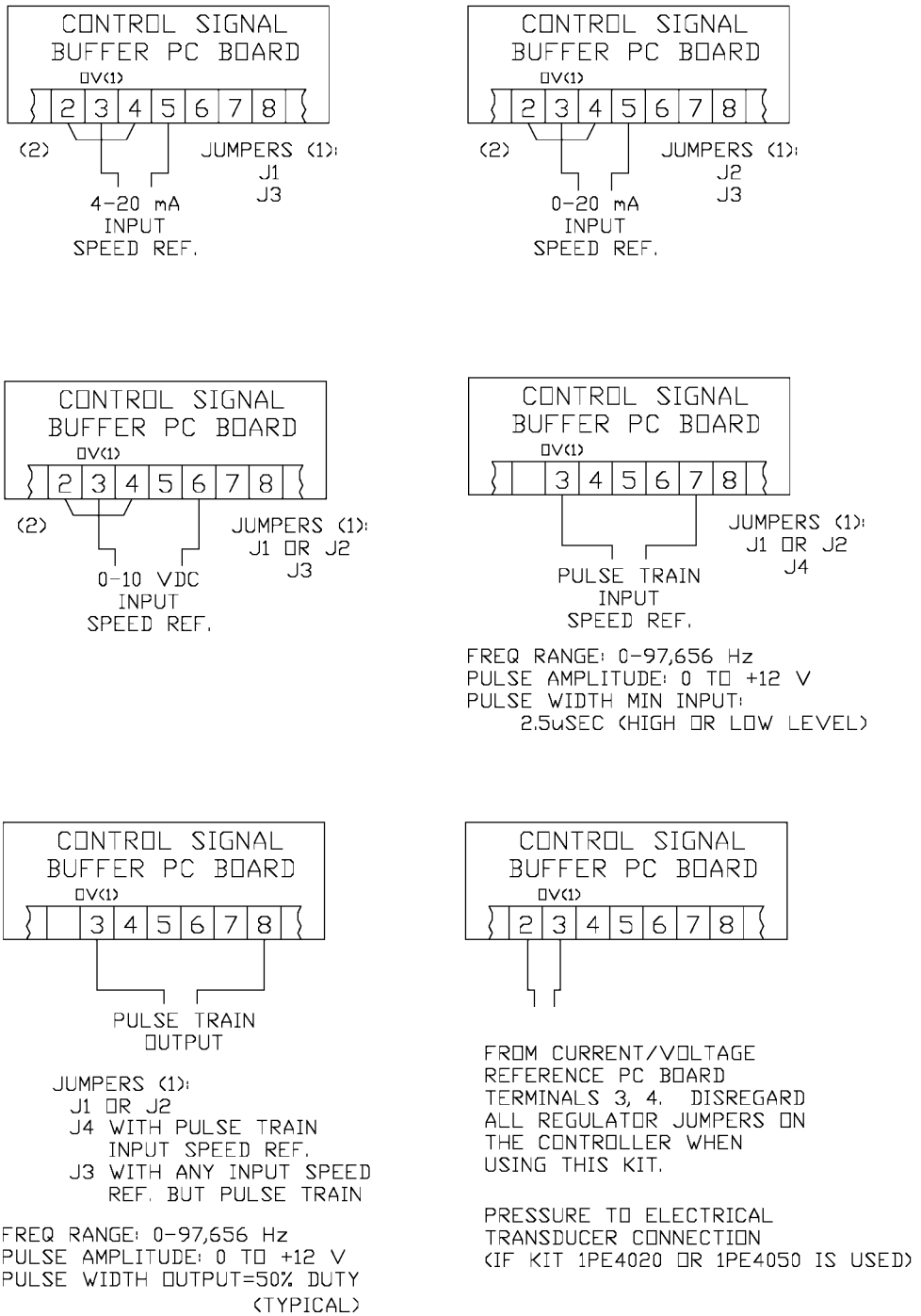


Figure 3-4. Speed Reference and Program Jumper Locations.

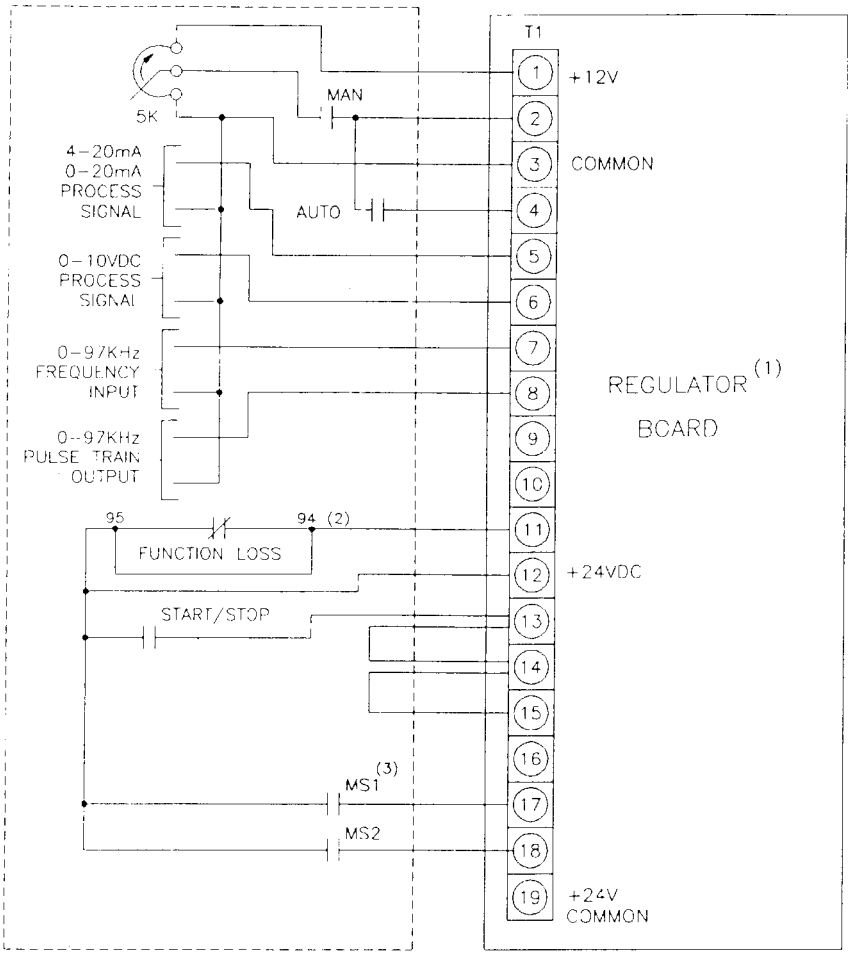


(1) SEE FIGURE 3-4 FOR LOCATION ON REGULATOR PC BOARD

(2) LOCAL AUTO MODE REQUIRES A JUMPER BETWEEN TERMINALS 2 AND 4 FOR ANALOG SPEED REFERENCE INPUTS.

(3) PLACEMENT OF JUMPERS J1 AND J2 DOES NOT AFFECT DRIVE OPERATION IN THIS CONFIGURATION.

Figure 3-5. Process Control Signal Connections.

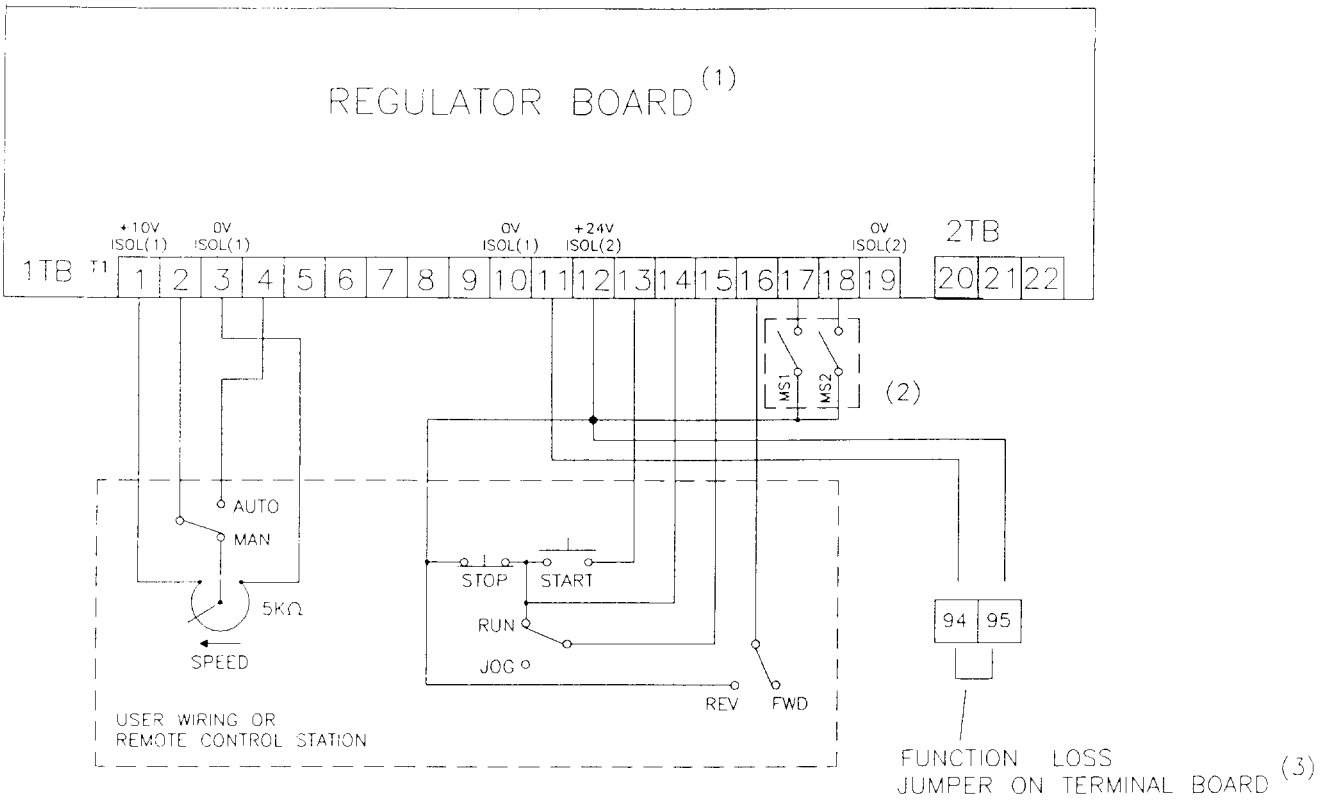


(1)
THE OPTIONAL CONTROL SIGNAL BUFFER CARD CAN BE INSTALLED. SEE INSTRUCTION MANUAL D2–3176.

(2)
WHEN USER–SUPPLIED FUNCTION LOSS INPUT, COAST–STOP PUSHBUTTON, OR INTERLOCKS ARE CONNECTED, REMOVE THE FACTORY–INSTALLED JUMPER BETWEEN TERMINALS 94 AND 95 IN ORDER FOR THESE CONTACTS TO BE OPERATIONAL. WHEN THESE CONTACTS OPEN, THE CONTROLLER STOPS ON AN IET AND THE MOTOR COASTS TO A REST. REFER TO FIGURE 3–8 FOR ACTUAL LOCATION OF JUMPER.

(3)
A THIRD PRESET SPEED, MS3, IS ENABLED WHEN BOTH MS1 AND MS2 CONTACTS ARE CLOSED. WHEN PARAMETER 1 IS SELECTED IN FUNCTION 57, THE SAME TERMINALS, 17 AND 18 ARE USED FOR THE STATIC MOP FUNCTION, AND NOT THE MULTI–SPEED PRESET FUNCTION.

Figure 3-6. Typical Remote/2-Wire (Single Contact Start/Stop Wiring).

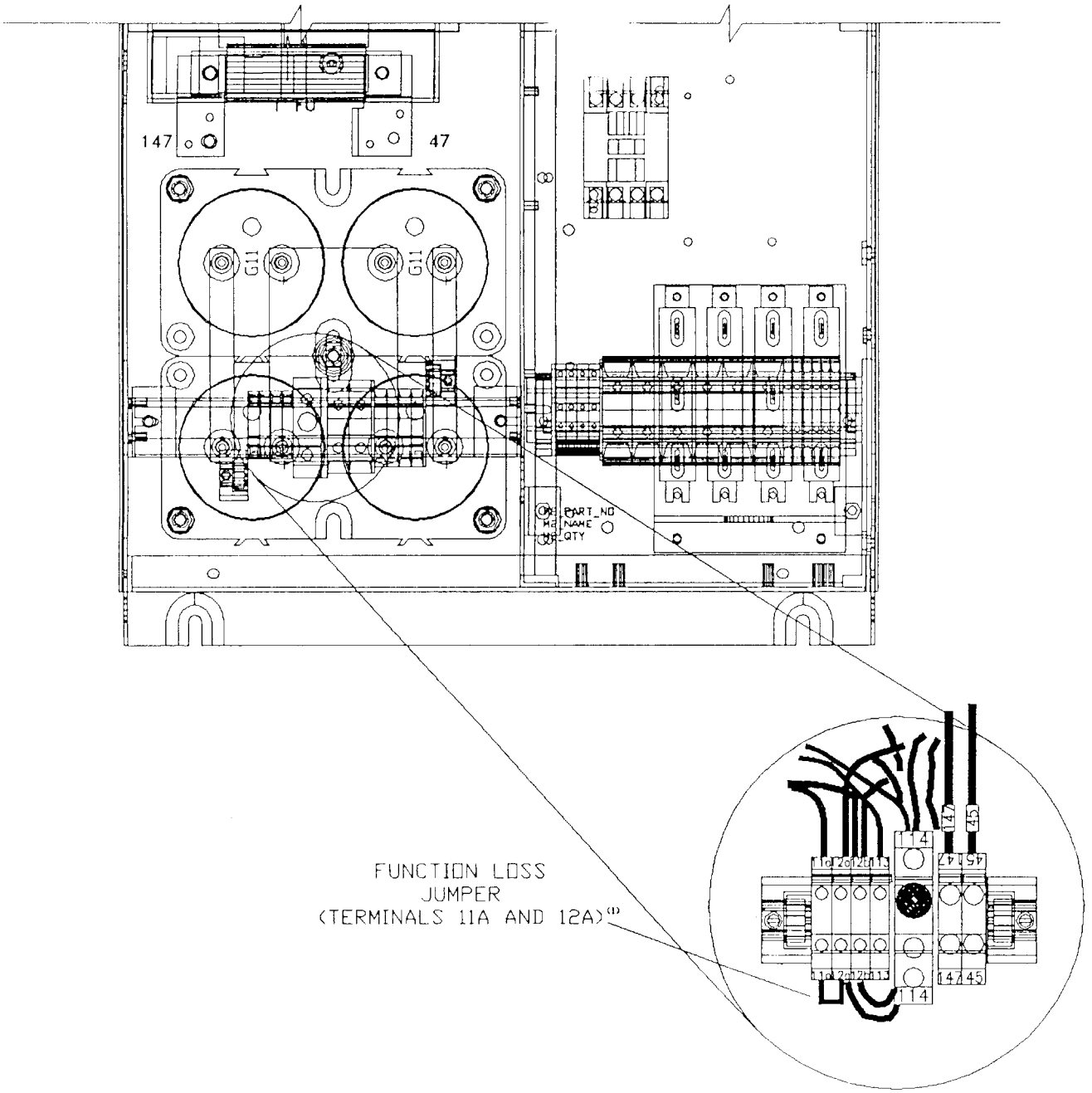


(1) THE OPTIONAL CONTROL SIGNAL BUFFER CARD CAN BE INSTALLED. SEE INSTRUCTION MANUAL D2-3176.

(2) A THIRD PRESET SPEED, MS3, IS ENABLED WHEN BOTH MS1 AND MS2 CONTACTS ARE CLOSED.

(3) WHEN USER-SUPPLIED FUNCTION LOSS INPUT, COAST-STOP PUSHBUTTON, OR INTERLOCKS ARE CONNECTED, REMOVE THE FACTORY-INSTALLED JUMPER BETWEEN TERMINALS 94 AND 95 IN ORDER FOR THESE CONTACTS TO BE OPERATIONAL. WHEN THESE CONTACTS OPEN, THE CONTROLLER STOPS ON AN IET AND THE MOTOR COASTS TO A REST. REFER TO FIGURE 3-8 FOR ACTUAL LOCATION OF JUMPER AND TERMINAL BOARD.

Figure 3-7. Typical Remote, (3-Wire Control) Operator Wiring.



(1) When user-supplied function loss input, coast-stop pushbutton, or interlocks are connected, remove the factory-installed jumper between terminals 11A and 12A on the terminal block in order for these contacts to be operational. When these contacts open, the controller stops on an IET and the motor coasts to rest.

Figure 3-8. Function Loss Jumper Location.

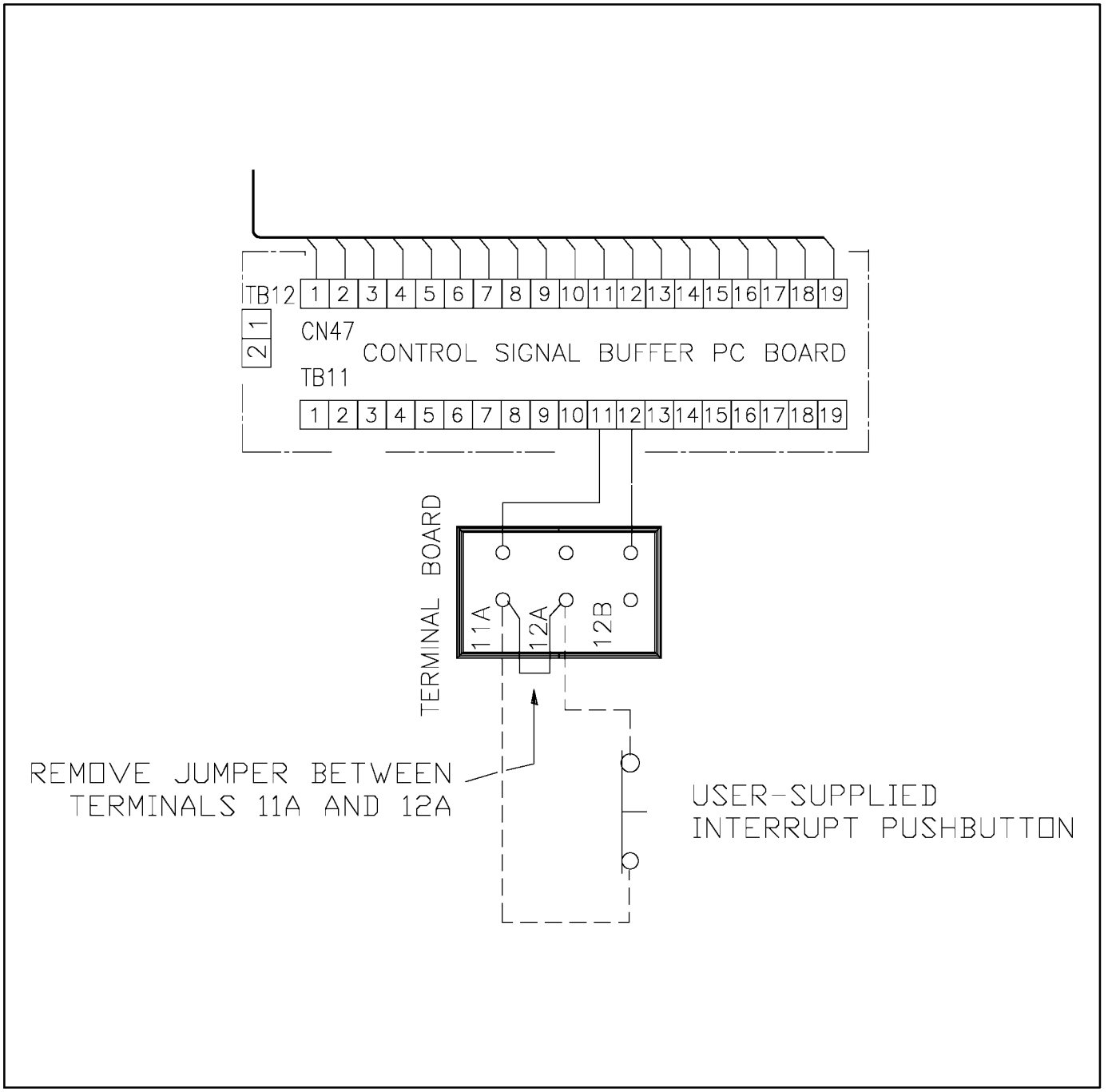


Figure 3-9. User-supplied Interrupt Wiring (GP2000 without Bypass).

Optional Remote Meter Interface Card

The optional Remote Meter Interface Card (RMI) has three isolated analog interface circuits for monitoring the controller frequency, voltage, and current. Each interface circuit is composed of an opto-coupler and an active filter. The output capacity of each interface circuit is 1 mA at 10 VDC.

The monitor signals for the controller output frequency and voltage are generated through calculation without actual measuring. The signal for the controller output current is generated through actual measurement. These three signals are always provided, regardless of the keypad monitor display.

When the controller output frequency reaches the overfrequency limit, the output at terminal 31 is 10 VDC.

When the controller output voltage is 506 VAC, the ouput at terminal 32 is 10 VDC for the controller input rating of 460 VAC. When the controller output current is 200% rated current, the output at terminal 33 is 10 VDC. See Figure 3-10. Terminal 34 is the common (OVI1) for these signals. See Figure 3-11 for the location of terminal board T3 and other card components.

These monitor signals are normally used for remote analog meters or the Remote Digital Meter kit (Model 3DM4000), which has an analog to digital converter.

The Remote Meter Interface Card also has three output contacts: Run Relay, Output Relay 1, and Output Relay 2. The Run Relay is energized while the controller is in the Run mode. Output Relay 1 is energized depending on the selection of Function 28, and Output Relay 2 is energized depending on the selection of Function 29. Functions 28, 29, 33, 34, and 35 are available only when the Remote Digital Meter Card is installed. See Section 5 of this instruction manual for detailed descriptions of these functions.

The Run Relay and Output Relay 2 have normally open contacts. Output Relay 1 has a Form C contact (1NO/1NC). The contact ratings are 1 ampere at 250 VDC and 2 amperes at 30 VDC. Figure 3-12 is a circuit diagram of the Remote Meter Interface Card.

When installing wiring for remote meters or customer sequence circuits, route the wiring through either of the control or signal conduit openings in the bottom or top of the controller. Do not allow the wires to come in contact with uninsulated components.

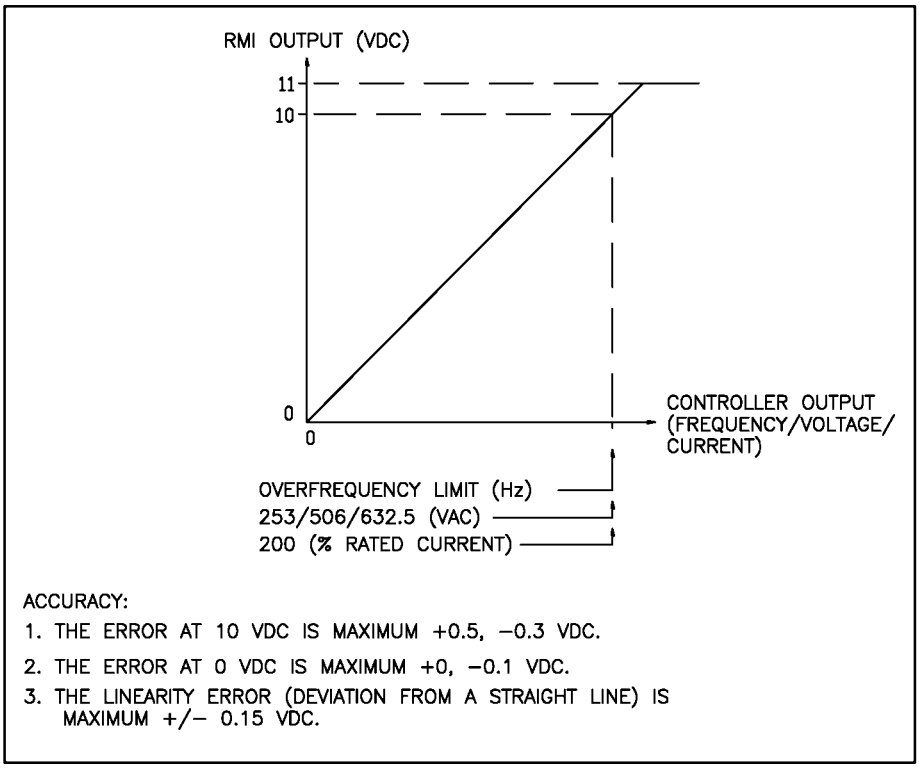
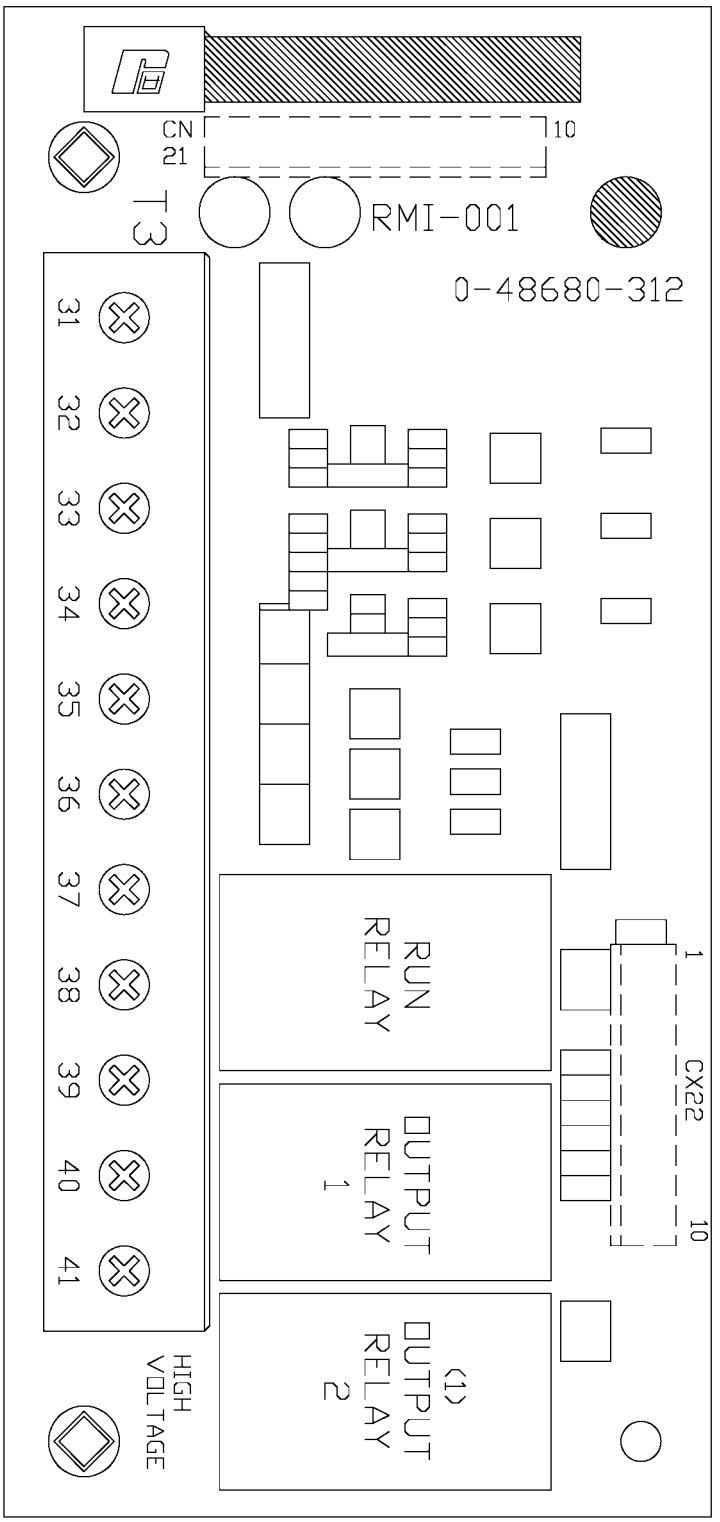


Figure 3-10. Optional Remote Meter Interface Card Output Characteristics.



(1) Output relays 1 and 2 are programmed using Functions 28 and 29. See Section 5 of this manual for details.

Figure 3-11. Optional Remote Meter Interface Card Components.

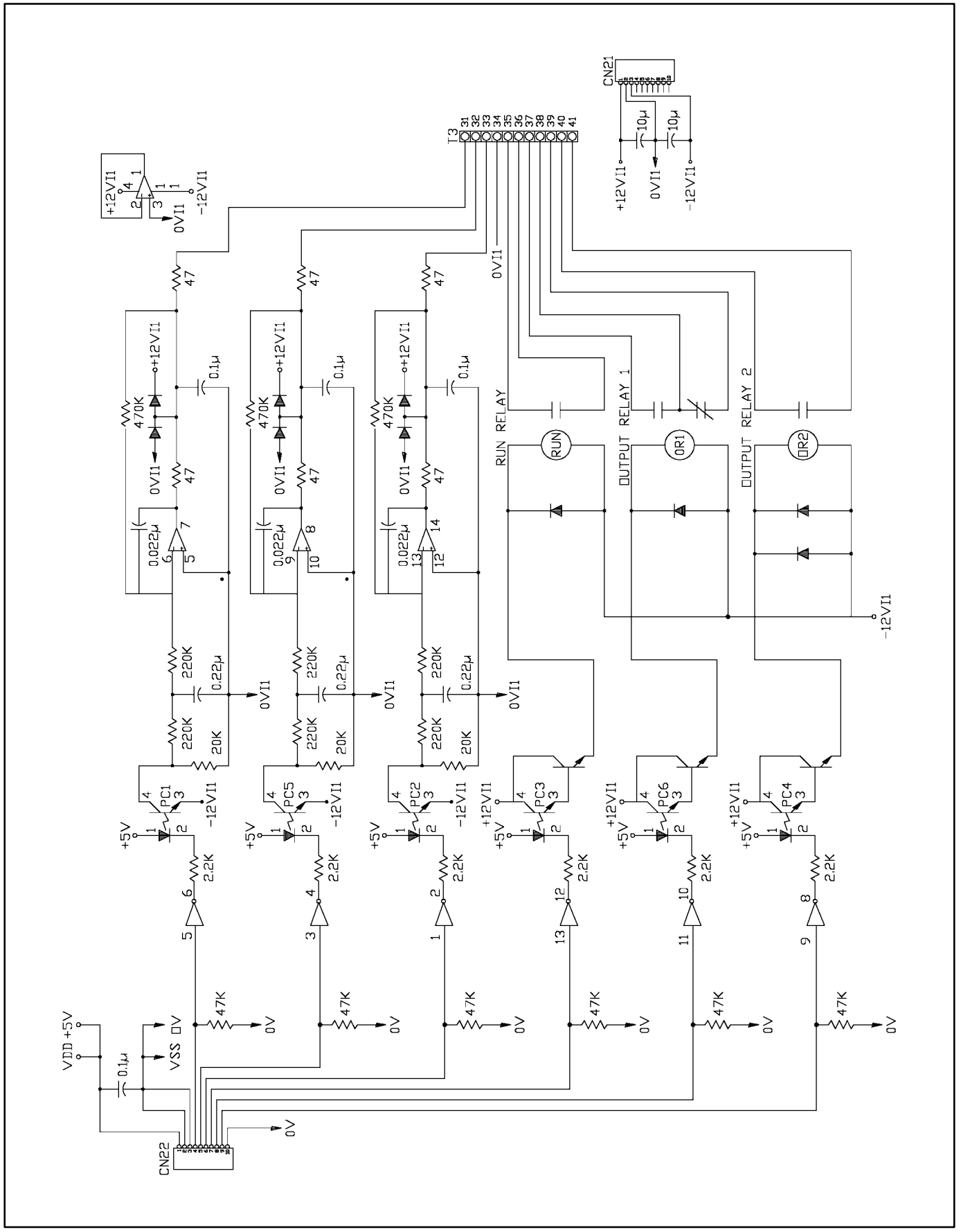


Figure 3-12. Optional Remote Meter Interface Card Circuit Diagram.

4: Start the Drive

DANGER

ONLY QUALIFIED ELECTRICAL PERSONNEL FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF THIS EQUIPMENT AND THE HAZARDS INVOLVED SHOULD START AND ADJUST IT. READ AND UNDERSTAND THIS MANUAL IN ITS ENTIRETY BEFORE PROCEEDING. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

Test Equipment Needed

CAUTION: Do not use a Megger to perform continuity checks in the drive equipment. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

For controller output measurements of voltage, amperage, and frequency as applied to the motor power leads, the 4-digit display on the controller keypad is satisfactory. For all other voltage, amperage, and ohmic measurements, an analog or digital volt-ohmmeter is required. Make certain the selected volt-ohmmeter is rated for the intended measurement values.

Although not required for controller startup and adjustments, the best method of obtaining actual motor voltage, current, and speed measurements is with a fundamental voltmeter, digital clamp-on ammeter, and a hand-held tachometer, respectively.

Check the Installation

DANGER

THIS EQUIPMENT IS AT LINE VOLTAGE WHEN A-C POWER IS CONNECTED TO THE CONTROLLER. DISCONNECT ALL UNGROUNDED CONDUCTORS OF THE A-C POWER LINE FROM THE CONTROLLER. AFTER POWER IS REMOVED, VERIFY WITH A VOLTMETER AT TERMINALS 147(+) AND 45(−) THAT THE D-C BUS CAPACITOR(S) IS DISCHARGED BEFORE TOUCHING ANY INTERNAL PARTS OF THE CONTROLLER. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

1. Make sure the upstream, external input disconnect is in the OFF position (power OFF).
2. Make sure the drive shutdown interlocks installed around the driven machine are operational. When activated, they should shut down the drive.

WARNING

GP2000 CONTROLLERS WITHOUT THE OPTIONAL BYPASS MODIFICATION ARE NOT EQUIPPED WITH A COAST-STOP PUSHBUTTON. THE USER MUST INSTALL A HARDWIRED, OPERATOR-ACCESSIBLE PUSHBUTTON THAT PROVIDES A POSITIVE INTERRUPT AND SHUTS DOWN THE DRIVE. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

3. On GP2000 controllers without the optional Bypass modification, make sure that the user-installed interrupt pushbutton is operational. When pushed, it should shut down the drive. The factory-installed jumper between terminals 11A and 12A must be removed for this device to work as required.

CAUTION: Make sure electrical commons are not intermixed in the controller. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

Check the Controller and Enclosure

1. Remove the controller enclosure cover, if not already removed.
2. Look for physical damage, remaining installation debris, wire strands, etc.
3. Use clean, dry, low pressure air (below 25 psi) for removing debris from the controller.
4. Check that there is adequate clearance around the controller for air flow.
5. Check that the controller is wired correctly. See Figure 3-3 (Input/Output), Figure 3-4 (Speed Reference), and/or Figures 3-6 or 3-7 (Remote Control).

WARNING

THE FACTORY-INSTALLED JUMPER ACROSS TERMINALS 11A AND 12A MUST BE REMOVED WHEN FUNCTION LOSS INPUT, COAST-STOP PUSHBUTTON, OR INTERLOCKS ARE USED SO THESE CONTACTS WILL OPEN TO STOP THE CONTROLLER. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

6. When a motor overload device and/or user-supplied interlocks or function loss devices are installed, make sure the factory-installed jumper across terminals 11A and 12A is removed. See Figure 3-8.
7. Check that all control and power terminal connections are tight. (See Table 3-4 for input and output power terminal tightening torques.)
8. Check that user-supplied upstream, branch circuit protection fuses are in place and seated in the fuseholders. Verify that the fuses are correctly rated for the controller. Refer to Table 2-2 for controller ratings and Table 3-2 for fuse ratings.
9. Using a voltmeter, check that rated power is available on the incoming line side of the upstream, external input disconnect.

CAUTION: Line voltage must correspond to controller rating. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

Check the Motor

1. Verify that motor nameplate data corresponds to the controller output ratings:
   - Voltage: Three-phase. If the motor has dual voltage capability, verify that it is connected for the voltage corresponding to the maximum controller output voltage rating.
   - Current: Verify that full-load current does not exceed the controller output current rating. If the motor is overframed, verify that the motor operating current does not exceed the controller's rated current and the motor horsepower rating is not more than one size larger than the controller's horsepower rating.
   - Frequency: 60 or 50 hertz or other frequency consistent with the controller output frequency.

   For synchronous motor applications, consult your Reliance Electric Sales Office.
2. Check that the motor is installed according to the motor instruction manual.
3. Disconnect any power factor correction capacitors connected to the motor.
4. If possible, uncouple the motor from the driven machinery.
5. Manually rotate the motor shaft to check that the motor is free from any binding or mechanical load problem.
6. Check that no loose items, such as shaft keys, couplings, etc., are present.
7. Check all connections for tightness and proper insulation.
8. Check that any motor thermal switch or overload device is wired to the controller correctly and that the proper heater elements are installed in the overload relay to protect the motor. Tables 4-1 and 4-2 list the data needed to select or replace the correct overload heaters. Use Table 4-1 to select the proper heater size. Table 4-2 shows the heater sizes shipped with the controller from the factory.

Table 4-1. Motor Overload Heater Selection for Use with GP2000 (Ambient Compensated).

	Full Load Motor Current (Amps)	
Catalog Number	**Min**	**Max**
FH20	1.35	1.47
FH23	1.79	1.95
FH27	2.59	2.83
FH29	3.12	3.42
FH30	3.43	3.73
FH31	3.74	4.07
FH33	4.40	4.87
FH36	5.4	5.9
FH37	6.5	7.1
FH38	7.2	7.8
FH40	8.6	9.4
FH41	9.5	10.3
FH42	10.4	11.3
FH45	13.6	14.9
FH46	15.0	16.3
FH47	16.4	18.0
FH49	19.9	21.7
FH50	21.8	23.9
FH52	24.0	26.2
FH78	33.6	37.5
FH79	37.6	41.5
FH82	51.0	55.0
FH83	56.0	61.0
FH84	62.0	66.0

Table 4.2 Standard Overload Heaters Used with the Motor Overload Kit (Heater Installed in Controller).

HP	Description	Quantity	Reliance Part
	Overload Heater (Model 1ML2010)		
1	FH30	3	701815−10AE
2	FH37	3	701815−10AM
3	FH41	3	701815−10AR
5	FH46	3	701815−10AW
7.5	FH50	3	701815−10BC
10	FH52	3	701815−10BE
	Overload Heater (Model 1ML4020)		
1	FH23	3	701815−10W
2	FH29	3	701815−10AD
3	FH33	3	701815−10AH
5	FH38	3	701815−10AN
7.5	FH42	3	701815−10AS
10	FH45	3	701815−10AV
15	FH49	3	701815−10AZ
20	FH52	3	701815−10BE
	Overload Heater (Model 1ML4050)		
25	FH78	3	701815−10BT
30	FH79	3	701815−10BU
40	FH82	3	701815−10BX
50	FH84	3	701815−10BZ

CAUTION: Overload heaters must be sized based on the motor's continuous current rating. Failure to install properly sized heaters may result in damage to, or destruction of the motor and equipment.

Check the Transformer (if used)

1. Check that the rating of the transformer (if used) matches the controller requirements. Refer to "Install a Transformer" in Section 3.
2. Check that the transformer is connected for the proper voltages.

Check the Grounding

DANGER

THE USER IS RESPONSIBLE TO MEET ALL CODE REQUIREMENTS WITH RESPECT TO GROUNDING ALL EQUIPMENT. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

1. Verify that a properly sized ground wire is installed between the controller ground terminal and a suitable earth ground. Verify the connections are tight.
2. With an ohmmeter, check for and eliminate any grounds between the input power leads to the controller ground terminal and between the output power leads to the controller ground terminal.
3. Verify that a properly sized ground wire is installed between the motor frame and a suitable earth ground and that the connections are tight.
4. With an ohmmeter, check for and eliminate any grounds between the motor frame and the motor power leads.
5. Verify that a properly sized ground wire is installed between the Remote Control Station (if used) and a suitable earth ground and that the connections are tight.
6. Verify that a properly sized ground wire is installed between the transformer (if used) and a suitable earth ground and that the connections are tight.
7. Verify the above ground wires are run **unbroken**.

Start the Controller – GP2000 Without Optional Bypass Modification

In most cases, the following startup procedure will successfully start and run the controller. This procedure requires the controller to be controlled locally from the keypad (Local Control). Reconfiguring the controller programmable functions is not necessary.

1. Follow all "Check the Installation" procedures if not already performed.
2. Make sure all power is OFF.
3. Set a voltmeter on the 1000 VDC or similar high voltage scale. Connect the voltmeter to terminals 147(+) and 45(−). Read this voltmeter every time you turn power OFF to verify that the D-C bus capacitor(s) is fully discharged. Within one minute after power is OFF, the bus voltage should measure 50 VDC or less.
4. If the controller has been stored for less than six months, proceed to Step 5. If the controller has been stored for over six months, form the capacitor(s) as follows:

DANGER

THE REMAINING STEPS TO FORM THE CAPACITOR(S) ARE MADE WITH POWER ON. EXERCISE EXTREME CARE BECAUSE HAZARDOUS VOLTAGE EXISTS. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

- Disconnect the motor leads from the controller, if connected.
- Turn the power ON.

  Note: When the power is turned ON for the first time, the 2-digit display will be blank and the 4-digit display will show SELF for approximately 1 second while the controller performs a self-diagnostic test. At the end of a successful test, the 4-digit display will show 5.0. At the end of an unsuccessful test, the 2-digit display will show a hexadecimal number and the 4-digit display will continue to show SELF. Refer to Troubleshoot the Controller if this condition exists.
- Observe that the voltmeter reading is the no load D-C bus voltage value with respect to the A-C input voltage. (See Table 4-3.)
- Let the controller sit undisturbed for fifteen minutes while the capacitor(s) form. **Put a tag on the controller that power is ON and hazardous voltage exists.**
- Turn the power OFF. Verify the D-C bus voltage is zero (read the voltmeter).

5. With the power OFF, connect the motor leads to the controller, if disconnected. **Uncouple the driven equipment from the motor, if possible.**

DANGER

THE REMAINING STEPS ARE MADE WITH POWER ON. EXERCISE EXTREME CARE BECAUSE HAZARDOUS VOLTAGE EXISTS. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

6. Turn the power ON. Observe that the voltmeter reading is the no load D-C bus voltage value listed in Table 4-3.

   Note: When the power is turned ON for the first time, the 2-digit display will be blank and the 4-digit display will show SELF for approximately 1 second while the controller performs a self-diagnostic test.

   At the end of a successful test, the 4-digit display will show 5.0. The following (red) LEDs will light: Local Control, RUN, FWD, and MAN.

   At the end of an unsuccessful test, the 2-digit display will show a hexadecimal number and the 4-digit display will continue to show SELF. Refer to Troubleshoot the Controller if this condition exists.

7. Verify that the following controls are selected (The red LED of each selected control key will be lit.):
   RUN
   FWD
   MAN

Table 4-3. D-C Bus Voltage Value.

A-C Input Line Voltage	Typical D-C Voltage between 147(+) and 45(−)	
	No Load in Stop Mode	Full Load in Run Mode
230 VAC	325 VDC	310 VDC
460 VAC	649 VDC	621 VDC
380 VAC	537 VDC	512 VDC
575 VAC	811 VDC	776 VDC

8. Press the START key. The green RUN LED will light, indicating the controller is in the Run mode. The controller will ramp to the preset output Hz. The 4-digit display will show the output Hz setting (The controller is shipped with minimum Hz factory set at 5 Hz.); the 2-digit display will be blank.

WARNING

THIS DRIVE IS INTENDED TO OPERATE AT A PREDETERMINED MINIMUM SPEED UNLESS DISCONNECTED FROM THE POWER SOURCE. IF THE APPLICATION REQUIRES ZERO SPEED OPERATION WITHOUT SUCH DISCONNECTION, THE USER IS RESPONSIBLE FOR ASSURING SAFE CONDITIONS FOR OPERATING PERSONNEL BY PROVIDING SUITABLE GUARDS, AUDIBLE OR VISUAL ALARMS, OR OTHER DEVICES. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

   Note: If the motor does not rotate, press the ▲ key to increase the output Hz enough to start motor shaft rotation.

9. While the controller is in the Run mode, you can monitor the output frequency, the output voltage, and the percentage of fullload amps of the controller. Press the MON key and watch the displays. The 2-digit display shows which output is being monitored: H for frequency, U for voltage, and PA for percentage of controller full-load amps. The 4-digit display shows the actual value of output frequency, voltage, or percentage amperage. The display scrolls to the next output reading each time the MON key is pressed. You can also monitor RPM, if necessary. Refer to Functions 46, 47, and 48.

   Note: To see the set frequency, press the ▲ or ▼ key one time. The 4-digit display will now show the set frequency and the 2-digit display will be blank. If AUTO or Remote Control is selected, the set frequency will be displayed when pressing the ▲ or ▼ key one time. In this case, the display will be showing the set frequency that is equal to the speed reference input.

10. Verify the direction of shaft rotation. Then press the STOP key to initiate the Stop mode. The 4-digit display will show the changing values of the output being monitored at the time the STOP key is pressed.

11. If the direction of shaft rotation is incorrect, change it as follows:
    - Press the STOP key and wait until the motor has completely stopped.
    - Turn the power OFF.

DANGER

THIS EQUIPMENT IS AT LINE VOLTAGE WHEN A-C POWER IS CONNECTED TO THE CONTROLLER. DISCONNECT ALL UNGROUNDED CONDUCTORS OF THE A-C POWER LINE FROM THE CONTROLLER. AFTER POWER IS REMOVED, VERIFY WITH A VOLTMETER AT TERMINALS 147(+) AND 45(−) THAT THE D-C BUS CAPACITOR(S) IS DISCHARGED BEFORE TOUCHING ANY INTERNAL PARTS OF THE CONTROLLER. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

- After verifying the D-C bus voltage is zero, reverse any two of the three motor power leads (U', V', or W').

12. Turn the power ON and press the START key.

    The speed of the A-C induction motor shaft varies with the controller output Hz. (See Section 6 for a description of controller fundamentals.) Changing the output Hz setting is similar to changing the position of a speed pot with analog controllers. Pressing the ▲ or ▼ keys will change the output Hz settings; then, pressing the SET key will lock in the values. The SET key is needed to lock in the new values. The output Hz setting may be changed while either in the Run mode or Stop mode using the ▲, ▼, and SET keys.

WARNING

UPON STARTUP, THE CONTROLLER WILL RETURN TO THE PREVIOUS SET SPEED. THE USER IS RESPONSIBLE FOR ENSURING THAT DRIVEN MACHINERY, ALL DRIVE-TRAIN MECHANISMS, AND PROCESS LINE MATERIAL ARE CAPABLE OF SAFE OPERATION AT A SPEED EQUIVALENT TO AT LEAST THAT WHICH WOULD RESULT FROM AN APPLIED FREQUENCY OF 20% ABOVE THE OVERFREQUENCY LIMIT (FUNCTION 38/FACTORY PRESET 90 HZ; MAXIMUM VALUE 405 HZ). FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

When changing the speed setting while in the Run mode, the SET key is not needed as long as power is not removed from the controller. If power is removed from the controller, upon startup the controller will return to the previous set speed. The 4-digit display will show the set speed in Hz and the 2-digit display will be blank.

Using the ▲ key or ▼ key, change the output Hz settings and run the motor without any load across the speed range. (The controller is shipped with the speed range factory set at 5.0 to 60 Hz.)

Note: If the application requires the minimum and maximum Hz settings to be changed, see Functions 3, 4, 38, and 43 in Section 5. In order to set or change any parameters, it is necessary to execute this from the STOP mode.

13. If the motor is unloaded and does not operate satisfactorily, go to Section 7; otherwise, go to Step 14.

14. Press the STOP key. Wait for the motor to completely stop. Turn the power OFF.

DANGER

THIS EQUIPMENT IS AT LINE VOLTAGE WHEN A-C POWER IS CONNECTED TO THE CONTROLLER. DISCONNECT ALL UNGROUNDED CONDUCTORS OF THE A-C POWER LINE FROM THE CONTROLLER. AFTER POWER IS REMOVED, VERIFY WITH A VOLTMETER AT TERMINALS 147(+) AND 45(−) THAT THE D-C BUS CAPACITOR(S) IS DISCHARGED BEFORE TOUCHING ANY INTERNAL PARTS OF THE CONTROLLER. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

15. Couple the driven equipment to the motor, if not already coupled.
16. With the power ON, start the controller by pressing the START key.
17. Run the drive across the speed range under load. If the motor does not rotate at minimum speed, increase manual torque boost until this occurs. (See Section 5, Function 7: Manual Torque Boost.)
18. Press the STOP key. If the controller is intended for use in Manual mode only, go to Step 24. If Remote mode is to be used, go to Step 19.
19. Turn the power OFF and verify that the D-C bus voltage is zero.

20. Connect a process signal as shown in Figure 3-7. If the optional Pressure-to-Electrical Transducer Kit (1PE4050, 1PE2025, 1PE3040) is used, install this kit according to Instruction Sheet D2-3175. Install all other customer wiring according to Figure 3-6 or 3-7.
21. Turn the power ON. Set the AUTO/MANUAL switch on the keypad to AUTO.
22. Select Function 0 and change the setting to "1" for "Remote Control, Terminal Strip." When the controller is started by a remote contact, it will now follow a process control signal.

WARNING

THE DRIVE MAY RESTART AUTOMATICALLY WITH THE AUTO-RESET ENABLED (FUNCTION 40, PARAMETER 1). ATTACH A WARNING TAG TO THE APPROPRIATE DRIVEN EQUIPMENT. BEFORE WORKING ON THIS EQUIPMENT, BE SURE THAT POWER IS REMOVED AND LOCKED OUT FROM THE DRIVE. FAILURE TO OBSERVE THIS PRECAUTION MAY RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

23. It Auto Reset (Restart) capability is desired, see Section 5, Function 40.
24. Turn the power OFF. After verifying the D-C bus voltage is zero, remove the voltmeter and any other instrumentation connected during startup.
25. Replace and secure the controller enclosure cover.

    If the drive operates satisfactorily, startup is complete.

    If the drive does not operate satisfactorily, go to Section 5. The factory set values of programmable functions, such as the following, may need to be adjusted:

    - local/remote operator control (Function 0)
    - minimum and maximum speed (Functions 3, 4, 38, and 43)
    - current limit (Function 5)
    - manual torque boost (Function 7)
    - base frequency (Function 11)
    - variable torque volts/hz curve selection (Function 23)
    - line-dip-ride-through (Function 27)
    - auto reset (Functions 40, 41, 42)

Start the Controller – GP2000 With Optional Bypass Modification

In most cases, the following startup procedure will successfully start and run the controller. This procedure requires the controller to be controlled locally from the keypad (Local Control). Reconfiguring the controller programmable functions is not necessary.

1. Follow all "Check the Installation" procedures if not already performed.
2. Make sure all power is OFF.
3. Set a voltmeter on the 1000 VDC or similar high voltage scale. Connect the voltmeter to terminals 147(+) and 45(−). Read this voltmeter every time you turn power OFF to verify that the D-C bus capacitor(s) is fully discharged. Within one minute after power is OFF, the bus voltage should measure 50 VDC or less. The red Bus Charge LED on the Power Supply board will gradually fade as the voltage decreases to zero.
4. If the controller has been stored for less than six months, proceed to Step 5. If the controller has been stored for over six months, form the capacitor(s) as follows:

DANGER

THE REMAINING STEPS TO FORM THE CAPACITOR(S) ARE MADE WITH POWER ON. EXERCISE EXTREME CARE BECAUSE HAZARDOUS VOLTAGE EXISTS. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

- Disconnect the motor leads from the controller, if connected.
- Turn the power ON.

  Note: When the power is turned ON for the first time, the 2-digit display will be blank and the 4-digit display will show SELF for approximately 1 second while the controller performs a self-diagnostic test. At the end of a successful test, the 4-digit display will show 5.0.

  At the end of an unsuccessful test, the 2-digit display will show a hexadecimal number and the 4-digit display will continue to show SELF. Refer to Troubleshoot the Controller if this condition exists.
- Observe that the voltmeter reading is the no load value with respect to the appropriate A-C input voltage listed in Table 4-3.
- Let the controller sit undisturbed for fifteen minutes while the capacitor(s) form. **Put a tag**

on the controller that power is ON and hazardous voltage exists.

- Turn the power OFF. Verify the D-C bus voltage is zero (read the voltmeter) and the Bus Charge LED has faded out.

5. With the power OFF, connect the motor leads to the controller, if disconnected. **Uncouple the driven equipment from the motor, if possible.**

DANGER

THE REMAINING STEPS ARE MADE WITH POWER ON. EXERCISE EXTREME CARE BECAUSE HAZARDOUS VOLTAGE EXISTS. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

6. Turn the power ON. Observe that the voltmeter reading is the no load value listed in Table 4-3.

   Note: When the power is turned ON for the first time, the 2-digit display will be blank and the 4-digit display will show SELF for approximately 1 second while the controller performs a self-diagnostic test.

   At the end of a successful test, the 4-digit display will show 5.0. The following (red) LEDs will light: Local Control, RUN, FWD, and MAN.

   At the end of an unsuccessful test, the 2-digit display will show a hexadecimal number and the 4-digit display will continue to show SELF. Refer to Troubleshoot the Controller if this condition exists.

7. Verify that the following controls are selected (The red LED of each selected control key will be lit.):
   RUN
   FWD
   MAN

8. Press the START key. The green RUN LED will light, indicating the controller is in the Run mode. The controller will ramp to the preset output Hz. The 4-digit display will show the output Hz setting (The controller is shipped with minimum Hz factory set at 5 Hz.); the 2-digit display will be blank.

WARNING

THIS DRIVE IS INTENDED TO OPERATE AT A PREDETERMINED MINIMUM SPEED UNLESS DISCONNECTED FROM THE POWER SOURCE. IF THE APPLICATION REQUIRES ZERO SPEED OPERATION WITHOUT SUCH DISCONNECTION, THE USER IS RESPONSIBLE FOR ASSURING SAFE CONDITIONS FOR OPERATING PERSONNEL BY PROVIDING SUITABLE GUARDS, AUDIBLE OR VISUAL ALARMS, OR OTHER DEVICES. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

   Note: If the motor does not rotate, press the ▲ key to increase the output Hz enough to start motor shaft rotation.

9. While the controller is in the Run mode, you can monitor the output frequency, the output voltage, and the percentage of fullload amps of the controller. Press the MON key and watch the displays. The 2-digit display shows which output is being monitored: H for frequency, U for voltage, and PA for percentage of controller full-load amps. The 4-digit display shows the actual value of output frequency, voltage, or percentage amperage. The display scrolls to the next output reading each time the MON key is pressed. You can also monitor RPM if necessary. Refer to Functions 46, 47, and 48.

   Note: To see the set frequency, press the ▲ or ▼ key one time. The 4-digit display will now show the set frequency and the 2-digit display will be blank. If AUTO or Remote Control is selected, the set frequency will be displayed when pressing the ▲ or ▼ key one time. In this case, the display will be showing the set frequency that is equal to the speed reference input.

10. Verify the direction of shaft rotation. Then press the STOP key to initiate the Stop mode. The 4-digit display will show the changing values of the output being monitored at the time the STOP key is pressed.

11. If the direction of shaft rotation is incorrect, change it as follows:
    - Press the STOP key and wait until the motor has completely stopped.
    - Turn the power OFF.

DANGER

THIS EQUIPMENT IS AT LINE VOLTAGE WHEN A-C POWER IS CONNECTED TO THE CONTROLLER. DISCONNECT ALL UNGROUNDED CONDUCTORS OF THE A-C POWER LINE FROM THE CONTROLLER. AFTER POWER IS REMOVED, VERIFY WITH A VOLTMETER AT TERMINALS 147(+) AND 45(−) THAT THE D-C BUS CAPACITOR(S) IS DISCHARGED BEFORE TOUCHING ANY INTERNAL PARTS OF THE CONTROLLER. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

- After verifying the D-C bus voltage is zero, reverse any

two of the three motor power leads (U', V', or W').

CAUTION: In order to assure proper motor rotation in inverter and bypass modes, the procedures in both Steps 11 and 12 should be followed. motor rotation in bypass must be the same as the rotation when in inverter forward direction. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

12. Perform the following additional procedure.
    - With the power off, switch to Bypass.
    - Turn the power ON.

    If the direction of shaft rotation is incorrect, do the following:
    - Press the STOP key and wait until the motor has completely stopped.
    - Turn the power OFF. Open the incoming power disconnect.

DANGER

THIS EQUIPMENT IS AT LINE VOLTAGE WHEN A-C POWER IS CONNECTED TO THE CONTROLLER. DISCONNECT ALL UNGROUNDED CONDUCTORS OF THE A-C POWER LINE FROM THE CONTROLLER. AFTER POWER IS REMOVED, VERIFY WITH A VOLTMETER AT TERMINALS 147(+) AND 45(−) THAT THE D-C BUS CAPACITOR(S) IS DISCHARGED BEFORE TOUCHING ANY INTERNAL PARTS OF THE CONTROLLER. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

DANGER

THE INVERTER DISCONNECT AND INVERTER ON/INVERTER OFF/BYPASS SWITCH MAY NOT ISOLATE ALL POWER IN THE CONTROLLER CABINET. REMOVE POWER BEFORE SERVICING THE EQUIPMENT. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

- After verifying that the D-C bus voltage is zero, reverse any two of the three incoming power leads (R', S', T'). Refer to Figure 4-1; or, for a more detailed wiring diagram, refer to Figure 6-4.

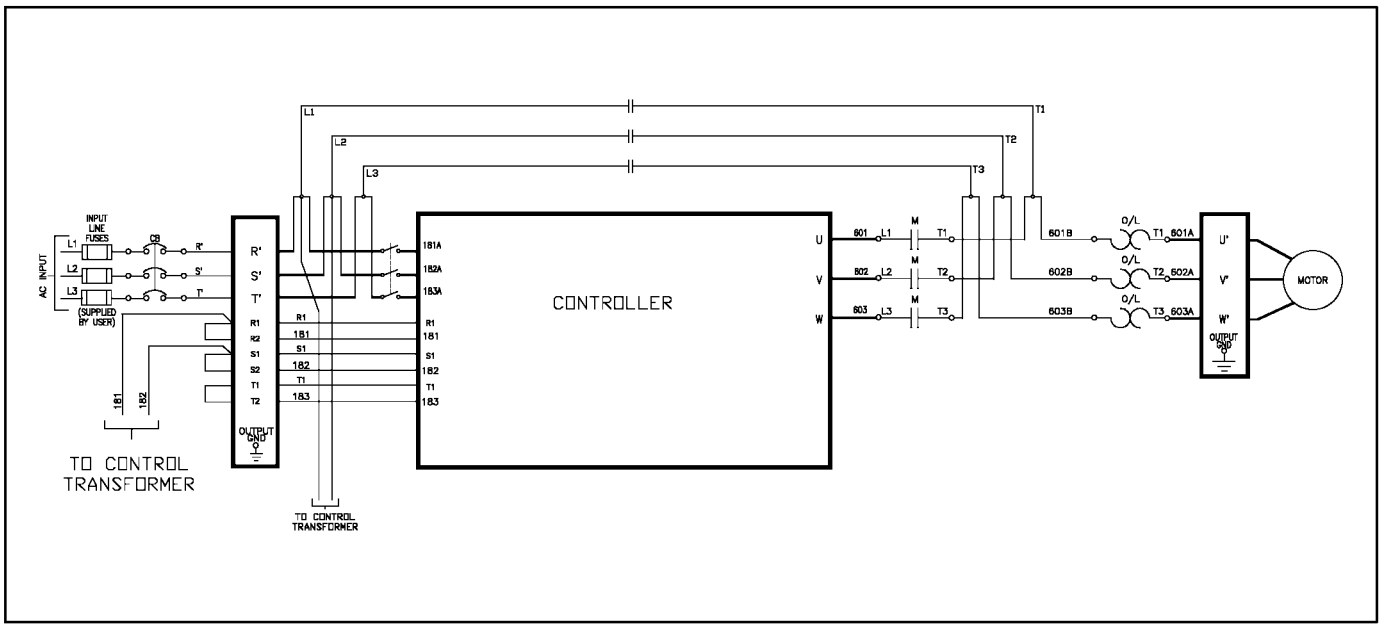


Figure 4-1. Typical Bypass Diagram

13. Close the incoming power disconnect. Turn the power ON and press the START key.

    The speed of the A-C induction motor shaft varies with the controller output Hz. (See Section 6 for a description of controller fundamentals.)

    Changing the output Hz setting is similar to changing the position of a speed pot with analog controllers. Pressing the ▲ or ▼ keys will change the output Hz settings; then, pressing the SET key will lock in the values. As long as power is not removed from the controller, the SET key is not needed to lock in the new values. The output Hz setting may be changed while either in the Run mode or Stop mode using the ▲, ▼, and SET keys. (When changing the speed

setting while in the Run mode, the SET key is not needed as long as power is not removed from the controller.) The 4-digit display will show the set speed in Hz and the 2-digit display will be blank.

Using the ▲ key or ▼ key, change the output Hz settings and run the motor without any load across the speed range. (The controller is shipped with the speed range factory set at 5.0 to 60 Hz.)

Note: If the application requires the minimum and maximum Hz settings to be changed, see Functions 3, 4, 38, and 43 in Section 5. In order to set or change any parameters, it is necessary to execute this from the STOP mode.

14. If the motor is unloaded and does not operate satisfactorily, go to Section 7; otherwise, go to Step 15.
15. Press the STOP key. Wait for the motor to completely stop. Turn the power OFF.

DANGER

THIS EQUIPMENT IS AT LINE VOLTAGE WHEN A-C POWER IS CONNECTED TO THE CONTROLLER. DISCONNECT ALL UNGROUNDED CONDUCTORS OF THE A-C POWER LINE FROM THE CONTROLLER. AFTER POWER IS REMOVED, VERIFY WITH A VOLTMETER AT TERMINALS 147(+) AND 45(−) THAT THE D-C BUS CAPACITOR(S) IS DISCHARGED BEFORE TOUCHING ANY INTERNAL PARTS OF THE CONTROLLER. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

16. Couple the driven equipment to the motor, if not already coupled.
17. With the power ON, start the controller by pressing the START key.
18. Run the drive across the speed range under load. If the motor does not rotate at minimum speed, increase manual torque boost until this occurs. (See Section 5, Function 7: Manual Torque Boost.)
19. Press the STOP key. If the controller is intended for use in Manual mode only, go to Step 25. If Remote mode is to be used, go to Step 20.
20. Turn the power OFF and verify that the D-C bus voltage is zero.
21. Connect a process signal as shown in Figure 3-7. If the optional Pressure-to-Electrical Transducer Kit (1PE4020 or 1PE4050) is used, install this kit according to Instruction Sheet D2-3175. Install all other customer wiring according to Figure 3-6 or 3-7.
22. Turn the power ON. Set the AUTO/MANUAL switch on the keypad to AUTO.
23. Select Function 0 and change the setting to "1" for "Remote Control, Terminal Strip." When the controller is started by a remote contact, it will now follow a process control signal.

DANGER

THE DRIVE MAY RESTART AUTOMATICALLY WITH THE AUTO-RESET ENABLED (FUNCTION 40, PARAMETER 1). ATTACH A WARNING TAG TO THE APPROPRIATE DRIVEN EQUIPMENT. BEFORE WORKING ON THIS EQUIPMENT, BE SURE THAT POWER IS REMOVED AND LOCKED OUT FROM THE DRIVE. FAILURE TO OBSERVE THIS PRECAUTION MAY RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

24. If Auto Reset (Restart) capability is desired, see Section 5, Function 40.
25. Turn the power OFF. After verifying the D-C bus voltage is zero, remove the voltmeter and any other instrumentation connected during startup.
26. Replace and secure the controller enclosure cover.

If the drive operates satisfactorily, startup is complete.

If the drive does not operate satisfactorily, go to Section 5. The factory set values of programmable functions, such as the following, may need to be adjusted:

- local/remote operator control (Function 0)
- minimum and maximum speed (Functions 3, 4, 38, and 43)
- current limit (Function 5)
- manual torque boost (Function 7)
- base frequency (Function 11)
- contant or variable torque volts/hz curve selection (Function 23)
- line-dip-ride-through (Function 27)
- auto reset (Functions 40, 41, 42)

5: Adjust the Controller Functions

DANGER

ONLY QUALIFIED ELECTRICAL PERSONNEL FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF THIS EQUIPMENT AND THE HAZARDS INVOLVED SHOULD START AND ADJUST IT. READ AND UNDERSTAND THIS MANUAL IN ITS ENTIRETY BEFORE PROCEEDING. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

Introduction to Programmable Functions

The controller offers users 57 software functions that are either selectable or adjustable by using the program keys on the keypad. The factory preset values for these functions suit a wide range of standard applications. To configure the controller for a specific application, activate and adjust the values of these functions as necessary.

This section describes how to configure the controller using the keypad and displays. It also gives a complete description of each function by its assigned function number. The functions list is in numerical order by the assigned function numbers. You can scroll through the list in ascending order with the PGM key. A quick reference summary of these functions, also in numerical order by the function number, is given in Table 8-2 at the end of this manual.

Function Menus and Passwords

To simplify the configuration process, the software functions list is divided into two menus. The first menu contains seven functions (0 through 6). Functions 0 through 5 are commonly used to adjust the controller for simple applications. Function 6, which permits access to the second menu, requires a password before it can be changed to allow access to Functions 7 through 57. Until the password is given and the Function 6 parameter is changed, you can scroll and modify only the first menu functions.

The second menu functions allow you to adjust the controller for more complex applications. Some of these functions cannot be selected without entering a second password. These functions are safety related and should be used only with a thorough understanding of their nature. Contact your nearest Reliance Electric Sales Office when your application requires these functions.

Configuring the Controller

1. Turn the power ON if not already on.
2. Press the STOP key to confirm the controller is in the Stop mode.
3. Press the PGM key. The Program Enable LED will light.
   Note: The controller is shipped from the factory with the Program jumper in the J5 position. This jumper must be in the J5 position in order for the Program Enable LED to light and configuration of the controller to be possible. If this LED does not light, the jumper is in the J6 position. To change its position, perform the following:
   - Turn the power OFF.

DANGER

THIS EQUIPMENT IS AT LINE VOLTAGE WHEN A-C POWER IS CONNECTED TO THE CONTROLLER. DISCONNECT ALL UNGROUNDED CONDUCTORS OF THE A-C POWER LINE FROM THE CONTROLLER. AFTER POWER IS REMOVED, VERIFY WITH A VOLTMETER AT TERMINALS 147(+) AND 45(−) THAT THE D-C BUS CAPACITOR(S) IS DISCHARGED BEFORE TOUCHING ANY INTERNAL PARTS OF THE CONTROLLER. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

   - Remove the front cover.
   - Verify with a voltmeter at terminals 147(+) and 45(−) that the D-C bus voltage is zero.
   - Locate the Program jumper on the regulator (see Figure 3-4).
   - Change the jumper position.
     In the J5 (Program Enable) position, the Program Enable LED will light when the PGM key is pressed and changing the controller configuration will be possible.
     In the J6 (Program Disable) position, the Program Enable LED will not light and unauthorized data entry will be prevented. Function values can be viewed on the 4-digit display but cannot be changed.
   - Replace the cover.
   - Turn the power ON and wait for the controller to complete its self-diagnostic test.

4. Press the PGM key to scroll through the functions list to the desired function number. The function number will show on the 2-digit display and the function value stored in memory will show on the 4-digit display.
5. To change the value of a particular function, scroll to the function number (2-digit display). Each function has a range of values that can be entered or selected. Press the or key to increase or decrease the value shown in the 4-digit display. The software will not allow you to make selections outside the function's range.

   Note: The function description included in this section gives the available selections or the value range, as applicable. The value set at the factory (initial factory setting) is also listed.
6. After changing a function value with the ▲ and ▼ keys, press the SET key to lock the new data in the controller memory.

   Depending on the specific application, an IET fault may occur with this new setting when the controller is put in the Run mode. If an IET does occur, the controller will stop and the 4-digit display will indicate the code of the IET causing the failure. Table 7-1 summarizes these codes. The controller cannot run while in an IET state. Reset the controller by pressing the STOP key. Clear the fault which may require a new function value to be entered. Note: The controller is shipped with preset values that will not cause IET trips under normal conditions.
7. When selections and changes are complete, press the MON key one time to return to the Stop mode.

   If the MON key is pressed a second time, the 4-digit display will show the code of the last occurring IET. If there have been no IETs, the display will show 0000. To return to the Stop mode, press the STOP key.

   If the PGM key is pressed while in the Run mode, the Program Enable is locked out; the Program Enable LED will not light. This program lock out condition can be cleared by pressing the MON key and then the STOP key.

First Menu Functions

0 Local/Remote Operation Control

Parameter Selection

0 = Local Control (Keypad)
1 = Remote Control (Terminal Strip)
2 = Remote Control (Reliance I/O Port requires optional Rail Interface Card)

Initial Setting

0

Description

When 1 is selected, operational control is through the terminal strip and the REMOTE LED is lit. Most GP2000 applications will require remote operation by selecting 1. When 0 is selected, the controller is operated locally and the LOCAL LED is lit. In the Remote mode (1, 2, or 3), the controller deactivates the RUN/JOG, FWD/REV, and AUTO/MAN keypad keys. When in the remote mode, the keypad cannot be used except to stop. These functions must be activated through the terminal strip for proper operation. See Section 3, "Install Control and Signal Wiring (if used)." The STOP key remains functional. The controller will not allow selection of 2 or 3 unless the optional Serial Communications Port Card is installed and wired in the controller.

1 Acceleration Time

Adjustment Range

5.0 – 360.0 seconds

Initial Setting

20.0

Description

Acceleration time is the normal time in which the motor reaches maximum Hz after starting. The acceleration rate (hertz/second) depends on the maximum Hz setting. If an acceleration time faster than 5 seconds is required, see Function 44. If the motor load inertia is high and/or the current limit (Function 5) setting is too low, acceleration time will be longer than the preset time. For Jog Acceleration Time, see Function 51.

Note: With very fast acceleration times, the motor may draw excessive current resulting in an overcurrent (OC-A) IET. To avoid this condition, reset the acceleration time for a longer period.

2 Deceleration Time

Adjustment Range

5.0 – 360.0 seconds

Initial Setting

20.0

Description

Deceleration time is the normal time in which the motor decreases from maximum Hz to zero Hz. Therefore, the deceleration rate (hertz/second) depends on the maximum Hz setting. If a deceleration time faster than 5 seconds is required, see Function 45. For Jog Deceleration time, see Function 52.

Note: Motor load inertia and input line conditions can extend the deceleration time to a value greater than the preset time. With very fast deceleration times, regenerative motor voltage may charge up the D-C bus voltage causing a high bus voltage (HU) IET. To avoid an IET condition, reset the deceleration time for a longer period. If a deceleration time faster than the acceptable range is required, install an optional Dynamic Braking Kit.

3 Minimum Hz

Adjustment Range

5.0 – 60.0 Hz

Initial Setting

5.0

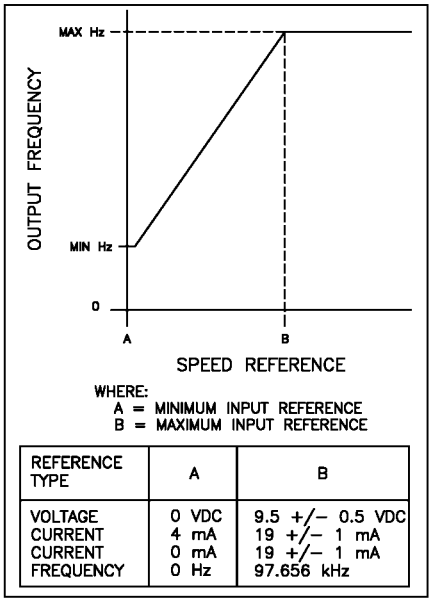
Description

DANGER

THE DRIVE IS INTENDED TO OPERATE AT A PREDETERMINED MINIMUM SPEED UNLESS DISCONNECTED FROM THE POWER SOURCE. IF THE APPLICATION REQUIRES ZERO SPEED OPERATION WITHOUT SUCH DISCONNECTION, THE USER IS RESPONSIBLE FOR ASSURING SAFE CONDITIONS FOR OPERATING PERSONNEL BY PROVIDING SUITABLE GUARDS, AUDIBLE OR VISUAL ALARMS, OR OTHER DEVICES. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

Minimum Hz is the minimum output frequency value that can be reached with the key. Minimum Hz must always be lower than maximum Hz (Function 4), and the speed setting value must always be within minimum and maximum Hz. When the AUTO key is selected to control speed by an external process control signal, the gain (output frequency/speed reference) can be adjusted with the minimum Hz setting and/or the maximum Hz setting. See Figure 5-1.

If a minimum Hz lower than 5 Hz is required, contact Reliance Electric for the second password to access Function 43, Extended Minimum Hz Range.



REFERENCE TYPE	A	B
VOLTAGE	0 VDC	9.5 +/– 0.5 VDC
CURRENT	4 mA	19 +/– 1 mA
CURRENT	0 mA	19 +/– 1 mA
FREQUENCY	0 Hz	97.656 kHz

Figure 5-1. Relationship of Output Frequency and Speed Reference for Process Control Auto Selection.

4 Maximum Hz

Adjustment Range

15.0 – Overfrequency Limit
Note: Overfrequency Limit (Function 38) is factory set at 90 Hz.

Initial Setting

60.0

Description

WARNING

THE USER IS RESPONSIBLE FOR ENSURING THAT DRIVEN MACHINERY, ALL DRIVE-TRAIN MECHANISMS, AND PROCESS LINE MATERIAL ARE CAPABLE OF SAFE OPERATION AT A SPEED EQUIVALENT TO AT LEAST THAT WHICH WOULD RESULT FROM AN APPLIED FREQUENCY 20% ABOVE THE OVERFREQUENCY LIMIT (FUNCTION 38/FACTORY PRESET 90 HZ; MAXIMUM VALUE 405 HZ). FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

Maximum frequency is the maximum output frequency value that can be reached with the ▲ key. When AUTO is selected to provide an external speed reference of 10 VDC, 20 mA, or 97.656 KHz into the controller, the gain can be adjusted with the minimum Hz setting and/or the maximum Hz setting. See Figure 5-1.

Maximum Hz can be programmed between 15 Hz and 90 Hz in the first menu. If a maximum Hz higher than 90 Hz is required, contact Reliance Electric for the second password to access Function 38, Overfrequency Limit.

5 Current Limit

Adjustment Range

50 – 150% rated current

Initial Setting

150

Description

This feature provides the means to limit motor output torque during run or acceleration. When output current attempts to exceed the preset current limit level, motor speed is decreased. This feature

automatically provides an adjustable torque limit for the driven equipment. (See Function 55 if IET tripping occurs under current limit conditions.)

6 Expand to Second Menu

Parameter Selection

0 = Basic (First Menu Only)
1 = Expand to Second Menu

Initial Setting

0

Password

0306

Description

Most simple applications will require only the adjustable functions found in the first menu. When you scroll through the functions list with the PGM key, at Function 6 the list will complete its cycle and return to Function 0. Note that the Program Enable LED goes off when you reach Function 6. This indicates that you cannot modify this function without a password.

DANGER

ONLY QUALIFIED ELECTRICAL PERSONNEL FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF THIS EQUIPMENT AND THE HAZARDS INVOLVED SHOULD START, ADJUST, OPERATE, AND/OR SERVICE IT. READ AND UNDERSTAND THIS MANUAL IN ITS ENTIRETY BEFORE PROCEEDING. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

If your application requires changing any function found in the second menu, complete the following to gain access to the second menu:

- With the PGM key, select Function 6.
- Press and hold in the SET key until 0000 flashes in the 4-digit display (approximately 3 seconds). The 2-digit display will be blank.
- Enter password 0306 with the ▲ and ▼ keys. When the 4-digit display shows this value, press the SET key.

Note: Some functions require the second password be entered. The number is given under that specific function.

- The 4-digit display will change to 0 (Function 6 value for Basic " first menu only), and the Program Enable LED will light.
- Change the 0 value to 1 with the key and press the SET key.

Now, when you press the PGM key to scroll the functions list, you will scroll to Function 7 and on through the list. As long as the parameter remains selected at 1, you can proceed to second-level functions. To change Function 6 back to "first menu only," repeat this password process and select 0.

Second Menu Functions

7 Manual Torque Boost

Adjustment Range

0 – 10% voltage

Initial Setting

2

Description

WARNING

THE DRIVE IS INTENDED TO OPERATE AT A PREDETERMINED MINIMUM SPEED UNLESS DISCONNECTED FROM THE POWER SOURCE. TO ENSURE MOTOR ROTATION AT THE MINIMUM SPEED SETTING, TORQUE BOOST MUST BE PROPERLY ADJUSTED. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

Torque boost is required to offset the voltage drop of the A-C motor at low speeds. For friction loads and large inertia loads, a high starting torque level may be needed. Manual torque boost is effective only at speeds lower than half of base frequency. Figure 5-2 illustrates the manual torque boost adjustable range and the V/Hz characteristics.

If the torque boost setting is too high or the acceleration ramp is too fast, the motor may draw excessive starting current. This could cause an overcurrent (OC-A or OC) IET. Also, too much torque boost may cause excessive motor heat and motor noise.

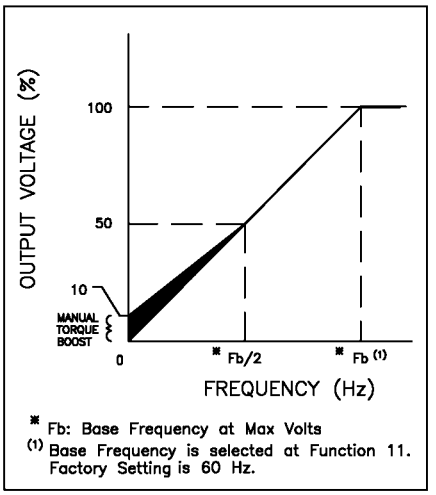


Figure 5-2. Manual Torque Boost Adjustable Range (Constant Torque shown).

8 Jog Frequency

Adjustment Range

0.0 – 60.0 Hz

Initial Setting

5.0

Description

Jogging can be accomplished in either Local Control or Remote Control. Jog frequency can be set from 0.0 to 60.0 Hz and is independent of any other set speed. The actual output frequency for jog is automatically limited between minimum and maximum Hz.

Jog speed cannot be changed with the and keys while the controller is in the Run mode. The only way to change Jog speed is to put the controller in the Stop mode, select Function 8 with the PGM key, and reset the jog frequency value.

9 Stop Mode Selection

Parameter Selection

0 = Coast-to-rest
1 = Ramp-to-rest

Initial Setting

0

Description

With parameter "0" selected, pressing the STOP key or giving an external Stop command causes the motor to coast to a rest. With parameter "1" selected, pressing the STOP key or giving an external Stop command causes the motor to ramp to a rest within a time equal to the preset deceleration time (Function 2) unless the inertia of the system in relation to the deceleration rate is such that the stored energy cannot be absorbed.

10 Automatic Flux Control

Adjustment Range

0 – 5% rated voltage

Initial Setting

0

Description

Automatic flux control optimizes the motor magnetic flux and, thus, the motor output torque. It senses the output current and adjusts the corresponding voltage to provide optimum flux for the torque conditions of the motor. This compensated voltage is adjustable from 0 to 5% rated voltage at 100% full load current of the controller.

Figure 5-3 illustrates the automatic flux control adjustable range as well as the V/Hz characteristics with both automatic flux control and manual torque boost. For optimum performance, low torque loads should be set at the low end of the range (≈0%) and high torque loads at the high end (≈5%).

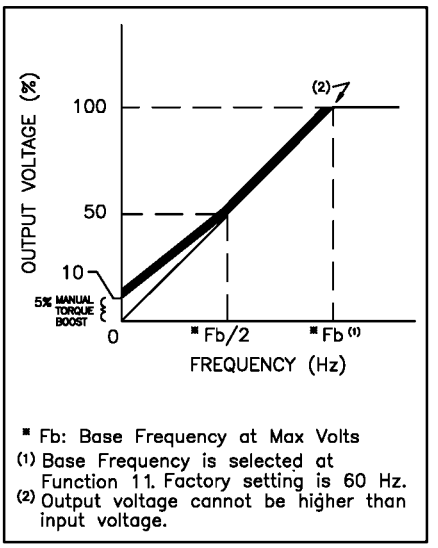


Figure 5-3. Automatic Flux Control Adjustable Range (Constant Torque shown).

11 Base Frequency Selection (Volts/Hz Ratio)

Adjustment Range

30.0 – 120.0 Hz (Variable torque)
30.0 – 400.0 Hz (Constant torque)

Initial Setting

60.0

Description

WARNING

THE USER IS RESPONSIBLE FOR ENSURING THAT DRIVEN MACHINERY, ALL DRIVE-TRAIN MECHANISMS, AND PROCESS LINE MATERIAL ARE CAPABLE OF SAFE OPERATION AT A SPEED EQUIVALENT TO AT LEAST THAT WHICH WOULD RESULT FROM AN APPLIED FREQUENCY 20% ABOVE THE OVERFREQUENCY LIMIT (FUNCTION 38/FACTORY PRESET 90 HZ; MAXIMUM VALUE 405 HZ). FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

The base frequency selection is used to adjust the controller output volts/hertz ratio. Base frequency is the frequency (30 – 400 Hz) at which the output voltage reaches maximum voltage. Maximum voltage is adjustable, if necessary. See Function 49 and 50. Below base frequency, output voltage varies with output frequency according to the V/Hz adjustment, and the variable torque V/Hz range. Above base frequency, output voltage is held constant as frequency increases (referred to as the constant horsepower range). Figure 5-4 shows the relationship of base frequency and V/Hz.

Note: The V/Hz ratio is affected by the settings of automatic flux control (Function 10) and manual torque boost (Function 7).

When the GP2000 is set for the variable torque curve (Function 23), the base frequency selection (Function 11) must be equal to or less than 120 Hz. Figure 5-11 shows the variable torque curve. In normal variable torque applications, base frequency should equal motor nameplate operating frequency.

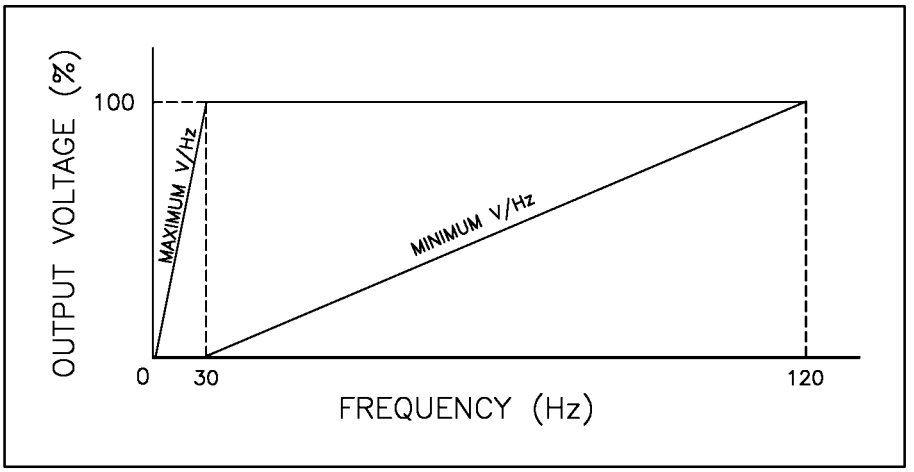


Figure 5-4. Relationship of Base Frequency and V/Hz Selection for Constant Torque Applications.

12 Electronic Thermal Overload Selection

Parameter Selection

0 = Normal Motor
1 = Forced Cooled Motor

Initial Setting

0

Description

An electronic thermal overload is useful in applications where motor horsepower rating is less than that of the controller. Function 12 allows selection of an output current profile best suited for the type of motor to be run. Function 13 allows adjustment of the output current value. Note that the electronic thermal overload functions similarly to a motor overload relay and does not measure actual motor temperature. A temperature measuring device is the best way to thermally protect a motor under all conditions.

A Function 12, "0" selection is best suited for motors with cooling fans integral to the motor shaft, such as totally enclosed fan cooled (TEFC) or open dripproof (ODP) motor types. A "1" selection is best suited for motors with cooling that is independent of motor speed, such as motors with constant speed cooling fans or totally enclosed non-ventilated (TENV) motor types.* Figure 5-5 shows the typical continuous current with respect to speed (output Hz) for each selection with Function 13 set at 50% and 100%.

* If a "1" is selected for this function, contact Reliance Electric for proper electronic thermal overload level adjustment (Function 13).

CAUTION: This function is not intended to act as a replacement for a hardwired thermal overload relay. The user is responsible for following the National Electrical code and all other applicable local codes with respect to motor overload protection. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

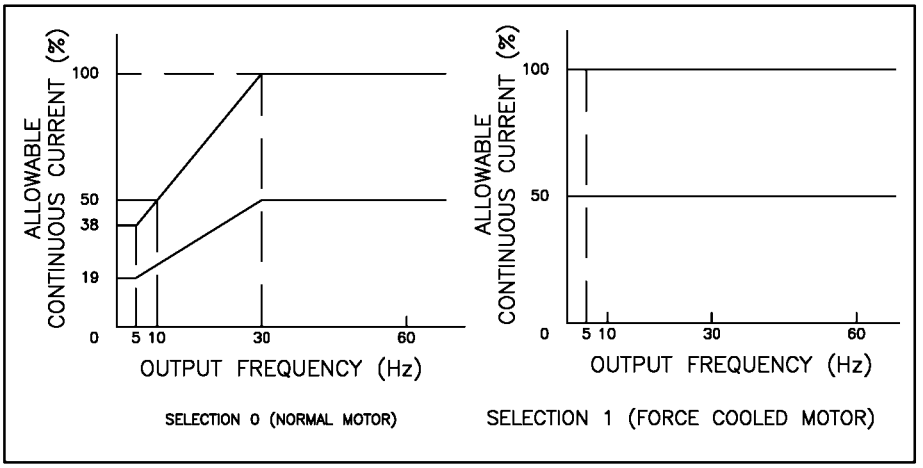


Figure 5-5. Allowable Continuous Current vs Output Hz (with Function 13 at 50% and 100% Settings).

13 Electronic Thermal Overload Level

Adjustment Range

20 – 100% rated current

Initial Setting

100

Description

The adjustment of this function is useful if the motor horsepower rating is less than the controller horsepower size. Using the formula below, calculate the setting level as a percentage of maximum continuous current:

$$\text{Setting Level (\%)} = \frac{\text{Motor Full Load Current}}{\text{Controller Output Rated Current}} \times 100$$

Figure 5-6 illustrates curves for the electronic thermal overload with the forced cooled motor selection at 100% and 50%. Table 5-1 shows the approximate trip time in seconds vs. the output current at various electronic overload levels and frequencies. For example, if the overload setting level is 100%, when a motor runs with 110% load at 60 Hz, an IET will occur after one minute.

Note: The calculated trip times given in Table 5-1 are based upon one overload trip. If successive trips occur, the trip times are shortened to more closely simulate the operation of a mechanical temperature overload device.

Note: All GP2000 controllers contain an overload relay separate from the electronic thermal overload relay. The overload relay must have proper heaters, and the electronic overload relay must be properly set. The overload relay trip causes a function loss IET if the controller does not have bypass. If the controller has bypass, the overload relay trip causes the controller to stop; and "CS" is displayed on the 4-digit display. If the electronic overload relay trips, the 4-digit display shows "OL"; and the controller stops.

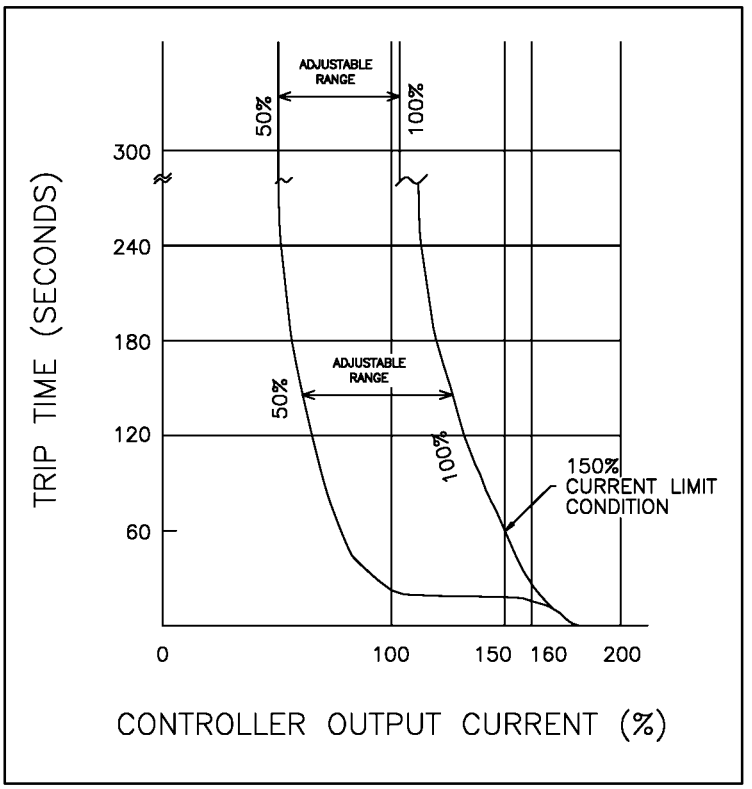


Figure 5-6. Electronic Thermal Overload Curves for Forced Cooled Motor Selection at 50% and 100% Overload Levels.

Table 5-1. Trip Time for Overload Protection Based on First Trip.

Note: Function 12, Electronic Thermal Overload, is set at 0.

Trip Time (second)

Electronic Thermal Overload Level (%)	Rated Output Current (%)	Output Frequency (Hz)					
		60 ~ 30	25	20	15	10	5
100	30	∞	∞	∞	∞	∞	∞
	40	∞	∞	∞	∞	∞	4349
	50	∞	∞	∞	∞	∞	255
	60	∞	∞	∞	∞	361	131
	70	∞	∞	∞	619	155	88
	80	∞	∞	2168	188	98	66
	90	∞	∞	241	111	72	53
	100	∞	334	127	79	57	45
	110	542	149	86	61	47	38
	120	181	96	65	50	40	33
	130	108	71	53	42	35	30
	140	77	56	44	36	31	27
	150	60	46	38	32	29	24
90	90	∞	334	127	79	57	45
	100	443	141	83	59	46	38
	110	157	89	62	48	39	33
	130	69	51	41	34	29	26
	150	44	36	31	27	24	21
80	80	∞	334	127	79	57	45
	90	361	131	80	58	45	37
	100	135	82	58	45	37	32
	110	83	59	46	38	32	28
	130	47	38	32	28	25	22
	150	33	28	25	22	20	18
70	70	∞	334	127	79	57	45
	80	292	121	76	55	44	36
	90	115	74	54	43	35	30
	100	71	53	42	35	30	26
	110	52	41	24	30	26	23
	130	34	29	25	22	20	18
	150	25	22	20	18	17	15
60	60	∞	334	127	79	57	45
	70	232	109	71	53	42	35
	80	96	65	49	40	33	29
	90	60	46	38	32	28	24
	100	44	36	31	27	24	21
	110	35	30	26	23	21	19
	130	25	22	20	18	16	15
	150	19	17	16	15	14	13
50	50	∞	334	127	79	57	45
	60	181	96	65	50	40	33
	70	77	56	44	36	31	27
	80	49	40	33	29	25	22
	90	36	31	27	24	21	19
	100	29	25	22	20	18	17
	110	24	21	19	17	16	15
	130	17	16	15	14	13	12
	150	14	13	12	12	11	10

14 Linear/S-Curve Acceleration

Parameter Selection

0 = Linear Acceleration
1 = S-Curve Acceleration

Initial Setting

0

Description

When S-Curve Acceleration is selected, acceleration will begin and end slowly. The acceleration time set at Function 1 will remain the same. Figure 5-7 illustrates S-Curve acceleration.

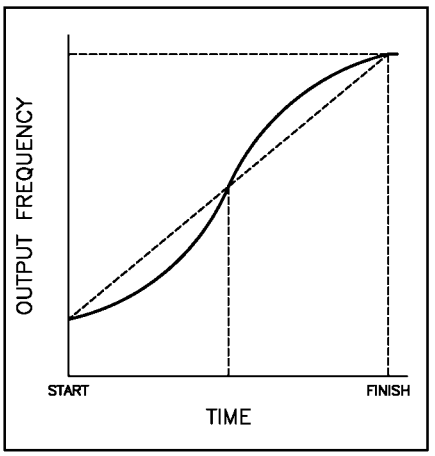


Figure 5-7. S-Curve Acceleration.

15 Linear/S-Curve Deceleration

Parameter Selection

0 = Linear Deceleration
1 = S-Curve Deceleration

Initial Setting

0

Description

When S-Curve Deceleration is selected, deceleration will begin and end slowly. The acceleration time set at Function 1 will remain the same. Figure 5-8 illustrates S-Curve deceleration.

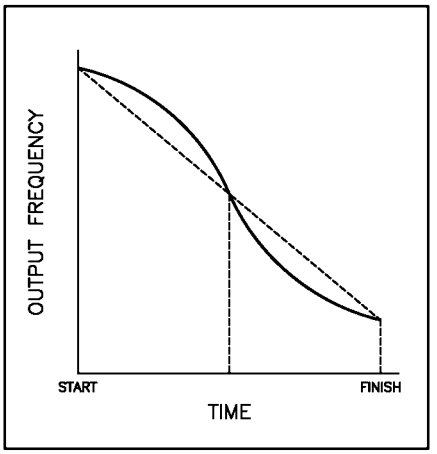


Figure 5-8. S-Curve Deceleration.

16, 17, 18 Multi-Speed Preset (MS1, MS2, MS3)

Note: The Multi-Speed Preset Functions 16, 17 and 18 cannot be seen in the LOCAL MODE, Function 0, Parameter 0.

Adjustment Range

0.0 – 400.0 Hz

Initial Setting

5.0

Description

When the controller is controlled remotely (Function 0, Parameter 1, 2, or 3), the controller can be configured to run at three different preset speeds. The frequency of each preset speed is limited between minimum and maximum Hz.

To select 1 to 3 preset speed values,

- Set the frequency level for each desired speed level (Functions 16, 17, and 18) using the ▲, ▼, and SET keys.
- Enable the desired speed level by wiring to the appropriate terminals according to Table 5-2. See Figure 3-7.

When the circuit is closed, the Multi-Speed Preset function overrides the external speed reference, causing the output frequency to accelerate or decelerate to the preset level (MS1, MS2, or MS3). When the circuit is open, control is returned to the external speed reference signal. The frequency of each preset speed overrides the avoidance frequency of Function 19, 20, 21 and 22. Figure 5-9 shows a typical multi-speed preset application.

Note: The Multi-Speed Preset is enabled when parameter 0 is selected in Function 57. When parameter 1 is selected in Function 57, the same terminals 17 and 18 will become inputs for the Static MOP. Controller must be in remote mode function 0 parameter = 1.

Table 5-2. Terminal Connections for Multi-Speed Preset.

Function Number	Preset Speed	Terminal (TB11) Connection
16	MS1	17 to 12
17	MS2	18 to 12
18	MS3	17 and 18 to 12

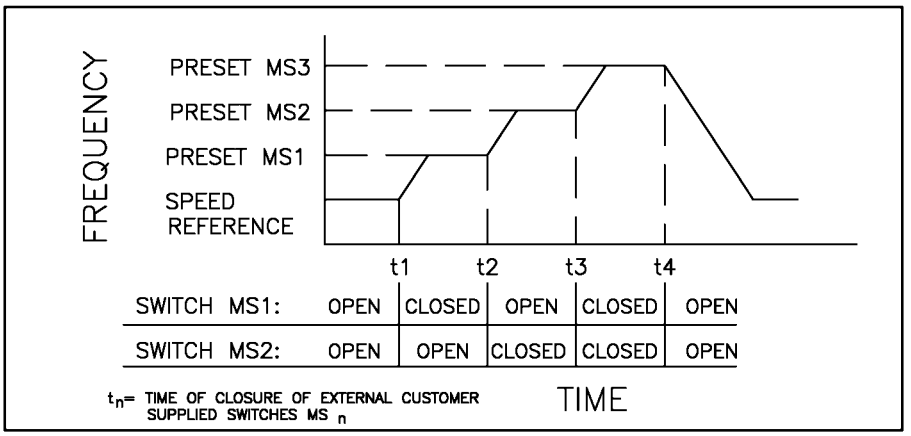


Figure 5-9. Typical Multi-Speed Preset Application.

19, 20, 21 Avoidance Frequency (AF1, AF2, AF3)

Adjustment Range

0.0 – 400.0 Hz

Initial Setting

0.0

Description

Operating a motor continuously at a particular frequency may cause vibrational resonance within the driven machinery. Three independent avoidance frequencies can be programmed to prevent motor vibration at these critical frequencies. See Figure 5-10.

The setting of each avoidance frequency is limited between minimum and maximum Hz. This function (19, 20, or 21) is used with Function 22, Avoidance Frequency Band.

Select 1 to 3 avoidance frequency bands using the ▲, ▼, and SET keys. Set each avoidance frequency value (AF1, AF2, and AF3 at Function 19, 20, and 21, respectively) as needed.

The avoidance frequency function is effective in both local and remote control. Normal acceleration and deceleration through these bands is unaffected by this function.

22 Avoidance Frequency Band (AFB)

Adjustment Range

0.2 – 10.0 Hz

Initial Setting

0.2

Description

This function is applicable with Functions 19, 20, and 21 (Avoidance Frequency). The avoidance frequency band selection will apply to each of the three avoidance frequencies set in Functions 19, 20, and 21. The actual range of avoidance frequency is calculated by the following formula:

$$AF1 - \frac{AFB}{2} < F_R < AF1 + \frac{AFB}{2}$$

where:

AF1 = Avoidance Frequency (set with Functions 19, 20, and 21)
AFB = Avoidance Frequency Band (set with Function 22)
F_R = Avoidance Range

To select 1 to 3 avoidance frequency bands:

Using the ▲, ▼, and SET keys, set each avoidance frequency value (AF1, AF2, and AF3 at Function 19, 20, and 21, respectively) as needed.

Using the ▲, ▼, and SET keys while at Function 22, select the desired avoidance frequency band that will be applied to each avoidance frequency value.

The following example illustrates how avoidance frequency works. Assume the following:

- Minimum Hz is set at 10.0.
- Maximum Hz is set at 60.0.
- Output speed follows a 0–10 VDC process signal.
- Desired avoidance frequency (AF1) is 40 Hz.
- Desired avoidance frequency bandwidth (AFB) is 10 Hz.

$$40 - \frac{10}{2} < F_R < 40 + \frac{10}{2}$$

$$35\ Hz < F_R < 45\ Hz$$

Before applying avoidance frequency values, the process signal voltage produces output frequency as follows:

0 VDC = 10.0 Hz
5.0 VDC = 35.0 Hz
5.8 VDC = 39.0 Hz
5.9 VDC = 39.5 Hz
6.6 VDC = 43.0 Hz
7.0 VDC = 45.0 Hz
7.1 VDC = 45.5 Hz
10.0 VDC = 60.0 Hz

After applying avoidance frequency values, the output frequency will be:

0 VDC = 10.0 Hz
5.0 VDC = 35.0 Hz
5.8 VDC = 35.0 Hz
5.9 VDC = 35.0 Hz
6.6 VDC = 35.0 Hz
7.0 VDC = 35.0 Hz
7.1 VDC = 45.5 Hz
10.0 VDC = 60.0 Hz

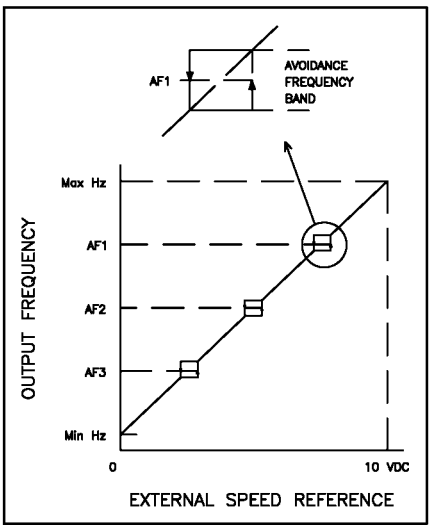


Figure 5-10. Avoidance Frequency Operation.

23 Variable Torque Volts/Hz Curve Selection

Parameter Selection

0 = Constant Torque Curve
1 = Variable Torque Curve

Initial Setting

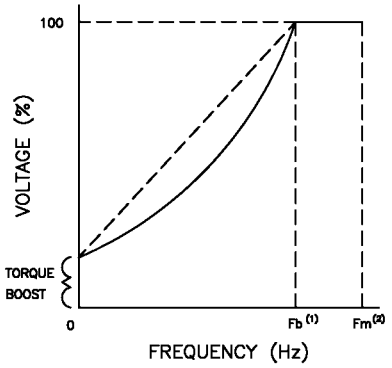
0

Description

WARNING

THE DRIVE IS INTENDED TO OPERATE AT A PREDETERMINED MINIMUM SPEED UNLESS DISCONNECTED FROM THE POWER SOURCE. TO ENSURE MOTOR ROTATION AT THE MINIMUM SPEED SETTING, TORQUE BOOST (FUNCTION 7) MUST BE PROPERLY ADJUSTED. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

When the GP2000 is set for the variable torque curve, the base frequency selection (Function 11) must be equal to or less than 120 Hz. Figure 5-11 shows the variable torque curve.



Fb: Base Frequency (<=120Hz)
Fm: Maximum Hz (<=120 Hz)

(1) Base frequency is selected at Function 11. Factory setting is 60 Hz.

(2) Maximum Hz is selected at Function 4. Factory setting is 60 Hz.

Figure 5-11. Variable Torque Curve

24, 25, 26 D-C Braking

Adjustment Range

24 Operation Time: 0.0 – 10.0 seconds
25 Voltage: 0–20% voltage
26 Frequency: 0.5 – 10.0 Hz

Initial Setting

24 Operation Time: 0.0
25 Voltage: 0
26 Frequency: 1.0

Note: D-C braking operation requires that Function 9 be set to "Ramp-to-rest."

Description

D-C braking is used to provide additional motor braking at speeds of 10 Hz or lower. If D-C braking is required, all three D-C braking functions (24, 25, and 26) must be adjusted. When the motor decelerates to the preset start frequency (Function 26), the preset constant D-C voltage (Function 25) is momentarily applied to the motor for the preset time (Function 24). See Figure 5-12. This function will not provide the holding torque of a mechanical brake.

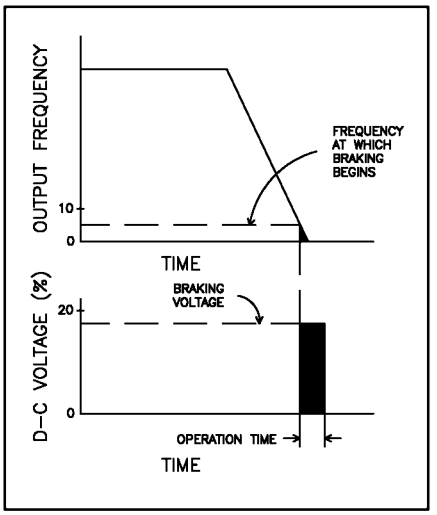


Figure 5-12. D-C Braking Operation.

27 Line-Dip-Ride-Through

Adjustment Range

15 – 500 milliseconds

Initial Setting

15

Description

If the line power supply is interrupted or line voltage dips for longer than the preset time, an IET will occur. The line-dip-ride-through time can be adjusted from 15 milliseconds to 500 milliseconds. The available adjustment range may not be usable. It is determined in conjunction with other drives on the same line and the load characteristics of the application. Also, this function must be used only when drive frequency is less than 100 Hz.

During a line voltage dip, the standard controller may have enough capacitance to keep the regulator active for 500 milliseconds. However, the load will determine how long the D-C bus voltage will remain above the minimum voltage at which the controller will IET. For example, if the load deceleration is slow (high inertia, low frictional loss), the controller may be able to maintain enough D-C bus voltage to ride through a line dip for 500 milliseconds. If the load deceleration is fast (low inertia, high frictional loss), the controller may only be able to remain above the minimum D-C bus voltage limit for the preset time.

28, 29 Output Relay (1 and 2)

Parameter Selection

0 = Not Used
1 = Zero Speed Detect
2 = Input Contactor
3 = Output Contactor
4 = Frequency Level Detection 1
5 = Frequency Level Detection 2
6 = Current Level Detection
7 = Reverse Rotation
8 = D-C Braking Operation
9 = Reserved

Initial Setting

0

Description

These functions use the Remote Meter Interface Card, which includes two relays. Each relay operates according to the parameter (0−9) selected. Function 28 configures output relay 1, and Function 29 configures output relay 2. Output relay 1 provides a form C contact (1NO and 1NC), and output relay 2 provides a form A contact (1NO). The response time of each relay is typically 8 milliseconds.

The ten parameters are described as follows:

0: The relay does not operate.
1: The relay is energized while output frequency is equal to or higher than 0.5 Hz.
2: This provides the control signal for an input contactor. The relay energizes when the controller is put into the Run mode.
3: This provides the control signal for an output contactor. The relay energizes when the controller is put into the Run mode.
4: The relay energizes when the output frequency is equal to or higher than the frequency level set in Function 33.
5: The relay energizes when the output frequency level is equal to or higher than the frequency set in Function 34.
6: The relay energizes when the output current level is equal to or higher than the current set in Function 35.
7: The relay energizes when the phase sequence of the output frequency is in reverse rotation.
8: The relay energizes when the D-C braking voltage is applied to the motor. This relay is not required for D-C braking to be operational.
9: Reserved.

30 Slip Compensation

Adjustment Range

0.0 − 5.0 Hz

Initial Setting

0.0

Description

Actual motor shaft speed is determined by two factors: the applied Hz and the slip of the motor. The slip of the motor, however, is fully determined by the type of induction motor and varies with the driven load.

Slip compensation senses motor slip and adjusts the applied Hz automatically. Because of changes in the load, the actual speed regulation of the motor is greatly improved with this function properly adjusted.

High efficiency motors have less slip and, therefore, have improved speed regulation capability. See Table 5-3 for slip adjustment values to achieve 1% speed regulation with Reliance XETM high efficiency motors.

Note: Slip compensation improves speed regulation by automatically adjusting the output Hz to the motor. This can be viewed on the 4-digit display when monitoring frequency (Hz).

Table 5-3.
Slip Compensation Adjustment.(1)

HP	Slip Adjustment
25	0.5 Hz
30	0.5 Hz
40	0.5 Hz

(1) Based on Reliance TEFC XE high efficiency motors to obtain 1% speed regulation:

$$\text{Speed Regulation} = \frac{\text{No Load RPM} - \text{Full Load RPM}}{\text{Full Load RPM}}$$

31 Inverse Reference

Parameter Selection

0 = Normal
1 = Inverse

Initial Setting

0

Password

Enter Second Password: 1123

Description

WARNING

WITH THE INVERSE REFERENCE FUNCTION ENABLED, LOSS OF THE EXTERNAL SPEED REFERENCE SIGNAL WILL CAUSE THE DRIVE TO GO TO MAXIMUM FREQUENCY. EXERCISE EXTREME CARE WHEN USING THIS FUNCTION. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

This function will invert the signal of an external speed reference, causing the GP2000 to run at maximum output frequency when there is loss of or minimum control signal (0 volts or 4 mA) and at minimum output frequency when there is maximum control signal (10 volts or 20 mA). This function may be used when the reference signal supplied by an external device is inverse to desired speed control. Refer to Figure 5-13.

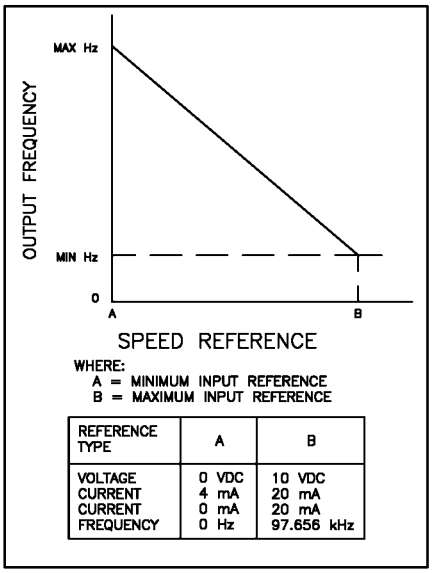


Figure 5-13. Inverse Relationship of Speed Reference and Output Frequency.

32 Function Loss Selection

Parameter Selection

0 = IET at Function Loss
1 = Coast-to-rest without an IET Output at Function Loss

Initial Setting

0 (without optional bypass modification)
1 (with optional bypass modification)

Password

Enter Second Password: 1123

Description

WARNING

GP2000 CONTROLLERS WITHOUT THE OPTIONAL BYPASS MODIFICATION ARE NOT EQUIPPED WITH A COAST-STOP PUSHBUTTON. THE USER MUST INSTALL A HARD-WIRED, OPERATOR- ACCESSIBLE PUSHBUTTON THAT PROVIDES A POSITIVE INTERRUPT AND SHUTS DOWN THE DRIVE. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

Controllers without bypass option:

Parameter set at "0" from the factory. A function loss signal causes the controller to stop, resulting in the following:

- The motor will coast to rest.
- The 4-digit display will show "FL" (function loss).
- The internal speed reference will be reset to zero.
- The IET relay will be latched on.
- The IET can be reset with the STOP key after the cause of the function loss is removed.
- The controller will restart with the START key after the IET is reset.

Controllers with bypass option:

Parameter set at "1" from the factory. A function loss signal causes the controller to stop, resulting in the following:

- The motor will coast to rest.
- The 4-digit display will indicate "CS" (coast stop).
- The internal speed reference will be reset to zero.
- The controller will restart with the START key after the cause of the function loss is removed.

33, 34 Frequency Level Detection (1 and 2)

Adjustment Range

0.5 – 405.0 Hz

Initial Setting

0.5

Description

This function is effective and displayed, only when parameter 4 or 5 is selected at Function 28 or 29. When the output frequency is equal to or higher than the set detection level, the selected output relay located on the Remote Meter Interface Card will energize as shown in Figure 5-14.

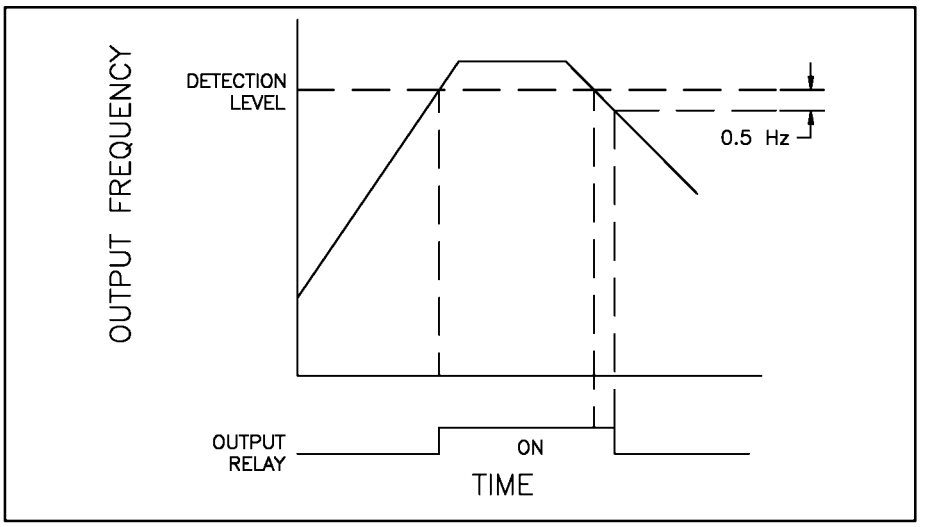


Figure 5-14. Frequency Level Detection Operation.

35 Current Level Detection

Adjustment Range

30 – 110% Rated Current

Initial Setting

100

Description

This function is effective and displayed, only when parameter 6 is selected at Function 28 or 29. When the output current is equal to or higher than the set detection level, the selected output relay located on the Remote Meter Interface Card will energize as shown in Figure 5-15.

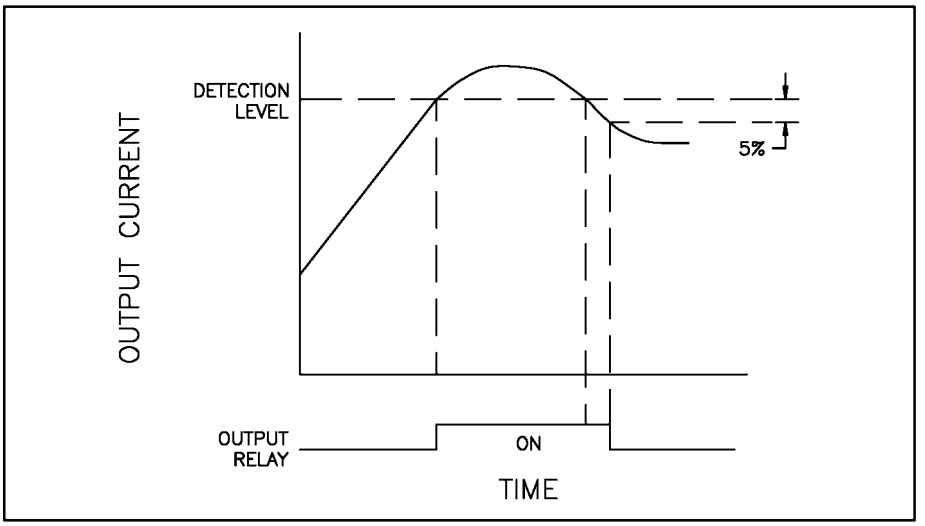


Figure 5-15. Current Level Detection Operation.

36 Reverse Disable

Parameter Selection

0 = Forward/Reverse Enable
1 = Reverse Disable on Keypad

Initial Setting

0

Description

This function is effective only when the controller is controlled locally (Function 0, parameter 0). If parameter 1 is selected, the FWD/REV key is locked in the forward position, preventing the motor from rotating in the reverse direction.

37 Automatic (Process Control) Disable on Local Control

Parameter Selection

0 = AUTO/MAN Key Enable
1 = AUTO Disable on Keypad

Initial Setting

0

Description

This function is effective only when the controller is controlled locally (Function 0, parameter 0). If parameter 1 is selected, the AUTO/MAN key is locked in the manual position, preventing the motor from responding to any external speed command.

38 Overfrequency Limit

Adjustment Range

50.0 – 405.0 Hz

Initial Setting

90.0

Password

Enter Second Password: 1123

Description

WARNING

THE USER IS RESPONSIBLE FOR ENSURING THAT DRIVEN MACHINERY, ALL DRIVE-TRAIN MECHANISMS, AND PROCESS LINE MATERIAL ARE CAPABLE OF SAFE OPERATION AT A SPEED EQUIVALENT TO AT LEAST THAT WHICH WOULD RESULT FROM AN APPLIED FREQUENCY 20% ABOVE THE OVERFREQUENCY LIMIT (FUNCTION 38/FACTORY PRESET 90 HZ; MAXIMUM VALUE 405 HZ). FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

The overfrequency limit is factory set at 90 Hz. The Maximum Hz setting (Function 4) is limited by the setting of this function.

39 D-C Offset Enable

Parameter Selection

0 = Offset Disable
1 = Offset Enable

Initial Setting

0

Password

Enter Second Password: 1123

Description

When parameter 0 is selected, D-C offset is disabled for normal operation of an induction motor. When this function is enabled (selection 1), the D-C offset function allows some D-C voltage to be output to the motor terminals at 0 Hz. The magnitude of this voltage is equal to the manual torque boost setting at Function 7. This may be required to synchronize the rotor of a permanent magnet synchronous motor to avoid high starting currents.

40, 41, 42 Auto-reset

Parameter Selection

40 Enable
0 = Auto-reset Disable
1 = Auto-reset Enable

Adjustment Range

41 Time: 0 – 10 times
42 Interval Time: 1 – 60 seconds

Initial Setting

40 Enable: 0
41 Time: 0
42 Interval Time: 1 second

Password

40 Enable: Enter Second Password: 1123

Description

DANGER

THE DRIVE MAY RESTART AUTOMATICALLY WITH THE AUTO-RESET ENABLED (FUNCTION 40, PARAMETER 1). ATTACH A WARNING TAG TO THE APPROPRIATE DRIVEN EQUIPMENT. BEFORE WORKING ON THIS EQUIPMENT, BE SURE THAT POWER IS REMOVED AND LOCKED OUT FROM THE DRIVE. FAILURE TO OBSERVE THIS PRECAUTION MAY RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

Select Auto-reset Enable (Function 40, Parameter 1) to automatically reset the controller when one of the following IETs occurs: overcurrent (OC, OC-A, OC-d, OC-G), high bus voltage, low bus voltage, or a line dip. (See Table 7-1.) The auto-reset operation can be repeated the number of times set in Function 41 (0 – 10 times) within the time interval set in Function 42 (1 – 60 seconds). The repeat number is returned to zero when the controller restarts successfully.

Note: Customer wiring must be as shown in Figure 3-6 or 3-7 to permit proper restart operations.

43 Extended Minimum Hz Range

Parameter Selection

0 = Disable (5 – 60 Hz)
1 = Enable (0 – 60 Hz)

Initial Setting

0

Password

Enter Second Password:1123

Description

DANGER

THE DRIVE IS INTENDED TO OPERATE AT A PREDETERMINED MINIMUM SPEED UNLESS DISCONNECTED FROM THE POWER SOURCE. IF THE APPLICATION REQUIRES ZERO SPEED OPERATION WITHOUT SUCH DISCONNECTION, THE USER IS RESPONSIBLE FOR ASSURING SAFE CONDITIONS FOR OPERATING PERSONNEL BY PROVIDING SUITABLE GUARDS, AUDIBLE OR VISUAL ALARMS, OR OTHER DEVICES. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

If a minimum Hz lower than 5 Hz is required, select parameter 1. Return to Function 3 and set the desired minimum Hz.

44 Extended Acceleration Time Range

Parameter Selection

0 = Disable (5.0 – 360.0 seconds)
1 = Enable (0.1 – 360.0 seconds)

Initial Setting

0

Description

When an acceleration time shorter than 5 seconds is required, select parameter 1. Return to Function 1 and set the desired acceleration time.

Note: With very fast acceleration and/or high manual torque boost settings, the motor may draw excessive current resulting in an IET.

45 Extended Deceleration Time Range

Parameter Selection

0 = Disable (5.0 – 360.0 seconds) 1 = Enable (0.1 – 360.0 seconds)

Initial Setting

0

Description

When a deceleration time shorter than 5 seconds is required, select parameter 1. Return to Function 2 and set the desired deceleration time.

Note: With very fast deceleration, the regenerative motor voltage may raise the D-C bus voltage too high, causing an IET. To avoid such an IET, increase the deceleration time or install a Dynamic Braking Kit (option).

46, 47, 48 RPM Monitor

Parameter Selection

46 Display Enable

0 = Disable

1 = Enable

47 Range Selection

0 = 150 – 9999 RPM

1 = 0 – 9999 RPM

Adjustment Range

WARNING

SETTING THE VALUE OF FUNCTION 48 WILL GIVE A DECEPTIVELY LOW INDICATION EVEN IF THE MACHINE IS RUNNING AT MAXIMUM SPEED. DO NOT SET FUNCTION 48 TO ZERO OR A LOW VALUE. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

48 Base Frequency Selection

150 – 9999 RPM

Initial Settings

46 Display Enable: 0

47 Range Selection: 0

48 Base Frequency Selection: 1750

Password

47 Range Selection: Enter Second Password: 1123

Description

When parameter 0 is selected in Function 46, output frequency, output voltage, and percentage of full-load amps of the controller can be monitored. When parameter 1 is selected in Function 46, RPM can also be monitored. The display can be scrolled by pressing the MON key. The 2-digit display shows "SP" when monitoring RPM.

Functions 46, 47 , and 48 can also be used to scale the 4-digit display differently. This can be done by entering a value for "Base Frequency" selection (Function 11) that is different than the actual motor speed, but represents some other engineering unit unique to the application. When Base Frequency selection of Function 48 is programmed, use the following formula:

Base Frequency Selection (Function 48) =

$$\frac{\text{Motor Rated RPM}^{(1)}}{\text{Motor Rated Hz}^{(2)}} \times \text{Base Frequency Hz}^{(3)}$$

Where,

(1) = "Motor Rated RPM" equals the RPM of the motor under full load and motor rated frequency conditions. This value for RPM can be found on the motor nameplate.

(2) = "Motor Rated Hz" equals the base frequency of the motor. This value can be found on the motor nameplate.

(3) = "Base Frequency" equals the setting of Function 11.

Example

"Motor Rated RPM" = 1750 RPM (Motor nameplate)
"Motor Rated Hz" = 60 Hz
"Base Frequency" (or number entered into Function 48) = 60 Hz

Function 48 would be equal to the following using the above equation:

$$\frac{1750}{60} \times 60 = 1750$$

Upon entering 1750 for Function 48, the 4-digit display would indicate "1750" at 60 Hz controller output, or full speed. In this case 1750 would be a good approximation of the actual motor speed. If it is desired that the display show the approximate speed of the motor of something other than motor RPM, enter a different number in Function 48 that is scaled to the needed application. Table 5-4 shows how Function 48 can be used.

Table 5-4. Two Typical Examples of Relationship between Output Hz and RPM Monitor.

Output Hz to Motor	Actual Motor Speed in RPM	Function 11 Enter:	Function 48 Enter:	4-digit Display reads:
60.0 Hz	1750	60.0	1750	1750
30.0 Hz	850	60.0	1400	700

WARNING

SETTING THE VALUE OF FUNCTION 48 WILL GIVE A DECEPTIVELY LOW INDICATION EVEN IF THE MACHINE IS RUNNING AT MAXIMUM SPEED. DO NOT SET FUNCTION 48 TO ZERO OR A LOW VALUE. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

When setting RPM to a value smaller than 150, select parameter 1 in Function 47. This requires the second password.

Note: The RPM monitor display ignores the slip compensation frequency if Slip Compensation (Function 30) is programmed.

49 Output Voltage Regulation Mode Selection

Parameter Selection

0 = Proportional to Input
1 = Fixed to Maximum Voltage (See Function 50)

Initial Setting

0

Description

When parameter 0 is selected, the maximum output voltage will be proportional to the input voltage. When parameter 1 is selected, the maximum output voltage will be equal to the setting value of Function 50. The output voltage or the V/Hz will be fixed even if the input voltage varies.

50 Maximum Voltage

Parameter Selection

190.0 – 230.0 Volts (1)
380.0 – 460.0 Volts (2)
475 – 575 Volts (3)

Initial Setting

230.0 (1)
460.0 (2)
575 (3)

(1) 230 VAC Controllers
(2) 460 VAC Controllers
(3) 575 VAC Controllers

Description

When the output frequency reaches the Base Frequency of Function 11, the output voltage will be equal to the Maximum voltage of Function 50. The regulator board automatically discriminates between the three types of controllers mentioned above, by sensing the PSBD power supply board.

51 Jog Acceleration Value

Parameter Selection

0.1 – 360.0 Seconds

Initial Setting

20.0

Description

When parameter "0" (Linear Acceleration) is selected in Function 53, use the following formula to determine the jog acceleration "value" set in this function:

Jog Accel Value =

$$\frac{\text{(Max Hz)}}{\text{(Jog Hz)}} \text{ X (Jog Accel Time)}$$

Where:

Jog Accel = Setting of Function 51
Max Hz = Setting of Function 4
Jog Hz= Setting of Function 8
Jog Accel Time= Time to reach from zero Hz to jog Hz

Example:

If 2 seconds for Jog Acceleration Time is required, and 60 Hz is set into Function 4 (Max Hz), and 10 Hz is set into Function 8 (Jog Hz), Function 51 will be set at 12 seconds (60/10 x 2).

When Parameter "1" (S-Curve Acceleration) is selected in Function 53, use the following formula:

Jog Accel Value =

$$\sqrt{\frac{\text{Max Hz}}{\text{Jog Hz}}} \text{ X (Jog Accel Time)}$$

52 Jog Deceleration Value

Parameter Selection

0.1 – 360.0 Seconds

Initial Setting

20.0

Description

When parameter "0" is selected in Function 54, use the following formula to determine the jog deceleration value set in this function:

Jog Decel Value =

$$\frac{(\text{Max Hz})}{(\text{Jog Hz})} \text{ X } (\text{Jog Decel Time})$$

Where:

Jog Decel =	Setting of Function 52
Max Hz =	Setting of Function 4
Jog Hz=	Setting of Function 8
Jog Decel Time=	Time to reach from jog Hz to zero Hz

Example:

If 4 seconds for Jog Deceleration Time is required, and 60 Hz is set into Function 4 (Max Hz), and 20 Hz is set into Function 8 (Jog Hz), Function 52 will be set at 12 seconds (60/20 x 4).

When Parameter "1" (S-Curve Deceleration) is selected in Function 54, use the following formula:

Jog Decel Value =

$$\sqrt{\frac{\text{Max Hz}}{\text{Jog Hz}}} \text{ X } (\text{Jog Decel Time})$$

53 Jog Acceleration Selection

Parameter Selection

0 = Linear Acceleration
1 = S-Curve Acceleration

Initial Setting

0

Description

When the S-Curve Jog Acceleration is selected, acceleration will begin and end slowly. Refer to Function 14.

54 Jog Deceleration Selection

Parameter Selection

0 = Linear Acceleration
1 = S-Curve Acceleration

Initial Setting

0

Description

When the S-Curve Jog Deceleration is selected, deceleration will begin and end slowly. Refer to Function 14.

55 Current Limit Deceleration Rate

Parameter Selection

0 – 100 Hz/Seconds

Initial Setting

90

Description

When the output current attempts to exceed the preset current limit (Function 5), the motor speed will decrease at a predefined, adjustable rate. Adjustment of this function can suppress instability of current that could cause an IET trip during a current limit condition. The amount of adjustment lower or higher from the initial setting will depend on all application parameters (such as, motor, controller HP, application load, line voltage, etc.) If adjusting Function 55 will not correct the condition, Function 1 (Accel Time) and Function 5 (Preset Current Limit) should be adjusted.

56 Start into a Rotating Motor

Parameter Selection

0 = Enable
1 = Disable (Quick Start)

Initial Setting

0

Description

When parameter 0 is selected, the controller can start into a rotating motor without causing an IET trip. When the motor speed is zero or very low, it takes approximately 0.5 seconds to measure the speed before the controller can go into a start condition. The delay can be avoided by disabling the "start into a rotating load feature" by selecting parameter 1.

57 MS Terminals Selection (Multi-Speed Preset or Static Motor Operated Pot {MOP})

Parameter Selection

0 = Multi-Speed Preset
1 = Static MOP

Initial Setting

0

Password

Enter Second Password: 1123

Description

When Remote Control "1" is selected in Function 0, Function 57 can be changed. (When parameter "0" is selected, terminals 17 and 18 can be used for the Multi-Speed Preset selection. Refer to Functions 16, 17, and 18). When parameter 1 of Function 57 is selected, terminals 17 and 18 can be used for the Static MOP. When terminal 17 is connected to terminal 12, the output frequency will increase with the same acceleration rate as Function 1. When terminal 18 is connected to terminal 12, the output frequency will decrease with the same deceleration rate as Function 2. When both terminals 17 and 18 are opened or closed simultaneously, the output frequency will not change and is held constant.

6: How the Controller Operates

Fundamentals of Variable Voltage, Variable Frequency Controllers

An A-C motor is normally a fixed speed machine operating from a constant voltage, constant frequency source, such as 460 VAC and 60 Hz. To vary the speed of the motor, the voltage and frequency of the source to the motor must be variable. A controller provides this source. The controller transforms its input (three-phase, constant A-C voltage, constant frequency) into an output compatible with the A-C adjustable speed requirement of the A-C motor (three-phase, variable voltage, variable frequency).

The basic equation to determine motor synchronous speed is

$$\text{Synchronous RPM} = \frac{\text{Controller Output Frequency} \times 120}{\text{Number of A-C Motor Poles}}$$

The relationship between output voltage and operating frequency is the "Volts per Hertz" ratio (V/Hz). Except at low speed, this ratio is usually a constant determined by this equation:

$$\text{V/Hz} = \frac{\text{Motor Nameplate Voltage}}{\text{Motor Nameplate Frequency}}$$

A typical functional block diagram is given in Figure 6-1 (460 VAC, 50 HP controller). The two major sections of a controller are the power circuit and the regulator. The power circuit consists of a diode bridge that converts A-C to D-C voltage and a solid state transistor module that transforms the constant D-C voltage into variable A-C voltage and variable frequency output power. The regulator controls the ON/OFF switching of the solid state transistor module in the power circuit.

Power Circuit Operation

A-C power is supplied to terminals R', S', and T' and is full-wave rectified by the diode power module to constant D-C voltage. A leakage current sensor detects a line-to-ground leakage and short circuits on the output of the diode cube. Along with the regulator, it protects against ground faults while the controller is in operation or during startup. Three suppressors (MOV) limit voltage transients within the maximum voltage rating of the diodes.

The rectified voltage is then fed into the D-C bus capacitors, which are charged through a precharge resistor to limit the charging current. Relay DCR is energized and bypasses the precharge resistor when the bus capacitor voltage reaches approximately 90% of the rated bus voltage. The positive D-C bus voltage lines run through the Hall Effect current sensor to detect D-C bus current. The Hall Effect current sensor detects a line-to-line short circuit within each transistor arm.

The filtered D-C bus voltage is fed into the transistor modules, which transform D-C bus voltage into three-phase A-C variable voltage, variable frequency by switching. Two of the three output lines on the transistor modules run through the Hall transformers to detect A-C output current. The A-C output current feedback protects against an overload or a line-to-line short circuit among the threephase output lines.

In summary, constant D-C voltage is produced by rectifying and filtering the incoming A-C power line. Variable voltage, variable frequency is produced by six output transistors inverting the constant D-C voltage to a PWM voltage waveform.

Controller Regulator Operation

The regulator is divided into four sections: the Regulator board, the Power Supply/Interface board, the Base Driver Board, and the Keypad.

The regulator is made by surface mount technology and is fully digital with two microprocessors. The PWM signal is produced by software. All adjustments are made via keypad inputs. The regulator is designed so that the controller can be controlled either locally from the keypad or remotely from a variety of speed signals, such as a start/stop control command. An external analog signal input for speed is converted to a pulse train adaptive by the microprocessor through the V/F converter. All external signals are optically isolated. The regulator provides an IET relay.

The Power Supply board provides the control power and the interface for high voltage feedback. The control power supply is composed of a switching regulator and a high frequency multiwinding transformer. The Base Driver board provides the isolated base driver for the transistors.

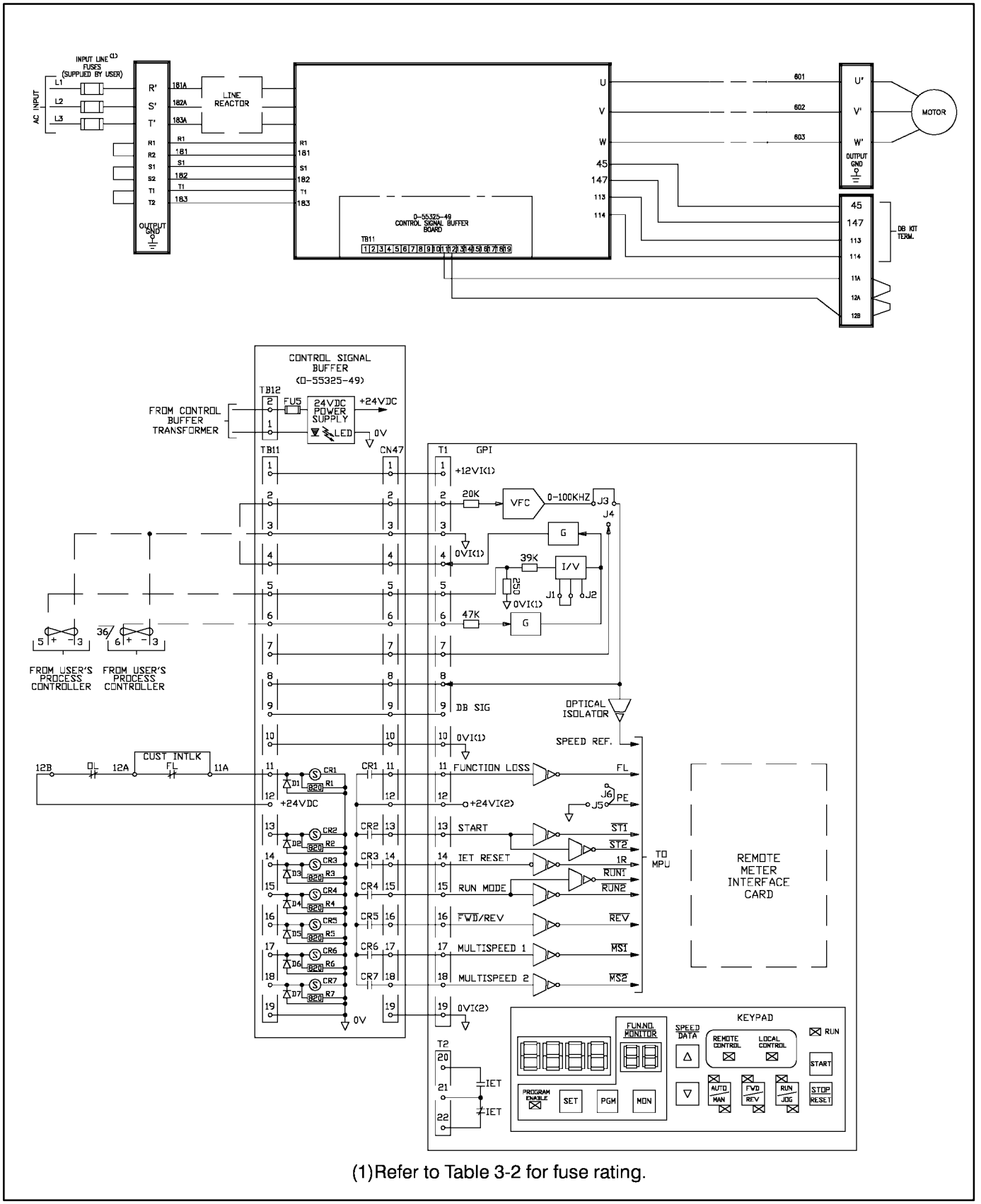
Bypass Operation (Optional)

DANGER

THE INVERTER DISCONNECT AND INVERTER ON/INVERTER OFF/BYPASS SWITCH MAY NOT ISOLATE ALL POWER IN THE CONTROLLER CABINET. REMOVE POWER BEFORE SERVICING THE EQUIPMENT. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

The optional bypass modification is required in many GP2000 pump and fan applications. This option consists of two power contactors, a 115 VAC control transformer, a three-position selector switch for fixed operation, and interlocking auxiliary contacts to ensure proper operation. These components are factory installed. The Bypass allows the user to operate the motor directly off the user-supplied power line while disconnecting the inverter portion of the controller. Refer to Figure 6-4 for bypass wiring detail.

Note: See Section 4, "Start the Controller with Bypass," if bypass option is added. Also see Section 5, "Function 32, Function Loss Selection."



(1)Refer to Table 3-2 for fuse rating.

Figure 6-1. Typical Functional Block Diagram (460 VAC, Three-phase, 25−40 HP Controller).

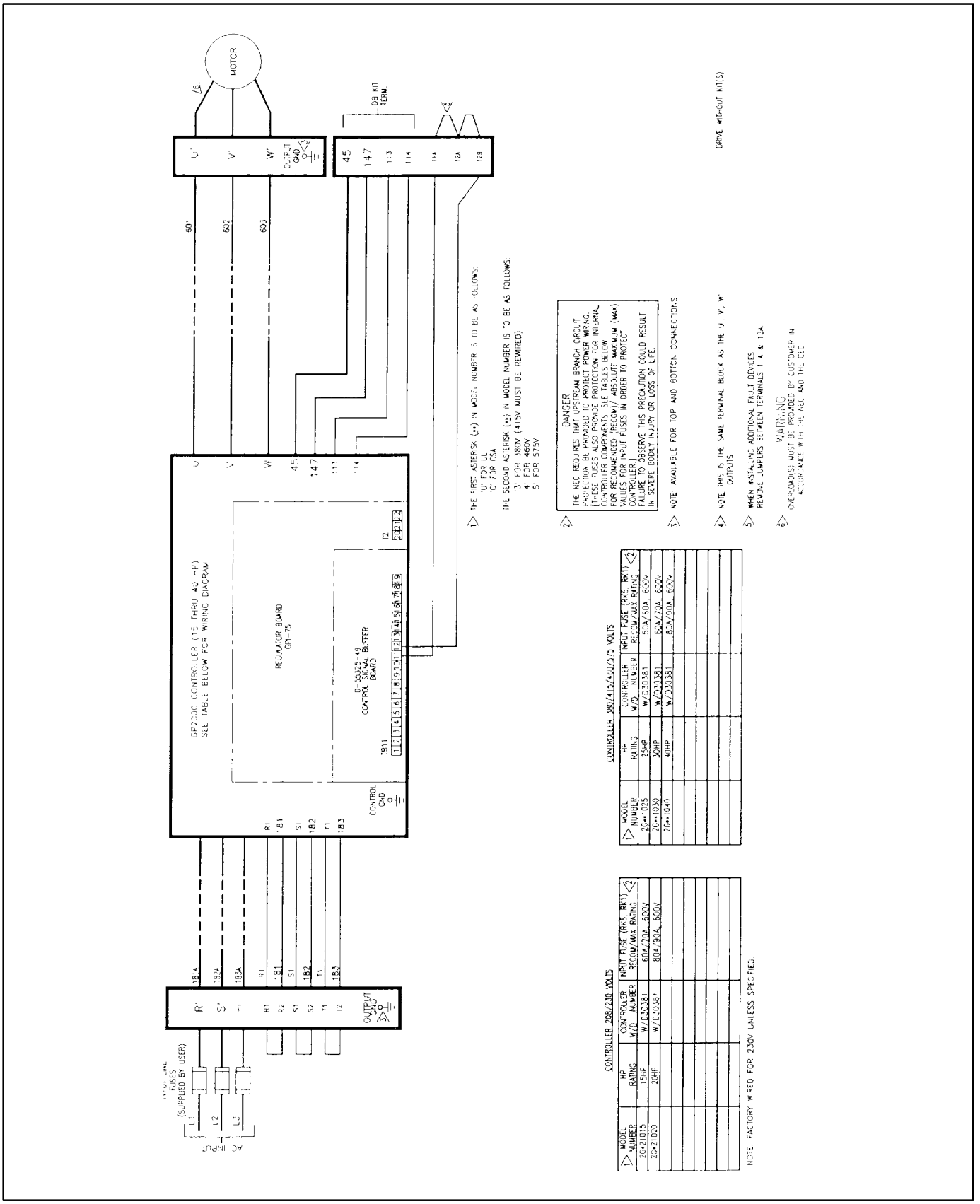


Figure 6-2. Functional Wiring Diagram.

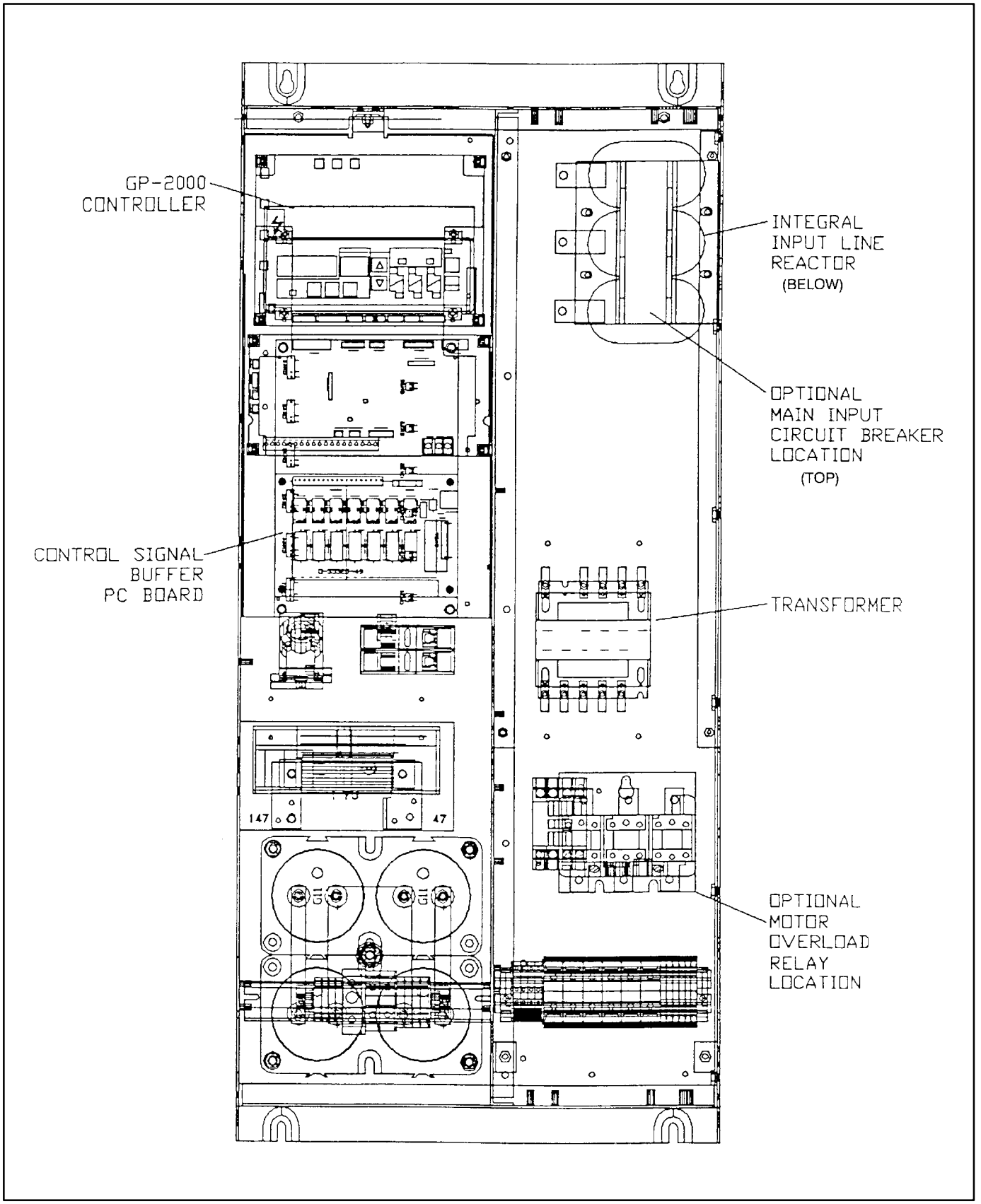


Figure 6-3. Typical GP2000 Component Locations.

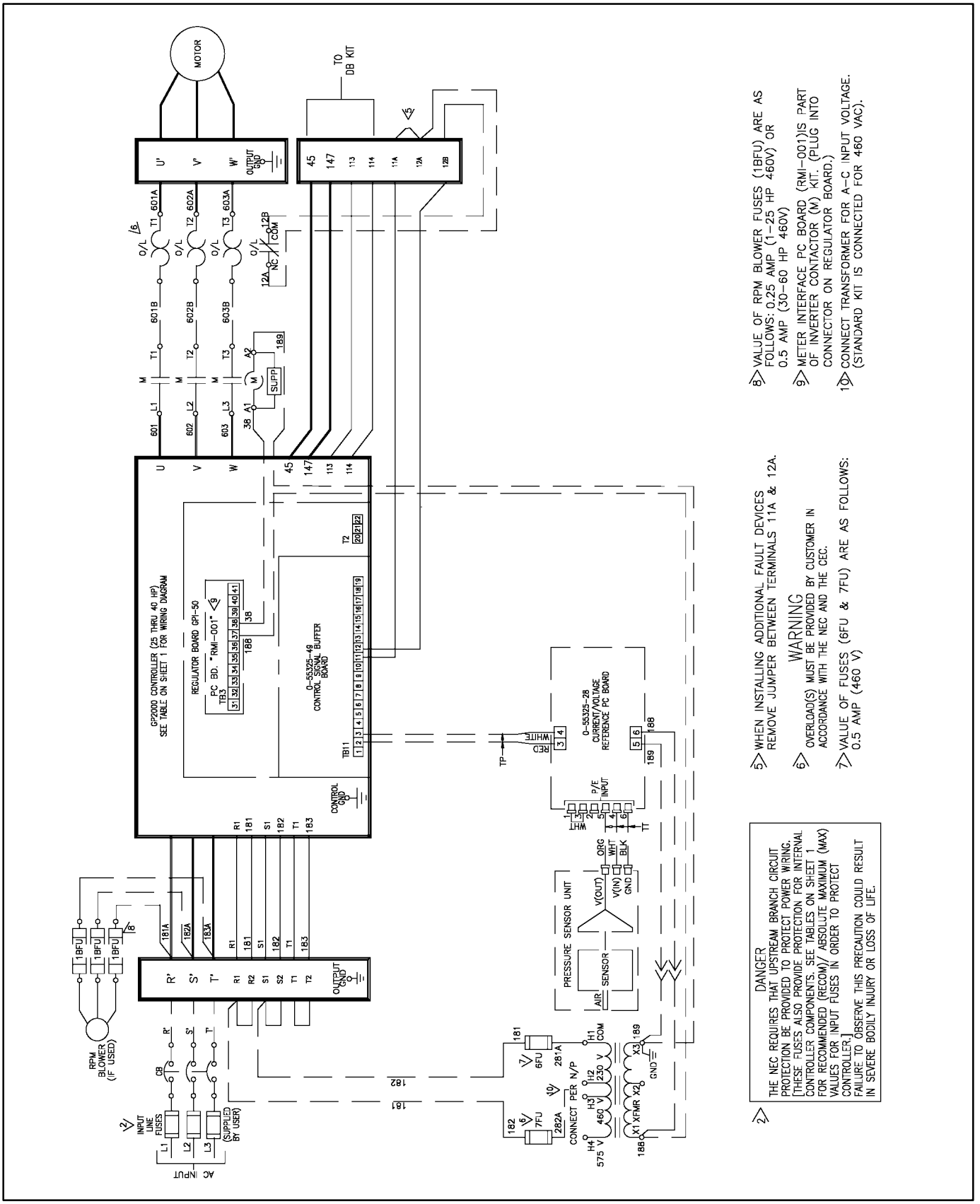


Figure 6-4. Bypass Wiring Diagram. Optional

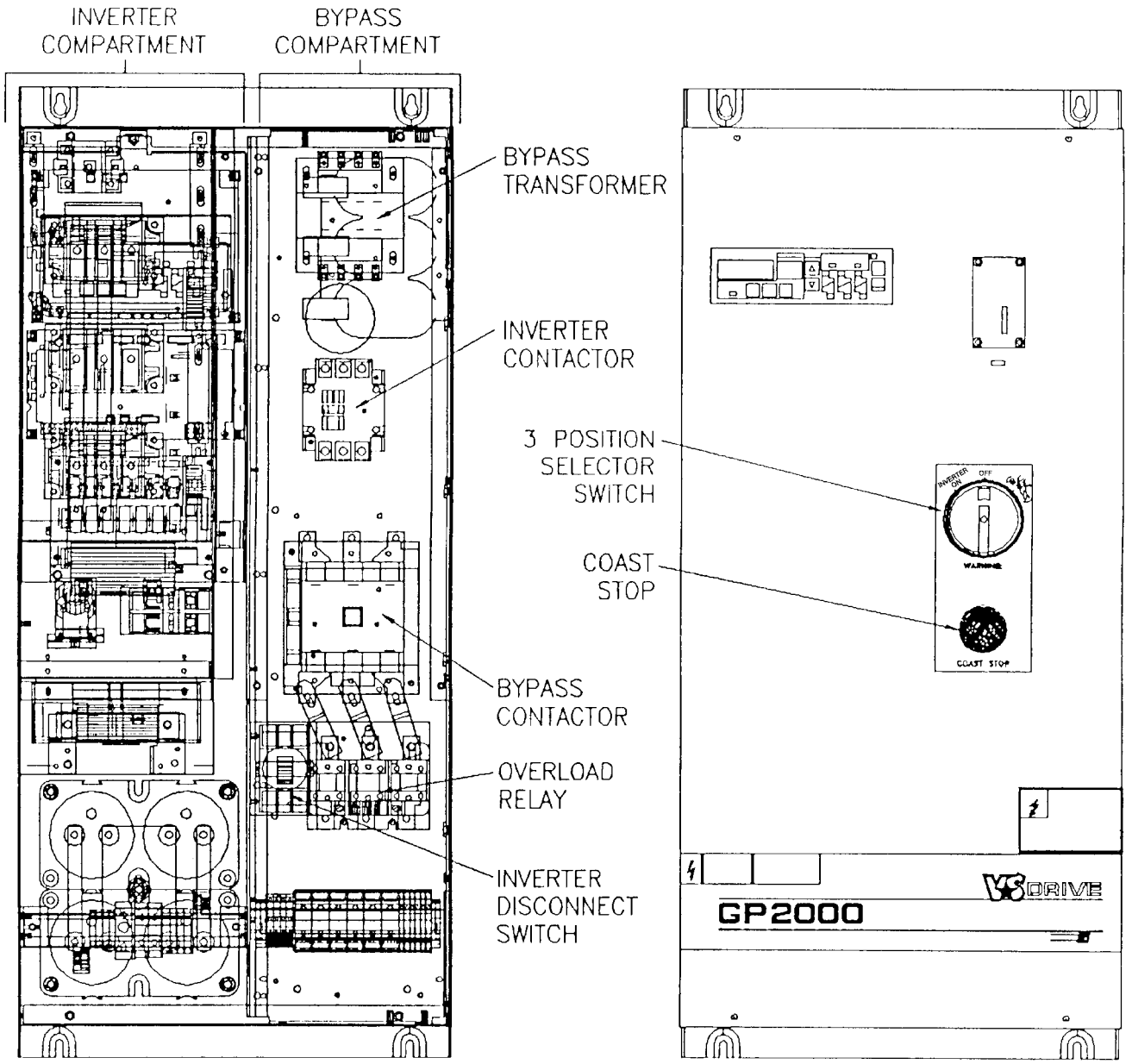


Figure 6-5. Typical GP2000 with Optional Bypass.

7: Troubleshoot the Controller

DANGER

ONLY QUALIFIED ELECTRICAL PERSONNEL FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF THIS EQUIPMENT AND THE HAZARDS INVOLVED SHOULD SERVICE IT. READ AND UNDERSTAND THIS MANUAL IN ITS ENTIRETY BEFORE PROCEEDING. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

Test Equipment Needed

CAUTION: Do not use a Megger to perform continuity checks in the drive equipment. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

For controller output measurements of voltage, amperage, and frequency, the motor power leads, the 4-digit display on the controller keypad is satisfactory. For all other voltage, amperage, and ohmic measurements, an analog or digital volt-ohmmeter is satisfactory. Make certain the selected volt-ohmmeter is rated for the intended measurement values.

Although not required for controller startup and adjustments, the best method of obtaining actual motor voltage, current, and speed measurements is with a fundamental voltmeter, digital clamp-on ammeter, and a hand-held tachometer, respectively.

Troubleshooting Aids

Several aids are provided for assisting with the troubleshooting procedure: a controller self-diagnostic test, an IET troubleshooting table, component identification figures, and wiring diagrams.

1. Whenever power is turned ON, the controller will perform a self-diagnostic test that takes approximately 10 seconds. If the test fails, a hexadecimal number will show in the 2-digit display and SELF will show in the 4-digit display. Should this "failed" condition occur, the Regulator board may be defective; contact Reliance Electric.
2. Table 7-1 lists the possible cause of an IET and gives the recommended action to eliminate the problem.
3. Figure 7-1 identifies components mounted behind the Regulator (GPI-50) Power Supply (MAP53) Base Driver boards. Refer to Table 7-2 for the replacement part numbers of these components.
4. Refer to the wiring diagram as necessary (Figure 7-2).

Helpful Reminders:

1. When an IET occurs, the IET relay energizes and the motor coasts to rest. The 4-digit display simultaneously will show the IET code of the first fault causing the IET.
2. To view the last three causes of an IET, make sure the controller is in the STOP mode; then press the MON key. Use the and keys to scroll through the last three IET causes.
3. The controller cannot start until the fault is cleared and the controller is reset. Press the STOP/RESET key to reset the controller.
4. To clear any stored IET fault history from controller memory:
   - An IET code must be showing on the 4-digit display.
   - Press and hold in the STOP key until "0000" shows on the 4-digit display (approximately 3 seconds).
5. The controller cannot be configured unless the Program jumper is in the J5 position. See Figure 3-4.

Troubleshooting Procedure

1. Check the 4-digit display for the following:
   - If an IET code displays, proceed to Table 7-1 for the possible IET cause and the action to take.
   - Clear the fault.
   - Reset the controller by pressing the STOP/RESET key.
   - Restart the controller. If the controller does not start, proceed to Step 2.
2. Turn the power OFF.

DANGER

THIS EQUIPMENT IS AT LINE VOLTAGE WHEN A-C POWER IS CONNECTED TO THE CONTROLLER. DISCONNECT ALL UNGROUNDED CONDUCTORS OF THE A-C POWER LINE FROM THE CONTROLLER. AFTER POWER IS REMOVED, VERIFY WITH A VOLTMETER AT TERMINALS 147(+) AND 45(−) THAT THE D-C BUS CAPACITOR(S) IS DISCHARGED BEFORE TOUCHING ANY INTERNAL PARTS OF THE CONTROLLER. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

3. Verify that the input power voltage is within 10% of the controller nameplate rating. If voltage is not within this range, apply the correct input voltage or add a transformer.
4. Make a complete physical inspection of all control and motor wiring. Check that connections are tight. Using Figures 3-2 through 3-8, verify that the drive is wired correctly.
5. Verify that wiring was installed according to the NEC and all local codes.
6. Check for ground faults and shorts.
7. Verify that service conditions are met. See "Service Conditions" in Section 2 of this manual.
8. Individually check that nearby relays, solenoids, brake coils, etc., are not causing electrical noise. Suppress any device that is inducing noise in the equipment.
9. With the motor connected to the controller and the motor uncoupled from the load if possible, verify that the motor will run.
   - If the motor runs, the problem could be the wrong controller for the application. Contact Reliance Electric.
   - If the motor does not run, disconnect the motor from the controller. Reconnect the motor to an external line and start the motor. If the motor still does not run, the motor may be defective and should be checked.
10. With the motor connected to the controller, verify that the controller will operate under Local Control. Place the controller under Local Control (Function 0, Parameter 0) and press the START key.
    - If the controller operates correctly, the problem could be a faulty process control signal or Remote Control Station, if used.
    - If the controller does not operate correctly, the problem could be misadjusted controller functions.
11. Verify the controller is adjusted properly. Record the adjustment settings and then return the controller to the initial factory settings. See Table 8-3. If possible, disconnect the motor from the controller. With the controller in Local Control, press the START key.
    - If the controller operates correctly with the initial settings, your controller was misadjusted. Readjust the controller as necessary.
    - If the controller does not operate correctly, contact Reliance Electric.

Table 7-1. Troubleshooting IETs.

IET Code	Type of IET	Possible Cause	Action
HU	High Bus Voltage	Input voltage too high Deceleration time too short	• Check input voltage. If incorrect, add transformer (see Section 3). • Increase deceleration time. • Install DB kit.
LU	Low Bus Voltage	Input voltage too low	• Check input voltage. If incorrect, add transformer (see Section 3). • Check D-C bus voltage. If incorrect, possible diode cube problem; contact Reliance Electric.
OC-A	Overcurrent−A	Acceleration time too short Momentary overload Torque boost or V/Hz too high	• Increase acceleration time. • Check for motor overload; reduce load on motor. • Adjust torque boost (Function 7) or V/Hz (Function 11).
OC-d	Overcurrent−D	Deceleration time too short	• Increase deceleration time.
OC-G	Overcurrent−G	Output line-to-ground	• Check isolation between ground and output terminals. Remove any grounds. • Possible leakage current sensor problem; contact Reliance Electric.
OC	Overcurrent	Output line-to-line Bus voltage line-to-line Momentary overload Torque boost or V/Hz too high	• Check isolation among each output line. Correct as necessary. • Check the transistor module for correct output. If incorrect, possible PS&BD board problem; contact Reliance Electric. • Possible Hall Effect current sensor problem; contact Reliance Electric. • Check for motor overload; reduce load on motor. • Adjust torque boost (Function 7) or V/Hz (Function 11).
OL	Overload	Internal thermal overload	• Reduce load on motor. • Reduce torque boost (Function 7).
OH	Overheat	Cooling fan fault	• Check cooling fan; correct as necessary.
LdIP	Line dip	A-C power supply interrupt	• Check input voltage. If incorrect, install appropriate A-C reactor in input line.
CPU	CPU error	Microprocessor logic error	• Turn power OFF for about 10 seconds, then turn power ON. • If not corrected, possible Regulator board problem; contact Reliance Electric.
Err1	Error 1	Memory error	• Turn power OFF for about 10 seconds, then turn power ON. • If error not corrected, scroll function list for incorrect parameter (− − − − in 4-digit display); readjust parameter. • If no parameter shows − − − −, possible Regulator board problem; contact Reliance Electric.
Err2	Error 2	Start/Stop or Run regulator circuit fault (during Remote Control operation only).	• Possible Regulator board problem; contact Reliance Electric.
FL	Function Loss	Function loss input is open (0VDC) (Function 32, parameter 0)	• Check external interlocks connected at terminals 11A−12A; correct as necessary. • Check for external short circuit between terminals 11−19; correct as necessary.
CS	Coast Stop	Function loss input is open (0VDC) (Function 32, parameter 1)	• Check external interlocks connected at terminals 11A−12A; correct as necessary. (Note: Controller will start with START key after cause of function loss is removed.) • Check for external short circuit between terminals 11−19; correct as necessary. • Check inverter/bypass selector switch position if bypass option is included. • Check that inverter contactor is picked up. • Check overload relay.
OP	1SC4000 Fault	Rail Interface Card Fault	• Refer to 1SC4000 Instruction Sheet D2-3170.
CF			

Table 7-2. Replacement Parts List.
460 V (25 – 40 HP)

Description	Qty. Per Controller	Reliance Part Number
Diode Cube 25 to 40 HP	1	701819-102AW
Transistor Module 25 HP 30 to 40 HP	3 3	602909-123AW 602909-124AW
D-C Bus Capacitor 25 to 40 HP	4	600442-23SS
Precharge Relay 25 to 40 HP	1	705310-32M
Precharge Resistor 25 to 40 HP	2	63481-104QAA
Voltage Detect Resistor 25 to 40 HP	1	63481-102TFB
Discharge Resistor 25 to 40 HP	2 2	63481-102TAA 63481-102TBF
Input Suppressor Assembly 25 to 40 HP	3	411026-8Y
Regulator PC Board 25 to 40 HP	1	0-48680-117
Power Supply PC Board 25 to 40 HP	1	0-48680-213
Fan Assembly 25 to 40 HP	1	69739-20S
Leakage Current Sensor Assembly 25 to 40 HP	1	611899-60R
Bus Clamp Assembly 25 to 40 HP	3	0-55325-76
Control Tranformer Assembly 25 to 40 HP	1	417155-14A
Keypad Assembly 25 to 40 HP	1	612180-801R
Hall Effect Current Sensor 25 HP 30 HP 40 HP	3 3 3	600595-13AA 600595-13AB 600595-13AC
Control Signal Buffer PC Board	1	0-55325-49
Control Signal Buffer PC Board Transformer	1	708205-31S
Base Driver PC Board	1	0-55325-46
Bus Fuse	1	64676-130ATX(1)
Control Transformer Fuse 25–50 HP	2	64676-64W(2)
DB Kit Control Fuse 25–50 HP	1	64676-21T

(1) 700 volt, 100 amp (Gould A70P100 or Brush XLF100)

(2) 600 volt, 1.25 amp (Littel Fuse Type KLDR Class CC Rejection)

Table 7-3. Replacement Parts List (Optional Bypass Components). 460 V (25 – 40 HP)

Quantity	Description	Reliance Part Number
1	Transformer	417155-RR
1	Bypass contactor	705310-37A
1	Inverter contactor	705310-54A
1	Overload relay	704263-5A
2	460/575 V primary fuses	64676-64D(1)

(1) 600 V, 1.0 amp (Littel Fuse Type KLDR Class CC Rejection)

Table 7-4. Replacement Parts List. 230/208 V (15 – 20 HP)

Description	Qty. Per Controller	Reliance Part Number
Diode Cube 15 to 20 HP	1	701819-102AW
Transistor Module 15 to 20 HP	3	602909-124AW
D-C Bus Capacitor 15 to 20 HP	4	600442-23SS
Precharge Relay 15 to 20 HP	1	705310-32M
Precharge Resistor 15 to 20 HP	2	63481-104QAA
Voltage Detect Resistor 15 to 20 HP	1	63481-102TFB
Discharge Resistor 15 to 20 HP	2 2	63481-102TAA 63481-102TBF
Input Suppressor Assembly 15 to 20 HP	3	411026-8Y
Regulator PC Board	1	0-48680-117
Power Supply PC Board	1	0-48680-215
Fan Assembly	1	69739-20S
Leakage Current Sensor Assembly	1	611899-60R
Bus Clamp Assembly	3	0-55325-76
Control Tranformer Assembly	1	417155-14A
Keypad Assembly	1	612180-801R
Hall Effect Current Sensor 15 HP 20 HP	3 3	600595-13AB 600595-13AC
Control Signal Buffer PC Board	1	0-55325-49
Control Signal Buffer PC Board Transformer	1	708205-31T
Base Driver PC Board	1	0-55325-46
Bus Fuse	1	64676-130ATX(1)
Control Transformer Fuse (2 FU, 3 FU)	2	64676-64W(2)

(1) 700 volt, 100 amp (Gould A70P100 or Brush XLF100)

(2) 600 volt, 1.25 amp (LittelFuse Type KLDR Class CC Rejection)

Table 7-5. Replacement Parts List (Optional Bypass Components). (230/208 V)

Quantity	Description	Reliance Part Number
1	Transformer	417155-8C
1	Bypass contactor	705310-37A
1	Inverter contactor	705310-54A
1	Overload relay	704263-5A
2	230/208 V primary fuses	64676-64G(1)

(1) 600 V, 2.0 amp (LittelFuse Type KLDR Class CC Rejection)

Table 7-6. Replacement Parts List. 380/416 V (22 kw/30 HP)

Description	Qty. Per Controller	Reliance Part Number
Diode Cube	1	701819-102AW
Transistor Module	3	602909-124AW
D-C Bus Capacitor	4	600442-23SS
Precharge Relay	1	705310-32M
Precharge Resistor	2	63481-104QAA
Voltage Detect Resistor	1	63481-102TFB
Discharge Resistor	2 2	63481-102TAA 63481-102TBF
Input Suppressor Assembly	3	411026-8Y
Regulator PC Board	1	0-48680-117
Power Supply PC Board	1	0-48680-213
Fan Assembly	1	69739-20S
Leakage Current Sensor Assembly	1	611899-60R
Bus Clamp Assembly	3	0-55325-76
Control Tranformer Assembly	1	417155-14A
Keypad Assembly	1	612180-801R
Hall Effect Current Sensor	3	600595-13AE
Control Signal Buffer PC Board	1	0-55325-49
Control Signal Buffer PC Board Transformer	1	708205-31V
Base Driver PC Board	1	0-55325-46
Bus Fuse	1	64676-130ATX(1)
Control Transformer Fuse (2 FU, 3 FU)	2	64676-64W(2)

(1) 700 volt, 100 amp (Gould A70P100 or Brush XLF100)

(2) 600 volt, 1.25 amp (LittelFuse Type KLDR Class CC Rejection)

Table 7-7. Replacement Parts List (Optional Bypass Components). (380/416 V)

Quantity	Description	Reliance Part Number
1	Transformer	417155-12A
1	Bypass contactor	705310-37A
1	Inverter contactor	705310-54A
1	Overload relay	704263-5A
2	380/416 V primary fuses	64676-64W(1)

(1) 600 V, 1.25 amp (LittelFuse Type KLDR Class CC Rejection)

Table 7-8. Replacement Parts List. 575 V (30 – 40 HP)

Description	Qty. Per Controller	Reliance Part Number
Diode Cube	1	701819-102AY
Transistor Module	3	602909-124AY
D-C Bus Capacitor	4	600442-27SQ
Precharge Relay	1	705310-32M
Precharge Resistor	2	63481-104QAA
Voltage Detect Resistor	1	63481-102TFB
Discharge Resistor	2 2	63481-102TAA 63481-102TBF
Input Suppressor Assembly	3	411026-8Z
Regulator PC Board	1	0-48680-117
Power Supply PC Board	1	0-48680-216
Fan Assembly	1	69739-20S
Leakage Current Sensor Assembly	1	611899-60R
Bus Clamp Assembly	3	0-55325-76
Control Tranformer Assembly	1	417155-14A
Keypad Assembly	1	612180-801R
Hall Effect Current Sensor 30 HP 40 HP	 3 3	 600595-13AA 600595-13AB
Control Signal Buffer PC Board	1	0-55325-49
Control Signal Buffer PC Board Transformer	1	708205-31V
Base Driver PC Board	1	0-55325-46
Bus Fuse	1	64676-130ATX(1)
Control Transformer Fuse (2 FU, 3 FU)	2	64676-64W(2)

(1) 700 volt, 100 amp (Gould A70P100 or Brush XLF100)

(2) 600 volt, 1.25 amp (LittelFuse Type KLDR Class CC Rejection)

Table 7-9. Replacement Parts List (Optional Bypass Components). (575 V)

Quantity	Description	Reliance Part Number
1	Transformer	417155-8C
1	Bypass contactor	705310-37A
1	Inverter contactor	705310-54A
1	Overload relay	704263-5A
2	575 V primary fuses	64676-64D(1)

(1) 600 V, 1.0 amp (LittelFuse Type KLDR Class CC Rejection)

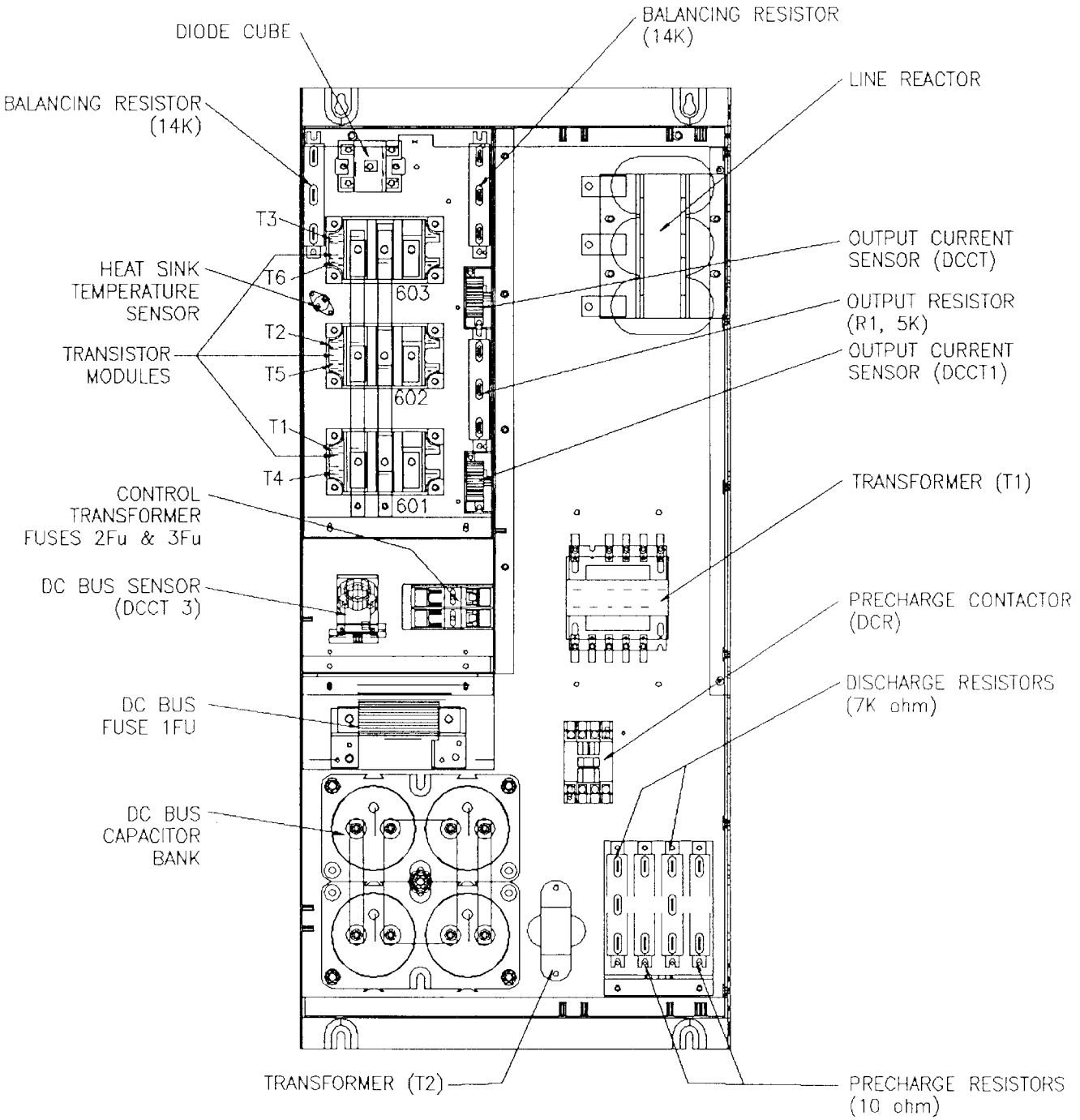


Figure 7-1. Typical Component Identification (25−40 HP, 460 VAC Power Module).

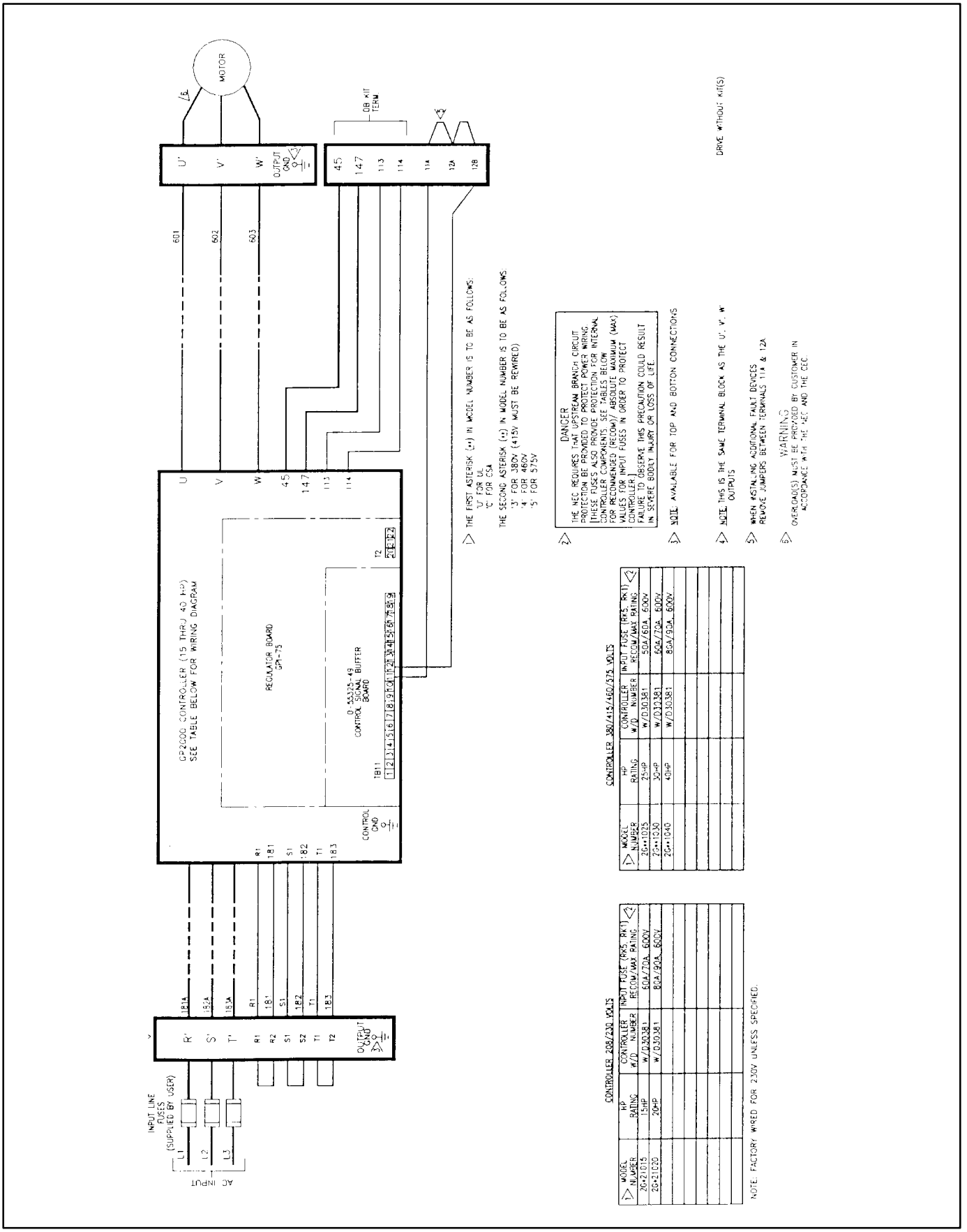


Figure 7-2. Typical Wiring Diagram (25−40 HP, 460 VAC Controllers).

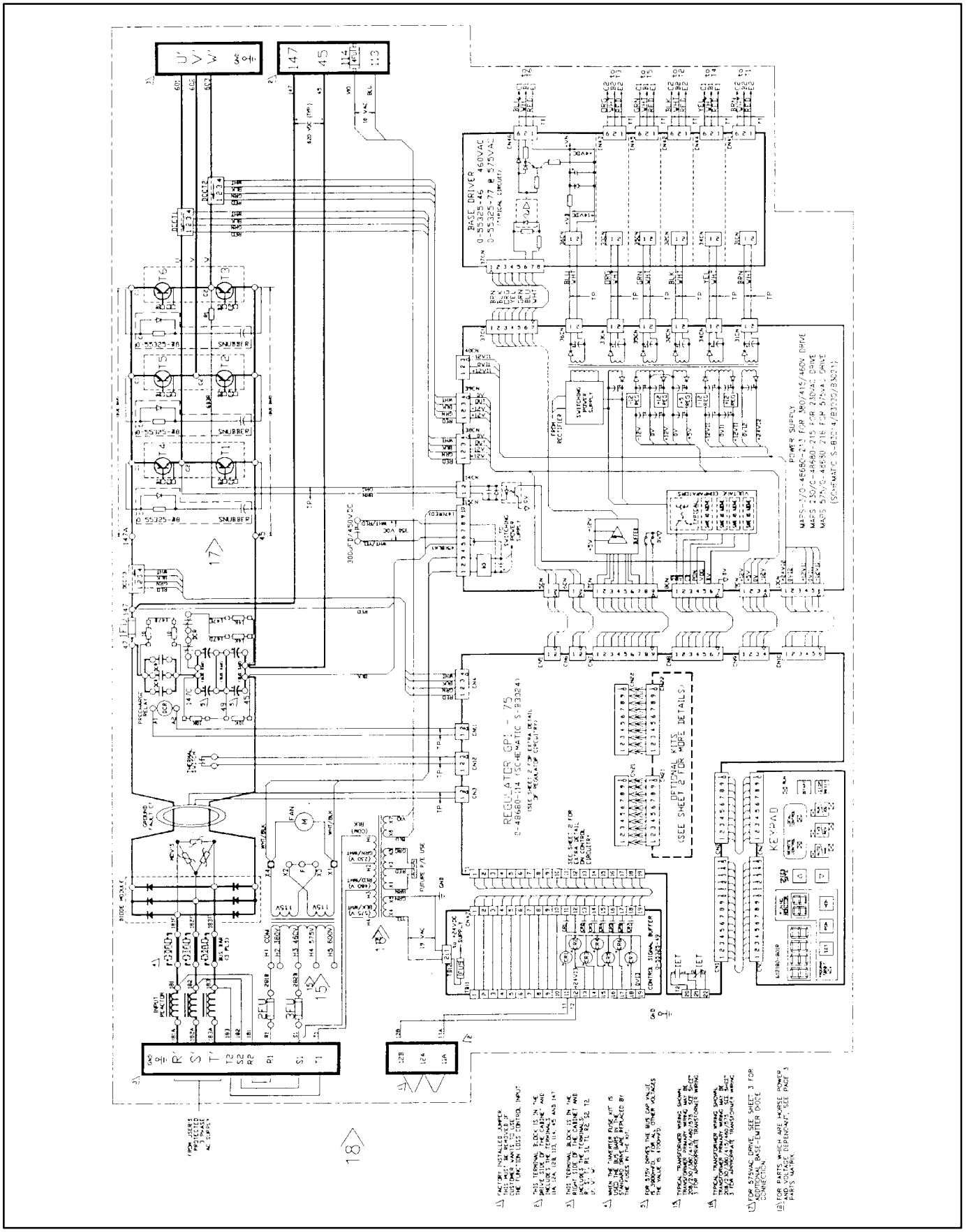
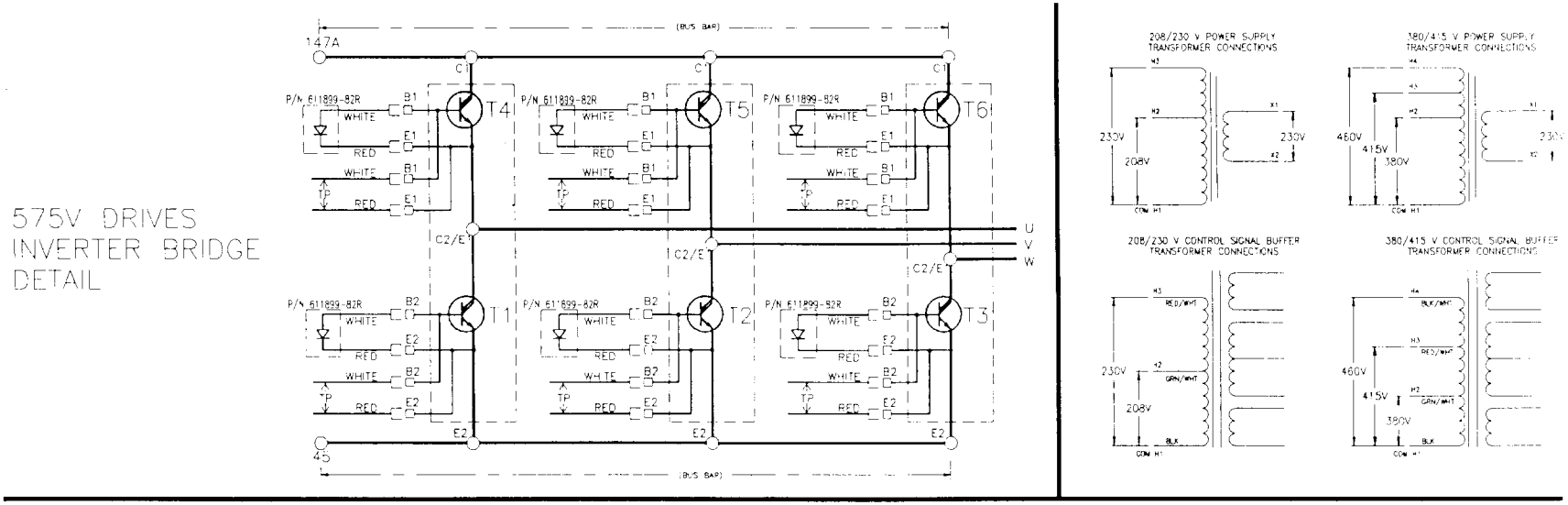


Figure 7-3. System Wiring Diagram.



PARTS MATRIX

DRIVE / COMPONENT	208, 230V 15 HP	208, 230V 20 HP		380, 415 V 22 KW		460V 25 HP	460V 30 HP	460V 40 HP		575V 30 HP	575V 40 HP	
TRANSISTOR	602909-123AW	602909-124AW		602909-124AW		602909-123AW	602909-123AW	602909-124AW		602909-124AY	602909-124AY	
RECTIFIER	701819-102AW	701819-102AW		701819-102AW		701819-102AW	701819-102AW	701819-102AW		701819-102AY	701819-102AY	
MOV'S	411026-8Y	411026-8Y		411026-8Y		411026-8Y	411026-8Y	411026-8Y		411026-8Z	411026-8Z	
SUPPLY CARD	0-48680-215	0-48680-215		0-48680-213		0-48680-213	0-48680-213	0-48680-213		0-48680-216	0-48680-216	
BASE DRIVE	0-55325-46	0-55325-46		0-55325-46		0-55325-46	0-55325-46	0-55325-46		0-55325-77	0-55325-77	
BUS CAPACITOR	600442-23SS	600442-23SS		600442-23SS		600442-23SS	600442-23SS	600442-23SS		600442-23SQ	600442-23SQ	
TRANSFORMER	417155-14A	417155-14A		417155-14A		417155-14A	417155-14A	417155-14A		417155-14A	417155-14A	
BUS FUSE	64676-130ATX	64676-130ATX		64676-130ATX		64676-130ATX	64676-130ATX	64676-130ATX		64676-140ARX	64676-140ARX	
CTRL FUSE	64676-64W	64676-64W		64676-64W		64676-64W	64676-64W	64676-64W		64676-64W	64676-64W	
HALL SENSOR	600595-13AB	600595-13AC		600595-13AE		600595-13AA	600595-13AB	600595-13AC		600595-13AA	600595-13AB	

Figure 7-4. Parts Matrix and 575 V Invertor Detail.

8: Quick Reference Guide

Controller Specifications

Table 8-1. Controller Three-Phase Ratings.

Controller Model Number	Nominal Horsepower Range	Controller 3-Phase Input Volts	Controller Input KVA	Input Amps at Rated Output Amps	Maximum Controller Output Amp
2GU41025	25	460	29.5	37	34.0
2GU41030	30	460	35.1	44	40.0
2GU41040	40	460	45.4	57	52.0
2GU21015	15	230/208	17.5	44.0	40.0
2GU21020	20	230/208	22.7	57.0	52.0
2GU31022	30/22 kw	380/415	31.7	48.0	44.0
2GU51030	30	575	34.0	35.0	32.0
2GU51040	40	575	45.4	44.0	41.0

Table 8-2. Record of User's Parameter Selections/Adjustments

Function Number		Functional Descriptions	Parameter Selection/ Adjustment Range	Initial Factory Setting	User Data	
					Date	Setting
First Menu	0	Local/Remote Operation Control	0 = Local Control 1 = Remote Control/Terminal Strip 2 = Remote Control I/O Port	0		
	1	Accel. Time (See Function 44)	5.0 – 360.0 Seconds	20.0		
	2	Decel. Time (See Function 45)	5.0 – 360.0 Seconds	20.0		
	3	Minimum Hz (See Function 43)	5.0 – 60 Hz	5.0		
	4	Maximum Hz (See Function 38)	15 – Overfrequency Limit	60.0		
	5	Current Limit	50 – 150% Current	150		
	6	Expand to Second Menu (First Password Necessary)	0 = Basic (First Menu Only) 1 = Expand to Second Menu	0		
Second Menu	7	Manual Torque Boost	0 – 10% Voltage	2		
	8	Jog Frequency	0.0 – 60.0 Hz (Note: The actual jog frequency automatically is limited between minimum Hz and maximum Hz.)	5.0		
	9	Stop Mode Selection	0 = Coast-to-rest 1 = Ramp-to-rest	0		
	10	Automatic Flux Control	0 – 5% Rated Voltage	0		
	11	Base Frequency Selection (Volts/Hz Ratio)	30.0 – 120.0 Hz	60.0		
	12	Electronic Thermal Overload Selection	0 = Normal Motor 1 = Forced Cooled Motor	0		
	13	Electronic Thermal Overload Level	20 – 100% Current	100		
	14	Linear/S-Curve Acceleration	0 = Linear Acceleration 1 = S-Curve Acceleration	0		
	15	Linear/S-Curve Deceleration	0 = Linear Deceleration 1 = S-Curve Deceleration	0		
	16	Multi-Speed Preset 1 MS1[3]	0.0 – 400.0 Hz (Note: The actual preset frequency automatically is limited between minimum Hz and maximum Hz.)	5.0		
	17	Multi-Speed Preset 2 MS2[3]		5.0		
	18	Multi-Speed Preset 3 MS3[3]		5.0		
	19	Avoidance Frequency 1 AF1	0.0 – 400.0 Hz (Note: The actual preset frequency automatically is limited between minimum Hz and maximum Hz.)	0.0		
	20	Avoidance Frequency 2 AF2		0.0		
	21	Avoidance Frequency 3 AF3		0.0		
	22	Avoidance Frequency Band AFB	0.2 – 10.0 Hz	0.2		
	23	Variable Torque Volts/Hz Curve Selection	0 = Constant Torque Curve 1 = Variable Torque Curve	0		
	24	D-C Braking Operation Time[4]	0.0 – 10.0 Seconds	0.0		
	25	D-C Braking Voltage[5]	0 – 20% Voltage	0		
	26	D-C Braking Start Frequency[5]	0.5 – 10.0 Hz	1.0		
	27	Line-Dip-Ride-Through	15 – 500 milliseconds	15		

Table 8-2. Record of User's Parameter Selections/Adjustments (Continued).

Function Number		Functional Descriptions	Parameter Selection/ Adjustment Range	Initial Factory Setting	User Data	
					Date	Setting
Second Menu (Cont.)	28	Output Relay 1 (Form C Contact) (Note: Requires the Remote Meter Interface Card.)	0 = Not Used 1 = Zero Speed Detect 2 = Input Contactor 3 = Output Contactor 4 = Frequency Level Detection 1	0		
	29	Output Relay 2 (Form A Contact) (Note: Requires the Remote Meter Interface Card.)	5 = Frequency Level Detection 2 6 = Current Level Detection 7 = Reverse Rotation 8 = D-C Braking Operation 9 = Reserved	0		
	30	Slip Compensation(6)	0.0 – 5.0 Hz	0.0		
	31	Inverse Reference(7) (Second Password Necessary)	0 = Normal 1 = Inverse	0		
	32	Function Loss Selection (Second Password Necessary)	0 = IET at Function Loss 1 = Coast-to-rest without an IET output at Function Loss	0(2) 1		
	33	Freq. Level Detection 1(8)	0.5 – 405.0 Hz	0.5		
	34	Freq. Level Detection 2(9)	0.5 – 405.0 Hz	0.5		
	35	Current Level Detection(10)	30 – 110% Current	100		
	36	Reverse Disable(11)	0 = Forward/Reverse Enable 1 = Reverse Disable on Keypad	0		
	37	Automatic (Process Control)(12) Disable on Local Control	0 = AUTO/MAN Key Enable 1 = AUTO Disable on Keypad	0		
	38	Overfrequency Limit (Second Password Necessary)	50.0 – 405.0 Hz	90.0		
	39	D-C Offset Enable(1) (Second Password Necessary)	0 = Offset Disable 1 = Offset Enable	0		
	40	Auto-reset Enable (Second Password Necessary)	0 = Auto-reset Disable 1 = Auto-reset Enable	0		
	41	Auto-reset Time(13)	0 – 10 Times	0		
	42	Auto-reset Interval Time(14)	1 – 60 Seconds	1		
	43	Extended Minimum Hz Range(1) (Second Password Necessary)	0 = Disable (5 – 60 Hz) 1 = Enable (0 – 60 Hz)	0		
	44	Extended Acceleration Time Range(1)	0 = 5.0 – 360.0 Seconds 1 = 0.1 – 360.0 Seconds	0		
	45	Extended Deceleration Time Range(1)	0 = 5.0 – 360.0 Seconds 1 = 0.1 – 360.0 Seconds	0		
	46	RPM Monitor Display Enable	0 = Disable 1 = Enable	0		
	47	RPM Monitor Range Selection (Second Password Necessary)	0 = 150 – 9999 RPM 1 = 0 – 9999 RPM	0		
	48	RPM Monitor Base Frequency Selection (See Function 47)	150 – 9999 RPM	1750		

(1) This function is settable in software to 500 ms, however, should not be changed for this controller.

(2) Parameter 32 is programmed with "1" when bypass option is added.

(3) Requires the Remote Meter Interface Card.

Table 8-2. Record of User's Parameter Selections/Adjustments (Continued).

Function Number	Functional Descriptions	Parameter Selection/ Adjustment Range	Initial Factory Setting	User Data	
				Date	Setting
Second Menu (Cont.) 49	Output Voltage Regulation Mode Selection (See Function 50)	0 = Proportional to input 1 = Fixed to Max Voltage	0		
50	Maximum Voltage	190.0 – 230.0[13] 380.0 – 460.0[14] 475 – 575[15]	230.0[13] 460.0[14] 575[15]		
51	Jog Acceleration Value	0.1 – 360.0 Seconds	20.0		
52	Jog Deceleration Value	0.1 – 360.0 Seconds	20.0		
53	Jog Acceleration Selection	0 = Linear Acceleration 1 = S-Curve Acceleration	0		
54	Jog Deceleration Selection	0 = Linear Deceleration 1 = S-Curve Deceleration	0		
55	Current Limit Deceleration Rate	0 – 100 Hz/Seconds	90		
56	Start into a Rotating Motor	0 = Enable 1 = Disable (Quick Start)	0		
57	MS Terminals Selection[15]	0 = Multi-Speed Preset 1 = Static MOP	0		

(3) Effective when "1" is selected in Function 0 and "1" is selected in Function 57.

(4) Effective when "1" is selected in Function 9.

(5) Ineffective when "0.0" is set in Function 24.

(6) Effective when "0" is selected in Function 39.

(7) Effective when "1" is selected in Function 0, or when "0" is selected in Function 0 while AUTO mode on keypad is selected.

(8) Effective when "4" is selected in Function 28 or 29.

(9) Effective when "5" is selected in Function 28 or 29.

(10) Effective when "6" is selected in Function 28 or 29.

(11) Effective when "0" is selected in Function 0.

(12) Effective when "0" is selected in Function 0.

(13) Effective when "1" is selected in Function 40.

(14) Ineffective when "0" is set in Function 41.

(15) Effective when "1" is selected in Function 0.

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