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GPD 402

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Installation • Operation • Maintenance

Adjustable Frequency Drives

Technical Manual
TM 4140

MagneTek
Drives & Systems

CONTENTS

GPD 402 RATINGS AND SPECIFICATIONS

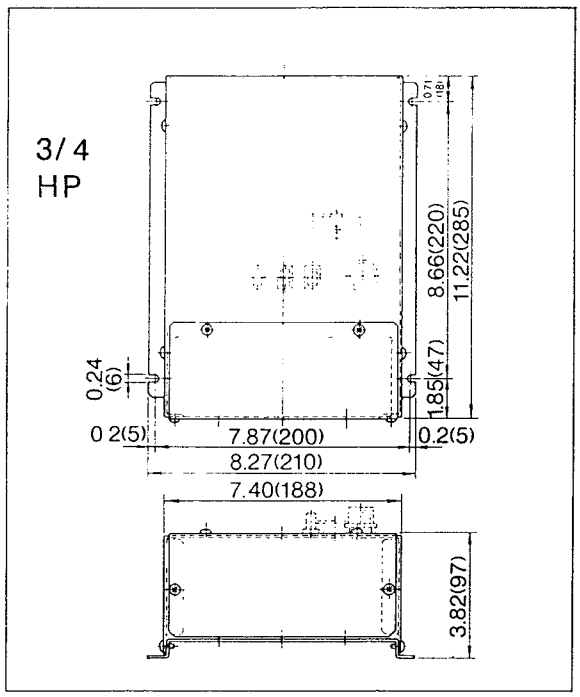
		3/4HP	1HP	3HP	5HP
Max Motor Output	Rated Capacity (3Ø Input)	1.2 KVA	1.8 KVA	4.2 KVA	7.0 KVA
	Rated Current (3Ø Input)	3 Amps	4.5 Amps	10.5 Amps	17.5 Amps
	Rated Capacity (1Ø Input)	1.2 KVA	1 8 KVA	4.2 KVA	Not Available
	Rated Current (1Ø Input)	3 Amps	4.5 Amps	10.5 Amps	
Approximate Weight		7 lb.	8 lb	13 lb	14 lb.
Input Power Supply		3 Phase 208/230 VAC ±10% 50/60HZ ±5%			
		1 Phase 208/230 VAC ±10% 50/60HZ ±5%			Not Available
Max Output Voltage		208/230 VAC ±10% Three Phase			
Control Method		Sinusoidal sine wave PWM			
Output Frequency		5 to 120 HZ (Frequency setting: in increments of 0.25HZ at 0 to 60HZ, in increments of 0 5HZ at 0 to 90HZ, 120HZ)			
Frequency Resolution		±0.25HZ (5 to 60HZ), ±0 5HZ (5 to 120HZ)			
Frequency Accuracy		±0.5% -10 to +40°C [+14 to +104°F]			
Allowable Overload Capacity		150% for two minutes			
Accel/Decel Time		0 35 to 26 sec (accel and decel set independently, with 16 selections available for each)			
Braking Torque		100% rating			
Input Signals	Run and Stop	Running reference from NO contact (Maintained)			
	FWD/REV Running	Reverse running reference from NO contact (Maintained)			
	Frequency Setting	0 to 10V, 1 to 5V, 4 to 20mA selectable			
	Multispeed	7 steps (5,10,20,30,40,50 & 60HZ) by 3 NO contacts (Maintained)			
	Reset	Fault circuit reset from NO contact (momentary)			
Integral Operator Controls	RUN/STOP/RESET switch	RUN/STOP (Maintained); RESET: NO (momentary)			
	FWD/REV switch	FWD: open, REV: NO (Maintained)			
	AUTO/MAN switch	AUTO· ext. freq. setting input; MAN: freq setting by FREQ. SET pot (on inverter cover)			
	FREQ. SET potentiometer	10K ohm; adjusts for 0 to 100% of max. output frequency			
	FREQUENCY meter	Provides analog display of inverter output frequency (HZ)			
Protective Functions	Instantaneous Power Failure	Protective circuit functions if power failure is detected			
	Undervoltage	Trips at 170V or less			
	Overcurrent	Trips by overcurrent caused by short circuit and/or ground fault			
	Overvoltage	Trips by overvoltage			
Environ-mental Condition	Location	Indoor (free from corrosive gases and dust)			
	Ambient Temperature	-10 to +40°C [+14 to +104°F]			
	Humidity	95% max relative (non-condensing)			
	Elevation	3300 feet max (1000 meters)			
	Vibration	0.5 G max			

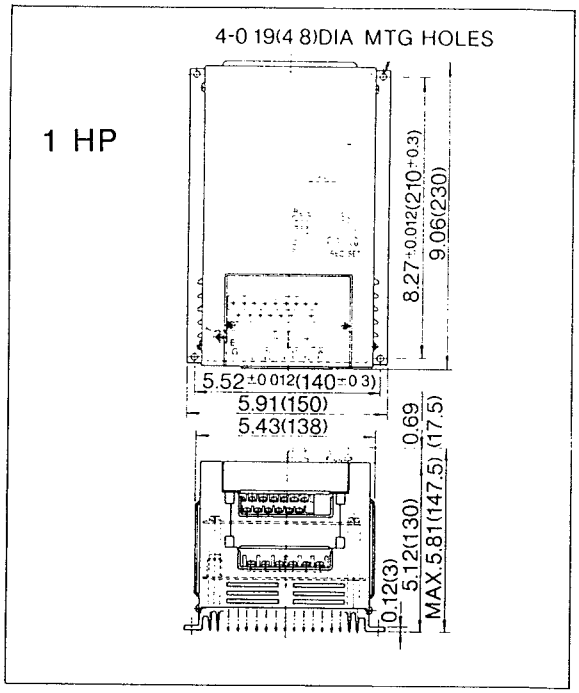
1. RECEIVING

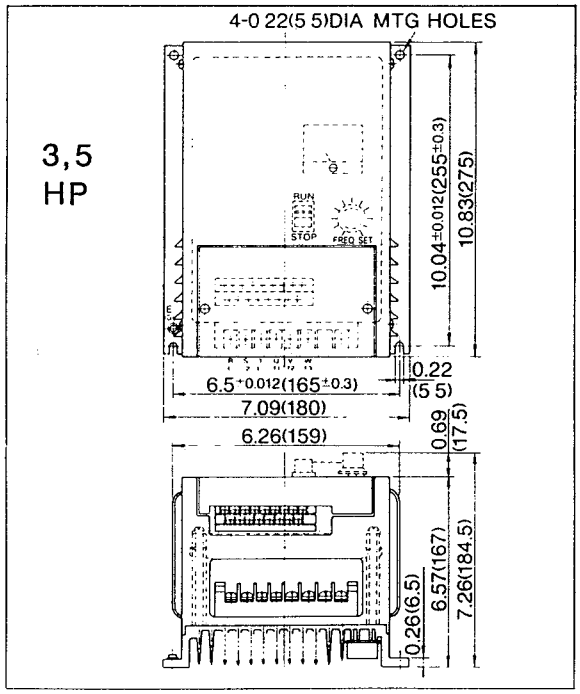
All equipment is tested against defect at MagneTek Drives & Systems. Any damages or shortages evident when the equipment is received must be reported immediately to the commercial carrier who transported the equipment. Assistance, if required, is available from the nearest MagneTek Drives & Systems representative. Always refer to the order number, equipment description, and serial number when contacting MagneTek Drives & Systems.

1.1 DIMENSIONS

Given in inches (mm)







2. INSTALLATION

2.1. LOCATION

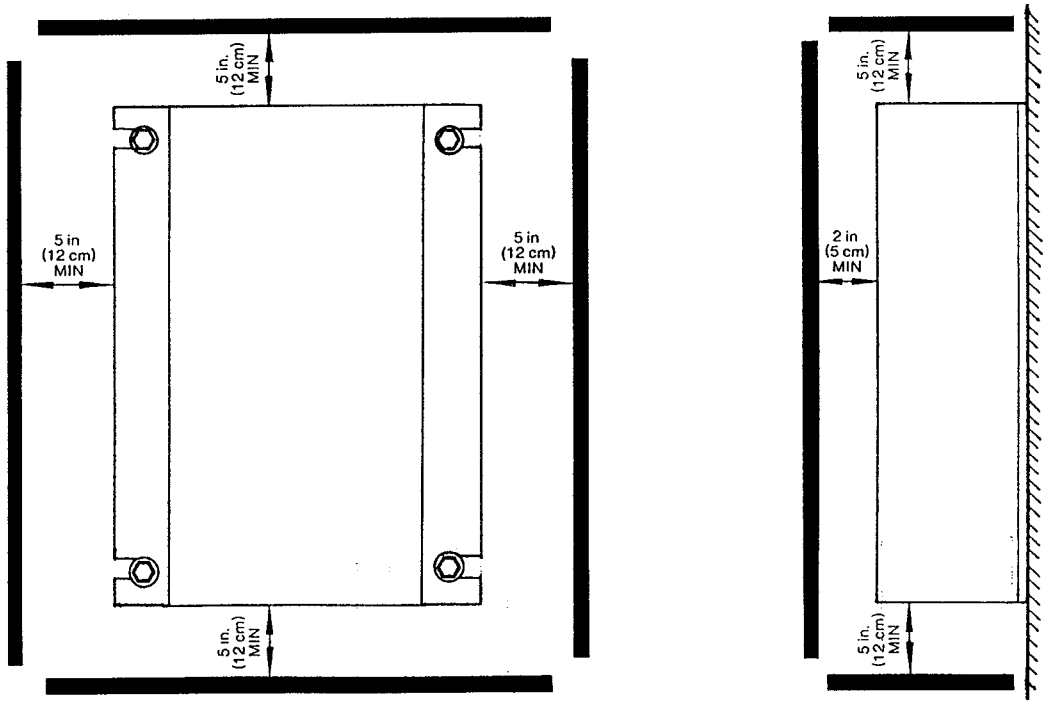
Location of the GPD 402 is important to achieve proper performance and normal operating life. The unit should be installed in areas where the following conditions exist.

- Ambient temperature: -10 to +40°C (+14 to +104°F): -10 to +50°C (+122°F) with cover removed.
- Protected from rain or moisture.
- Protected from direct sunlight.
- Protected from corrosive gasses or liquids.
- Free from airborne dust or metallic particles.
- Free from vibration.

2.2. POSITIONING

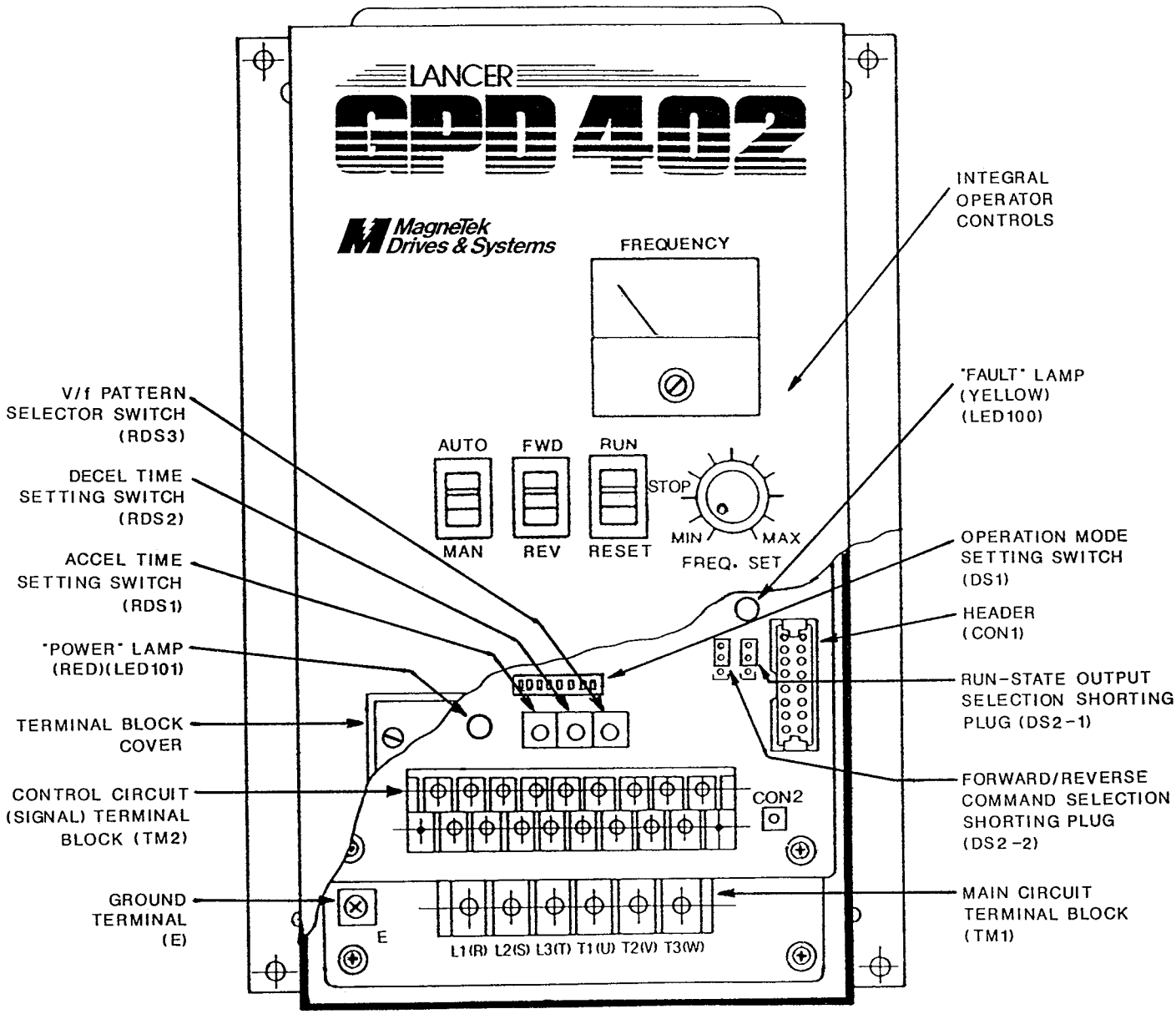
For cooling and maintenance purposes, ensure there is sufficient clearance around the GPD 402 whether it is enclosed in a cabinet or not, as shown in Figure 1. Keep 5 inches (12 cm) clearance between wiring duct and GPD 402.

To maintain effective cooling conditions, it must be installed on a flat vertical and level surface, so that product name can be read correctly, using the four mounting screws.



(a) Front View (b) Side View

Figure 1. Clearance Requirements for Proper Cooling and Maintenance



NOTE: EXACT LOCATIONS VARY PER HP RATING

Figure 2. Major Control Component Layout

3. WIRING

3.1 INTERCONNECTION

Connections must be made according to either Figure 3 or Figure 4. Before wiring, remove terminal block cover, run the leads through the lead entrance at the unit bottom and connect them at the terminal blocks.

Wire size must be:

- 14 AWG (2 mm^2) with M4 terminal screw for main circuit (TM1) terminals L1 (R), L2 (S), L3 (T), T1 (U), T2 (V), T3 (W), and E.

- 18 AWG (0.75 mm^2) with M3 terminal screw for signal circuit (TM2) terminals 1 to 17.

3.2 Main Circuit Connections

1) MOLDED CASE CIRCUIT BREAKER (MCCB) AND MAGNETIC CONTACTOR (MC)
   Be sure to connect MCCBs rated 30AF, 10A between power supply and input terminals L1 (R), L2 (S), and L3 (T). To ensure safety, it is recommended that a MC rated 250V, 10A or more containing a self-holding circuit be provided at power supply.

   Do not connect MC between motor and GPD 402 output terminals. Turning on or off the magnetic contactor allows full-voltage starting current into the inverter and causes the GPD 402 to stop. Frequent ON/OFF operations of MC may cause irreparable damage to GPD 402.

2) Input terminals L1 (R), L2 (S), and L3 (T) can be connected in any combination for 3Ø power supply input. IF A SINGLE PHASE (1Ø) POWER SUPPLY input is to be used, WIRE TO TERMINALS L1 (R) AND L2 (S) ONLY. Terminal L3 (T) is left blank.

3) Never connect AC power supply to output terminals T1 (U), T2 (V), and T3 (W). To do so will damage the GPD 402.

4) DIRECTION OF MOTOR ROTATION
   When the GPD 402 output terminals T1 (U), T2 (V), and T3 (W) are connected to motor terminals T1, T2 and T3, respectively, motor rotates forward.

5) POWER FACTOR CORRECTION CAPACITORS
   Never connect power factor correction capacitors between the GPD 402 output terminals T1 (U), T2 (V), T3 (W), and motor.

3.3 Grounding

1) The GPD 402 must be solidly grounded using ground terminal E of the GPD 402. Ground resistance should be 100 ohms or less.

2) Never ground the GPD 402 in common with welding machines, motors, and other large-current electrical equipment, or ground pole. Run the ground lead in a separate conduit from leads for large-current electrical equipment.

3.4 Control Circuit Connections

1) SIGNAL LEADS
To prevent erroneous operation due to noise, use twisted or shielded wire for connections to signal terminals 4 and 12. The signal lines must be separated from main circuit terminals T1 (U), T2 (V), T3 (W), L1 (R), L2 (S), and L3 (T) and large current (200V, 100V relay sequence)circuit.
Lead length should NOT EXCEED 66 feet (20 meters). The sheath of shielded signal wires should be connected AT THE INVERTER END ONLY (terminal 4 or 10); the far end should be dressed neatly and left unconnected.

2) BRAKE MOTORS
When used with brake motors, the brake power supply must be separate from the motor power supply. The GPD 402 and brake motor must be wired so that the brake ENGAGES AFTER the GPD 402 main circuit is turned off. This provides a positive motor stop when the GPD 402 protective circuit is disabled.

3.4.1 Local Operator Control

If operation will be controlled using only the operator devices mounted on the GPD 402 front cover, complete wire connections using Figure 3.

3.4.2 Remote Operator Control (Front Cover in Place)

If operation will be controlled using only operator devices mounted remote from the GPD 402, BUT the front cover integral devices HAVE NOT been removed, proceed as follows:

- Place GPD 402 AUTO / MAN switch to AUTO.
- Place GPD 402 RUN / STOP / RESET switch to STOP.
- Position the GPD 402 FREQ SET pot to the MIN position.

Complete all external wire connections using Figure 4. **DO NOT INSTALL** the JUMPER shown between CON 1(16) and CON 2(2).

3.4.3 Remote Operator Control (Front Cover Removed)

If operation will be controlled using only operator devices mounted Remote from the GPD 402 and the integral control devices (front cover) have been physically removed, complete all wire connections using Figure 4.

Important

The jumper between CON 1(16) and CON 2(2) MUST be installed;
otherwise, the Remote Freq Set potentiometer will have NO AFFECT on operation.

4. TEST RUN

4.1 Checks Before Test Run

- Correct connections
- No short-circuit conditions
- No loose screws
- Proper load conditions
- Correct input power (no voltage drop or voltage imbalance, power supply capacity: 3KVA or more)

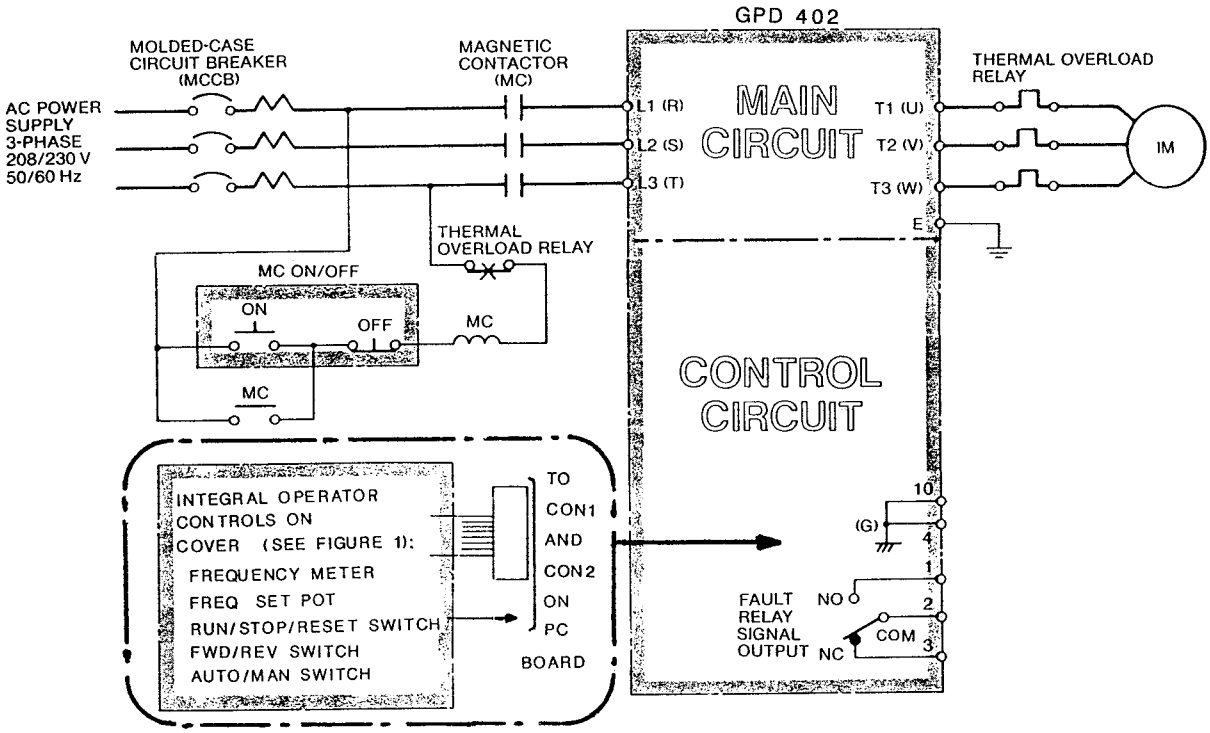


Figure 3. Basic Interconnections Using Local Operator Control

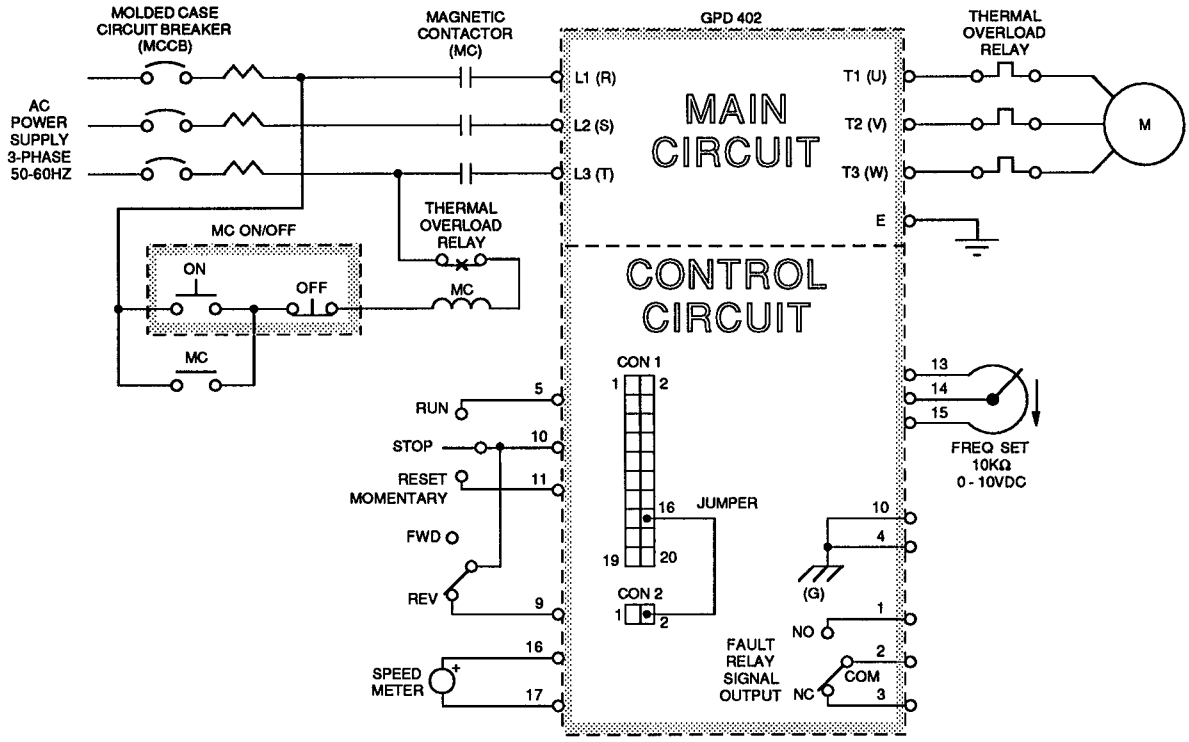


Figure 4. Basic Interconnections Using Remote Operator Control

4.2. PRESETTING AND ADJUSTMENT

4.2.1. Operation Mode Setting Switch

Operation mode setting switch (DS1) consists of eight ON/OFF dip switches printed on a base board. Select the operation modes from Table 1 according to the application. All the ON/OFF slide switches have been preset at factory to OFF as shown in Figure 5.

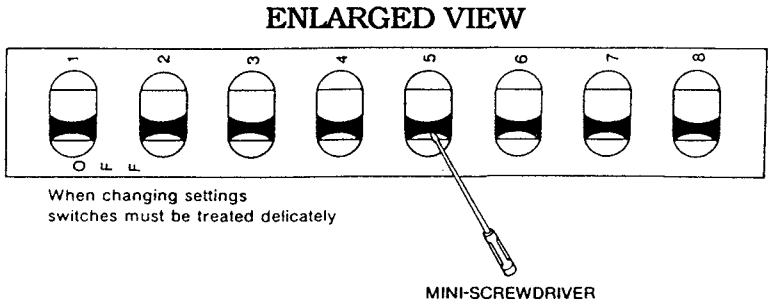


Figure 5. Operation Mode Setting Switch (DS1) (ON/OFF Slide Switches)

Table 1. Selection of Operation Modes

SLIDE SWITCH NO.	SETTING	ON/OFF	OPERATION MODE
1	Stopping mode	ON	Coasts to a stop
		OFF	Brakes to a stop
2 (NOTE 2)	Offset selection	ON	Frequency reference initiated at 1 VDC or 4mA
		OFF	Frequency reference initiated at 0 VDC or 0mA
3 and 4 (NOTE 1)	High-speed frequency limit (f_{Vmax})	3: ON 4: OFF	50HZ
		3: OFF 4: OFF	60HZ
		3: OFF 4: ON	90HZ
		3: ON 4: ON	120HZ
5	Running/ stopping	ON	Runs at frequency reference of 5HZ or above; Stops at frequency reference of less than 5HZ
		OFF	Runs at 5HZ with frequency reference of 0 to 5HZ
6	Rapid stop	ON	Stops rapidly in approx 0.2s with stop command
		OFF	Brakes to a stop in the time set by RDS2
7 and 8 (NOTE 1)	Frequency setting signal	7 OFF 8: OFF	Frequency set by frequency setting potentiometer (10K ohm) or 0 to 10 VDC signal
		7: OFF 8: ON	Frequency set by 1 to 5 VDC signal
		7: ON 8: OFF	Frequency set by 4 to 20mA DC signal
		7: ON 8: ON	Frequency setting input is not used

NOTE:
1. 3 and 4, 7 and 8 must be set in combination respectively.
2. When using 1-5 VDC reference or 4-20mA reference.

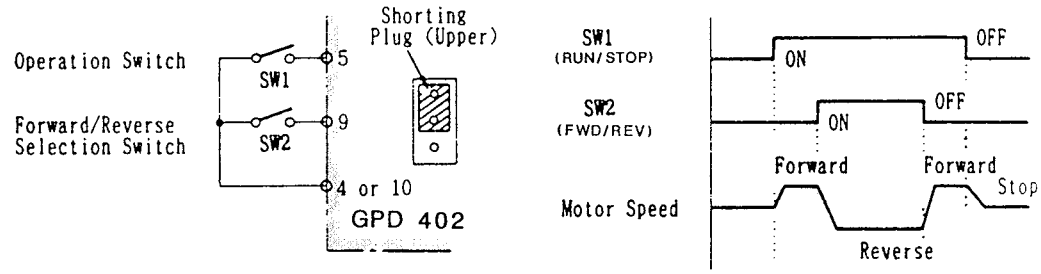
4.2.2. Forward/Reverse Command and Run-State Output Selection Switches

Table 2. Selection of Forward/Reverse Command and Run-State Output

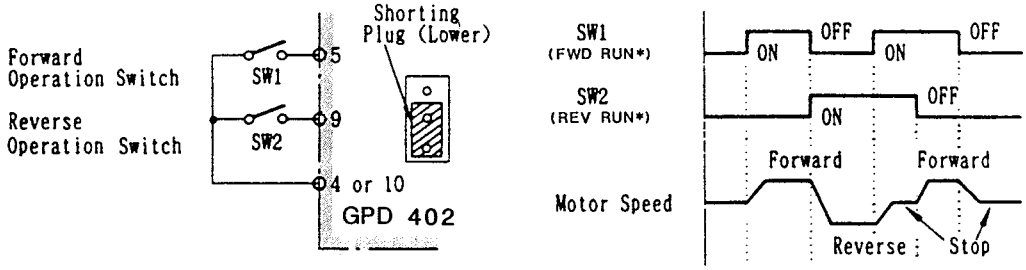
SWITCH	MODE	SHORTING PLUG	DESCRIPTION OF OPERATION
DS2-2	Forward/ Reverse Command Selection	Upper	Mode A: Operation (RUN/STOP) command & forward/reverse command are inputs.
		Lower	Mode B: Forward operation command and reverse operation command are inputs
DS2-1	Run-State Output Selection	Upper	Frequency synchronization signal output
		Lower	Output during run

1) Forward/Reverse Command Selection Switch (DS2-2; shorting plug).

The method of controlling forward or reverse operation is selected by setting Mode A or B as shown below (factory set to mode A).



Mode A: Selection of forward or reverse operation is controlled by combining the operation (RUN/STOP) signal and forward/reverse signal. For forward operation only, the forward/reverse selection switch is not required. (The integral FWD/REV switch can be disabled by disconnecting either wire on the back of the switch.)



Mode B: Selection of forward or reverse operation is controlled by the forward operation and reverse operation signals. The motor stops if both forward and reverse operation signals are inputted simultaneously.

*NOTE

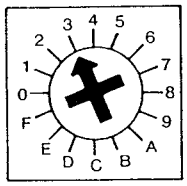
If Mode B is selected, integral controls should be relabeled as follows: on RUN/STOP/RESET switch, change "RUN" to read "FWD RUN": on FWD/REV switch, change "FWD" to read "STOP" and change "REV" to read "REV RUN".

2) Run-State Output Selection (DS2-1; shorting plug).

The position of this shorting plug determines which of two status signals is available as an output at TM2 terminal 12 or CON1-17. The signal is an open collector output (Vccmax = 35V, Icmax = 50mA).

4.2.3. Acceleration/Deceleration Time Selector Switches

Accel and decel times, as well as dynamic braking time, are set by switches RDS1 and RDS2. The switches have been factory set to notch 3. Switches may be reset to meet your application and load requirements. Table 3 shows available times at frequency limit of 60HZ (or 120HZ).



RDS1: Accel Time Selector Switch
RDS2: Decel Time Selector Switch

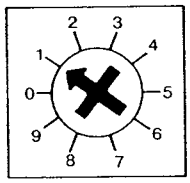
Table 3. Accel/Decel Time and Dynamic Braking Time at Switch Notches

NOTCH	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Accel or Decel Time	0.35	0.50	0.75	1.00	1.50	2.00	2.50	3 00	3.30	3 80	4.40	5 30	6.50	8.60	12 8	26 0
Dynamic Braking Time (see note)	0.09	0 10	0.11	0.12	0.13	0.15	0.16	0.19	0.21	0.25	0.30	0.37	0.50	0 75	1.50	3.00

NOTE: Set by switch RSD2 position, i e related to decel time.

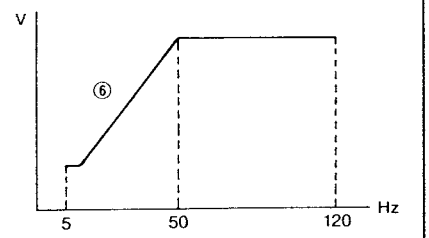
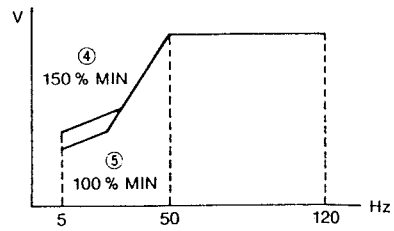
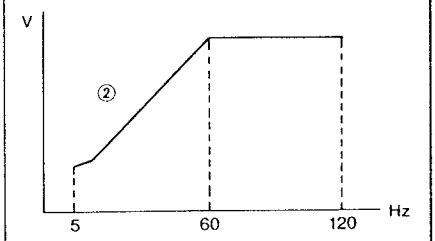
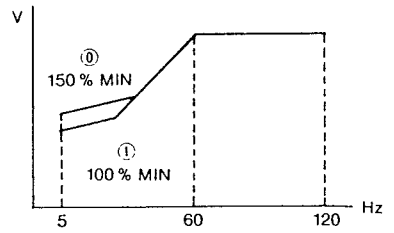
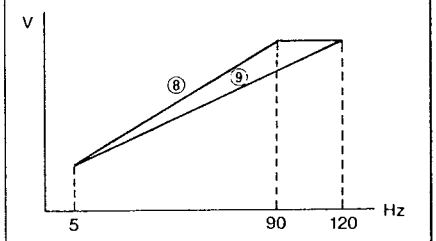
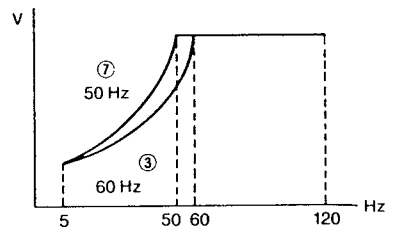
4.2.4. V/f Pattern Selector Switch

V/f pattern selector switch (RDS3) sets the relationship of output voltage to output frequency. The V/f pattern selector switch has been factory preset at notch 1. Ten V/f patterns are available as described in Table 4. Select the one which provides optimum motor operation. Setting excessively high voltage at low frequency may cause overcurrent and result in activating overcurrent protective function to shut off the transistor power.



V/f Pattern
Selector Switch (RDS3)

Table 4. V/f Patterns

Application	Hz	V/f Pattern	Application	Hz	V/f Pattern
General Purpose (Start at 50% torque of the rating)	50 Hz		High-start Torque (Start at more than 100% torque of the rating)	50 Hz	
	60 Hz			60 Hz	
	90 Hz or 120 Hz		Fans and Pumps (At variable torque)	50/60 Hz	

NOTE:

1. Circled numbers above indicate the notch to be set by the V/f pattern selector switch and their respective pattern curve.
2. For notch 4 or 0, contact your sales representative for assistance in motor selection.

PATTERN NOTCH NO.	SELECTION
0 (at 60HZ) 4 (at 50HZ)	<u>For high starting torque of 150% rated torque.</u> Use next higher inverter capacity: combination with motor output for inverters may activate overvoltage protective circuit. Continuous operation of standard motors at low frequency cannot be made. Use a special motor.
1 (at 60HZ) 5 (at 50HZ)	<u>For starting torque of 100% rated torque.</u> Optimum for constant torque such as conveyors. Continuous operation of standard motors at low frequency cannot be made. Use a special motor.
2 (at 60HZ) 6 (at 50HZ)	<u>For starting at 50% of rated torque.</u> For the application requiring 50% starting torque or less, noise and vibration at low frequency will be reduced as compared with 100% rated starting torque mode of pattern 1 and 5.
3 (at 60HZ) 7 (at 50HZ)	For variable torque loads, especially for fans and pumps.
8 (at 90HZ) 9 (at 120HZ)	For high-frequency motor at 90HZ or 120HZ.

4.3. SIGNAL CONNECTIONS

Signals can be connected through the signal terminal block (TM2) or connector CON1. Tables 5 and 6 list the functions of terminal block TM2 and connector CON1, respectively.

Terminals of TM2 and pins of CON1 with same function are directly connected internally, therefore, use either one of them. The operator controls on the cover are factory wired to CON1, so external connections to TM2 terminals with same function are not needed.

Table 5. Terminal Block TM2 Function.

TERM. NO.	SIGNAL NAME	FUNCTION
1 thru 3	Fault Signal Outputs	Contact signal outputs from Fault relay indicating that inverter protective circuit activates and operation stops See para 4 3 2
4, 10	I/O Common	Common terminals for I/O terminals 5 thru 9, 11 and 12. 0V of control circuit (GND). Also connection for sheath of shielded signal wiring (except frequency setting input).
5	Operation or Forward Operation	For input of operation (RUN/STOP) signal or forward operation signal (determined by shorting plug position switch DS2-2, see para 4 2.2) Connected to terminal 4 or 10.
6 thru 8	Multispeed Operation Inputs	Inputs for multispeed operation. See para 4 3 5
9	Forward/Reverse Selection or Reverse Operation Input	For input of forward/reverse signal or reverse operation signal (determined by position of switch DS2-2; see para. 4 2 2). Connected to terminal 4 or 10.
11	Reset Input	For resetting inverter after tripping. Connected to terminal 4 or 10. (ON. Reset)
12	Frequency Synchronization Signal Output (DS2-1, upper position)	Open collector output which indicates that output frequency has reached the set frequency. (low - when synchronized, high - in other cases)
	Output During Run (DS2-1, lower position)	Open collector output which indicates that run command is on (low - during run, high - in other cases)
13	Frequency Setting Common	0V of control circuit (GND). Connected to low side of remote frequency setting potentiometer, or minus (-) of 0 to 10V, 1 to 5V, or 4 to 20mA frequency setting input. Also connection for sheath of shielded frequency setting wiring.
14	Frequency Setting Input	Inputs plus (+) signal of 0 to 10V, 1 to 5V, or 4 to 20mA. For remote frequency setting potentiometer, connect to wiper (center pin) The frequency setting input at terminal 14 is only acknowledged by the inverter if the integral AUTO/MAN switch is set to the AUTO position.
15	Frequency Setting Power Output	10 VDC; Use as power supply for frequency setting potentiometer (10K ohms).
16, 17	Frequency Meter Driving Output	Connects to frequency meter, 1mA DC at 60 or 120HZ (Plus (+) at terminal 16, minus (-) at terminal 17). Use moving coil type DC ammeter for frequency meter.

Table 6. CON1 Connector Function

PIN NO. (Note 1)	SIGNAL NAME	FUNCTION
1	Not used	
2, 18 *	I/O Common	0V of control circuit (GND). Connect to low side of frequency setting potentiometer, if used. Also connection for sheath of shielded signal wiring.
3	Fault Signal Output	Open collector signal output indicating inverter protective circuit activates and operation stops. Low at stop by fault, high in other cases 50mA, 35V.
4 *	Operation or Forward Operation Input	For input of operation (RUN/STOP) signal or forward operation signal (determined by shorting plug position of switch DS2-2, see para. 4.2 2) Connected to pin 2 or 18.
5-7	Multispeed Operation Inputs	Inputs for multispeed operation See para 4 3 5.
8 *	Forward/Reverse Selection or Reverse Operation Input	For input of forward/reverse signal or reverse operation signal (determined by shorting plug position of switch DS2-2; see para. 4.2 2) command Connected to pin 2 or 18
9 *	Reset Input	For resetting inverter after tripping. Connected to pin 2 or 18. (ON: Reset)
10-14	Not used	
15 *	Frequency Setting Power Output	10 VDC, Use as power supply for frequency setting potentiometer (10K ohm).
16 *	Frequency Setting Input	<u>WITH INTEGRAL (ENCLOSURE MOUNTED) CONTROLS:</u> - When AUTO/MAN switch is placed to MAN, receives frequency setting input from the wiper of FREQ. SET pot. - When AUTO/MAN switch is placed to AUTO, receives external frequency setting input wired to TM2 terminal 14. <u>WITH INTEGRAL CONTROLS DISABLED:</u> - A jumper wire must be installed from this pin to CON2 on the PC board when the frequency setting input is wired to TM2 terminal 14. (If external input is wired directly to this pin instead of to TM2, the jumper wire is not required.)
17	Frequency Synchronization Signal Output (DS2-1, upper position)	Open collector output which indicates that output frequency reaches the set frequency. (Low - when synchronized, High in other cases.)
	Output During Run (DS2-1, lower position)	Open collector output which indicates that run command is on (Low - during run, High - in other cases)
19 * 20 *	Frequency Meter Driving Output	Connect a frequency meter, 1mA DC at 60 or 120HZ (pin 19 at "+" and pin 20 at "-"). Use a moving coil type DC ammeter for frequency meter.

NOTE:
1. * indicates pin numbers used by factory wiring to "integral" operator controls on cover of unit.

4.3.1. Location of CON1 Connector Pins

Pin header (receptacle) CON1 is mounted on the PC board. Be sure to observe pin keying of its mating connector if removed and replaced. Connector must always be firmly seated.

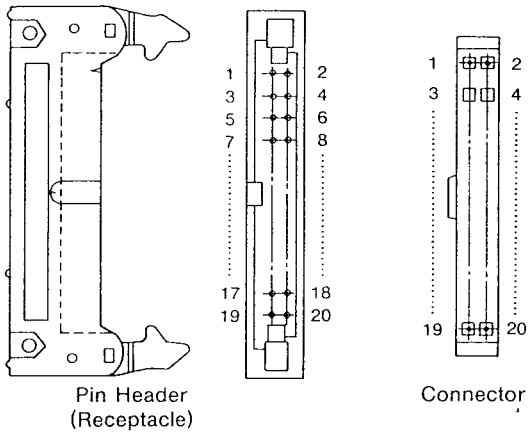


Figure 6. CON1 Connector Pins

4.3.2. Fault Signal Outputs, Terminals 1, 2, 3

Provide the contact outputs if the inverter is tripped.

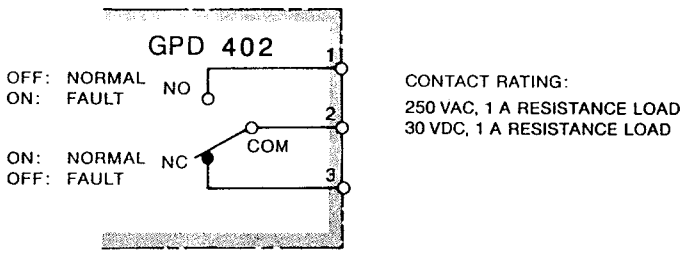
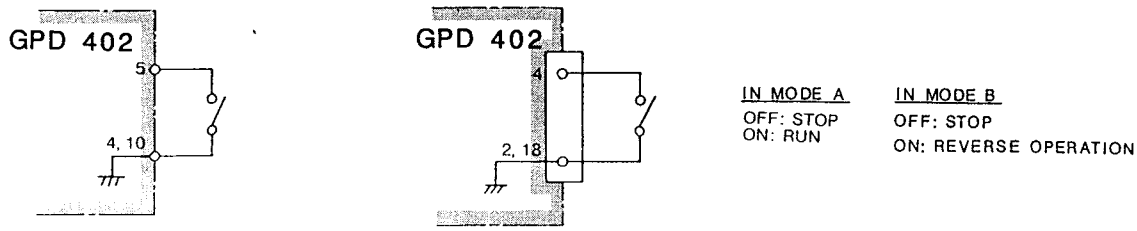


Figure 7. Connections of Fault Relay Signal Outputs

4.3.3. Remote RUN/STOP or Forward Operation, Terminal 5 to 4 or 10

See Figure 8. For remote running or stopping of motor, use a toggle switch (30 VDC, 3A, contact resistance: 0.010 ohm or less). Terminals 4 and 10 are connected internally. RUN/STOP or forward operation signal input (Mode A or Mode B operation) is selected by shorting plug position at switch DS2-2.



(a) Terminal Block TM2 Used (b) Connector CON1 Used

Figure 8. Connections of RUN/STOP or Forward Operation Input

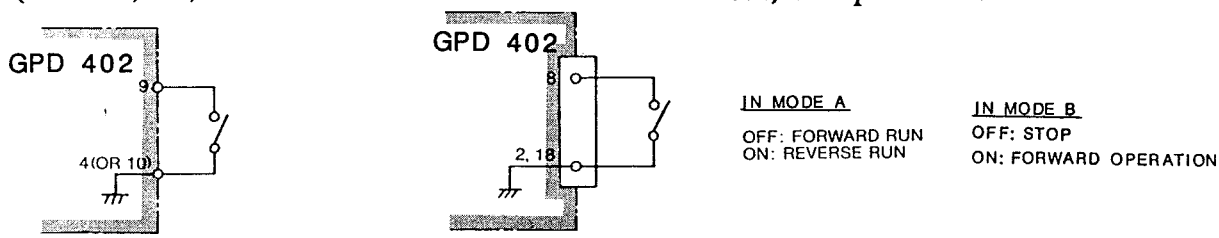
WARNING

IF RUN/STOP (OR FORWARD OPERATION) INPUTS ARE WIRED TO BOTH TM2 AND CON1, A "CLOSED" (LOW) CONDITION OF EITHER INPUT WILL START THE DRIVE. HOWEVER, BOTH MUST BE "OPEN" (HIGH) IN ORDER TO STOP THE DRIVE.

4.3.4. Forward/Reverse Selection or Reverse Operation, Terminal 9 to 4 or 10

See Figure 9. In Mode A, motor runs forward by turning off terminals 9 and 4 and reverses by turning them on. Forward/reverse running can be changed during operation. For forward operation only, this switch is not required.

In Mode B, reverse operation is commanded by turning on terminals 9 and 4. Use toggle switch (30 VAC, 3A, contact resistance: 0.010 ohms or less) or equivalent.



(a) Terminal Block TM2 Used (b) Connector CON1 Used

Figure 9. Connections of Forward/Reverse Selection or Reverse Operation Input

NOTE

In Mode B, if forward operation and reverse operation commands are simultaneously executed, inverter output becomes "0" (zero).

4.3.5. Multispeed Operation, Terminals 6, 7, 8 to 4 or 10

See Figures 10 and 10A . When preset multispeed operation is desired, refer to Table 7 and position external switches S1 to S3 to obtain the desired sequence of output frequencies.

Relay contacts or open collector inputs can be used instead of switches.

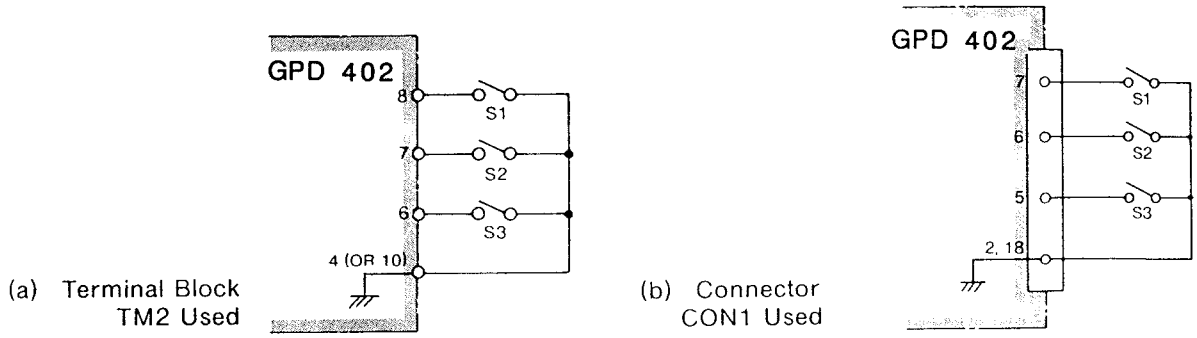


Figure 10. Connections of External ON/OFF Switches for Multispeed Operation

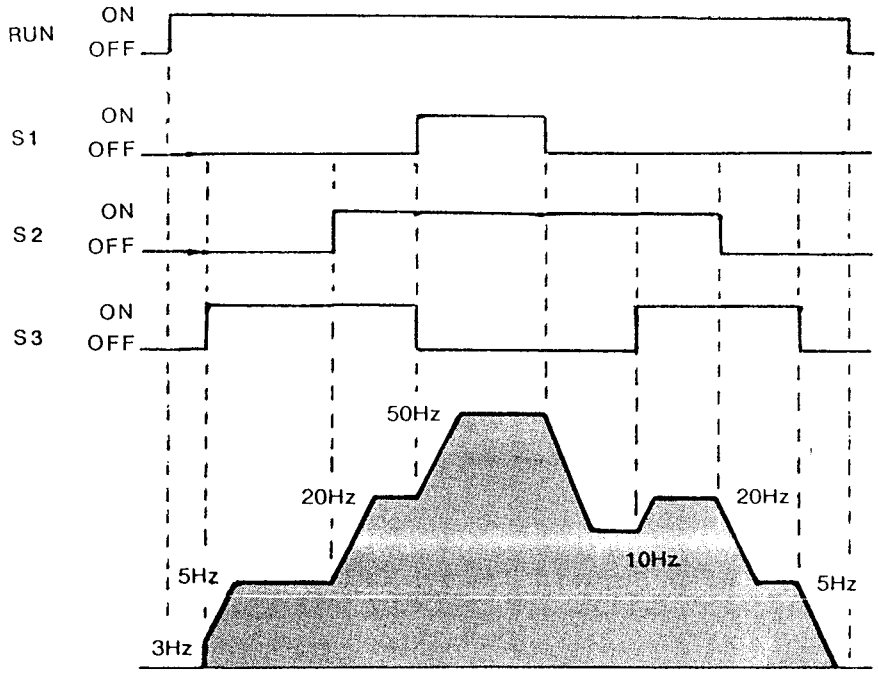


Figure 10A. Example of Multispeed Operation

Table 7. Setting of External Multispeed Switches

EXTERNAL ON / OFF SWITCHES			OUTPUT FREQUENCY
S1	S2	S3	
OFF	OFF	OFF	As set by FREQ. SET pot or external frequency setting input signal.
OFF	OFF	ON	5HZ
OFF	ON	OFF	10HZ
OFF	ON	ON	20HZ
ON	OFF	OFF	30HZ
ON	OFF	ON	40HZ
ON	ON	OFF	50HZ
ON	ON	ON	60HZ

4.3.6 Reset, Terminal 11 to 4 or 10

To reset the inverter after fault shutdown (trip), momentarily close terminals 11 and 4 (resets the inverter's Fault relay). If no reset input is used, the inverter can only be reset by turning off and then reapplying input power.

4.4. TEST RUN OPERATION

CAUTION
UNCOUPLE THE MOTOR FROM THE DRIVEN MACHINE TO INSURE SAFETY.

1. Place RUN/STOP switch to STOP and FWD/REV switch to FWD, or check that both forward operation and reverse operation commands are off. Turn off the external multispeed switches, if used.

2. Adjust the FREQ. SET pot or external frequency setting input to command a low output frequency (approx. 5-10HZ).

NOTE
If switch DS1-5 has been set to ON, a frequency setting signal commanding less than 5HZ will not result in an output to the motor.

3. Apply power to the GPD 402. Unit is now in standby. Note that POWER lamp is lit and visible through louvers on left side of cover.

4. Place RUN/STOP switch to RUN or turn on forward operation command. Check that the motor is running forward. If shaft rotation is incorrect, change FWD/REV switch to REV or turn off forward operation command and turn on reverse operation command.

IMPORTANT
If "reverse" operation signal produces proper "forward" shaft rotation, motor connections MUST BE CORRECTED after completion of test run operation.

If the inverter is wired for forward operation only and shaft rotation is incorrect, remove run command and wait for motor to stop rotating. Then turn off input power and reverse any two of the motor leads T1(U), T2(V), T3(W). Reapply power, and again apply run command.

5. Increase and decrease the frequency setting signal. The GPD 402 output frequency increases or decreases according to the preset accel/decel times. Motor accelerates or decelerates according to the output frequency. If the motor does not run smoothly during acceleration or deceleration, or the GPD 402 stops due to a malfunction, the accel/decel time is assumed to have been set too short for the load level.

6. Accel/decel time and V/f pattern can be changed during motor operation. See paragraphs 4.2.3 and 4.2.4.

7. If any of the protective functions activate, indicating a GPD 402 malfunction, turn off the AC main circuit power by turning off the circuit breaker (MCCB) or magnetic contactor (MC). Verify the motor rotation has stopped, and then reapply power.

   Trouble can be located by the blinking "FAULT" lamp (YELLOW) on the PC board. If the GPD 402 stops, remove the terminal block cover and observe the blinking "FAULT" lamp while referring to Table 8.

8. If load inertia (WK^2) is excessively large, a rapid acceleration or deceleration time setting may cause the inverter to trip due to overvoltage (OV). In such cases a braking discharge resistor may be required.

5. OPERATION

After the test run is completed, start the operation keeping the following in mind.

1. For general purpose motors combined with the GPD 402, motor temperature rises, noise and vibration increase as compared with commercial power.

2. Operate the motor at the temperature below the allowable temperature rise level, since motor cooling effects decrease at low speed operation.

3. Motor ratings

- When two or more motors are controlled by a single GPD 402, verify that the total motor current does not exceed the inverter rating.

- When multipole motors of more than 8 poles or special purpose motors are used, verify that motor current is within the inverter rating.

- Even with a small load, never use a motor whose current exceeds the inverter rating.

4. Never connect a capacitor at the inverter output, for it may cause activation of the overcurrent protective function.

5. To start and stop the motor, use the RUN/STOP switch (or the forward operation or reverse operation command) and NOT the magnetic contactor (MC) or circuit breaker (MCCB) which are used only for emergency stop.

6. If the supply voltage changes due to a momentary power failure, protective functions may activate and stop the GPD 402, resulting in the motor coasting to a stop. Turning on the AC power supply within one second after the activation of protective functions will not restart the motor. Power input after approximately 10 seconds will restart the motor. For an application requiring positive motor stop in an emergency, provide magnetic contactor (MC) including self-holding circuit at power input as shown in Figure 3.

7. Restart the motor after verifying that it has come to a full stop. If operation is started during motor coasting, the overcurrent protective function may be activated.

6. MAINTENANCE

GPD 402 requires almost no routine checks. It will function efficiently and longer if it is kept clean, cool and dry, observing precautions listed in paragraph 2.1. Check for tightness of electrical connections, discoloration or other signs of overheating. When servicing or inspecting, turn off AC main circuit power and WAIT TEN MINUTES BEFORE REMOVING THE TERMINAL BLOCK COVER. The capacitors are still CHARGED and can be quite DANGEROUS.

6.1. INSULATION RESISTANCE TEST

- For megger-testing the external circuit, REMOVE ALL the GPD 402 wiring. Do not apply the test voltage to the inverter.

- For megger-testing the inverter, measure the insulation resistance of the MAIN CIRCUIT ONLY with a 500 VDC megger.

Connect the AC main circuit terminals L1 (R), L2 (S), L3 (T), T1 (U), T2 (V), and T3 (W) by a common wire as shown in Figure 11. After that, measure the insulation resistance between the common wire and ground (terminal E) with a megger. If reading is above 1M ohms, it is considered satisfactory. NEVER MEASURE THE INSULATION RESISTANCE OF THE CONTROL CIRCUIT.

NEVER make a conduction test of the control circuit.

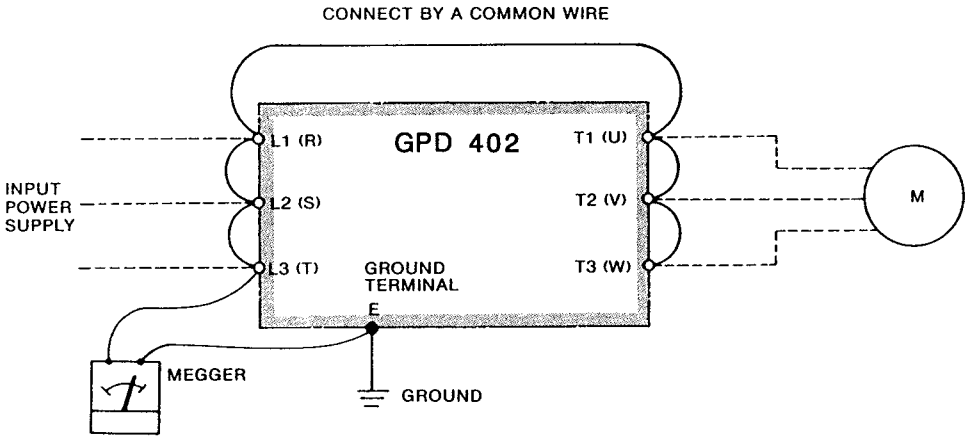
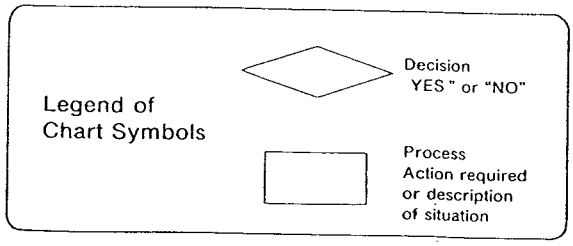


Figure 11. Connections for Megger-Testing

7. TROUBLESHOOTING

If the GPD 402 malfunctions, find the cause and take the corrective actions by following the flowcharts given in Figures 12 to 14.



1) Motor will not run

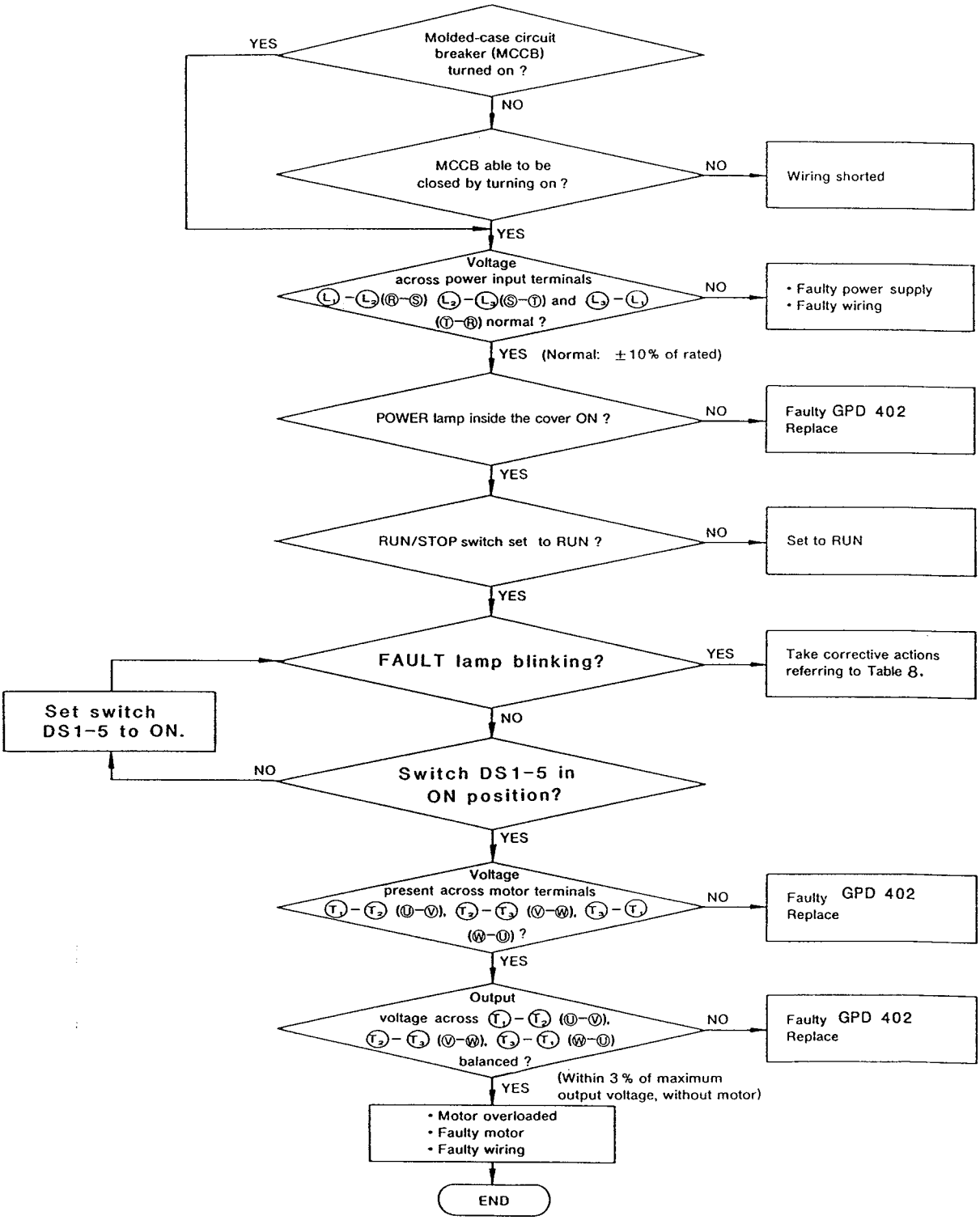


Figure 12. Motor Will Not Run

2) Motor overheat

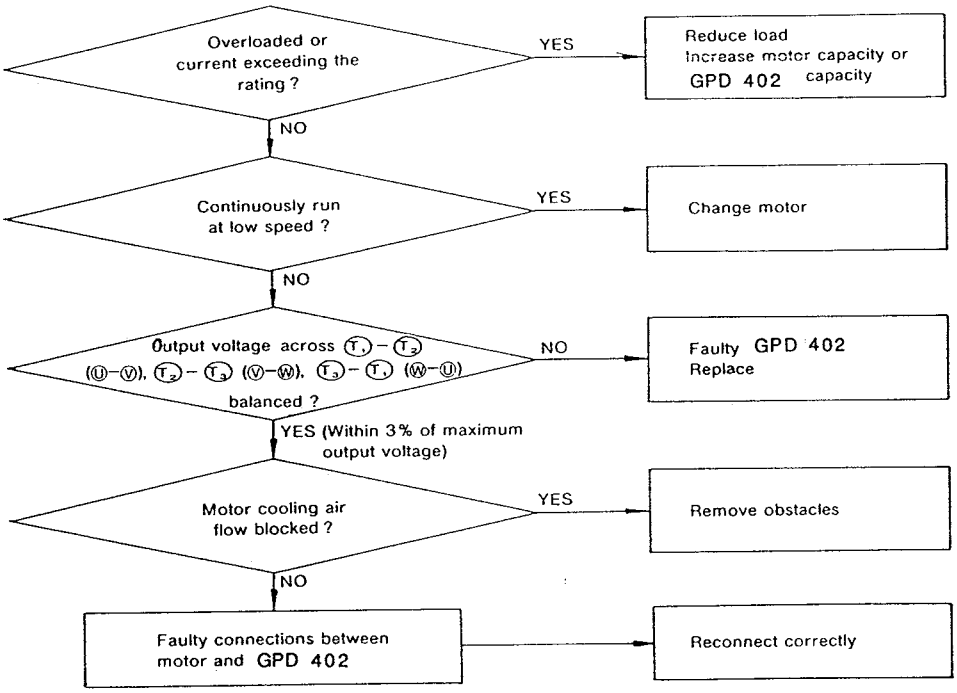


Figure 13. Motor Overheat

3) Motor hunting

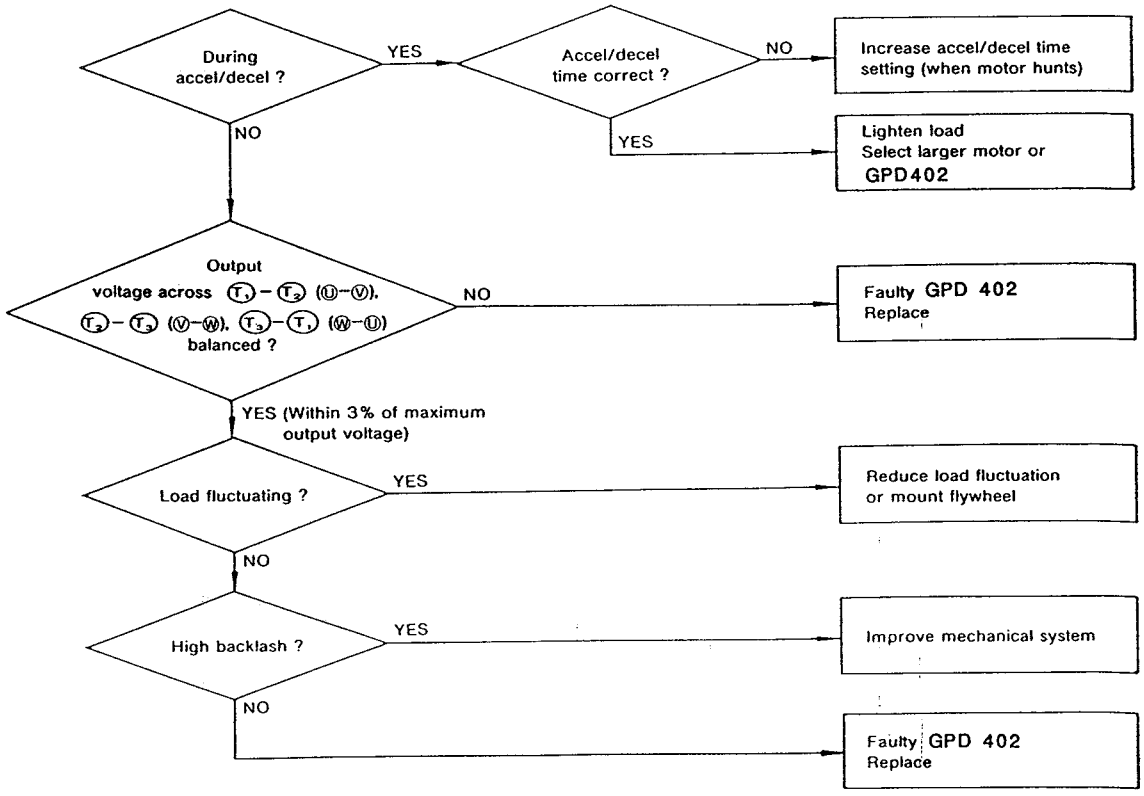


Figure 14. Motor Hunting

7.1. FAULT INDICATIONS - FAULT LAMP ACTIVATION

If the GPD 402 malfunctions, the "FAULT" lamp (LED 100: yellow) lights. Depending on the type of malfunction, the lamp will blink in a repetitive pattern. See Table 8 for trouble shooting procedures.

Table 8. Troubleshooting Procedures Table

OPERATION OF FAULT LAMP	CAUSE	HOW TO CHECK	WHAT TO DO
2 blinks, pause, repeat ...	Instantaneous overcurrent protection.		
	– GPD 402 output circuit shorted or ground fault	– Disconnect wiring from GPD 402 output terminals and measure the resistance across motor leads and ground Use an ohmmeter across motor leads, and a megger across any one of motor leads and ground.	If less than 1M ohm, correct the short-circuit or ground fault conditions
	– Accel/decel time set too short.	– Extend the accel / decel time and operate the motor.	– Extend the accel / decel time until overcurrent protective function stops.
	– Load too heavy	– Run motor without load – Check load conditions.	– Change V/f pattern. – Reduce load.
	– Power factor correction capacitor connected to GPD 402 output.	---	Remove.
	– Incorrect V/f pattern selection.	– Run motor with frequency set at 5HZ, and V/f pattern selector switch RDS3 at notch 3 or 7.	– Select the optimum V/f pattern.
3 blinks, pause, repeat ...	Overvoltage protection – Decel time set too short.	– Extend the decel time and operate the motor.	– Extend the decel time until overvoltage protective function stops
4 blinks, pause, repeat ...	Undervoltage protection – Supply voltage too low. – Momentary power failure (15ms or more).	Measure supply voltage with voltmeter.	Restart the motor when the measured voltage is correct. – Eliminate the cause of voltage drop.
5 blinks, pause, repeat ...	– Ground fault. – Transistor module damaged.	Remove all GPD 402 terminals. Check continuity between any one motor lead and ground with a 500V megger.	If less than 1M ohm, eliminate the cause of ground fault
6 blinks, pause, repeat ...	– Microcomputer malfunction due to noise.	Check to see if noise source exists at inverter Input/Output.	Prevent noise generation. Insert a noise filter at inverter primary or secondary side

7.2. TEST POINTS AND INSTRUMENTS

The test points and instruments, for measuring input (primary) and output (secondary) voltages, current and power are shown below and listed in Table 9. Measured data may differ depending on the instruments and circuit.

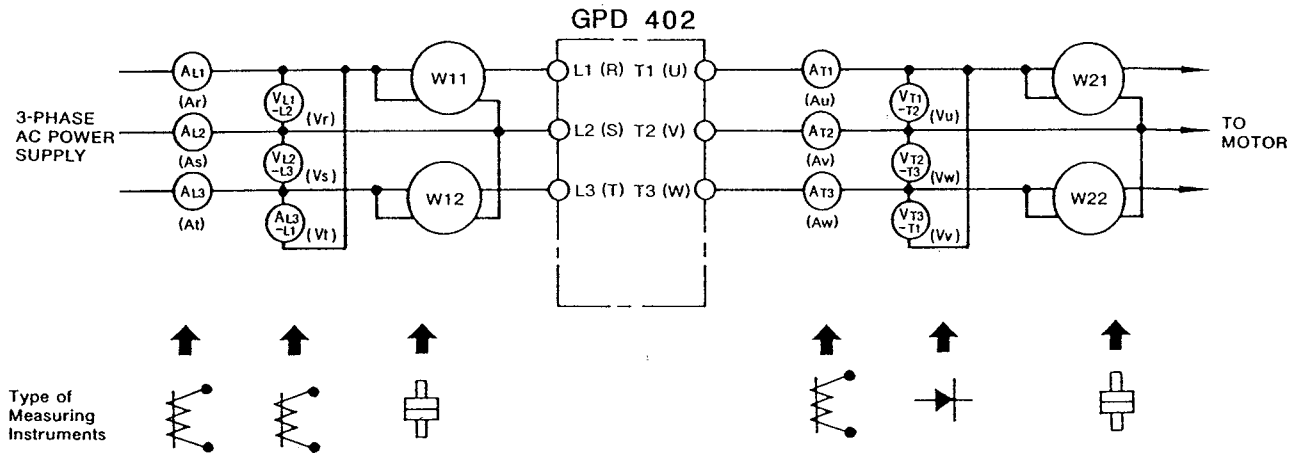
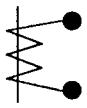
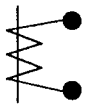
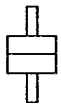
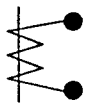
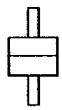


Table 9. Test Points and Instruments

ITEM	POINTS	INSTRUMENT	NOTE
Supply Voltage V_1	Across L1-L2 (R-S), L2-L3 (S-T), L3-L1 (T-R); V_{L1-L2}, V_{L2-L3}, V_{L3-L1}, (V_R, V_S, V_T)	 Moving-iron type 50HZ/60HZ	Commercial power supply: 187 to 253V
Power Supply Current I_1	Line current L1, L2, L3 (R, S, T) A_{L1}, A_{L2}, A_{L3} (A_R, A_S, A_T)	 Moving-iron type	---
Power Supply Power P_1	L1, L2, L3 (R, S, T) and across L1-L2 (R-S), L2-L3 (S-T), L3-L1 (T-R): W_{L1}, W_{L2}, W_{L3} (W_R, W_S, W_T)	 Electrodynamometer	$P_1 = W_{11} + W_{12}$
Power Supply Power Factor Pf_1	Calculate from measured supply voltage, power supply current, and power supply power $Pf_1 = \frac{P_1}{\sqrt{3}\, V_1 \times I_1} \times 100\ (\%)$		
Output Voltage V_2	Across T1-T2 (U-V), T2-T3 (V-W), T3-T1 (W-U): V_{T1-T2}, V_{T2-T3}, V_{T3-T1} (V_U, V_V, V_W)	 Rectifier type. Moving-iron type cannot be used.	Difference between each line and max output voltage: 3% or below
Output Current I_2	Line current at T1, T2, T3 (U, V, W): A_{T1}, A_{T2}, A_{T3} (A_U, A_V, A_W)	 Moving-iron type	Rated current of GPD 402 or below (±10% or below at each line)
Output Power P_2	T1, T2, T3 (U, V, W) and across T1-T2 (U-V), T2-T3 (V-W), T3-T1 (W-U): W_{T1}, W_{T2}, W_{T3} (W_U, W_V, W_W)	 Electrodynamometer type. Three identical rating single-phase meters are used.	$P_2 = W21 + W22$
Output Power Factor Pf_2	Calculate same as power factor on supply side. $Pf_2 = \frac{P_2}{\sqrt{3}\, V_2 \times I_2} \times 100\ (\%)$		