

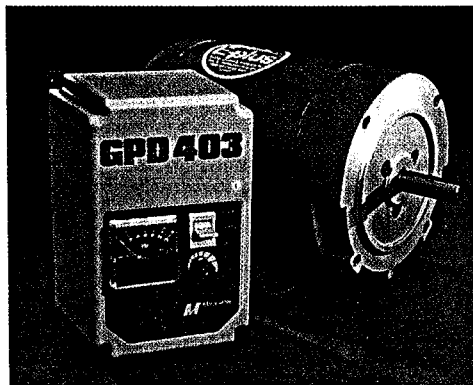
GPD 403



Adjustable Frequency Drive

0.75hp - 10hp

Installation and Operations Manual



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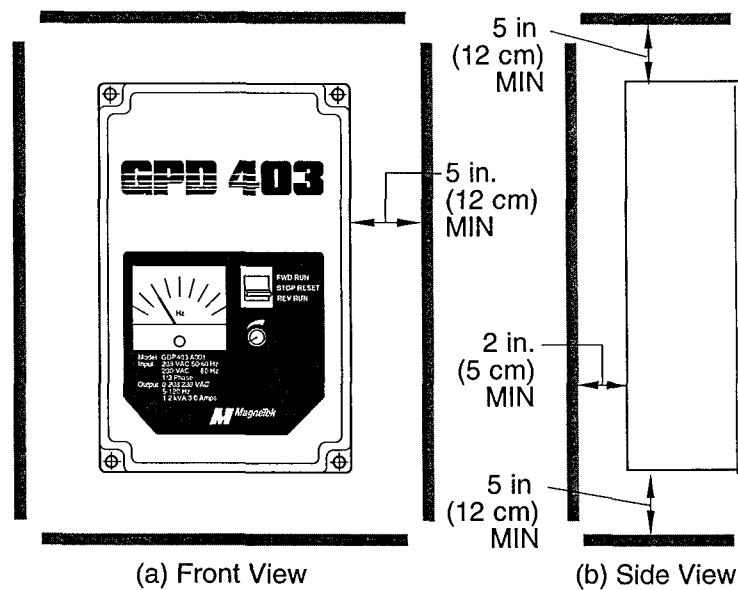
1 RECEIVING. All equipment is tested against defect at the factory. Any damages or shortages evident when the equipment is received must be reported immediately to the commercial carrier who transported the equipment. Assistance, if required, is available from the nearest MagneTek representative. Always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

2 INSTALLATION. Location of the GPD 403 is important to achieve proper performance and normal operating life. The unit should be installed in an area where the following conditions exist:

- Ambient temperature -10 to $+40^{\circ}\text{C}$ ($+14$ to $+104^{\circ}\text{F}$), -10 to $+50^{\circ}\text{C}$ ($+122^{\circ}\text{F}$) with cover removed
- Protected from rain or moisture
- Protected from direct sunlight
- Free from vibration
- Protected from corrosive gasses or liquids
- Free from airborne dust or metallic particles

To maintain effective cooling conditions, the GPD 403 must be installed on a flat vertical and level surface, so that product name can be read correctly, using four mounting screws. Ensure there is a minimum 5 inch (12 cm) clearance around the GPD 403, as shown in Figure 1. Except for connections to the GPD 403, avoid running wiring ducts through the clearance space.

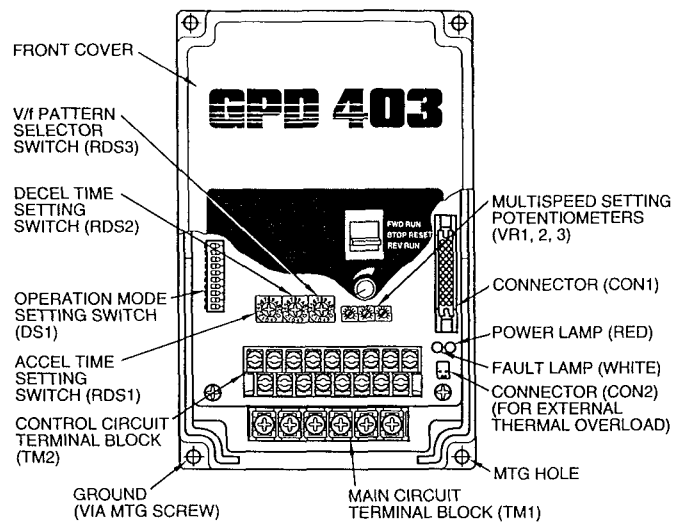
*Figure 1.
Installation
Clearance
Requirements*



3 WIRING. Connections must be made according to either Figure 3 or Figure 4 (see pages 6 and 8) Before wiring, remove GPD 403 front cover Run the leads through the lead entrance at the bottom of the unit and connect them at the terminal blocks

Wire size must be

- 14 AWG (2 mm²) with M4 terminal screw for main circuit (TM1) terminals L1 (R), L2 (S), L3 (T), T1 (U), T2 (V), and T3 (W)
- 18 AWG (0.75 mm²) with M3 terminal screw for signal circuit (TM2) terminals 1 to 17



3.1 MAIN CIRCUIT CONNECTIONS.

- 1 **Molded Case Circuit Breaker (MCCB) and Magnetic Contactor (MC)** Be sure to connect a MCCB (rated as listed on page 47) between power supply and input terminals L1 (R), L2 (S), and L3 (T) To ensure safety, it is recommended that a MC rated 250V, containing a self-holding circuit, be provided at the power supply
Do not connect MC between motor and GPD 403 output terminals. Turning the magnetic contactor on or off allows full-voltage starting current into the GPD 403 and causes the GPD 403 to stop. Frequent ON/OFF operations of MC may damage the GPD 403.
- 2 Connect 3Ø power supply input to terminals L1 (R), L2 (S), and L3 (T) in any sequence.
IMPORTANT: If a single phase (1Ø) power supply is 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 403
- 4 **Direction of Motor Rotation.** When the GPD 403 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 403 output terminals T1 (U), T2 (V), T3 (W), and motor

6 **Brake Motors** When used with brake motors, the brake power supply must be separate from the motor power supply The GPD 403 and brake motor must be wired so that the brake ENGAGES AFTER the GPD 403 main circuit is turned off This provides a positive motor stop when the GPD 403 protective circuit is disabled

3.2 GROUNDING. The GPD 403 must be solidly grounded using one of the bottom mounting screws of the GPD 403 Ground resistance should be 100 ohms or less

Never ground the GPD 403 in common with welding machines, motors, other large-current electrical equipment, or ground poles Run the ground lead in a separate conduit from leads for large-current electrical equipment

3.3 CONTROL CIRCUIT CONNECTIONS. To prevent erroneous operation due to noise, use twisted or shielded wire for connections to signal terminals 4 through 17 Signal wiring must be separated from main circuit terminals T1 (U), T2 (V), T3 (W), L1 (R), L2 (S), and L3 (T) and large current (200V, relay sequence) circuits Lead length should NOT EXCEED 66 feet (20 meters) The sheath of shielded signal wires should be connected AT THE GPD 403 END ONLY (terminal 4 or 10); the far end should be dressed neatly and left unconnected

3.3.1 Local Operator Control. If operation will be controlled using only the operator devices mounted on the GPD 403 front cover, complete wire connections using Figure 3

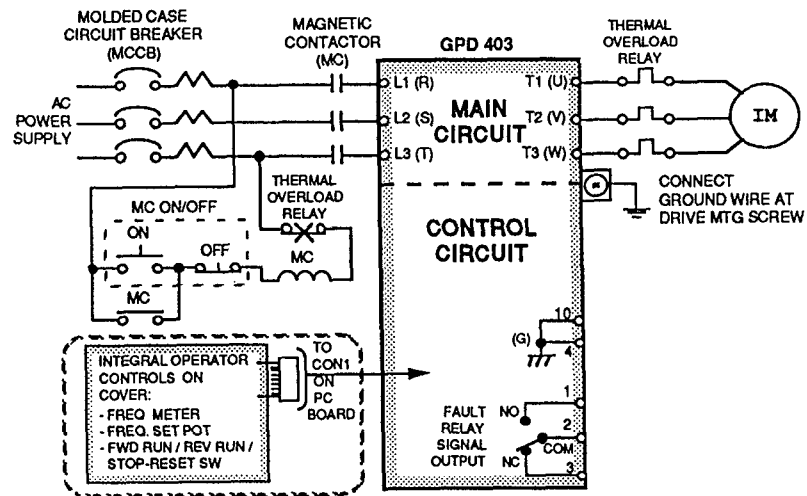


Figure 3. Basic Interconnections Using Local (Integral) Operator Control (DS1-4 in ON Position)

3.4 INTERNAL SETTINGS AND SIGNAL CONNECTIONS. The GPD 403 is shipped with factory settings suitable for most applications. However, additional wiring and internal adjustments may be required, depending on your particular application. The paragraphs which follow should be reviewed and understood before performing the Test Run (section 4)

Any additional signal inputs required for the application can be connected to the signal terminal block (TM2) or connector CON1. Tables 1 and 2 list the functions of terminal block TM2 and connector CON1, respectively.

Terminals of TM2 and CON1 with the same function are directly connected internally. Therefore, use either one, BUT NEVER BOTH SIMULTANEOUSLY. The operator controls on the cover are factory wired to CON1, so external connections to TM2 terminals with the same function are not required.

CAUTION: Do not use TM2 and CON1 simultaneously. Doing so may short the external reference input. If it is required to have operator control from the devices mounted on the front cover and external reference input, consult your MagneTek representative.

3.4.1 CON1 (receptacle) (see Figure 5) is mounted on the PC board. Observe pin keying of its mating connector if removed and replaced. Connector must always be firmly seated

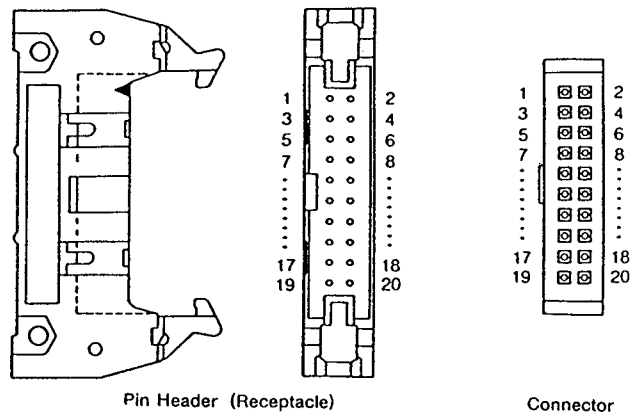


Figure 5. CON1 Connector Pins

Table 1. Terminal Block TM2 Function

TERM. NO.	SIGNAL NAME	FUNCTION
1 thru 3	Fault Signal Outputs	Contact signal outputs from Fault relay indicating that GPD 403 protective circuit activates and operation stops See para 3.4.4
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	Run / Stop or Forward Operation	For input of RUN / STOP signal (Operation Mode A) or forward operation signal (Operation Mode B) Operation Mode determined by slide switch #4 of DS1, see para 3.4.3 Connected to terminal 4 or 10
6	Forward / Reverse Selection or Reverse Operation Input	For input of forward / reverse signal (Operation Mode A) or reverse operation signal (Operation Mode B) Operation Mode determined by slide switch #4 of DS1, see para 3.4.3 Connected to terminal 4 or 10
7, 8	Multispeed Operation Inputs	Inputs for multispeed operation See para 3.4.9
9	Reset Input	Resets GPD 403 after tripping Connected to terminal 4 or 10 (ON Reset)
11	Frequency Synchronization Signal Output	Open collector output which indicates that output frequency has reached the set frequency (low - when synchronized, high - in other cases) 50mA, 35V
12	Output During Run	Open collector output which indicates that run command is on (low - during run, high - in other cases) 50mA, 35V
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 freq 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)
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 2. CON1 Connector Function

PIN NO.	SIGNAL NAME	FUNCTION
1	Not used	-- --
2, 10, 18 *	I/O Common	0V of control circuit (GND) Connect to low side of freq setting potentiometer, if used Also connection for sheath of shielded signal wiring
3 *	Reset Input	For resetting GPD 403 after tripping Connected to pin 2 or 18 (ON Reset)
4 *	Operation or Forward Run Input	For input of RUN / STOP signal or FWD RUN signal (determined by slide switch #4 of DS1, see para 3.4.3) Connected to pin 2, 10 or 18
5 *	Forward / Reverse Selection or Reverse Operation Input	For input of forward / reverse signal or REV RUN signal (determined by slide switch #4 of DS1, see para 3.4.3) Connected to pin 2, 10 or 18
6, 7	Multispeed Operation Inputs	Inputs for multispeed operation See para 3.4.9
8 *	Frequency Setting Power Output	10 VDC; Use as power supply for frequency setting potentiometer (10K ohm)
9 *	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)
11-14	Not used	-- --
15	Frequency Synchronization Signal Output	Open collector output which indicates that output frequency reaches the set frequency (Low - when synchronized, High in other cases) 50mA, 35V
16	Output During Run	Open collector output which indicates that run command is on (Low - during run, High - in other cases) 50mA, 35V
17	Fault Signal Output	Open collector signal output indicating GPD 403 protective circuit activates and operation stops. Low at stop by fault, high in other cases 50mA, 35V.
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.

- * Indicates pin numbers used by factory wiring to "integral" operator controls on GPD 403 front cover

3.4.2 Operation Mode Setting Switch (DS1) consists of ten ON/OFF slide switches printed on a base board. All the slide switches are factory set to OFF, with the exception of switch number 4, as shown in Figure 6. Select the desired operation modes, from Table 3, for your application.

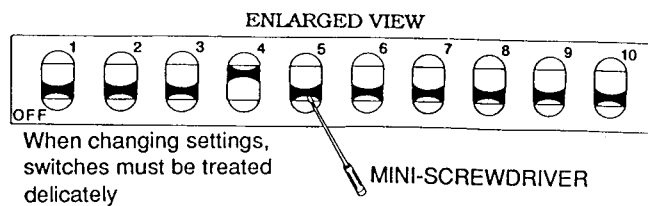


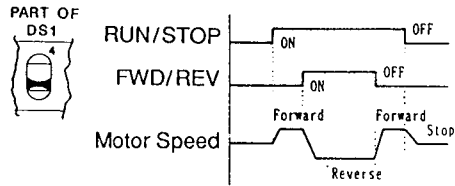
Figure 6 Switch DS1 (ON/OFF Slide Switches)

Table 3. Selection of Operation Modes

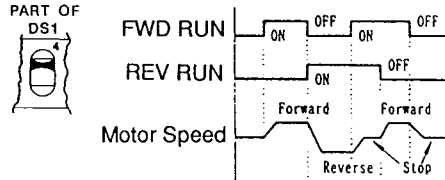
SLIDE SWITCH NO.	FUNCTION	POSITION / OPERATION MODE
1	Stopping mode	OFF = Ramp to stop; ON = Coast to stop
2	DC Injection	OFF = DC injection applied at speeds below 2Hz ON = DC injection not applied
3	Not used	OFF or ON = No effect on operation
4	Forward/Reverse operation (para. 3.4.3)	OFF = Mode A Using RUN and FWD/REV commands ON = Mode B. Using FWD RUN or REV RUN command
5	Motor Thermal Overload (para. 3.4.8)	OFF = Motor thermal overload not used ON = Motor thermal overload used
6 & 7	Max Output Frequency	6 OFF, 7 OFF = 60Hz; 6 ON, 7 OFF = 50Hz 6 . OFF, 7 . ON = 90Hz; 6 . ON, 7 . ON = 120Hz
8	Offset selection	OFF = Offset not provided ON = Offset provided (for 1-5VDC or 4-20mA operations)
9 & 10	Frequency Reference input	9 OFF, 10 OFF = 0 to 10 V, from 10K ohm potentiometer 9 OFF, 10 ON = 1 to 5 V 9 ON, 10 OFF = UNDEFINED SETTING — DO NOT USE 9 ON, 10 ON = 4 to 20mA

3.4.3 Forward / Reverse Command and Run-State Output Selection. The method of controlling forward or reverse operation is selected by setting Mode A or B as shown below (factory set for Mode B)

Mode A: Selection of forward or reverse operation is controlled by combination of RUN / STOP signal and FWD / REV signal. For forward operation only, the forward/reverse selection switch is not required.



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



3.4.4 Fault Signal Outputs, Terminals 1, 2, & 3 provide the contact outputs if the GPD 403 is tripped.

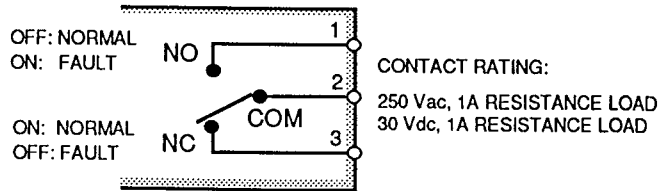
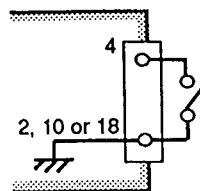
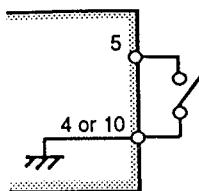


Figure 7. Connections of Fault Relay Signal Outputs

3.4.5 RUN / STOP or Forward Operation, Terminals 5 to 4 or 10.

For remote running or stopping of motor, use a toggle switch (30 Vdc, 3A, contact resistance. 0.010 ohm or less) or equivalent. Terminals 4 and 10 are connected internally. RUN / STOP or forward operation signal input (Mode A or Mode B operation) is selected by slide switch #4 of DS1



IN MODE A :
 OFF : STOP
 ON : RUN
IN MODE B :
 OFF : STOP
 ON : FORWARD OPERATION

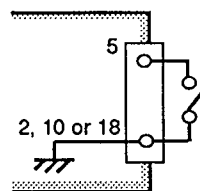
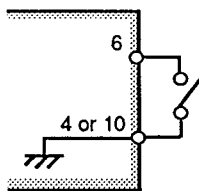
(a) Terminal Block TM2 Used (b) Connector CON1 Used

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.

3.4.6 Forward / Reverse Selection or Reverse Operation, Terminal 6 to 4 or 10.

In Mode A, motor runs forward with terminals 6 and 4 open, and reverses by closing them. Forward / reverse running can be changed during operation. For forward operation only, this switch is not required.



IN MODE A :
 OFF : FORWARD RUN
 ON : REVERSE RUN
IN MODE B :
 OFF : STOP
 ON : REVERSE OPERATION

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

Figure 9 Connections of Forward / Reverse or Reverse Operation Input

In Mode B, reverse operation is commanded by closing terminals 6 and 4. Use toggle switch (30 Vac, 3A, contact resistance 0.010 ohms or less) or equivalent.

NOTE: In Mode B, if forward operation and reverse operation commands are simultaneously executed, GPD 403 output becomes "0" (zero)

3.4.7 RESET, Terminal 9 to 4 or 10 (CON1 pin 3 to 2, 10, or 18). To reset the GPD 403 after a fault shutdown (trip), momentarily close terminals 9 and 4 or 10 (or CON1 pins 3 and 2, 10, or 18). This action resets the GPD 403 fault relay. This can be accomplished both remotely and locally if the front cover with integral operators is in place.

If resetting the GPD 403 via the integral FWD RUN / REV RUN / STOP - RESET switch, two scenarios can be encountered, resulting in two different reset procedures.

- 1 GPD 403 faults while FWD RUN / REV RUN / STOP - RESET switch is in the FWD RUN or REV RUN position. Moving the switch to the STOP - RESET position resets the GPD 403's fault relay.
- 2 GPD 403 faults while FWD RUN / REV RUN / STOP - RESET switch is in the STOP - RESET position. The switch must be moved to the FWD RUN or REV RUN position, then back to the STOP - RESET position to reset the GPD 403's fault relay.

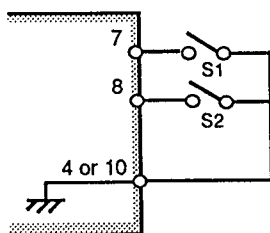
If the integral operator controls are removed and no reset input is used, the GPD 403 can only be reset by removing and reapplying input power.

3.4.8 Motor Thermal Overload, CON2 on the PC board allows use of the motor's thermal overload as an external fault input to the GPD 403. Wire the NC contact of the thermal overload to a 2-pin female Molex connector and press onto the pins of CON2. With DS1 position 5 set to ON, when the thermal overload trips, the Fault relay will trip to shut down the drive.

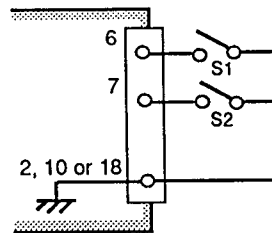
3.4.9 Multispeed Operation, Terminals 7, 8 to 4 or 10.

When preset multispeed operation is desired, refer to Table 4 and position external switches S1 and S2 to obtain the desired sequence of output frequencies.

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



(a) Terminal Block TM2 Used



(b) Connector CON1 Used

Figure 10 Connections of External ON / OFF Switches For Multispeed Operation

3.4.10 Multispeed Setting Potentiometers VR1, VR2 and VR3 allow setting of frequency output levels for 4-step speed setting. Each has an adjustment range of 2 to 120Hz. To adjust them, external multi-speed select switches, S1 and S2, must be wired to the GPD 403 (see paragraph 3.4.9). With power applied to the drive, close the switches in the combination needed to select one of the setting potentiometers (see Table 4), then adjust the potentiometer until the frequency meter reading is the desired output level. Repeat for the other two potentiometers.

Table 4. Setting of External Multispeed Switches

EXTERNAL ON / OFF SWITCHES		OUTPUT FREQUENCY
S1	S2	
OFF	OFF	As set by FREQ SET pot or external frequency setting input signal
ON	OFF	Preset frequency of internal pot VR1
OFF	ON	Preset frequency of internal pot VR2
ON	ON	Preset frequency of internal pot VR3

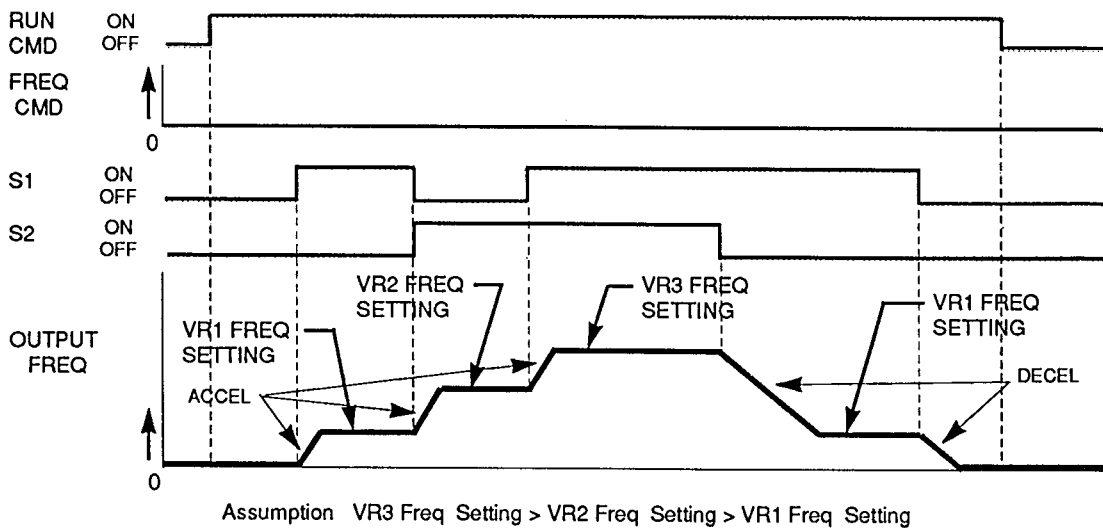


Figure 11. Example of Multispeed Operation

3.4.11 Acceleration/Deceleration Time Selector Switches (RDS1 and RDS2).

Accel and decel times, as well as DC injection time, are set by these two switches. The switches have been factory set to notch 6. They may be reset to meet your application and load requirements. Table 5 shows available times at max output frequency of 60Hz or 120Hz.

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

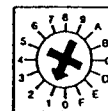
If 50Hz max output frequency has been selected, multiply Table 5 values by 50Hz/60Hz (i.e. .833).
If 90Hz max output frequency has been selected, multiply Table 5 values by 90Hz/120Hz (i.e. .75).

Table 5. Accel/Decel Time and DC Injection 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	0.1	0.15	0.2	0.3	0.5	0.75	1.0	1.5	2.0	3.0	5.0	7.5	10.0	15.0	20.0	30.0
DC Injection Time (1)	0.20	0.22	0.25	0.27	0.3	0.33	0.36	0.40	0.45	0.50	0.60	0.80	1.0	1.5	2.0	3.0

1 Set by switch RDS2 position, i.e. related to decel time

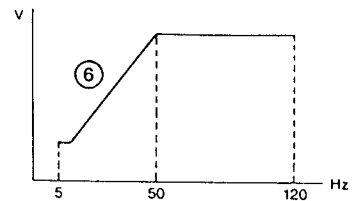
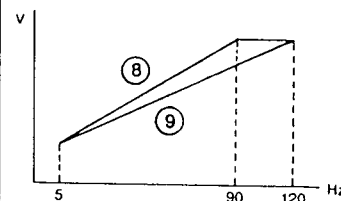
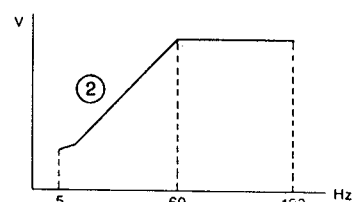
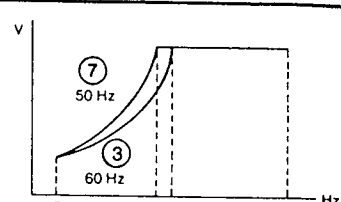
3.4.12 V/f Pattern Selector Switch (RDS3) sets the relationship of output voltage to output frequency. This switch is factory preset at notch 1. Ten V/f patterns are available; select the one which provides optimum motor operation (see chart below and illustration on next page). Setting excessively high voltage at low frequency may cause overcurrent and result in activating overcurrent protective function to shut off the GPD 403 output.



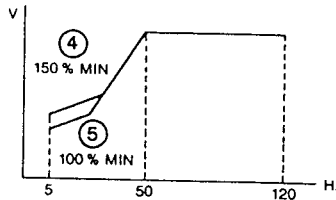
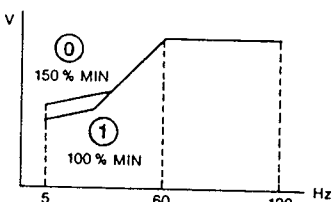
RDS3 : V/f Pattern
Selector Switch

IMPORTANT: DO NOT USE switch positions A thru F.

RDS3 NOTCH	SELECTION
0 (at 60Hz) 4 (at 50Hz)	For high starting torque of 150% rated torque Use GPD 403 with capacity one size above motor rating Continuous operation of standard motors at low frequency cannot be made (use a special motor).
1 (at 60Hz) 5 (at 50Hz)	For starting torque of 100% rated torque Optimum for constant torque such as conveyors Continuous operation of standard motors at low frequency cannot be made.
2 (at 60Hz) 6 (at 50Hz)	For starting at 50% of rated torque For an application requiring 50% starting torque or less, noise and vibration at low frequency will be reduced as compared with patterns 1 and 5.
3 (at 60Hz) 7 (at 50Hz)	For variable torque loads, i.e. for fans and pumps
8 (at 90Hz) 9 (at 120Hz)	For motor operation to 90Hz or 120Hz

Application	Hz	V/f Pattern	Application	Hz	V/f Pattern
General Purpose (Start at 50% of torque rating)	50 Hz		General Purpose (Start at 50% of torque rating)	90 Hz or 120 Hz	
	60 Hz			50/60 Hz	

• Circled number indicates a notch of the V/f pattern selector switch and its respective pattern curve

Application	Hz	V/f Pattern
High-start Torque (Start at more than 100% of torque rating)	50 Hz	
	60 Hz	

- Circled number indicates a notch of the V/f pattern selector switch and its respective pattern curve
- For notch 4 or 0, contact your sales representative for assistance in motor selection

4 TEST RUN.

4.1. **PRE-CHECKS.** Verify that the following actions have been completed:

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

4.2 TEST RUN OPERATION.

CAUTION: Uncouple the motor from the driven machine to insure safety.

1. Place FWD RUN / REV RUN / STOP-RESET switch to STOP-RESET position, 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).
3. Apply power to the GPD 403. Unit is now in standby. If operating the GPD 403 with front cover removed, note that the "POWER" lamp (RED) is lit.

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

IMPORTANT: If "reverse" operation signal produces "forward" shaft rotation, or if the GPD 403 is wired for forward operation only and shaft rotation is incorrect, motor connections **MUST BE CORRECTED** after completion of test run operation.

IMPORTANT: To correct motor connections, first remove run command and wait for motor to stop rotating. Turn off input power. 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 403 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 403 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 (with the drive in STOP condition) to obtain desired motor operation. See paragraphs 3.4.11 and 3.4.12.
7. If any of the protective functions activate, indicating a GPD 403 malfunction, turn off the AC main circuit power by turning off the circuit breaker (MCCB) or magnetic contactor (MC). Verify that motor rotation has stopped, and then reapply power. Trouble can be located by the blinking "FAULT" lamp (WHITE) on the PC board. If the GPD 403 stops, remove the front cover and observe the blinking "FAULT" lamp, then refer to paragraph 7.2.
8. If load inertia (WK^2) is excessively large, a rapid deceleration time setting may cause the GPD 403 to trip due to overvoltage (OV).

5 NORMAL DRIVE OPERATION. After the test run is completed, couple the motor to the driven machine and begin normal operation, keeping the following in mind

- 1 For general purpose motors combined with the GPD 403, motor temperature rises, noise and vibration increase as compared with commercial power
- 2 Operate the motor at a temperature below the allowable temperature rise level, since motor cooling decreases at low speed operation
- 3 Motor ratings
 - When two or more motors are controlled by a single GPD 403, verify that the total motor current does not exceed the GPD 403 rating
 - When multipole motors of more than 8 poles or special purpose motors are used, verify that motor current is within the GPD 403 rating
 - Even with a small load, never use a motor whose current exceeds the GPD 403 rating
- 4 To start and stop the motor, use the FWD RUN / REV RUN / STOP-RESET switch (or the forward or reverse operation command) and NOT the magnetic contactor (MC) or circuit breaker (MCCB), which are used for emergency stop only

- 5 If the supply voltage changes due to a momentary power failure, protective functions may activate and stop the GPD 403, 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, install a magnetic contactor (MC) including self-holding circuit at power input as shown in Figure 3.
6. 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. The GPD 403 requires almost no routine checks. It will function efficiently and longer if it is kept clean, cool and dry, observing precautions listed in section 2. 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 FRONT COVER**. The capacitors are still **CHARGED** and are **DANGEROUS**.

6.1. INSULATION RESISTANCE TEST.

- 1 For megger-testing the external circuit, **REMOVE ALL** the GPD 403 wiring. Do not apply the test voltage to the GPD 403.
- 2 For megger-testing the GPD 403, 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 12. Measure the insulation resistance between the common wire and ground with a megger. If reading is above 1M ohms, it is considered satisfactory. **NEVER MEASURE THE INSULATION RESISTANCE OF THE CONTROL CIRCUIT OR MAKE A CONDUCTION TEST OF THE CONTROL CIRCUIT.**

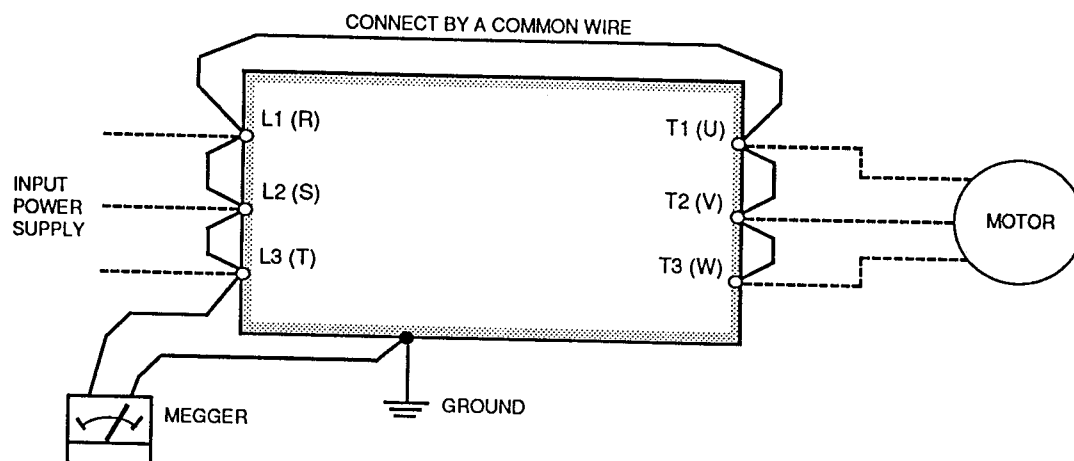
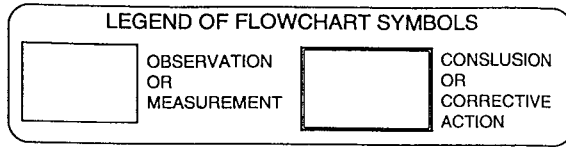


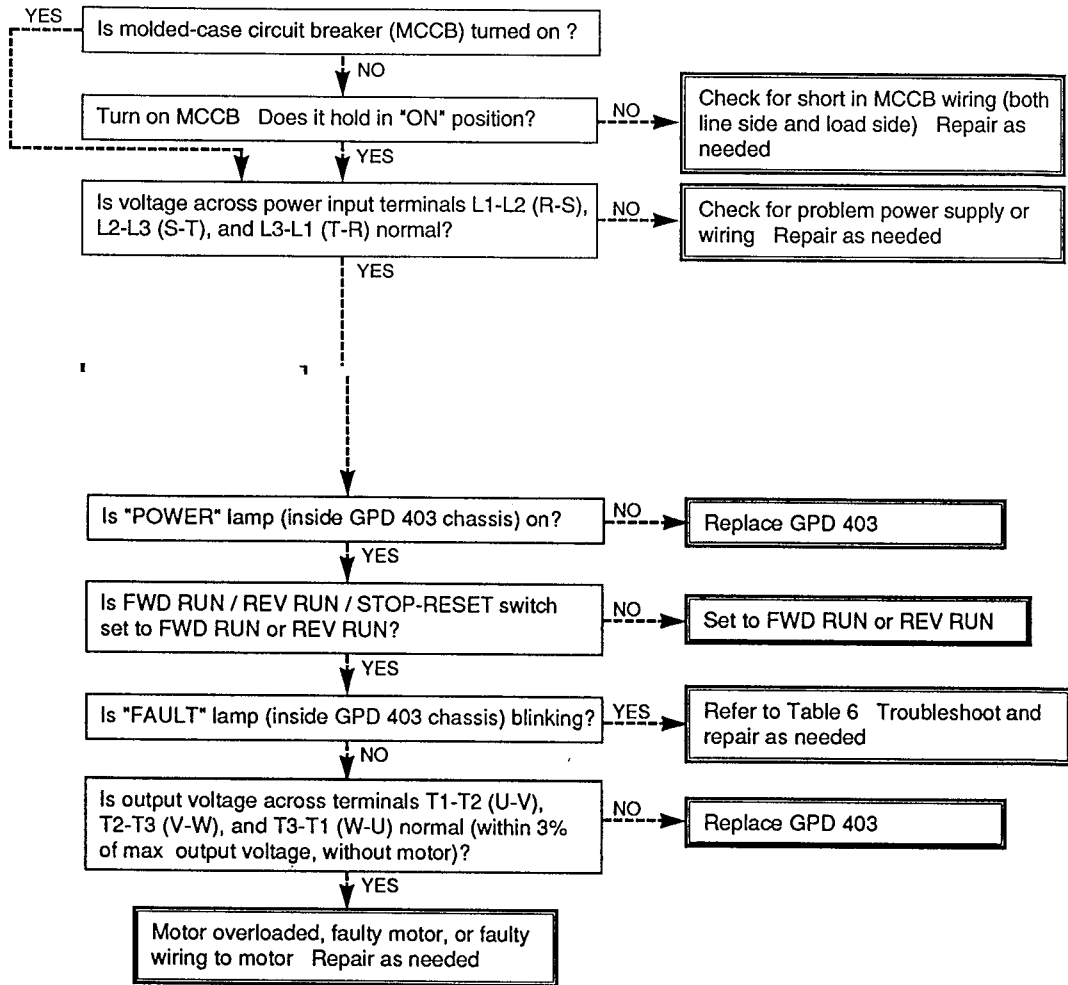
Figure 12. Connections for Megger Testing

7.1 TROUBLESHOOTING FLOWCHARTS

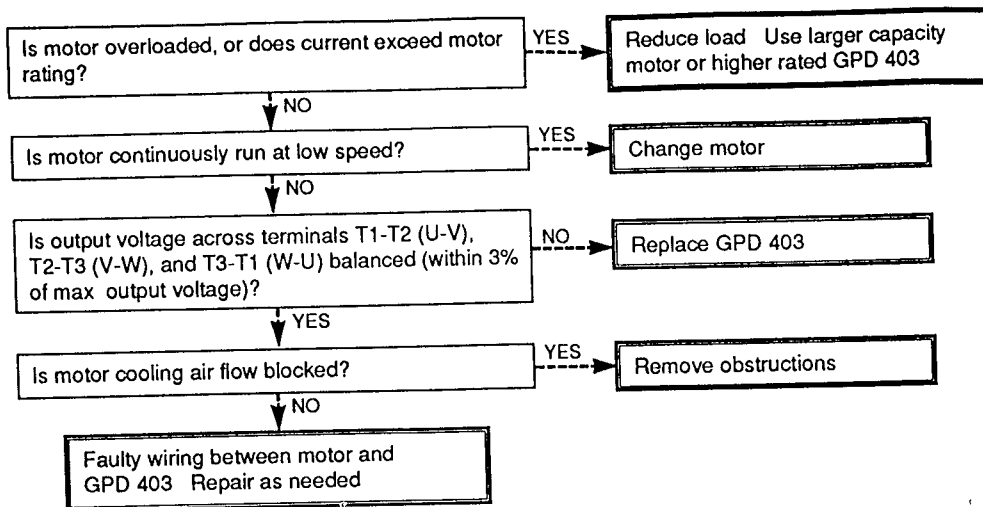
give simplified check and repair procedures based on elementary observations of motor control problems.



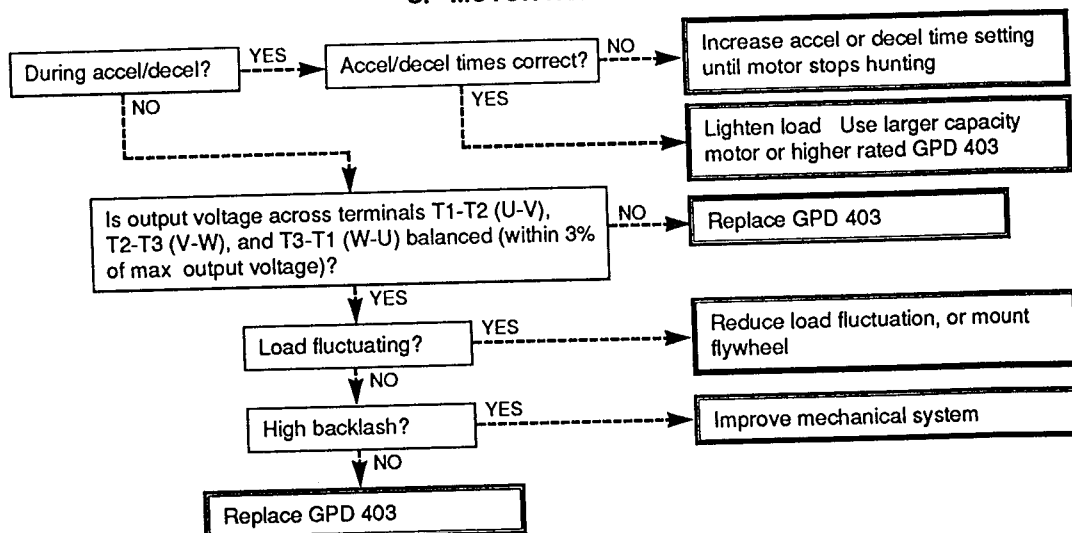
A. MOTOR WILL NOT RUN



B. MOTOR OVERHEATS



C. MOTOR HUNTING



7.2 FAULT INDICATIONS – FAULT LAMP ACTIVATION. If the GPD 403 malfunctions, the "FAULT" lamp (WHITE) lights. Depending on the type of malfunction, the lamp will blink in a repetitive pattern. See Table 6 for troubleshooting procedures.

Table 6. Troubleshooting Procedures Table

FAULT LAMP OPERATION	CAUSE	HOW TO CHECK	WHAT TO DO
1 blink, pause, repeat	Motor thermal overload has tripped	Check motor load status	<ul style="list-style-type: none"> – Improve motor cooling capability – Reduce motor load
2 blinks, pause, repeat	<i>INSTANTANEOUS OVERCURRENT PROTECTION</i>		
	GPD 403 output circuit shorted or ground fault	Disconnect wiring from GPD 403 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	Set RDS1 / RDS2 for longer accel / decel time and operate the motor.	Extend the accel / decel time until overcurrent protective function stops.
	Load too heavy	<ul style="list-style-type: none"> – Run motor without load – Check load conditions 	<ul style="list-style-type: none"> – Change V/f pattern (RDS3) – Reduce load
	Power factor correction capacitor connected to GPD 403 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	<i>OVERVOLTAGE PROTECTION</i> Decel time set too short	Set RDS2 for longer decel time and operate the motor.	Extend the decel time until overvoltage protective function stops.

Table 6. Troubleshooting Procedures Table - Continued

FAULT LAMP OPERATION	CAUSE	HOW TO CHECK	WHAT TO DO
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	Disconnect all GPD 403 wiring 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 GPD 403 Input / Output	Prevent noise generation Insert a noise filter at GPD 403 input or output side

NOTE: If the actions in this table do not correct the problem, contact MagneTek for assistance

7.3 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 7. Measured data may differ depending on the instruments and circuit

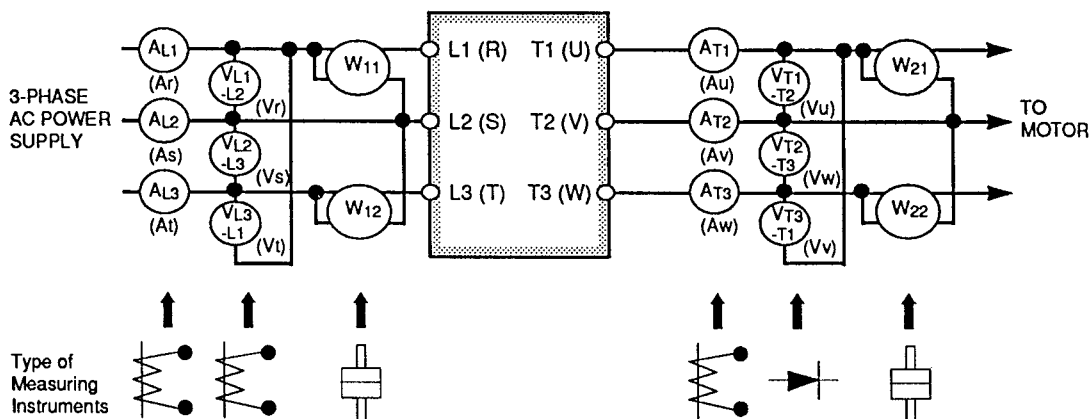








Table 7. Test Points and Instruments

ITEM	POINTS	INSTRUMENT	REMARKS
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 180 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)	 Electro-dynamometer	$P_1 = W_{11} + W_{12}$
Power Supply 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 403 or below ($\pm 10\%$ 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)	 Electro-dynamometer type Three identical rating single-phase meters are used	$P_2 = W_{21} + W_{22}$
Output Power Factor Pf_2	Calculate same as power factor on supply side $Pf_2 = \frac{P_2}{\sqrt{3} V_2 \times I_2} \times 100 (\%)$		

GPD 403 RATINGS AND SPECIFICATIONS

DRIVE RATING – HP (kW)		3/4 (0.4)	1 (.75)	2 (1.5)	3 (2.2)	5 (3.7)
Max Motor Output	Rated Capacity	1 0 kVA	1 5 kVA	2 5 kVA	3 5kVA	6 kVA
	Rated Current	3 Amps	4 5 Amps	7 5 Amps	10 5 Amps	17 5 Amps
Approximate Weight (Protected Chassis)		2 lb	2 5 lb	3 7 lb	6 lb	9 lb
MCCB Rated Current		5 Amps	10 Amps	20 Amps	20 Amps	30 Amps
Input Power Supply (Note 1)		Single Phase or 3 Phase 180 - 242 VAC 50Hz (±5%) 180 - 253 VAC 60Hz (±5%)				
Max Output Voltage		180 - 253 VAC 3 Phase				
Control Method		Sinusoidal sine wave PWM				
Output Frequency		2 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 01Hz (2 to 60Hz), ±0 02Hz (2 to 120Hz)				
Frequency Accuracy		±0 5% -10 to +40°C [14 to +104°F] (to +50°C [+122°F] with cover removed)				
Allowable Overload Capacity		150% for two minutes, 200% for 30 seconds 300% peak				
Accel/Decel Time		0 1 to 30 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	4 steps by 2 NO contacts (Maintained) Step frequencies settable by internal pots				
	Reset	Fault circuit reset from NO contact (momentary)				
Output Signals	Frequency Synchronization	Open collector output 50mA, 35V				
	During Run	Open collector output 50mA, 35V				
Integral Operator Controls	FWD RUN / REV RUN / STOP-RESET switch	3 position switch with maintained contacts				
	FREQ SET potentiometer	10K ohm; adjusts for 0 to 100% of max output frequency				
	FREQ meter	0-60 Hz or 0-120 Hz (depending on DS1-6 & 7 setting)				

NOTES:

1. When a single phase power supply is used, connect to terminals L1 (R) and L2 (S).

GPD 403 RATINGS AND SPECIFICATIONS - Continued

DRIVE RATING – HP (kW)		3/4 (0.4)	1 (.75)	2 (1.5)	3 (2.2)	5 (3.7)
Protective Functions	Undervoltage	Trips at 170V or less				
	Overcurrent	Trips by overcurrent caused by short circuit or ground fault				
	Overvoltage	Trips by overvoltage during regeneration				
Environmental Condition	Location	Indoor (free from corrosive gases and dust)				
	Ambient Temperature	-10 to +40°C [+14 to +104°F] (to 50°C [+122°F] with cover removed)				
	Humidity	95% max relative (non-condensing)				
	Elevation	3300 feet max (1000 meters)				
	Vibration	0.5 G max				

GPD 403 RATINGS AND SPECIFICATIONS (460V UNITS)

DRIVE RATING – HP (kW)		3/4 (0.4)	1 (.75)	2 (1.5)	3 (2.2)	5 (3.7)	7.5 (5.5)	10 (7.5)
Max Motor Output	Rated Capacity	1.0 kVA	1.5 kVA	2.5 kVA	3.5 kVA	6 kVA	9 kVA	12 kVA
	Rated Current	1.5 A	2.3 A	4.0 A	5.5 A	9.0 A	11.0 A	17.5 A
Enclosure		Open Chassis						
Approximate Weight (Open Chassis)		4.9 lb.	4.9 lb.	5.8 lb.	5.8 lb.	12.4 lb.	15.6 lb.	17.0 lb.
MCCB Rated Current		5 A	5 A	10 A	10 A	20 A	20 A	30 A
Input Power Supply		3 Phase 342 - 484 VAC 50Hz (±5%) 342 - 506 VAC 60Hz (±5%)						
Max Output Voltage		3 Phase 380 - 460 VAC						
Output Control Element		IGBT (Insulated Gate Bi-polar Transistor)						
Carrier Frequency		1 to 4 kHz						
Control Method		Sinusoidal sine wave PWM						
Output Frequency		2 to 120 Hz (0.1 to 360Hz available)						
Frequency Resolution		±0.01Hz (2 to 60Hz), ±0.02Hz (2 to 120Hz)						
Frequency Accuracy		±0.5% -10 to +40°C [14 to +104°F]						

GPD 403 RATINGS AND SPECIFICATIONS (460V UNITS) - Continued

DRIVE RATING – HP (kW)		3/4 (0.4)	1 (.75)	2 (1.5)	3 (2.2)	5 (3.7)	7.5 (5.5)	10 (7.5)
Allowable Overload Capacity		150% for two minutes; 200% for 30 seconds 300% peak						
Accel/Decel Time		0 1 to 30 sec (accel and decel set independently, with 16 selections available for each)						
Braking		Braking by charging capacitor and discharging resistor, or DC injection braking for less than 2Hz (100% braking torque)						
Input Signals	Run and Stop	Running reference from NO contact (Maintained)						
	FWD / REV Running	Reverse running reference from NO contact (Maintained)						
	Frequency Setting	Analog Frequency setting pot, or any of 0 to 10V, 1 to 5V, or 4 to 20mA selectable						
	Multispeed	4 steps by 2 NO contacts (Maintained) Step frequencies settable by internal pots						
	Reset	Fault circuit reset from NO contact (momentary)						
Output Signals	Frequency Synchronization	Open collector output 50mA, 35V						
	During Run	Open collector output 50mA, 35V						
Protective Functions	Undervoltage	Trips at 300V or less						
	Overcurrent	Trips by overcurrent caused by short circuit or ground fault						
	Overvoltage	Trips by overvoltage during regeneration						
Environmental Condition	Location	Indoor (free from corrosive gases and dust)						
	Ambient Temperature	-10 to +40°C [+14 to +104°F] for enclosed type (to 50°C [+122°F] for built-in type)						
	Humidity	95% max relative (non-condensing)						
	Elevation	3300 feet max (1000 meters)						
	Vibration	0.5 G (4.9m/s ²) max at 10 to 55Hz						

GPD 403



Data subject to change without notice GPD is a trademark of MagneTek, Inc

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