

GPD 506/P5 Start-up Procedure and Checklist

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Before proceeding, familiarize yourself with TM (or I/O) 4506. you will find:

- *“Simplified” Start-Up* on page i
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- Connection diagrams on page 1-10 and 1-15
- *“Initial” Start-Up* on page 2-1
- *Digital Operator* description on page 4-1
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Preparation for GPD506/P5 Drive Start-Up

For HVAC Applications

In order to provide you with the most reliable drive available, and to avoid any extra costs related to loss or reduction of warranty coverage, an authorized Yaskawa Electric service representative should complete this start-up procedure. Please complete the following checklist and maintain it in a secured location as technical service personnel may request information from this checklist. Inability to provide this information may result in delays and extra costs to the end user.

Date: _____

Start-up Person:

Customer (Company): _____

Sales Order #: _____

Printed Name: _____

Phone #: _____

Location: _____

Serial #: _____

Company: _____

Signature: _____

Owners Representative:

Printed Name: _____

Company: _____

Phone #: _____

Signature: _____

Check Step

- 1. The GPD 506/P5 is thoroughly tested at the factory. The start-up person should verify that the drive is free of shipping and installation damage. Shipping damage is not covered by the Yaskawa warranty; claims must be filed directly with the shipping company as soon as possible.
- 2. Review the Technical Manual, TM 4506, Installation/Operation Manual, I/O 4506 and any option instructions and schematics shipped with the drive.
- 3. Verify that the model numbers and voltage ratings are as specified in the purchase order by matching the nameplate data for each unit to the purchase order.
- 4. Verify that the drive has been installed in accordance with TM (or I/O) 4506, Section 1. "RECEIVING AND INSTALLATION".
CAUTION: Failure to comply with TM (or I/O) 4506 Section 1, starting on page 1-1, may void the product warranty.
- 5. Inspect the security of the supply line power, ground connections and all control circuit connections as identified in these documents:
 - **Drive alone:** refer to the Technical Manual TM (or I/O) 4506, Section 1.
 - **Drive/Bypass package:** refer to the bypass schematic and TM (or I/O) 4506, Section 1.
 - **Additional options:** refer to any option instructions and schematics included with shipment.

IMPORTANT: Double check all the power wires and motor wires (**L1, L2, L3** and **T1, T2, T3**) to make sure that they are securely tightened down to their respective lugs, loose wire connections may cause problems at any time.

IMPORTANT: Confirm that the incoming line power supply is connected to the drive INPUT TERMINALS **L1, L2, & L3**, and NOT to the output motor terminals **T1, T2 & T3**.

6. Review the installer's "as wired" schematic. Determine where the motor "safety circuit" is connected. Verify that the customer's emergency contacts are properly terminated in the drive's safety shutdown circuit:
- If normally closed, these contacts may be wired in series with the RUN command contacts, which are between terminal **S1** and **SC** of the drive. No special programming is required. - See TM (or I/O) 4506, page 1-15.
 - Alternately, these contacts could be wired to terminal **S3** as External Fault Inputs, and may be either normally closed or normally open contacts. - See TM 4506, page 5-29 for programming instructions.

Verify that all other field installed wires are correctly terminated (including the shields).

7. Record the motor nameplate information:
Voltage _____ Service Factor _____ Full Load Amps (FLA) _____
8. Verify that the input voltage matches the drive's rating.
9. Verify that the motor is wired for the application voltage.
10. **IMPORTANT:** Verify that the motor rated full load amps (FLA) does **not** exceed the rated output current of the drive controlling it. When multiple motors are simultaneously operated by the drive, the **sum** of all motor rated FLA values must be less than or equal to that of the drive controlling them.
11. Record any other connections to the drive, by terminal number to determine if special programming of any of the follow is required.
- Multi-function Inputs - see TM 4506, paragraph 5.19 starting on page 5-28
 - Multi-Function Outputs - see TM 4506, paragraph 5.20, starting on page 5-41
12. Verify that the building automation system logic is ready to perform adequately for start, stop and speed command functions.

THIS CONCLUDES THE PREPARATION PROCESS FOR DRIVE START-UP. KEEP YOUR TECHNICAL MANUAL, INSTALLATION/OPERATION MANUAL , OPTION SCHEMATICS, AND ANY OTHER INSTRUCTIONS SENT WITH THE DRIVE EASILY ACCESSIBLE TO ASSIST YOU THROUGH THE REMAINDER OF THE START-UP PROCESS.

HVAC Start-Up Procedure for GPD 506/P5 WITH Bypass Option:

(For start-up of GPD 506/P5 without Bypass please go to page 8)

[Please review "Preparation for Drive Start-up on page 1]

Check Step

1. Verify that the electrical supply power lines are connected to the input circuit breaker and that the motor leads are connected to the output terminals of the overload relay. Ensure that all connections are tight, factory connections sometimes come loose during shipment.
2. Record all other connections to the bypass cabinet or the VFD and confirm that the building management system logic is ready to perform adequately for start, stop and speed command functions.
3. Before applying power, make sure that the following conditions are met:
 - The **DRIVE/OFF/BYPASS** switch is in the **OFF** position.
 - The **HAND/STOP/AUTO** switch is in the **STOP** position.
 - The **NORMAL/TEST** switch is in the **NORMAL** position.
[Note: If the **TEST** position is selected while the **DRIVE/OFF/BYPASS** switch is in the **DRIVE** position; the fault code "EF3" will be displayed on the digital operator. **TEST** mode is only available when in the **OFF** or **BYPASS** positions.]
 - The VAV terminal unit dampers, in fan applications, are open to prevent duct flexing or damage in a full speed or across the line starting situation.
 - The electro-mechanical motor overload, labeled "**S12**", is adjusted to equal the full load amps (FLA) from the motor nameplate.
4. Apply power to the drive and bypass package, make sure that all three phases are present and that the input voltage is correct for the system being set up. Then move the **DRIVE/OFF/BYPASS** switch to the **DRIVE** position.
[Note: If the **FAULT** light is *on* at this time, press the reset button on the motor overload relay, labeled "**S12**" and check the "safety device" circuit between terminals **TB1-1** and **TB1-2**.]
5. The **DRIVE**, **STOP** and **REMOTE SEQ** and **REF** LEDs on the drive should be *on*.

Quick start displays are directly available by pressing the **DSPL** key. When scrolling through these displays, the **DRIVE** LED is *on* when the drive can accept a run command (drive mode) and *off* when it can not accept a run command. - See TM (or I/O) 4506, page 4-2
6. Press the **DSPL** key until "Parameter nXXX" is displayed -or- simultaneously press the **DSPL** and **ENTER** keys. This enters the "Programming mode" of the GPD 506/P5 – from here, any of the 116 parameters can be accessed and changed using the **DSPL**, **▲**, **▼**, and **ENTER** keys. - See TM 4506, page 5-1 for a list of programmable features. Using the **DSPL**, **▲**, and **ENTER** keys as needed, verify that the parameters are correct for the drive and installation conditions. See the "Special Parameter Settings as printed on page 2 of the bypass schematic and consider any parameters specific to this application.

IMPORTANT

- The, “Special Parameter Settings” Table on page 2 of the bypass schematic documents several parameters that have been factory set to meet the needs of the bypass control circuit (for example: the **LOCAL/REMOTE** key has been disabled). These parameters should not be changed. If an “initialization” is performed, via parameter **n001**, to re-set the drive to “factory settings”, then the parameters in Table 4 must be re-established in order for the bypass to work properly.
- The Special Parameters Table is also used to document parameters that have been factory set, for convenience, to typical values for fan and pump applications. These parameters may be changed to meet the needs of the specific application and include: **n006** Reverse prohibit, **n018** Acceleration time, **n019** Deceleration time and **n055** Momentary power loss ride-through. For example: In fan applications employing duct high pressure safety limit switches, it may be necessary to further adjust the deceleration time to avoid high pressure limit trips due to damper closure as the system is shut down. An alternate solution in this situation is to set parameter **n004** to “Coast to Stop”. - See TM 4506, page 5-55]
- 7. Using the **DSPL**, **▲**, and **ENTER** keys, display “Motor Rated FLA”. Set this parameter to the Full Load Amps (FLA) rating on the nameplate of the motor. This will provide motor overload protection. - See TM 4506, page 5-57
- 8. Set **n009** to “Enter Not Used” to avoid the need to press the **ENTER** key when adjusting the speed command from the digital operator.
- 9. Verify **n072** is set to “Enabled” to enable the Stall Prevention During Deceleration function. - See TM 4506, page 5-53
- 10. Set **n073** to “100%” to optimize Stall Prevention During Acceleration for most HVAC applications. - See TM 4506, page 5-53
- 11. Press the display key again to return to **DRIVE** operation. The **Remote SEQ and REF** LED’s should be *on* at this time as well as the **STOP** and **DRIVE** LEDs.
- 12. To start the Drive, move the **HAND/STOP/AUTO** switch to **HAND**. The **RUN** LED will turn *on* and the Drive will ramp up to “6 HZ” -or- ramp to the speed potentiometer setting if a speed pot. is included in the bypass unit. Verify that motor rotation is correct. [Note: In bypass packages the drive is programmed at the factory for 5 seconds of DC injection braking at start (to stop a rotating motor when switching from **BYPASS** to **DRIVE**), expect to see this delay each time the drive is started. - See TM 4506, page 5-8]

If the direction of motor rotation is wrong, turn the **DRIVE/OFF/BYPASS** switch to **OFF**; and turn Power *Off!* Wait for the Red CHARGE LED (near the drive power terminals) to go out. When it does, swap the wires on the motor terminals T1 & T2 or on the output terminals of the motor overload relay, labeled “**S12**”. Tighten the terminal lugs, reapply the power, turn to **DRIVE**; and re-check the rotation direction.

- 13. With correct motor rotation, press the **DSPL** key until “Frequency Ref” is displayed. Using the **▲, ▼, ENTER, RUN,** and **STOP** keys, manually run the drive throughout its entire operating range, while observing operation. If excessive vibration of the driven load is noted at specific input frequencies, the Critical Frequency Rejection function may be used to eliminate this vibration, by programming **n062** through **n064**. - See TM 4506, page 5-7.

- 14. Determine whether the remote speed reference is a 0-10 VDC or a 4-20 mA signal. Connect the positive side of a 0-10 VDC signal to terminal **TB1-22** of the bypass terminal strip. Connect the positive side of a 4-20 mA signal to terminal **TB1-20**. Connect the COMMON of the remote speed reference to terminal **TB1-21**. - See the connection diagram on page 1 of the bypass schematic.
[Note: Connect only one input. The factory default is 0 to 10 VDC, to change to 4-20 mA adjust parameter **n043** to “FV=AUX FI=MSTR” as shown on page 5-15 of TM 4506] Turn the **HAND/STOP/AUTO** switch to **AUTO**, then request a run command and speed reference from the building automation system to confirm remote operation.

- 15. Check the signal for proper polarity. Observe if the remote speed command can achieve the minimum and maximum speeds desired. If not, perform the following: - See TM 4506, pages 5-13 and 5-14 for further information.

For 0-10 VDC input (Terminal **FV**)

1. With no input, adjust Bias (**n049** setting) until an output of “0.0 Hz” is obtained.

2. With full scale input, adjust Gain (**n048** setting) until an output of “60.0 Hz” (or other desired maximum frequency) is obtained.

For 4-20 mA input (Terminal **FI**)

1. With 4 mA input, adjust Bias (**n051** setting) until an output of “0.0 Hz” is obtained.

2. With 20 mA input, adjust Gain (**n050** setting) until an output of “60.0 Hz” (or other desired maximum frequency) is obtained.

- 16. Turn the **DRIVE/OFF/BYPASS** switch to **OFF**. If the drive is in the **RUN** mode, it will ramp to a stop before input power shuts *off*. Once power to the drive is *off*, select the **TEST** position of the **NORMAL/TEST** switch. Only input power is supplied in this mode of operation, the motor is not connected to the drive output. The remote “**SEQ**” & “**REF**” LED’s should now be *off*. **RUN, STOP,** and Frequency Reference may now be selected using the Digital Keypad. When the **TEST** function is verified, press the **STOP** button on the drive and return the switch to **NORMAL**.

- 17. Verify that the electro-mechanical motor overload relay, labeled “**S12**”, is adjusted to equal the full load amps (FLA) value from the motor nameplate.

- 18. In preparation for testing the bypass, observe the trip setting of the circuit breaker, labeled **CB1**. The trip point is factory set at the lowest possible setting and must be adjusted for each application. This breaker will trip due to inrush current and load inertia unless it is re-set! For fan applications adjust the trip setting to ten times motor FLA. For pump applications adjust the trip setting to six times motor FLA. If circuit breaker tripping is experienced at these settings during motor starting on bypass, increase the setting gradually until the motor can be started without circuit breaker tripping.

- 19. Be prepared to monitor rotation of the motor in bypass operation. “Bump” the **BYPASS/OFF/DRIVE** switch to the **BYPASS** position and quickly back to **OFF**. Check the motor rotation. Do not allow the motor to operate in **BYPASS** until rotation is correct!

- 20. If the rotation direction in bypass is correct, skip the rest of this step. If not check for the following and perform the described corrections:
 - Turn off the incoming power feed to the drive. Since the correct rotation in Drive mode was previously established, do not change any output wires at motor.
 - Instead, verify that power to the circuit breaker is off. Now Swap **L1 & L2** on the input side of the circuit breaker/disconnect switch, labeled “**CB1**”. This will affect rotation in the bypass operation only. Once connections are complete and tight, reapply incoming power and repeat the previous step to re-check the rotation direction.

- 21. Run the motor in bypass by placing the **BYPASS/OFF/DRIVE** switch in **BYPASS**. Record all the phase voltages and currents at this time.

- 22. Select the **STOP** position of the **HAND/STOP/AUTO** switch and place the **BYPASS/OFF/DRIVE** switch in **DRIVE**. Turn to the **HAND** position and scroll the frequency reference to “60 HZ” operation. Monitor the voltages and currents in each of the output phases at full speed to make sure that the voltages are balanced and that the currents are within the motor nameplate rating during accel, stable speed, and decel.

- 23. If this application requires the drive to operate in PID mode, see TM 4506, pages 5-45 through 5-49.

- 24. With the **BYPASS/OFF/DRIVE** switch set to **OFF**, set the building automation system to give the drive a run command and a speed request. Put the **BYPASS/OFF/DRIVE** switch into **BYPASS** and let the load speed up and stabilize. Turn the **BYPASS/OFF/DRIVE** switch to **OFF** momentarily, then move the switch to **DRIVE**. Observe if the DC braking is enough to stop the fan in the time period set in parameter **n070** (5 sec factory setting). If not, set this parameter out to its maximum setting, which is 10.0 seconds. If this is not enough, slowly increase the braking current setting (parameter **n068**) but do not go above 90% to protect the drive output devices. - See TM 4506, page 5-8

THIS COMPLETES THE START-UP PROCEDURE FOR THE GPD506 WITH BYPASS.

HVAC Start-Up Procedure for GPD 506/P5 WITHOUT Bypass Option:

(For start-up of GPD 506/P5 with Bypass please go to page 4)

[Please review "Preparation for Drive Start-up" on page 1]

Check Step

1. Energize the drive, confirm that all three phases are present and that the input voltage is correct for the system being set up. The **DRIVE**, **STOP** and **REMOTE SEQ** and **REF** LEDs should be *on*.

Quick start displays are directly available by pressing the **DSPL** key. When scrolling through these displays, the **DRIVE** LED is *on* when the drive can accept a run command (drive mode) and *off* when it can not accept a run command. - See TM (or I/O) 4506, page 4-2

2. Press the **LOCAL/REMOTE** key to turn *off* the **REMOTE SEQ** and **REF** LEDs. This puts the drive in the local control mode, allowing **RUN**, **STOP** and speed commands by the digital operator. "Frequency Ref" should be displayed on the Digital Operator (if not, press the **DSPL** key until the display reads "Frequency Ref").

3. Press the **▲** key until the display reads "6.0 Hz". Press the **ENTER** key. Press the **DSPL** key until "Output Freq" is displayed. Press the **RUN** key. The display should ramp up to "6.0 Hz".

4. Press the **DSPL** key until "Forward/Reverse" is displayed. The display should read "For" (Forward direction) and the **FWD** LED should be *on* (If not, press the **▲** key until the display reads "For", and then press the **ENTER** key). Check the direction of the motor shaft rotation to be sure that the proper direction of motor rotation is established.

If the direction of motor rotation is wrong, press the **STOP** key. Remove power from the drive. Wait for the Red CHARGE LED (near the power terminals) to go out. When it does, swap the wires on motor terminals **T1** & **T2**. Tighten the terminal lugs, and power up the drive. Press the **LOCAL/REMOTE** key to put the drive in the Local control mode, then press the **RUN** key and verify that the direction of the motor shaft rotation is now correct.

5. Press the **DSPL** key until "Output Freq" is displayed. Press the **STOP** key. The display should ramp down to "0.0 Hz" and the **FWD** LED should go *off*.

6. Using the **DSPL**, **▲**, and **ENTER** keys as needed, display "Accel Time 1". Set this parameter to "60.0 Sec". This will establish a typical 60 second accel ramp for fan applications. For pump applications, this value may be left at the default 10 seconds.

7. Using the **DSPL**, **▲**, and **ENTER** keys, display "Decel Time 1". Set this parameter to "60.0 Sec". This will establish a typical 60 second decel ramp for fan applications. For pump applications, this value may be left at the default 10 seconds.
[Note: In fan applications employing duct high pressure safety limit switches, it may be necessary to further adjust this deceleration time to avoid high pressure limit trips due to damper closure as the system is shut down. An alternate solution in this situation is to set parameter **n004** to "Coast to Stop". - See TM 4506, page 5-55]

- 8. Press the **DSPL** key until “V/f Selection” is displayed. “60 Hz Preset” should be displayed on the second line (If not, press the **▲** key until the display reads “60 Hz Preset”, and then press the **ENTER** key). This will establish an optimum volts/hertz pattern for HVAC applications. - See TM 4506, page 5-60
- 9. Using the **DSPL**, **▲**, and **ENTER** keys, display “Motor Rated FLA”. Set this parameter to the Full Load Amps (FLA) rating on the nameplate of the motor. This will provide motor overload protection. - See TM 4506, page 5-57
- 10. Press the **DSPL** key until “Parameter nXXX” is displayed -or- simultaneously press the **DSPL** and **ENTER** keys. This enters the “programming mode” of the GPD 506/P5 – from here, any of the 116 parameters can be accessed and changed using the **DSPL**, **▲**, **▼**, and **ENTER** keys. - See TM 4506, page 5-1 for a list of programmable features.
- 11. Set **n001** to “3”. This allows all the GPD506 parameters (**n001-n116**) to be both Read & Set. - See TM 4506, page 5-50
- 12. Set **n006** to “REV Prohibited” to disable Reverse operation.
- 13. Set **n009** to “Enter Not Used” to avoid the need to press the **ENTER** key when adjusting the speed command from the digital operator.
- 14. Set **n055** to “2 Seconds Max” to enable the Power Loss Ride Through function. - See TM 4506, page 5-26
- 15. Set **n060** to “10” to enable the maximum number of Automatic Restart Attempts, see TM 4506, page 5-5. **WARNING: Selecting the auto-restart feature can cause the motor to start unexpectedly.** - See TM 4506, page 5-5
- 16. Press the **DSPL** key until “Frequency Ref” is displayed. Using the **▲**, **▼**, **ENTER**, **RUN**, and **STOP** keys, manually run the drive throughout its entire operating range, while observing operation. If excessive vibration of the driven load is noted at specific input frequencies, the Critical Frequency Rejection function may be used to eliminate this vibration, by programming **n062** through **n064**. - See TM 4506, page 5-7.
- 17. Verify that **n072** is set to “Enabled” to enable the Stall Prevention During Deceleration function. - See TM 4506, page 5-53
- 18. Set **n073** to “100%” to optimize Stall Prevention During Acceleration for most HVAC applications. - See TM 4506, page 5-53
- 19. Press the display key again to return to **DRIVE** operation. If you are using a remote speed command, press the **LOCAL/REMOTE** key until the **REMOTE SEQ** and **REF** LEDs are *on*. This puts the drive in the Remote Control mode.

- 20. Determine whether the remote speed reference is a 0-10 VDC or a 4-20 mA signal. Connect the positive side of a 0-10 VDC signal to terminal **FV**. Connect the positive side of a 4-20 mA signal to terminal **FI**. Connect the COMMON of the remote speed reference to terminal **FC**. - See the connection diagram on page 1-15 in TM (or IO) 4506.

[Note: Connect only one input. The factory default is 0 to 10 VDC, to change to 4-20 mA adjust parameter **n043** to "FV=AUX FI=MSTR" as shown on page 5-15 of TM 4506]

- 21. Check the signal for proper polarity. Observe if the remote speed command can achieve the minimum and maximum speeds desired. If not, perform the following: - See TM 4506, pages 5-13 and 5-14 for further information.

For 0-10 VDC input (Terminal **FV**)

1. With no input, adjust Bias (**n049** setting) until an output of "0.0 Hz" is obtained.
2. With full scale input, adjust Gain (**n048** setting) until an output of "60.0 Hz" (or other desired maximum frequency) is obtained.

For 4-20 mA input (Terminal **FI**)

3. With 4 mA input, adjust Bias (**n051** setting) until an output of "0.0 Hz" is obtained.
4. With 20 mA input, adjust Gain (**n050** setting) until an output of "60.0 Hz" (or other desired maximum frequency) is obtained.

- 22. If your application requires the PID function for closed-loop Setpoint Control operation, see TM 4506, pages 5-45 through 5-49.

THIS COMPLETES THE START-UP PROCEDURE FOR THE GPD506 WITHOUT BYPASS.