Index

5101 Davis Dr., PO Box 12173, Research Triangle Park, NC 27709 Phone: 919-767-3813 Fax: 919-767-3969

Industrial Products Division

VFD-B

Application Guide

Delta AC Drives online

visit our Web page at:
http://www.delta.com.tw

Product Information, Operation Manuals

Technical Support: (919) 767-3813

Comments on this manual can be sent to:
callyson@deltartp.com

5101 Davis Dr., PO Box 12173, Research Triangle Park, NC 27709 Phone: 919-767-3813 Fax: 919-767-3969

Industrial Products Division

Quick Start (general parameters to set for all applications)

The following 10 parameters should always be programmed to verify the drive is set-up correctly for the motor and the application.

Parameter # B Drive	Default Value	Description
02-00	00	Determine the source of speed control. This is how the AC drive will control the speed of the motor. The speed can be controlled by the AC drive keypad, or via an external analog input (0- 10V, 4-20mA).
02-01	00	Determine the location of start/stop commands. This is how the AC drive will RUN, STOP, and change directions. The start/stop commands can be controlled by the AC drive keypad, or the remote I/O terminal block in the drive.
02-02	00	Determine a Stop method. The drive will either control the deceleration (ramp to stop) or after receiving a STOP command the drive will let the motor coast (coast to stop).
01-00	60.00	Maximum Output Frequency (normally set to motor freq. rating). This is the maximum speed you would like the motor to run at.
01-01	60.00	Motor Base Frequency (always set to rated freq. on motor nameplate). This is the frequency the motor was designed to run at. Not programming the frequency will result in poor performance of the motor.
01-02	220.0/440.0	Maximum Motor Voltage (always set to motor nameplate rated voltage). This is the voltage rating of the motor and incorrectly programmed will result in poor performance and possible damage to the motor.
01-09	10/60	Acceleration (based from 0hz to Maximum Output Freq.)
01-10	10/60	Deceleration (based from Maximum Output Freq. to 0Hz)
07-00	100	Full Load Amps of the motor. The B drive setting is a % of the AC drives rated output current. Pr. setting = (motor amps/drive amps) x 100.
07-01	40	No Load Amps (normally set to 40% of full load setting). Formula: Pr. setting = 0.4 x Full load setting.

5101 Davis Dr., PO Box 12173, Research Triangle Park, NC 27709 Phone: 919-767-3813 Fax: 919-767-3969

Industrial Products Division

How to use a maintained external switch for start/stop control

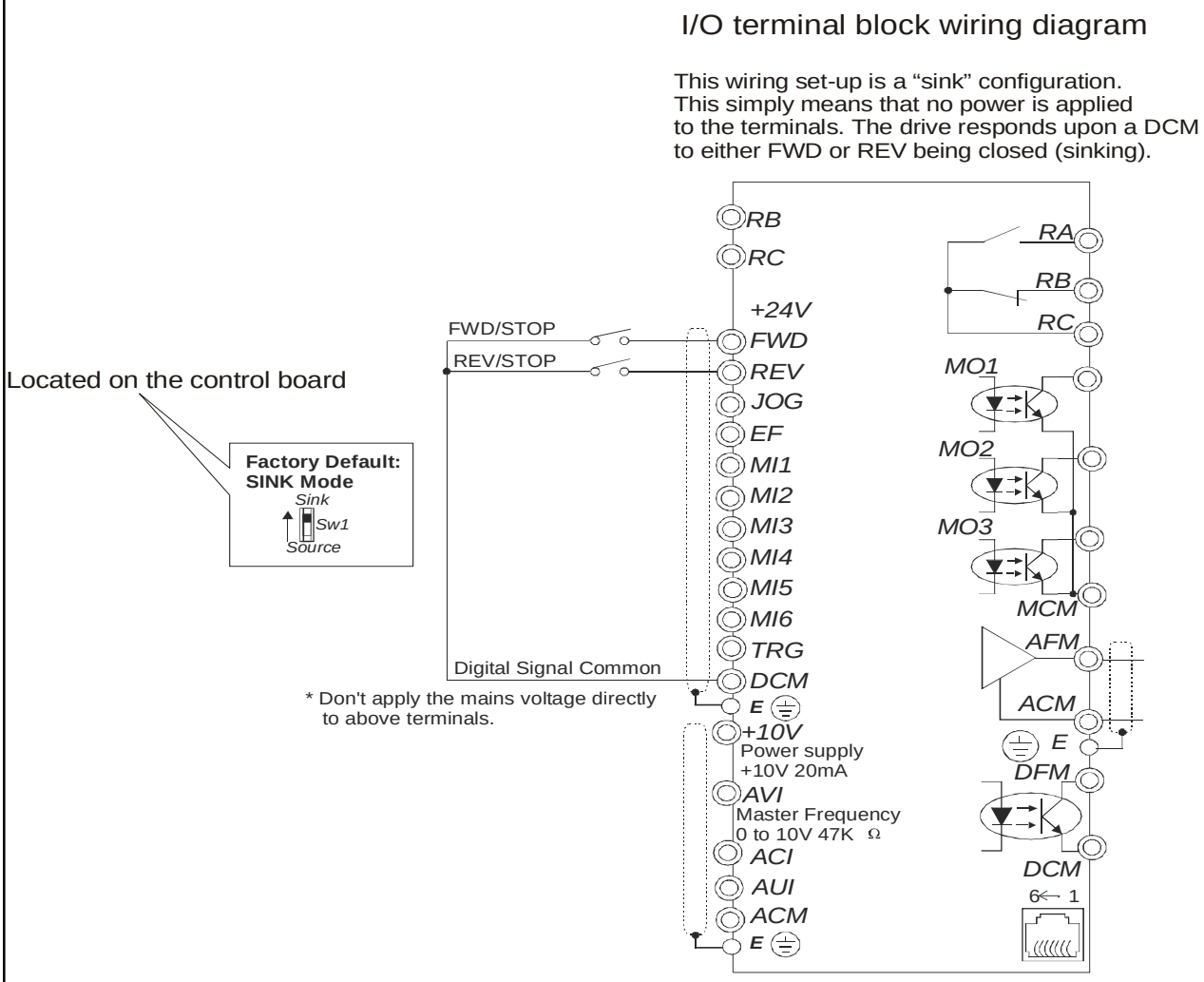
The AC Drive can be controlled via the keypad or by external switches that are wired to the green I/O terminal block. The following is an example of how to use external switches to control the starting, stopping, and direction of the AC drive.

The following parameters must be changed.

VFD-B

Pr. 02-01 = set to 01 (Operate via remote I/O terminals, keypad STOP enabled)
Pr. 02-05 = set to 00 (FWD/STOP, REV/STOP)

2 Wire Control - FWD/STOP, REV/STOP Wiring Diagram



5101 Davis Dr., PO Box 12173, Research Triangle Park, NC 27709 Phone: 919-767-3813 Fax: 919-767-3969

2 Wire Control - RUN/STOP, FWD/REV

The following parameters must be changed.

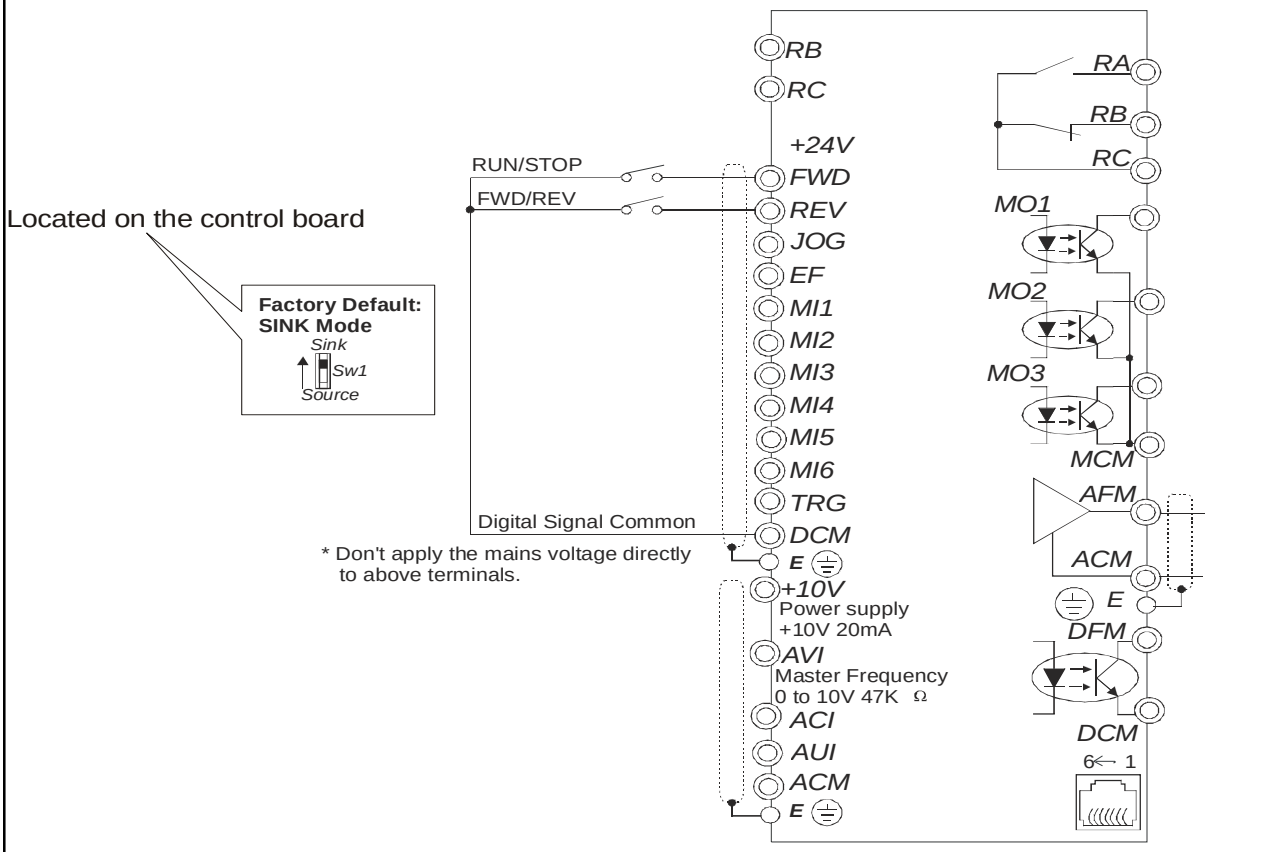
VFD-B

Pr. 02-01 = set to 01 (Operate via remote I/O terminals, keypad STOP enabled)
Pr. 02-05 = set to 01 (RUN/STOP, FWD/REV)

2 Wire Control - RUN/STOP, FWD/REV Wiring Diagram

I/O terminal block wiring diagram

This wiring set-up is a “sink” configuration. This simply means that no power is applied to the terminals. The drive responds upon a DCM to either FWD or REV being closed (sinking).



Industrial Products Division

How to use a momentary external switch for start/stop control

The AC Drive can be controlled via the keypad or by external switches that are wired to the green I/O terminal block. The following is an example of how to use external switches to control the starting, stopping, and direction of the AC drive.

The following parameters must be changed.

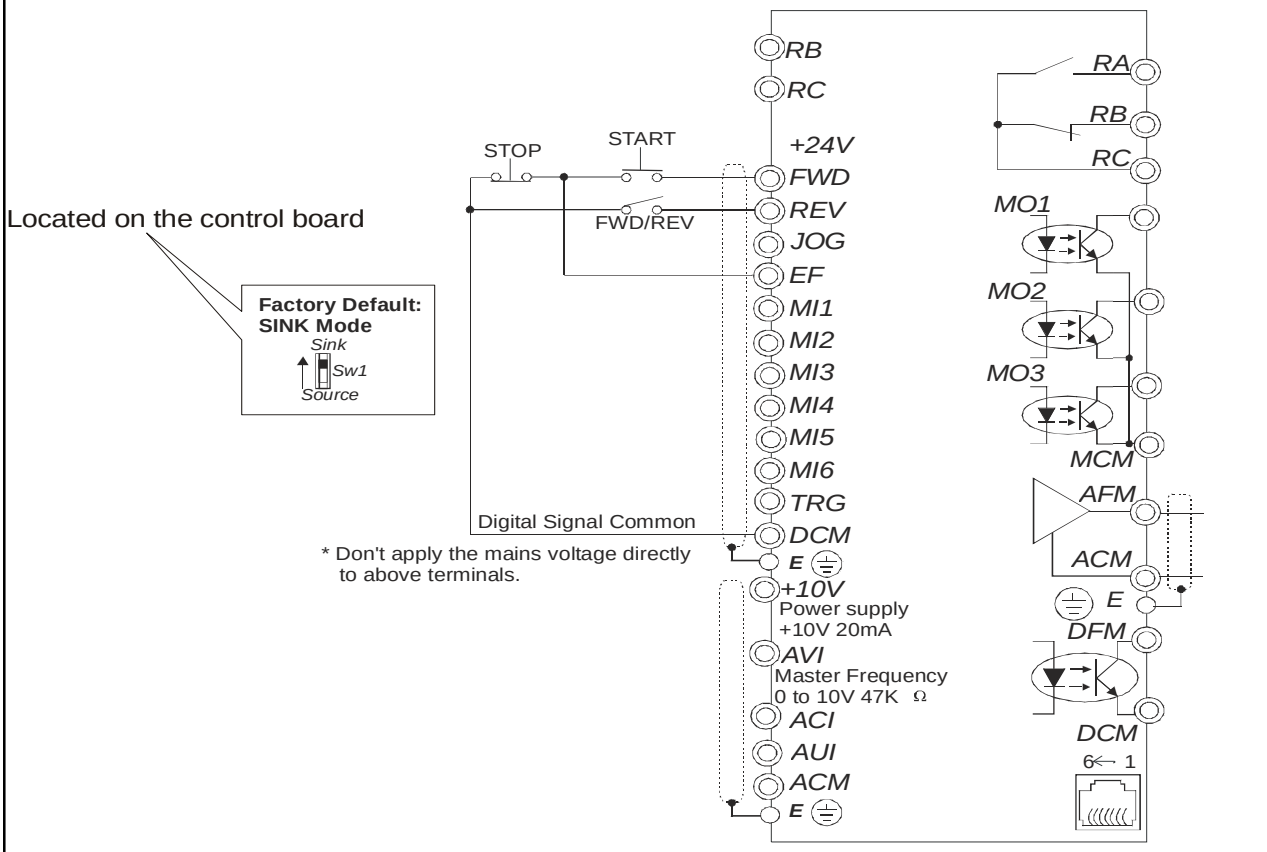
VFD-B

Pr. 02-01 = set to 01 (Operate via remote I/O terminals, keypad STOP enabled)
Pr. 02-05 = set to 02 (3 wire momentary control)

3 Wire Control - Wiring Diagram

I/O terminal block wiring diagram

This wiring set-up is a "sink" configuration. This simply means that no power is applied to the terminals. The drive responds upon a DCM to either FWD or REV being closed (sinking).



5101 Davis Dr., PO Box 12173, Research Triangle Park, NC 27709 Phone: 919-767-3813 Fax: 919-767-3969

Industrial Products Division

How to de-rate a drive for use on a smaller motor

The Delta AC Drive may be used with a motor of lesser HP and current, but several parameters should be changed to protect the motor from over current.

Parameter Numbers and Descriptions - VFD-B
6-01 Over Current Stall Prevention during Acceleration
6-02 Over Current Stall Prevention during Steady State
6-03 Over Torque Detection Mode
6-04 Over Torque Detection Level
6-05 Over Torque Detection Time
6-06 Electronic Thermal Overload Relay Selection
6-07 Electronic Thermal Characteristics
7-00 Motor FLA
7-01 Motor No Load Amps

Example: 1hp 230V drive on a 0.5hp 230V motor.
Drive output = 5amps
Motor = 2.2amps

07-00 Motor FLA
Entered in % for B drive. (Motor amps / Drive amps) x 100 = (2.2 / 5) x100 = 44%
Enter 44% into Motor FLA parameter 07-00.

07-01 Motor No Load amps
Entered in % for B drive. (0.4 x motor FLA) = 0.4 x 44% = 17.6 = 18%
Enter 18 into Motor No Load Amps parameter 07-01.

Electronic Thermal Overload (I^2T function)

1) **Electronic Thermal Overload Relay Selection (parameter 06-06)**. The selections are based on the motor. Standard motor is a fan cooled unit and a special motor is an inverter duty motor that is not fan cooled or may be fan cooled by an external electric motor.

a. Choosing a “standard motor” will cause the drive to shut down sooner at slow speeds. This is done because the drive believes the heat induced on the motor at low speeds is high and the fan is not running fast enough to cool the motor.

b. Selecting “Special Motor” tells the drive the motor attached can handle higher heating of the windings before the motor will fail.

2) The **Electronic Thermal Characteristics (parameter 06-07)** is the time for the drive to shut down after detecting 150% of current (the current is based on Motor FLA).

5101 Davis Dr., PO Box 12173, Research Triangle Park, NC 27709 Phone: 919-767-3813 Fax: 919-767-3969

Other Parameters to change when using a drive on a lesser HP motor

Over current Stall Prevention on acceleration (parameter 06-01)

Should be around 170% of motor FLA.

1.7 x 2.2amps = 3.74amps

3.74amps / 5amps = 75% of drive rating is the stall prevention level

Enter 75% into Over Current Stall Prevention parameter

Over current Stall Prevention during Steady State (parameter 06-02)

Same sequence as above, but the overload % may only need to be 130-150%

Over Torque Detection parameter setup

1) A **Mode (parameter 06-03)** should be chosen for your application. Such as detection on acceleration only, or detection on steady state only.

2) The **Over Torque Detection level (parameter 06-04)** is normally 150% of the motors rated FLA.
   1.5 x 2.2 = 3.3amps
   3.3amps / 5amps = 66% of drive rating, is the detection level
   Enter 66% in the Over Torque Detection level parameter.

3) The **Over Torque Detection Time (parameter 06-05)** needs to be determined by the user. The drive will detect the over torque instantly, but the Over Torque Detection Time is how quickly the drive will conduct the chosen **Mode** setting. Example: after 10 seconds of over torque detection on acceleration, the drive should stop. **Mode** set to “detection during acceleration and stop after detection. **Time** set to 10 seconds.

5101 Davis Dr., PO Box 12173, Research Triangle Park, NC 27709 Phone: 919-767-3813 Fax: 919-767-3969

Set-up for VFD-B Pump Pressure Feedback

Application ACI Signal Follower

00-03 = 01

01-07 = 100

01-08 = 45

01-09 = 20

01-10 = 20

02-00 = 02

02-01 = 01

02-04 = 01

02-07 = 02

04-04 = 31

04-05 = 20

04-06 = 25

04-07 = 32

04-11 = 100

04-12 = 1

04-14 = 1

06-01 = 70

06-02 = 70

07-00 = 38

07-01 = 15

08-04 = 1

In this application the drive will follow the ACI signal from the transducer and either slow down if the pressure increases or speed up if the pressure decreases. There is a lower bound limit, which will keep the drive running at no less than 27Hz.

5101 Davis Dr., PO Box 12173, Research Triangle Park, NC 27709 Phone: 919-767-3813 Fax: 919-767-3969

PID Feedback Set-up for Pump Applications

Consider a pump connected to a manifold, which feeds parallel loads through several valves. Control system goal is to maintain a constant pressure despite changes in flow. Flow can be adjusted by changing pump speed at constant pressure.

Process control error would be the difference between set point and manifold pressure therefore drive should change its frequency output to cancel that error.

We suggest PID feedback (proportional-integral) control.

PI control

Proportional gain (P) allows adjustments on drive frequency output, which are proportional to the computed error (large error, large adjustment). Integral gain (I) adjusts frequency output based on the duration of the error (the longer the error is present, the harder it tries to correct)

Programming

1-Assume pressure transducer is 4-20 mA for 0-5 kg/cm2 (*)
2-Assume set-point is 3.6 kg/cm2 (*)
3-Assume Min Freq is 0 and Max Freq is 60 (*)

Do the following calculations:

-Gain over Frequency input,

Pr.10-01 = [Max Freq – Min. Freq] / 20mA = (60-0)/20 = 3 Hz/mA

- Convert pressure to frequency,

Set point = 3.6 kg * (20 mA /5 kg) * (3 Hz/mA) + Min Freq = 43.2 Hz

4- Input this number (F 43.2) on keypad display
5- Change Pr.02-01 to d01 (keypad STOP enabled)
6- Change Pr.10-00 to d02 (PID input from ACI, 4-20 mA)

Tuning

Use the following suggested values but modify as necessary to improve control performance:

Pr.10-02 = 5.0
Pr.10-03 = 25.0

Wiring

Connect pressure transducer output to drive terminals ACI-ACM

5101 Davis Dr., PO Box 12173, Research Triangle Park, NC 27709 Phone: 919-767-3813 Fax: 919-767-3969

PID Feedback Set-up for Pump Applications (con't)

00-03 = 01

02-01 = 01

02-04 = 01

04-04 = 28

04-05 = 20

04-06 = 25

04-07 = 32

06-01 = 70

06-02 = 70

07-00 = 38

07-01 = 15

08-04 = 01

10-00 = 02

In this application the drive uses an ACI PID feedback signal and maintains pressure based on a setpoint in the drive. First relate the pressure transducer range to the drives 0-60Hz as follows:

30psi = 20ma = 60Hz

20psi = 15ma = 40Hz

15psi = 12ma = 30Hz

7.5psi = 8ma = 15Hz

0psi = 4ma = 0Hz

In the example above if the system needed to maintain 15psi then the frequency setpoint on the drive would be 30Hz. A 12ma signal would keep the drive running at a steady state. Any other signal back from the transducer would then increase or decrease the speed of the drive to maintain 15psi.

5101 Davis Dr., PO Box 12173, Research Triangle Park, NC 27709 Phone: 919-767-3813 Fax: 919-767-3969

Industrial Products Division

VFD-M

Application Guide

Delta AC Drives online

visit our Web page at:
http://www.delta.com.tw

Product Information, Operation Manuals

Technical Support: (919) 767-3813

Comments on this manual can be sent to:
callyson@deltartp.com

5101 Davis Dr., PO Box 12173, Research Triangle Park, NC 27709 Phone: 919-767-3813 Fax: 919-767-3969

Industrial Products Division

Quick Start (general parameters to set for all applications)

The following 10 parameters should always be programmed to verify the drive is set-up correctly for the motor and the application.

Parameter # M Drive	Default Value	Description
00	00	Determine the source of speed control. This is how the AC drive will control the speed of the motor. The speed can be controlled by the AC drive keypad, or via an external analog input (0- 10V, 4-20mA).
01	00	Determine the location of start/stop commands. This is how the AC drive will RUN, STOP, and change directions. The start/stop commands can be controlled by the AC drive keypad, or the remote I/O terminal block in the drive.
02	00	Determine a Stop method. The drive will either control the deceleration (ramp to stop) or after receiving a STOP command the drive will let the motor coast (coast to stop).
03	60.00	Maximum Output Frequency (normally set to motor freq. rating). This is the maximum speed you would like the motor to run at.
04	60.00	Motor Base Frequency (always set to rated freq. on motor nameplate). This is the frequency the motor was designed to run at. Not programming the frequency will result in poor performance of the motor.
05	220.0/440.0	Maximum Motor Voltage (always set to motor nameplate rated voltage). This is the voltage rating of the motor and incorrectly programmed will result in poor performance and possible damage to the motor.
10	10	Acceleration (based from 0hz to Maximum Output Freq.)
11	10	Deceleration (based from Maximum Output Freq. to 0Hz)
52	FLA	Full Load Amps of the motor. The M drive setting is the actual current on the motor nameplate.
53	0.4xFLA	No Load Amps (normally set to 40% of full load setting). Formula: Pr. setting = 0.4 x Full load setting.

5101 Davis Dr., PO Box 12173, Research Triangle Park, NC 27709 Phone: 919-767-3813 Fax: 919-767-3969

How to use a maintained external switch for start/stop control

The AC Drive can be controlled via the keypad or by external switches that are wired to the green I/O terminal block. The following is an example of how to use external switches to control the starting, stopping, and direction of the AC drive.

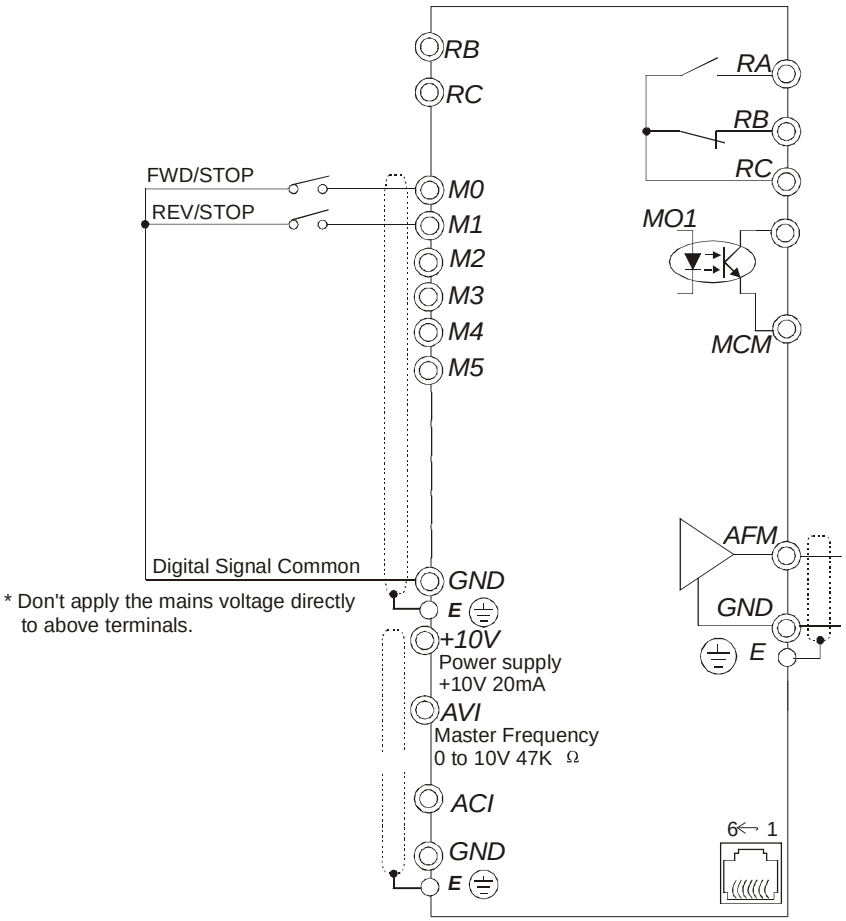
The following parameters must be changed.

VFD-M

Pr. 01 = set to 01 (Operate via remote I/O terminals, keypad STOP enabled)
Pr. 38 = set to 00 (FWD/STOP, REV/STOP)

2 Wire Control - FWD/STOP, REV/STOP Wiring Diagram

I/O terminal block wiring diagram



5101 Davis Dr., PO Box 12173, Research Triangle Park, NC 27709 Phone: 919-767-3813 Fax: 919-767-3969

2 Wire Control - RUN/STOP, FWD/REV

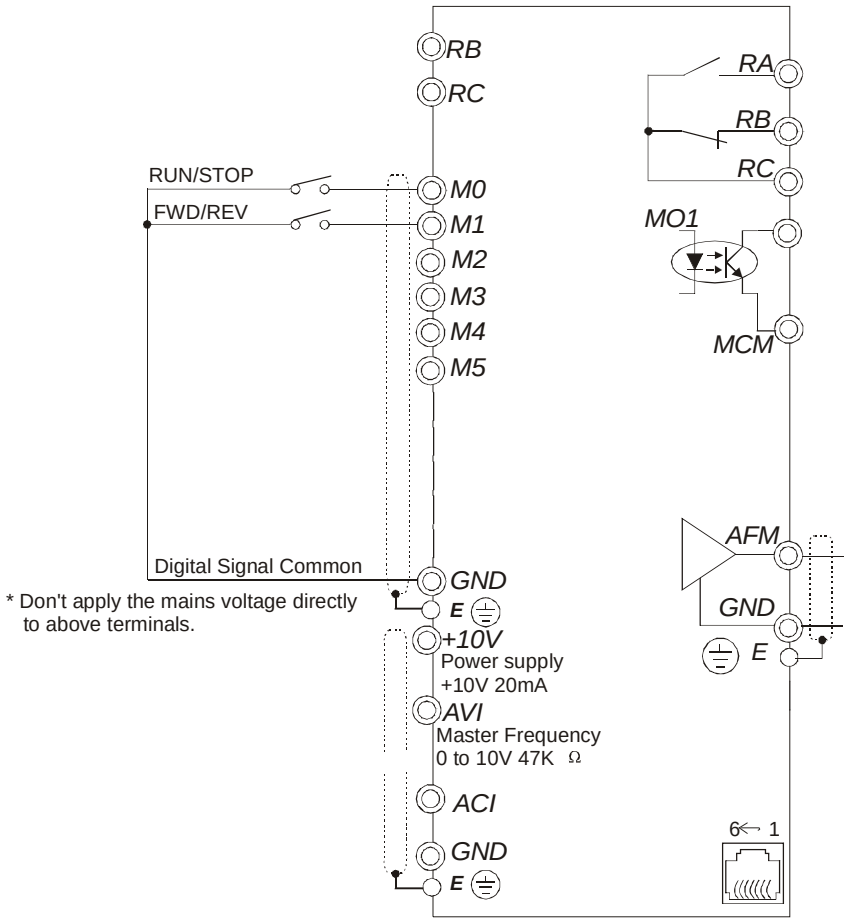
The following parameters must be changed.

VFD-M

Pr. 01 = set to 01 (Operate via remote I/O terminals, keypad STOP enabled)
Pr. 38 = set to 01 (RUN/STOP, FWD/REV)

2 Wire Control - RUN/STOP, FWD/REV Wiring Diagram

I/O terminal block wiring diagram



How to use a momentary external switch for start/stop control

The AC Drive can be controlled via the keypad or by external switches that are wired to the green I/O terminal block. The following is an example of how to use external switches to control the starting, stopping, and direction of the AC drive.

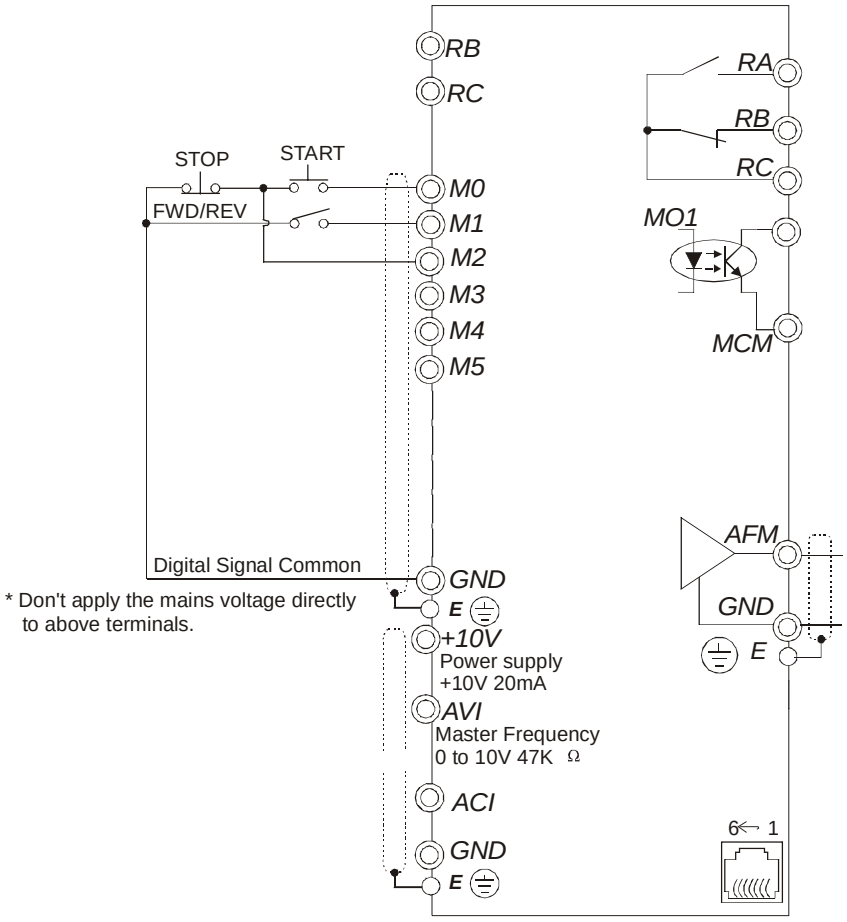
The following parameters must be changed.

VFD-M

Pr. 01 = set to 01 (Operate via remote I/O terminals, keypad STOP enabled)
Pr. 38 = set to 02 (3 wire momentary control)

3 Wire Control - Wiring Diagram

I/O terminal block wiring diagram



How to de-rate a drive for use on a smaller motor

The Delta AC Drive may be used with a motor of lesser HP and current, but several parameters should be changed to protect the motor from over current.

Parameter Numbers and Descriptions - VFD-M
26 Over Current Stall Prevention during Acceleration
27 Over Current Stall Prevention during Operation
60 Over Torque Detection Mode
61 Over Torque Detection Level
62 Over Torque Detection Time
58 Electronic Thermal Overload Relay Selection
59 Electronic Thermal Motor Overload
52 Motor FLA
53 Motor No Load Amps

Example: 1hp 230V drive on a 0.5hp 230V motor.
Drive output = 5amps
Motor = 2.2amps

52 Motor FLA
Entered in actual amps for M drive.

53 Motor No Load amps
(0.4 x motor FLA) = 0.4 x actual motor current = .88 = 1 amp
Enter 1 into Motor No Load Amps parameter 53.

Electronic Thermal Overload (I^2T function)

1) **Electronic Thermal Overload Relay Selection (parameter 58)**. The selections are based on the motor. Standard motor is a fan cooled unit and a special motor is an inverter duty motor that is not fan cooled or may be fan cooled by an external electric motor.

a. Choosing a “standard motor” will cause the drive to shut down sooner at slow speeds. This is done because the drive believes the heat induced on the motor at low speeds is high and the fan is not running fast enough to cool the motor.

b. Selecting “Special Motor” tells the drive the motor attached can handle higher heating of the windings before the motor will fail.

2) The **Electronic Thermal Motor Overload (parameter 59)** is the time for the drive to shut down after detecting 150% of current (the current is based on Motor FLA).

5101 Davis Dr., PO Box 12173, Research Triangle Park, NC 27709 Phone: 919-767-3813 Fax: 919-767-3969

Other Parameters to change when using a drive on a lesser HP motor

Over current Stall Prevention on acceleration (parameter 26)

Should be around 170% of motor FLA.

1.7 x 2.2amps = 3.74amps

3.74amps / 5amps = 75% of drive rating is the stall prevention level

Enter 75% into Over Current Stall Prevention parameter

Over current Stall Prevention during Operation (parameter 27)

Same sequence as above, but the overload % may only need to be 130-150%

Over Torque Detection parameter setup

1) A **Mode (parameter 60)** should be chosen for your application. Such as detection on acceleration only, or detection on steady state only.

2) The **Over Torque Detection level (parameter 61)** is normally 150% of the motors rated FLA.
   1.5 x 2.2 = 3.3amps
   3.3amps / 5amps = 66% of drive rating, is the detection level
   Enter 66% in the Over Torque Detection level parameter.

3) The **Over Torque Detection Time (parameter 62)** needs to be determined by the user. The drive will detect the over torque instantly, but the Over Torque Detection Time is how quickly the drive will conduct the chosen **Mode** setting. Example: after 10 seconds of over torque detection on acceleration, the drive should stop. **Mode** set to “detection during acceleration and stop after detection. **Time** set to 10 seconds.

5101 Davis Dr., PO Box 12173, Research Triangle Park, NC 27709 Phone: 919-767-3813 Fax: 919-767-3969

Industrial Products Division

VFD-S

Application Guide

Delta AC Drives online

visit our Web page at:
http://www.delta.com.tw

Product Information, Operation Manuals

Technical Support: (919) 767-3813

Comments on this manual can be sent to:
callyson@deltartp.com

5101 Davis Dr., PO Box 12173, Research Triangle Park, NC 27709 Phone: 919-767-3813 Fax: 919-767-3969

Quick Start (general parameters to set for all applications)

The following 10 parameters should always be programmed to verify the drive is set-up correctly for the motor and the application.

Parameter # S Drive	Default Value	Description
2-00	d0	Determine the source of speed control. This is how the AC drive will control the speed of the motor. The speed can be controlled by the AC drive keypad, or via an external analog input (0- 10V, 4-20mA).
2-01	d0	Determine the location of start/stop commands. This is how the AC drive will RUN, STOP, and change directions. The start/stop commands can be controlled by the AC drive keypad, or the remote I/O terminal block in the drive.
2-02	d0	Determine a Stop method. The drive will either control the deceleration (ramp to stop) or after receiving a STOP command the drive will let the motor coast (coast to stop).
1-00	d60.0	Maximum Output Frequency (normally set to motor freq. rating). This is the maximum speed you would like the motor to run at.
1-01	d60.0	Motor Base Frequency (always set to rated freq. on motor nameplate). This is the frequency the motor was designed to run at. Not programming the frequency will result in poor performance of the motor.
1-02	d220/440	Maximum Motor Voltage (always set to motor nameplate rated voltage). This is the voltage rating of the motor and incorrectly programmed will result in poor performance and possible damage to the motor.
1-09	d10	Acceleration (based from 0hz to Maximum Output Freq.)
1-10	d10	Deceleration (based from Maximum Output Freq. to 0Hz)
7-00	d85	Full Load Amps of the motor. The S drive setting is a % of the AC drives rated output current. Pr. setting = (motor amps/drive amps) x 100.
7-01	d50	No Load Amps (normally set to 40% of full load setting). Formula: Pr. setting = 0.4 x Full load setting.

5101 Davis Dr., PO Box 12173, Research Triangle Park, NC 27709 Phone: 919-767-3813 Fax: 919-767-3969

How to use a maintained external switch for start/stop control

The AC Drive can be controlled via the keypad or by external switches that are wired to the green I/O terminal block. The following is an example of how to use external switches to control the starting, stopping, and direction of the AC drive.

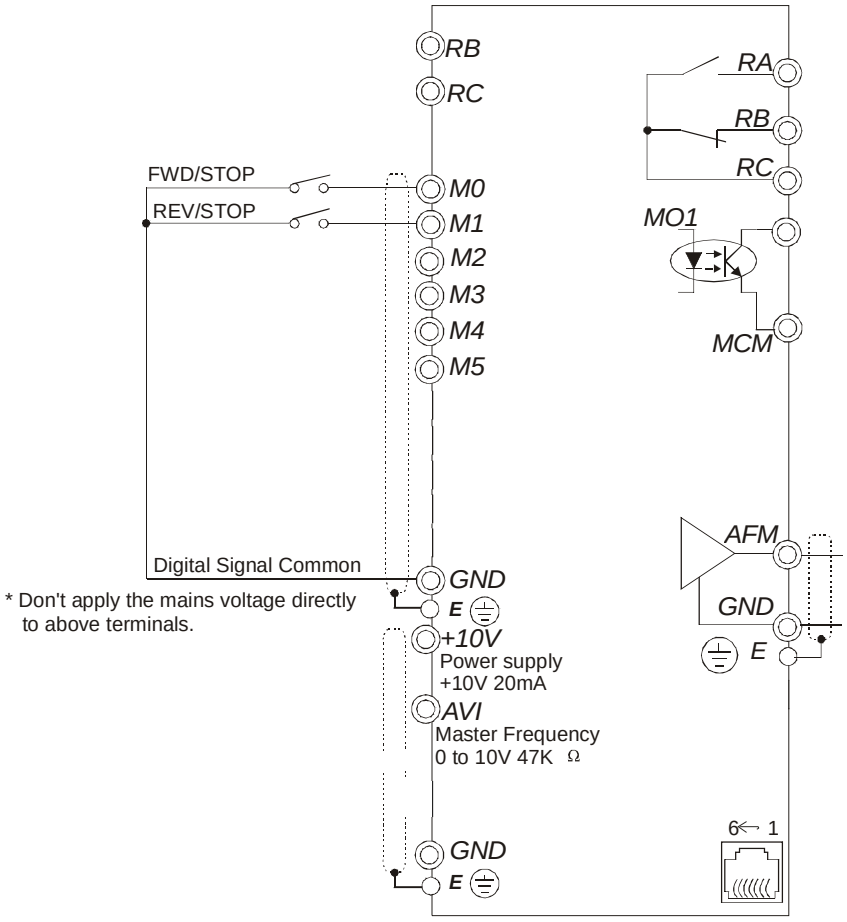
The following parameters must be changed.

VFD-S

Pr. 2-01 = set to d1 (Operate via remote I/O terminals, keypad STOP enabled)
Pr. 4-04 = set to d1 (FWD/STOP, REV/STOP)

2 Wire Control - FWD/STOP, REV/STOP Wiring Diagram

I/O terminal block wiring diagram



5101 Davis Dr., PO Box 12173, Research Triangle Park, NC 27709 Phone: 919-767-3813 Fax: 919-767-3969

2 Wire Control - RUN/STOP, FWD/REV

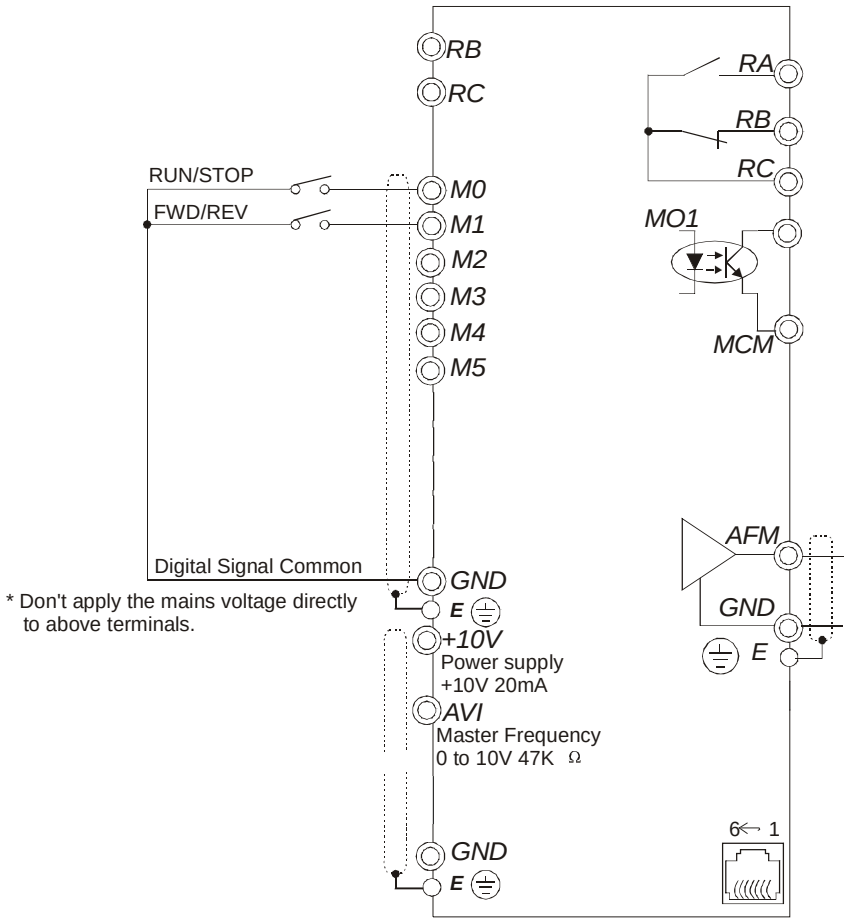
The following parameters must be changed.

VFD-S

Pr. 2-01 = set to d1 (Operate via remote I/O terminals, keypad STOP enabled)
Pr. 4-04 = set to d2 (RUN/STOP, FWD/REV)

2 Wire Control - RUN/STOP, FWD/REV Wiring Diagram

I/O terminal block wiring diagram



How to use a momentary external switch for start/stop control

The AC Drive can be controlled via the keypad or by external switches that are wired to the green I/O terminal block. The following is an example of how to use external switches to control the starting, stopping, and direction of the AC drive.

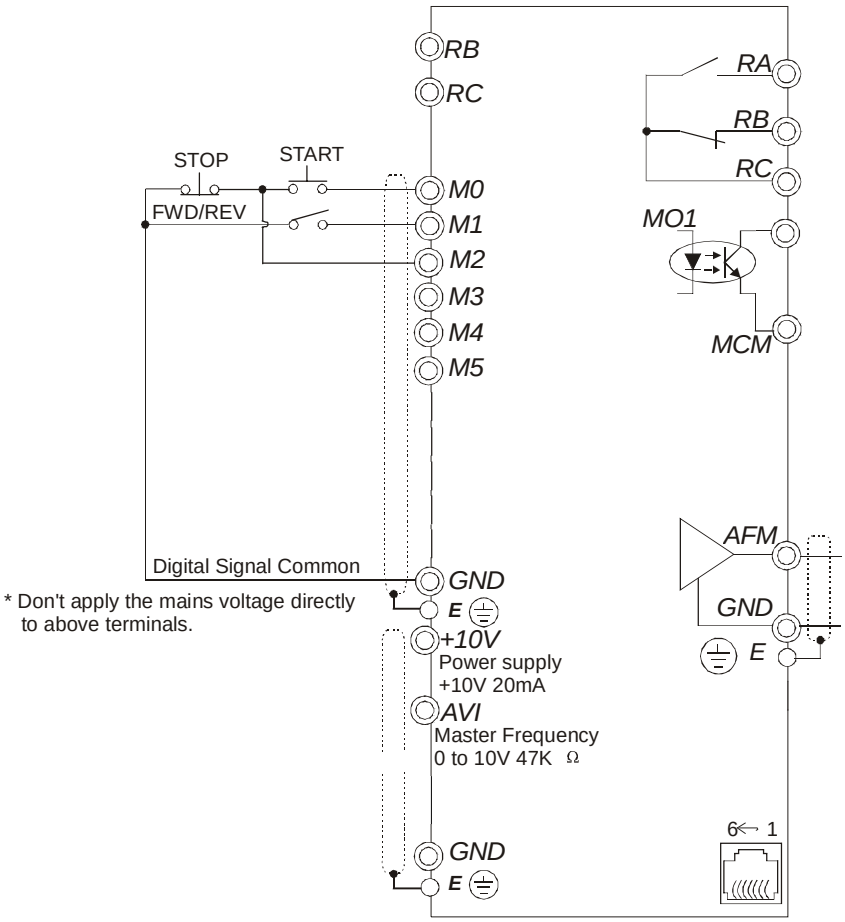
The following parameters must be changed.

VFD-S

Pr. 2-01 = set to d1 (Operate via remote I/O terminals, keypad STOP enabled)
Pr. 4-04 = set to d3 (3 wire momentary control)

3 Wire Control - Wiring Diagram

I/O terminal block wiring diagram



How to de-rate a drive for use on a smaller motor

The Delta AC Drive may be used with a motor of lesser HP and current, but several parameters should be changed to protect the motor from over current.

Parameter Numbers and Descriptions - VFD-S
6-02 Over Current Stall Prevention Level
6-03 Over Torque Detection Mode
6-04 Over Torque Detection Level
6-05 Over Torque Detection Time
6-06 Electronic Thermal Overload Relay Selection
6-07 Electronic Thermal Characteristics
7-00 Motor FLA
7-01 Motor No Load Amps

Example: 1hp 230V drive on a 0.5hp 230V motor.
Drive output = 5amps
Motor = 2.2amps

7-00 Motor FLA
Entered in % for S drive. (Motor amps / Drive amps) x 100 = (2.2 / 5) x100 = 44%
Enter 44% into Motor FLA parameter 07-00.

7-01 Motor No Load amps
Entered in % for S drive. (0.4 x motor FLA) = 0.4 x 44% = 17.6 = 18%
Enter 18 into Motor No Load Amps parameter 07-01.

Electronic Thermal Overload (I^2T function)

1) **Electronic Thermal Overload Relay Selection (parameter 6-06)**. The selections are based on the motor. Standard motor is a fan cooled unit and a special motor is an inverter duty motor that is not fan cooled or may be fan cooled by an external electric motor.

a. Choosing a “standard motor” will cause the drive to shut down sooner at slow speeds. This is done because the drive believes the heat induced on the motor at low speeds is high and the fan is not running fast enough to cool the motor.

b. Selecting “Special Motor” tells the drive the motor attached can handle higher heating of the windings before the motor will fail.

2) The **Electronic Thermal Characteristics (parameter 6-07)** is the time for the drive to shut down after detecting 150% of current (the current is based on Motor FLA).

5101 Davis Dr., PO Box 12173, Research Triangle Park, NC 27709 Phone: 919-767-3813 Fax: 919-767-3969

Other Parameters to change when using a drive on a lesser HP motor

Over current Stall Prevention Level (parameter 6-02)

Should be around 130-150% of motor FLA.

1.3 x 2.2amps = 2.86amps

2.86amps / 5amps = 57% of drive rating is the stall prevention level

Enter 57% into Over Current Stall Prevention parameter

Over Torque Detection parameter setup

1) A **Mode (parameter 6-03)** should be chosen for your application. Such as detection on acceleration only, or detection on steady state only.

2) The **Over Torque Detection level (parameter 6-04)** is normally 150% of the motors rated FLA.
   1.5 x 2.2 = 3.3amps
   3.3amps / 5amps = 66% of drive rating, is the detection level
   Enter 66% in the Over Torque Detection level parameter.

3) The **Over Torque Detection Time (parameter 6-05)** needs to be determined by the user. The drive will detect the over torque instantly, but the Over Torque Detection Time is how quickly the drive will conduct the chosen **Mode** setting. Example: after 10 seconds of over torque detection on acceleration, the drive should stop. **Mode** set to “detection during acceleration and stop after detection. **Time** set to 10 seconds.

5101 Davis Dr., PO Box 12173, Research Triangle Park, NC 27709 Phone: 919-767-3813 Fax: 919-767-3969

Industrial Products Division

VFD-V

Application Guide

Delta AC Drives online

visit our Web page at:
http://www.delta.com.tw

Product Information, Operation Manuals

Technical Support: (919) 767-3813

Comments on this manual can be sent to:
callyson@deltartp.com

5101 Davis Dr., PO Box 12173, Research Triangle Park, NC 27709 Phone: 919-767-3813 Fax: 919-767-3969

Quick Start (general parameters to set for all applications)

The following 10 parameters should always be programmed to verify the drive is set-up correctly for the motor and the application.

Parameter # V Drive	Default Value	Description
00-20	0	Determine the source of speed control. This is how the AC drive will control the speed of the motor. The speed can be controlled by the AC drive keypad, or via an external analog input (0- 10V, 4-20mA).
00-21	0	Determine the location of start/stop commands. This is how the AC drive will RUN, STOP, and change directions. The start/stop commands can be controlled by the AC drive keypad, or the remote I/O terminal block in the drive.
00-22	0	Determine a Stop method. The drive will either control the deceleration (ramp to stop) or after receiving a STOP command the drive will let the motor coast (coast to stop).
01-00	60.00	Maximum Output Frequency (normally set to motor freq. rating). This is the maximum speed you would like the motor to run at.
01-01	60.00	Motor Base Frequency (always set to rated freq. on motor nameplate). This is the frequency the motor was designed to run at. Not programming the frequency will result in poor performance of the motor.
01-02	220.0/440.0	Maximum Motor Voltage (always set to motor nameplate rated voltage). This is the voltage rating of the motor and incorrectly programmed will result in poor performance and possible damage to the motor.
01-12	10/60	Acceleration (based from 0hz to Maximum Output Freq.)
01-13	10/60	Deceleration (based from Maximum Output Freq. to 0Hz)
05-01	FLA	Full Load Amps of the motor. The V drive setting is the actual current rating of the motor.
05-02	0.4xFLA	No Load Amps (normally set to 40% of full load setting). Formula: Pr. setting = 0.4 x Full load setting.

5101 Davis Dr., PO Box 12173, Research Triangle Park, NC 27709 Phone: 919-767-3813 Fax: 919-767-3969

Industrial Products Division

How to use a maintained external switch for start/stop control

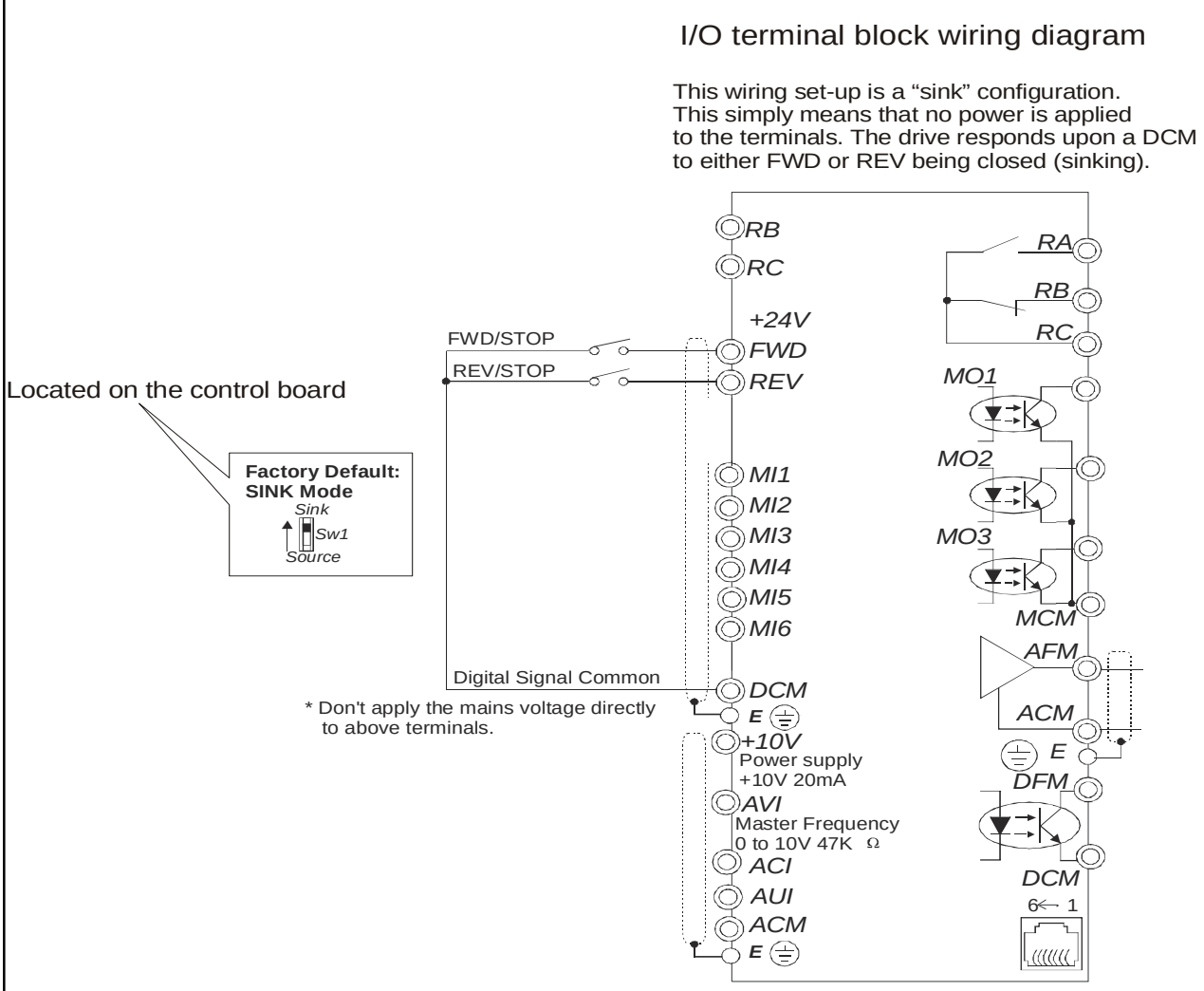
The AC Drive can be controlled via the keypad or by external switches that are wired to the green I/O terminal block. The following is an example of how to use external switches to control the starting, stopping, and direction of the AC drive.

The following parameters must be changed.

VFD-V

Pr. 00-21 = set to 01 (Operate via remote I/O terminals, keypad STOP enabled)
Pr. 02-00 = set to 00 (FWD/STOP, REV/STOP)

2 Wire Control - FWD/STOP, REV/STOP Wiring Diagram



5101 Davis Dr., PO Box 12173, Research Triangle Park, NC 27709 Phone: 919-767-3813 Fax: 919-767-3969

2 Wire Control - RUN/STOP, FWD/REV

The following parameters must be changed.

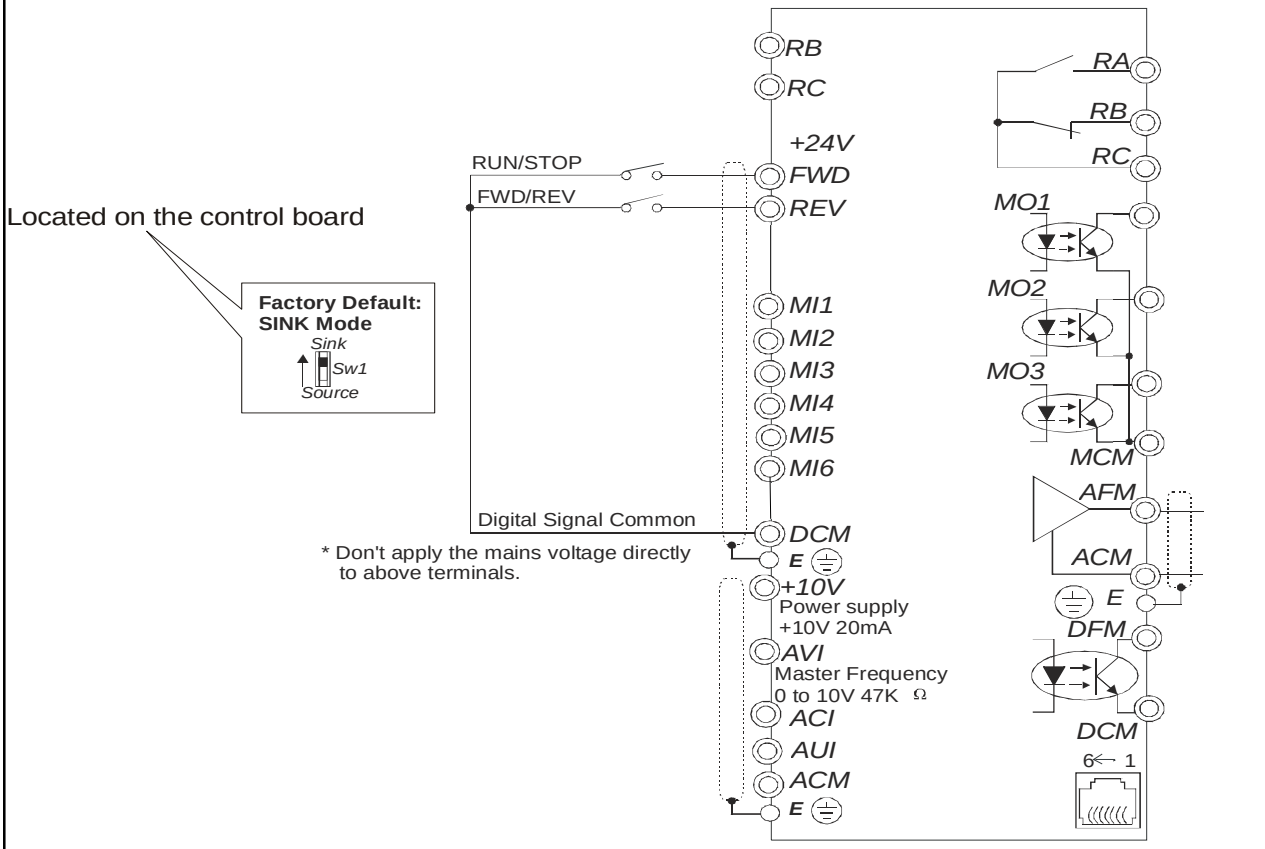
VFD-V

Pr. 00-21 = set to 01 (Operate via remote I/O terminals, keypad STOP enabled)
Pr. 02-00 = set to 02 (RUN/STOP, FWD/REV)

2 Wire Control - RUN/STOP, FWD/REV Wiring Diagram

I/O terminal block wiring diagram

This wiring set-up is a “sink” configuration. This simply means that no power is applied to the terminals. The drive responds upon a DCM to either FWD or REV being closed (sinking).



Industrial Products Division

How to use a momentary external switch for start/stop control

The AC Drive can be controlled via the keypad or by external switches that are wired to the green I/O terminal block. The following is an example of how to use external switches to control the starting, stopping, and direction of the AC drive.

The following parameters must be changed.

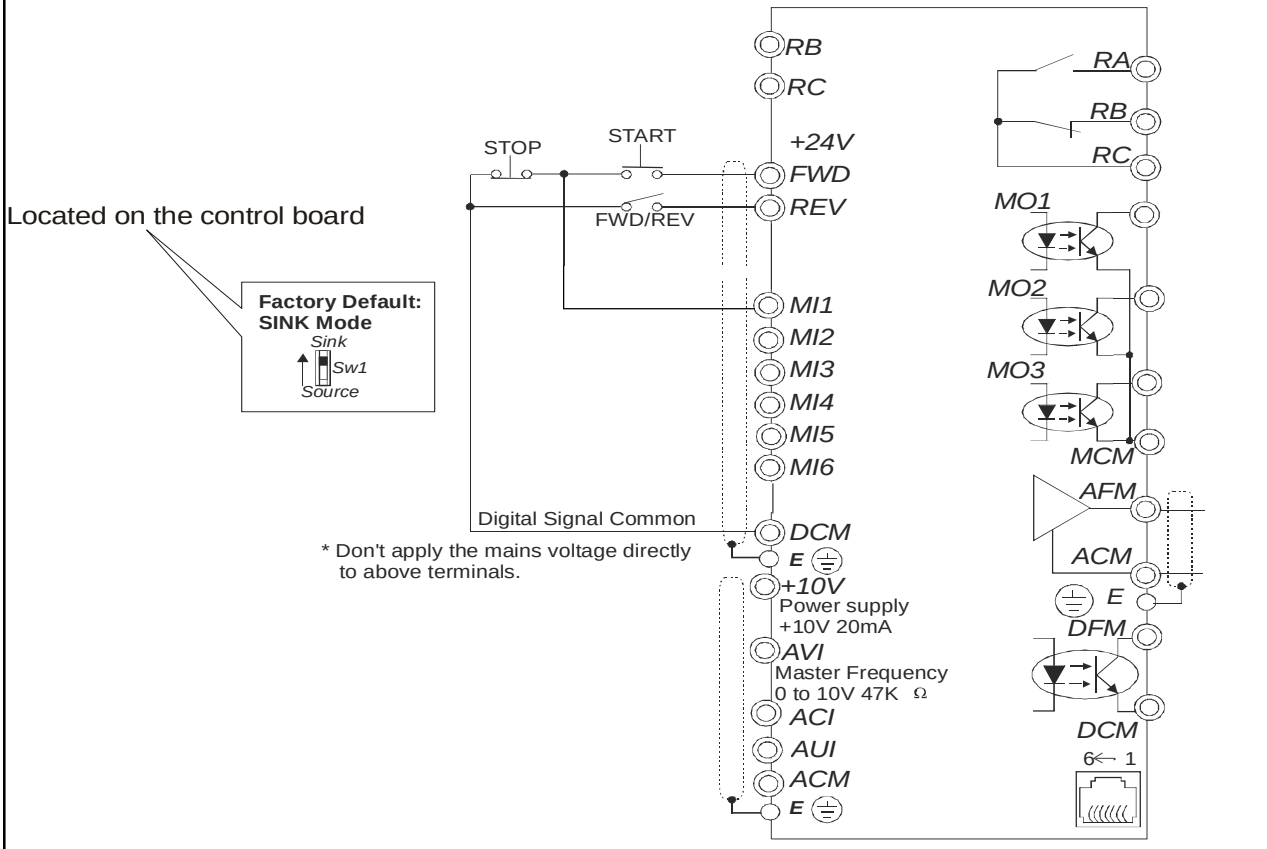
VFD-V

Pr. 00-21 = set to 01 (Operate via remote I/O terminals, keypad STOP enabled)
Pr. 02-00 = set to 04 (3 wire momentary control)

3 Wire Control - Wiring Diagram

I/O terminal block wiring diagram

This wiring set-up is a "sink" configuration. This simply means that no power is applied to the terminals. The drive responds upon a DCM to either FWD or REV being closed (sinking).



5101 Davis Dr., PO Box 12173, Research Triangle Park, NC 27709 Phone: 919-767-3813 Fax: 919-767-3969

How to de-rate a drive for use on a smaller motor

The Delta AC Drive may be used with a motor of lesser HP and current, but several parameters should be changed to protect the motor from over current.

Parameter Numbers and Descriptions - VFD-V
06-03 Over Current Stall Prevention during Acceleration
06-04 Over Current Stall Prevention during Operation
06-06 Over Torque Detection Mode
06-07 Over Torque Detection Level
06-08 Over Torque Detection Time
06-13 Electronic Thermal Overload Relay Selection
06-14 Electronic Thermal Relay Time
05-01 Motor FLA
05-02 Motor No Load Amps

Example: 1hp 230V drive on a 0.5hp 230V motor.
Drive output = 5amps
Motor = 2.2amps

05-01 Motor FLA
Entered in actual current for the V drive.

05-02 Motor No Load amps
Entered in actual current for the V drive. (0.4 x motor FLA) = 0.4 x 2.2 = 0.88 = 1
Enter 1 into Motor No Load Amps parameter 05-02.

Electronic Thermal Overload (I^2T function)

1) **Electronic Thermal Overload Relay Selection (parameter 06-13)**. The selections are based on the motor. Standard motor is a fan cooled unit and a special motor is an inverter duty motor that is not fan cooled or may be fan cooled by an external electric motor.

a. Choosing a “standard motor” will cause the drive to shut down sooner at slow speeds. This is done because the drive believes the heat induced on the motor at low speeds is high and the fan is not running fast enough to cool the motor.

b. Selecting “Special Motor” tells the drive the motor attached can handle higher heating of the windings before the motor will fail.

2) The **Electronic Thermal Relay Time(parameter 06-14)** is the time for the drive to shut down after detecting 150% of current (the current is based on Motor FLA).

5101 Davis Dr., PO Box 12173, Research Triangle Park, NC 27709 Phone: 919-767-3813 Fax: 919-767-3969

Other Parameters to change when using a drive on a lesser HP motor

Over current Stall Prevention on acceleration (parameter 06-03)

Should be around 170% of motor FLA.

1.7 x 2.2amps = 3.74amps

3.74amps / 5amps = 75% of drive rating is the stall prevention level

Enter 75% into Over Current Stall Prevention parameter

Over current Stall Prevention during Steady State (parameter 06-04)

Same sequence as above, but the overload % may only need to be 130-150%

Over Torque Detection parameter setup

1) A **Mode (parameter 06-06)** should be chosen for your application. Such as detection on acceleration only, or detection on steady state only.

2) The **Over Torque Detection level (parameter 06-07)** is normally 150% of the motors rated FLA.
   1.5 x 2.2 = 3.3amps
   3.3amps / 5amps = 66% of drive rating, is the detection level
   Enter 66% in the Over Torque Detection level parameter.

3) The **Over Torque Detection Time (parameter 06-08)** needs to be determined by the user. The drive will detect the over torque instantly, but the Over Torque Detection Time is how quickly the drive will conduct the chosen **Mode** setting. Example: after 10 seconds of over torque detection on acceleration, the drive should stop. **Mode** set to “detection during acceleration and stop after detection. **Time** set to 10 seconds.

5101 Davis Dr., PO Box 12173, Research Triangle Park, NC 27709 Phone: 919-767-3813 Fax: 919-767-3969

Industrial Products Division

Setting up the VFD-V in Closed Loop VECTOR Control

Step	Pr.	Description	Setting	Notes
1	00-15	Upper bound carrier freq	12	
2	00-16	Lower bound carrier freq	8	
3	01-09	Start-up frequency	0	
4	01-01	Motor rated frequency	60	
5	01-02	Motor rated voltage	460/230	Must be set to the motor rating
6	05-01	full load motor current	FLA	Set to the motors max Amps
7	05-02	no load motor current	NL	Only if you are conducting static tune
8	05-00	auto tune	1, 2, 3	1 = Dynamic, 2 = Dynamic, 3= Static

Press PU and then Run the drive. “STOP and RUN” LEDs will light during Auto tuning. RUN LED will turn off after Auto tuning is complete.

9	00-04	User defined setting	46	Encoder frequency and direction
10	10-00	Encoder pulse count	?	enter your encoder pulse count

RUN the drive in V/F mode. Press the MODE key to veiw “U” user defined setting. When the FWD direction LED is lit, the PG feedback should be positive (no symbol). When the REV direction LED is lit the PG Feedback should be negative (-).

12	10-01	encoder direction	0, 1	Depending on Step 11
13	00-10	control method	3	closed loop vector
14	Quick Test:			

Run the motor at 30hz and make sure everything is ok. Run at 1hz and verify everything is ok. After the speed test, begin tuning group 5 for PI (5-21 thru 5-30)

16	05-21	low speed P (P1)	30	30-40 gives good low end punch
	05-22	Low speed I (I1)	0.15	0.05 is for extreme reaction
	05-23	High speed P (P2)	25	
	05-24	High speed I (I2)	0.25	
	05-25	P1/I1 to P2/I2 Transition Freq	7	
	05-26	Excitation current boost %	10	
	05-27	Low Speed Torque Control%	10	
	05-28	Low Speed torque Control delay	0.01	
	05-29	Vibration damping %	100	
	05-30	R1 Detection update	0	Measures R1 at each RUN command
17	Acceleration and Deceleration			
	01-12	Acceleration	2	Can go lower at a later time
	01-13	Deceleration	2	Can go lower at a later time
18	PG feedback fault parameters			
	10-02	PG feedback fault treatment	0	
	10-03	PG Feedack fault time delay	0.1	Time before PGErr will occur
	10-04	PG Feedback scan time	0.01	Use 0.25+ for PPRs below 1024

5101 Davis Dr., PO Box 12173, Research Triangle Park, NC 27709 Phone: 919-767-3813 Fax: 919-767-3969

Setting up the VFD-V in Closed Loop VECTOR Control (con't)

Step	Pr.	Description	Setting	Notes
18 (con't)	10-05	PG Slip range (%)	10	10-05 x 01-00 = slip frequency
		Slip Frequency is added to and subtracted from the command freq = Slip range		
	10-06	PG Stall Level	110	10-06 x 01-00 = max feedback frequency
		If the Feedback signal is higher than this “max feedback freq”, a PGErr will occur		
19	00-20	Source of Frequency command	?	customer choice
20	00-21	Source of Operation command	?	customer choice
21	02-00	2 wire/3 wire operation	?	customer choice
22	06-01	Over Voltage Stall Prevention	380/760	Must be set to the motor rating
23	06-03	Over Current Stall Prevention - A	250	During acceleration
24	06-04	Over Current Stall Prevention - O	250	During operation

The drive is now set properly for normal closed loop control.

5101 Davis Dr., PO Box 12173, Research Triangle Park, NC 27709 Phone: 919-767-3813 Fax: 919-767-3969

Set-up for VFD-V Digital Pulse Input Speed Command

Step	Pr.	Description	Setting	Notes
2	00-20	Input Speed command	4, 6	4 (speed and direction), 6 (speed only)
3	10-12	Channel 2 Direction	0, 1	Change if drive direction is opposite

Must use a PG04 encoder card and the digital pulse input must be on channel 2. Unused inputs must be shorted to DCM. Speed only needs A2. Speed and Direction need input A2 and B2.

Setup for VFD-V Digital Follower (pulse per pulse)

1 Two V drives, Both must use a PG04 encoder card

Master: Closed loop

Motor Encoder on Channel 1

Speed command could be on Channel 2 or from another source

A/O, B/O, DCM tied to channel 2 on follower

Follower: Closed or Open loop vector follower

Speed and direction input on Channel 2 (A2, B2, DCM)

2 PG04 encoder card wiring is critical to make this work correctly

Master: Motor Encoder Feedback = A1, A1not, B1, B1not, Z1, Z1not, VP, DCM

Digital Speed command input = A2, B2, DCM, VP (A2not and B2not tied to DCM)

Digital output = A/O, B/O, DCM tied to channel 2 on follower PG04

Follower: Motor Encoder Feedback = A1, A1not, B1, B1not, Z1, Z1not, VP, DCM

Speed command from Master = A2, B2, DCM, VP (A2not and B2not tied to DCM)

3 Set drives up using “Closed Loop VECTOR Control setup” information

5101 Davis Dr., PO Box 12173, Research Triangle Park, NC 27709 Phone: 919-767-3813 Fax: 919-767-3969

Setup for VFD-V Digital Follower (pulse per pulse) (con't)

Step	Pr.	Description	Setting	Notes
4	Pr. 10-07	Multiplier for Channel two	?	
5	Pr. 10-08	Multiplier for Channel one	?	

These two parameters are used to change the ratio of the digital input speed command compared to the motor encoder feedback.

Example:

Motor Encoder = 2000 ppr

Digital Speed input wheel = 100ppr

If 10-07 = 1 and 10-08 = 1, then 1 complete turn of the digital input wheel will only cause 1/20th of a turn on the motor. To make one turn on the Digital input wheel generate 1 turn of the motor, then change 10-07 = 20.

5101 Davis Dr., PO Box 12173, Research Triangle Park, NC 27709 Phone: 919-767-3813 Fax: 919-767-3969

Set-up VFD-V Closed Loop Position Control

Set the drive up using the “Closed Loop VECTOR Control Setup” information

Step	Pr.	Description	Setting	Notes
1	01-13	Deceleration time	1	Only part of the time to get to position
2	00-04	User defined setting	31	Encoder count display
3	2-01/2-06	Multi Function Input	30	Closed = Go to Position
4	10-09	Position Point	?	What ever is your position point needed
5	10-10	Position Point Deviation range	5	10 pulse count window of accuracy
6	10-13	Position Gain P	50	
7	10-14	Position Integral I	0.05	
8	10-15	Position Derivative D	0.05	
9	10-16	Orient Speed	10	Freq to run after hitting Z input
10	10-17	Creep Point	50	# of pulses before reaching position point
11	10-18	Loop Speed	2	Freq to run after passing Creep point
12	10-19	Loop Point	10	# of pulses before reaching position point

The speed after reaching Loop point is not programmable.

13 Quick Test:

Run the motor at 30hz and initialize a position command.

If at 30hz the position is reached with no overshoot, then try 60hz. Any time overshoot is reached, Pr. 10-16 thru 10-19 must be tuned again. Adding Brake resistors and disabling OV stall will help reach target with little or no overshoot.

5101 Davis Dr., PO Box 12173, Research Triangle Park, NC 27709 Phone: 919-767-3813 Fax: 919-767-3969

Set-up VFD-V Closed Loop Position Control(con't)

P2P Position Control

14	02-01	Multi function input 1 (MI1)	1	Preset speed 1
15	02-02	Multi function input 2 (MI2)	2	Preset speed 2
16	02-03	Multi function input 3 (MI3)	3	Preset speed 3
17	02-04	Multi function input 4 (MI4)	36	Postion mode 2
18	02-05	Multi function input 5 (MI5)	39	P2P position mode
19	02-06	Multi function input 6 (MI6)	?	Not used in this example
20	10-23	P2P location achieved range	8	range of pulse deviation from command
21	10-24	P2P acceleration time	0.3	only used during P2P
22	10-25	P2P Deceleration time	0.3	only used during P2P
23	10-26	P2P delay time	0.1	
24	10-29	P2P control mode	0	Based on external direction commands
25	10-33	Position command 0	?	no inputs closed
26	10-34	Position command 1	?	input 1 closed
27	10-35	Position command 2	?	input 2 closed
28	10-36	Position command 3	?	input 1 & 2 closed
29	10-37	Position command 4	?	input 3 closed
30	10-38	Position command 5	?	input 1 & 3 closed
31	10-39	Position command 6	?	input 2 & 3 closed
32	10-40	Position command 7	?	input 1, 2, & 3 closed
33	10-41	P2P pulse multiplier	1	each # in the position command = 1pulse

5101 Davis Dr., PO Box 12173, Research Triangle Park, NC 27709 Phone: 919-767-3813 Fax: 919-767-3969

Set-up VFD-V Closed Loop Position Control(con't)

Tuning for PID for P2P Position Control

34	10-13	Postion mode 1 (P) gain	50	Below 05-25 setting
35	10-14	Postion mode 1 (I) Integration	0.1	Below 05-25 setting
36	10-15	Postion mode 1 (D) Derivative	0.20	Below 05-25 setting
37	10-27	Postion mode 2 (P) gain	50	Above 05-25 setting
38	10-28	Postion mode 2 (I) Integration	0.1	Above 05-25 setting
39	10-22	Postion mode SPEED gain	90	only for speed loop response, not position

Operation in P2P Position Control

a MI4 must be closed to DCM whenever P2P is wanted

b MI1-MI3 must be initiated next

c MI5 must finally initiated (it is edge triggered and will need to be turned off then on for the next move

d when in this mode, the incoming pulses on channel 2 of the PG04 card have priority

and will cause the motor to turn. Jumper CH 2 inputs to gnd on PG04 to verify this will not happen

Industrial Products Division

VFD-F

Application Guide

Delta AC Drives online

visit our Web page at:
http://www.delta.com.tw

Product Information, Operation Manuals

Technical Support: (919) 767-3813

Comments on this manual can be sent to:
callyson@deltartp.com

5101 Davis Dr., PO Box 12173, Research Triangle Park, NC 27709 Phone: 919-767-3813 Fax: 919-767-3969

Industrial Products Division

ASIA
DELTA ELECTRONICS, INC.
Taoyuan Plant
31-1, SHEIN PAN ROAD TAIWAN,
R.O.C.
Phone: 886-3-362-6301
Fax: 886-3-362-7267
http://www.deltaww.com

NORTH/SOUTH AMERICA
DELTA PRODUCTS CORPORATION
Sales Office
P.O Box 12173
5101 Davis Drive
RESEARCH TRIANGLE PARK, NC 27709
USA
Phone: (919) 767-3813
Fax: (919) 767-3969
http://www.deltaww.com
http://www.deltadrives.com

EUROPE
DELTRONICS (NETHERLANDS) B.V.
INDUSTRIEGEBIED VENLO NR. 9031
COLUMBUSWEG 20
NL-5928 LC VENLO
THE NETHERLANDS
Phone: (+31) 77-324-1930
Fax: (+31) 77-324-1931
http://www.deltaww.com