Bardac drives

drive.web automation

DRIVE TRAINING

AC Drives / DC Drives / drive.web / savvy-SFD

Bardac drives . . . the safe bet!

AC & DC Drives

Bardac has a large inventory of AC & DC drives, spare parts and support products, ready for same day shipment.

For manuals, application notes, and software, please visit our website:
www.bardac.com

If you still have questions call 888-667-7333.

If you need tech support, we have experienced application engineers ready to help.

If you need local on site support, we will put you in touch with a local, factory-trained service organization.

Key information needed to help Bardac select the appropriate replacement drive

Bardac drives

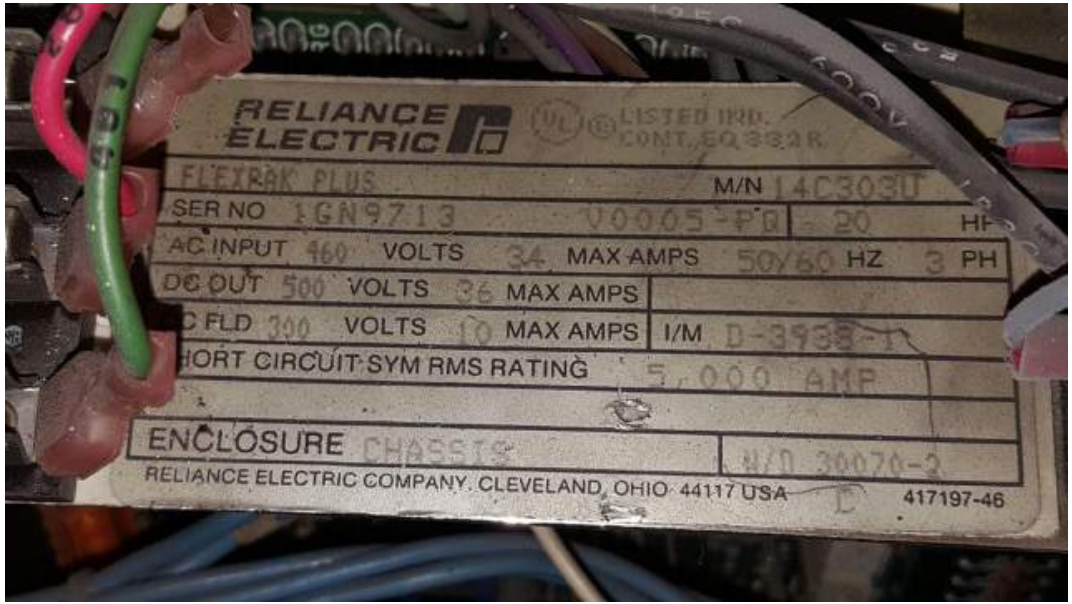
- ✓ **Provide a picture of the motor nameplate**

DC Drives

Key information needed to help Bardac select the appropriate replacement drive

Bardac drives

- ✓ **Provide a picture of the existing drive nameplate**



Key information needed to help Bardac select the appropriate replacement drive

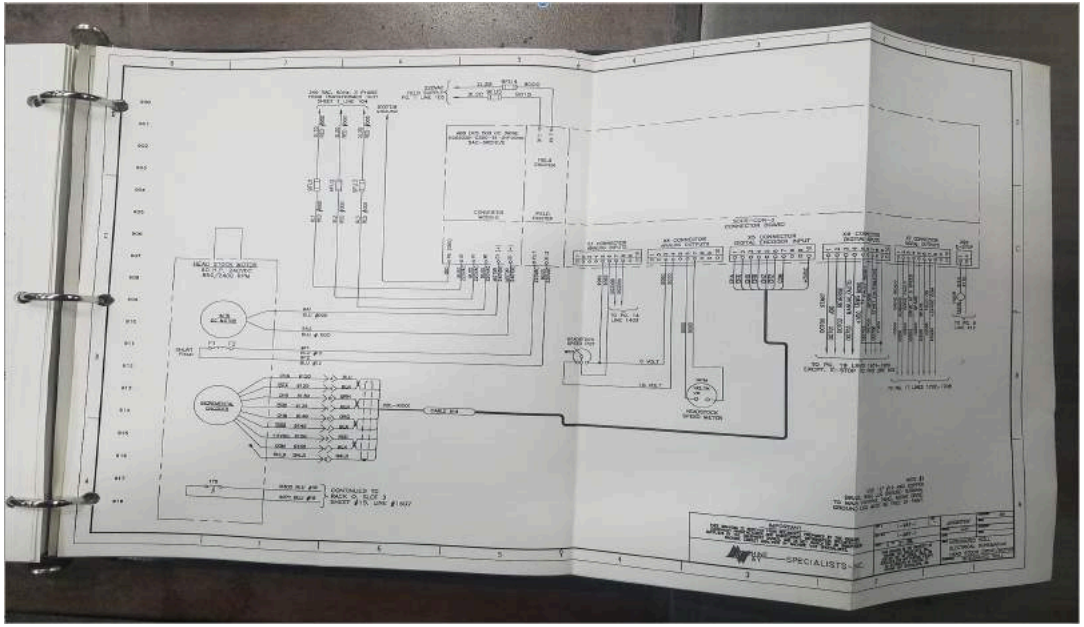
Bardac drives

- ✓ Outline dimensions of the existing drive

Key information needed to help Bardac select the appropriate replacement drive

Bardac drives

- ✓ **If possible … a PDF of the electrical schematics showing the existing drive and how it is connected**



DC Drives

Regen vs Non Regen

Non Regenerative

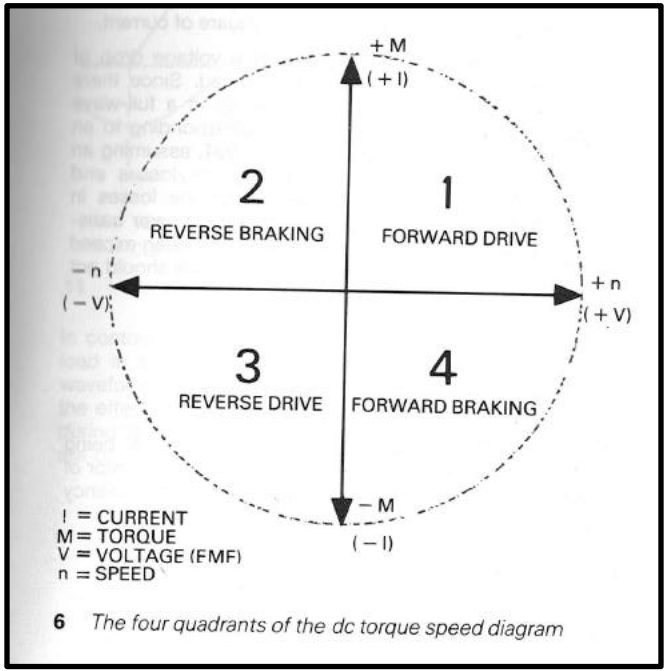
Provides motoring torque in one direction only

Typical Applications:
Extruders & Mixers

Regenerative

Provides speed and torque control in all 4 quadrants, i.e.
Electronic Reversing,
Braking torque - fast stop, Controlled stop
Hold back against an overhauling load, creating tension in a web, etc...

Typical Applications:
Nips, Unwinds, Rewinds, Traverses
Test stands



6 *The four quadrants of the dc torque speed diagram*

basicPLX

Bardac drives

Basic Controller – No fuses or contactor

IMPORTANT! To ensure warranty, these drives must be installed with a new main contactor and new high speed fuses for the line, armature and control connections.

DC Drives

powerPLX

powerDRIVE Packages

PL/X DC drives up to 400 horsepower are available in compact **powerDRIVE** packages complete with:

- Main contactor
- High speed 3-phase line fuses
- High speed armature fuse
- High speed control/field fuses
- Line filter (100HP & up)
- Optional motor blower starter (100HP & up)

PL/X Models & Ratings

Bardac drives

2-Quadrant, Non-Reversing, Non Regenerative Drives

hp @ 500V arm 460VAC	hp @ 240V arm 230VAC	Armature Amps DC @ 40°C	Field Amps DC power(basic)	powerDRIVE Model	Dimensions W x H x D (weight) inches (LBS)	basicDRIVE Model	Dimensions W x H x D (weight) inches (LBS)	Line Reactor Model
20	10	36	5(8)	powerPL15/36	8.5 x 11.4 x 11.7 (26)	PL15/36	8.5 x 11.4 x 6.9 (16)	LM37
30	10	51	5(8)	powerPL20/51	8.5 x 11.4 x 11.7 (26)	PL20/51	8.5 x 11.4 x 6.9 (16)	LM52
60	25	99	5(8)	powerPL40/99	8.5 x 11.4 x 11.7 (30)	PL40/99	8.5 x 11.4 x 6.9 (17)	LM120
75	35	123	5(8)	powerPL50/123	8.5 x 11.4 x 11.7 (30)	PL50/123	8.5 x 11.4 x 6.9 (17)	LM120
100	50	164	10(16)	powerPL65/164	16 x 33 x 9.7 (80)	PL65/164	8.5 x 16.2 x 8.6 (27)	LM150
125	60	205	10(16)	powerPL85/205	16 x 33 x 9.7 (80)	PL85/205	8.5 x 16.2 x 8.6 (27)	LM195
150	75	270	10(16)	powerPL115/270	16 x 33 x 9.7 (82)	PL115/270	8.5 x 16.2 x 8.6 (28)	LM240
200	100	330	10(16)	powerPL145/330	16 x 33 x 9.7 (89)	PL145/330	8.5 x 16.2 x 8.6 (28)	LM300
250	125	405	20(32)	powerPL185/405	16 x 43.5 x 14.4 (143)	PL185/430	8.5 x 19.9 x 14.4 (43)	LM375
300	150	480	20(32)	powerPL225/480	16 x 43.5 x 14.4 (143)	PL225/530	8.5 x 19.9 x 14.4 (45)	LM480
400	200	630	20(32)	powerPL265/630	16 x 43.5 x 14.4 (154)	PL265/630	8.5 x 19.9 x 14.4 (45)	LM600

PL/X Models & Ratings

Bardac drives

4-Quadrant, Regenerative Drives

hp @ 500V arm 460VAC	hp @ 240V arm 230VAC	Armature Amps DC @ 40°C	Field Amps DC power(basic)	powerDRIVE Model	Dimensions W x H x D (weight) inches (LBS)	basicDRIVE Model	Dimensions W x H x D (weight) inches (LBS)	Line Reactor Model
20	10	36	5(8)	powerPLX15/36	8.5 x 11.4 x 11.7 (26)	PLX15/36	8.5 x 11.4 x 6.9 (16)	LM37
30	10	51	5(8)	powerPLX20/51	8.5 x 11.4 x 11.7 (26)	PLX20/51	8.5 x 11.4 x 6.9 (16)	LM52
60	25	99	5(8)	powerPLX40/99	8.5 x 11.4 x 11.7 (30)	PLX40/99	8.5 x 11.4 x 6.9 (17)	LM120
75	35	123	5(8)	powerPLX50/123	8.5 x 11.4 x 11.7 (30)	PLX50/123	8.5 x 11.4 x 6.9 (17)	LM120
100	50	164	10(16)	powerPLX65/164	16 x 33 x 9.7 (80)	PLX65/164	8.5 x 16.2 x 8.6 (27)	LM150
125	60	205	10(16)	powerPLX85/205	16 x 33 x 9.7 (80)	PLX85/205	8.5 x 16.2 x 8.6 (27)	LM195
150	75	270	10(16)	powerPLX115/270	16 x 33 x 9.7 (82)	PLX115/270	8.5 x 16.2 x 8.6 (28)	LM240
200	100	330	10(16)	powerPLX145/330	16 x 33 x 9.7 (89)	PLX145/330	8.5 x 16.2 x 8.6 (28)	LM300
250	125	405	20(32)	powerPLX185/405	16 x 43.5 x 14.4(143)	PLX185/430	8.5 x 19.9 x 14.4 (43)	LM375
300	150	480	20(32)	powerPLX225/480	16 x 43.5 x 14.4 (145)	PLX225/530	8.5 x 19.9 x 14.4 (45)	LM480

PL/PLX Documentation

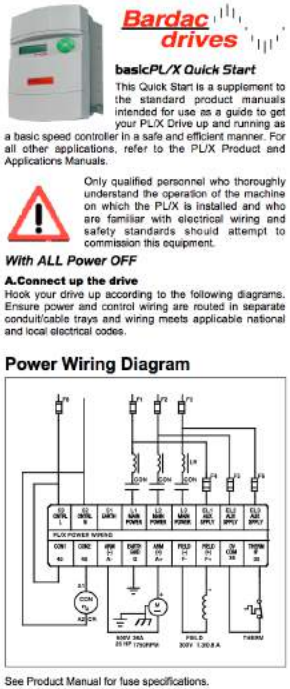
Bardac drives

PL/PLX Quick Start

(A folded, single-sheet flyer)

This should get you through 90% of all start-ups.

Look for this document!



Bardac drives

basicPL/X Quick Start

This Quick Start is a supplement to the standard product manuals intended for use as a guide to get your PL/X Drive up and running as a basic speed controller in a safe and efficient manner. For all other applications, refer to the PL/X Product and Applications Manuals.

Only qualified personnel who thoroughly understand the operation of the machine on which the PL/X is installed and who are familiar with electrical wiring and safety standards should attempt to commission this equipment.

With ALL Power OFF

A.Connect up the drive

Hook your drive up according to the following diagrams. Ensure power and control wiring are routed in separate conduit/cable trays and wiring meets applicable national and local electrical codes.

Power Wiring Diagram

See Product Manual for fuse specifications.

Product Manual

A 227-page reference document!

Bardac drives

PL / PLX Digital DC Drive

Part 1 Basic Product Manual

HG102633 v5.15

Part 1
PL / PLX
Digital DC Drive

Part 2
Application Blocks

Part 3
High Power Modules

DC Drives

Drive Ventilation Requirements

A DC drive will dissipate approximately 3 x the motor current (watts).

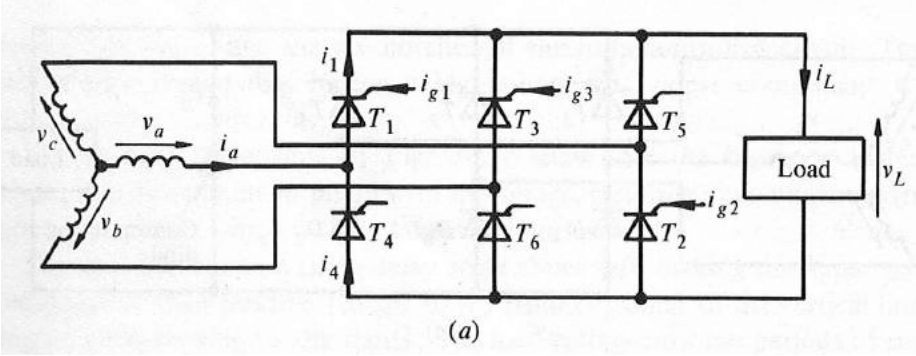
Example: A 200HP 330A DC drive will dissipate 3 x 330 = 990Watts (when the motor is fully loaded). An evaluation must be done to ensure correct enclosure cooling and air flow. Enclosure manufacturers and cooling system manufacturers have useful calculators on their websites to assist with fan/filter and air conditioning selection.

Drives must be located in the cooling air flow. Do not install drives at the top of the enclosure, out of the flow of cooling air, or sitting in a hot spot.

Do not leave off enclosure filters - *drives could get contaminated!* Modern drives are small with close pitch circuit tracks, unlike the discretely wired drives of yesteryear.

Contamination will cause problems!

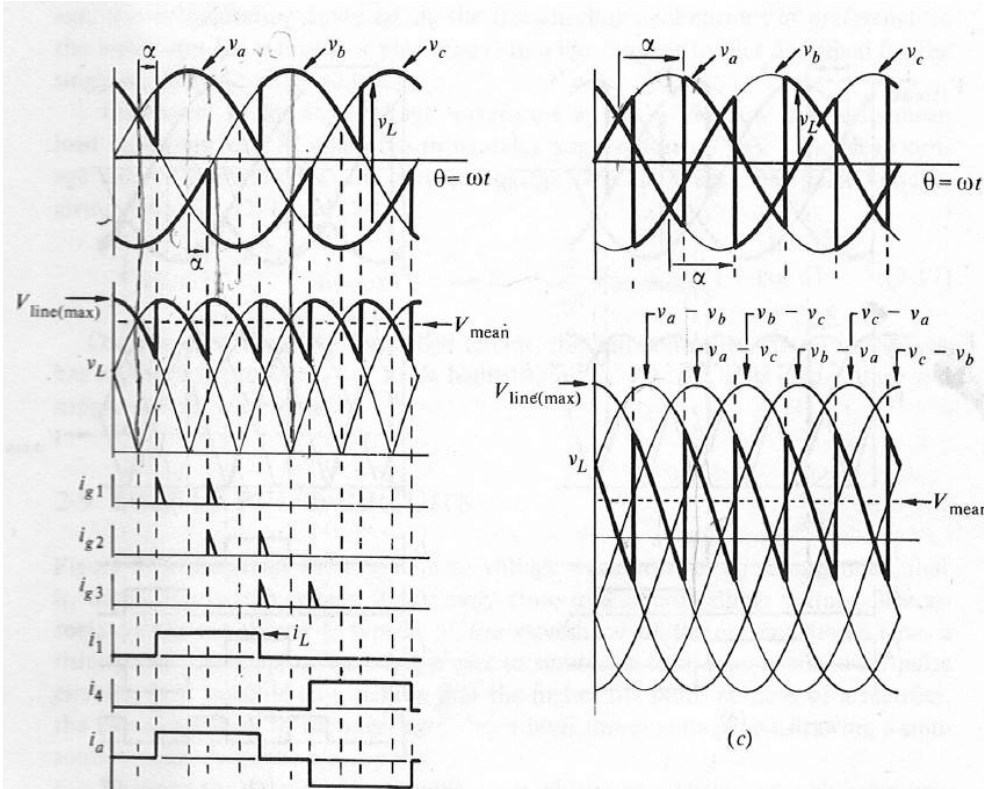
Line Reactors vs. Isolation Transformers vs. No Impedance



Impedance will not allow instantaneous current changes, so it helps stop nuisance fuse blowing when commuting from one SCR to the next.

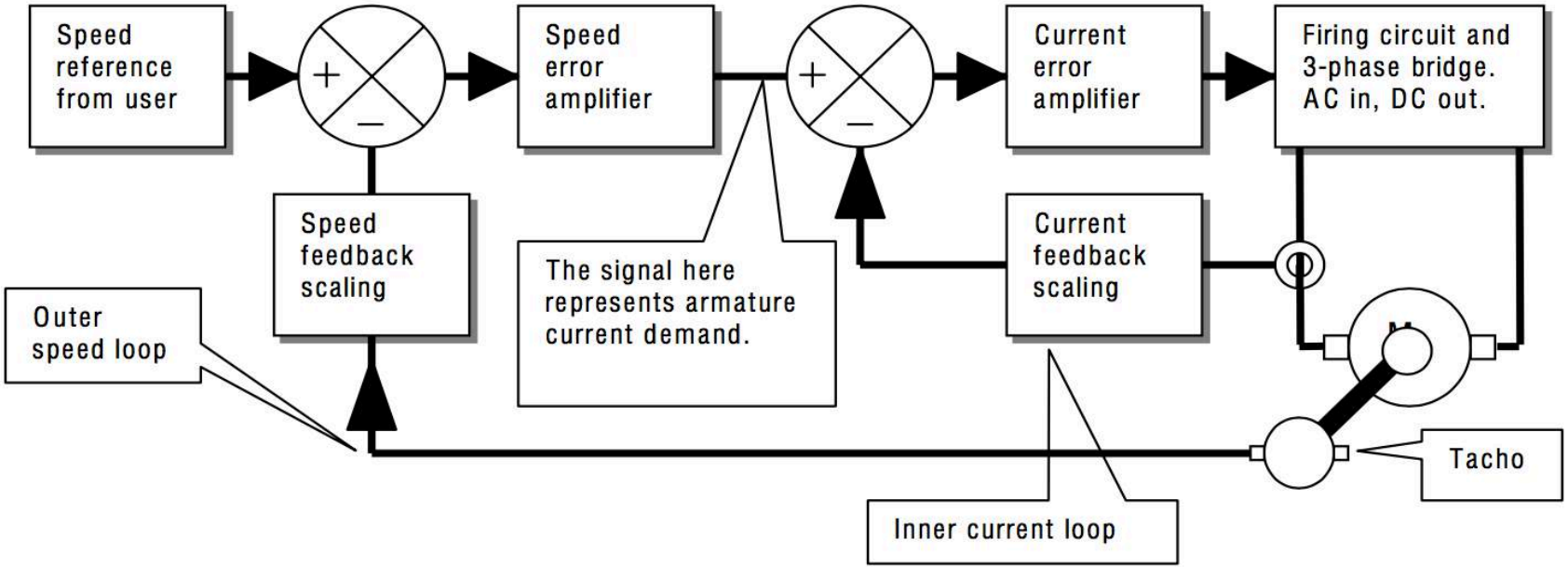
Impedance will also help to stop cross talk from drive to drive, this can cause the SCRs to turn on at the wrong.

With no impedance there is a far greater risk of blowing expensive fuses!



Armature Voltage Feedback / Encoders / DC Tachometers / AC Tachometers

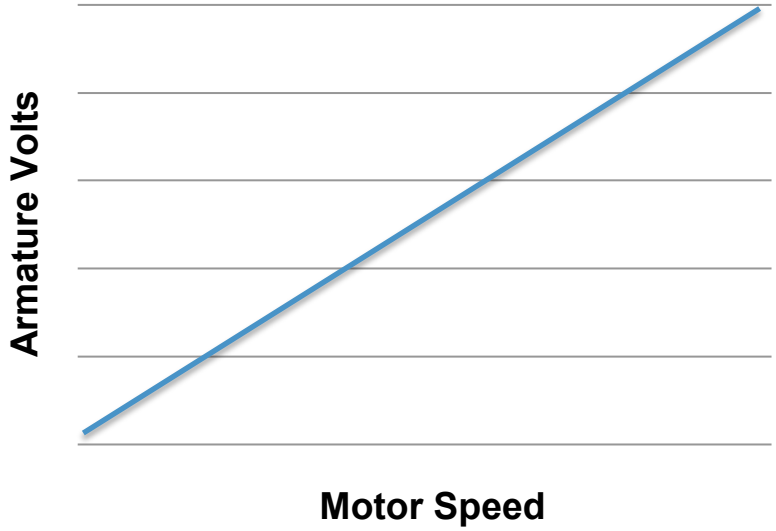
Bardac drives



Armature Voltage Feedback

Bardac drives

- Armature voltage feedback is proportional to motor speed.
- Always start up a DC drive initially set to armature voltage feedback.
- Make sure that the drive is functioning correctly, that the feedback is equal and opposite to the speed reference.
- Least expensive feedback, least accurate approx. 10% speed regulation with unregulated field, 2% with regulated field.



Encoder Feedback

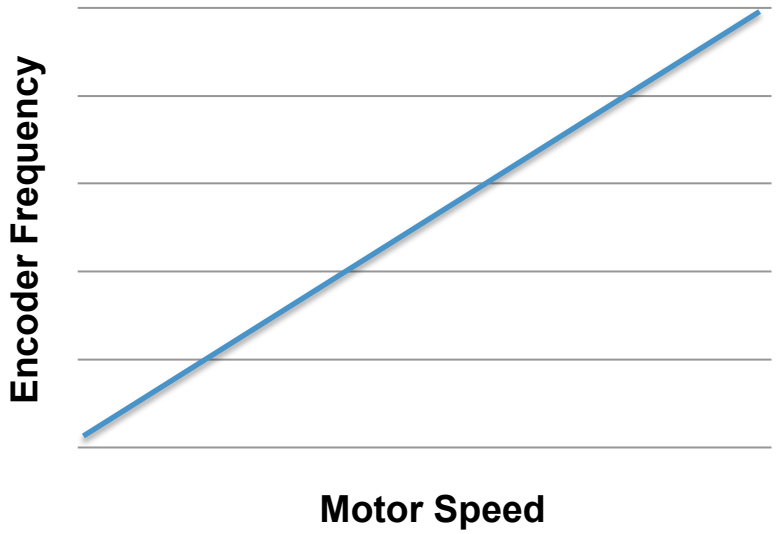
- Frequency is proportional to motor speed.
- Maximum frequency that the drive can accept is 100kHZ.

$$\text{Frequency} = \frac{\text{PPR x Motor Speed}}{60}$$

Example:
Motor encoder = 1024PPR
Motor base speed = 1750RPM

$$\text{Frequency} = \frac{1024 \text{ x } 1750}{60} = 29.87\text{kHZ}$$

- Next least expensive feedback, most accurate 0.01% to absolute, hollow shaft easy to mount

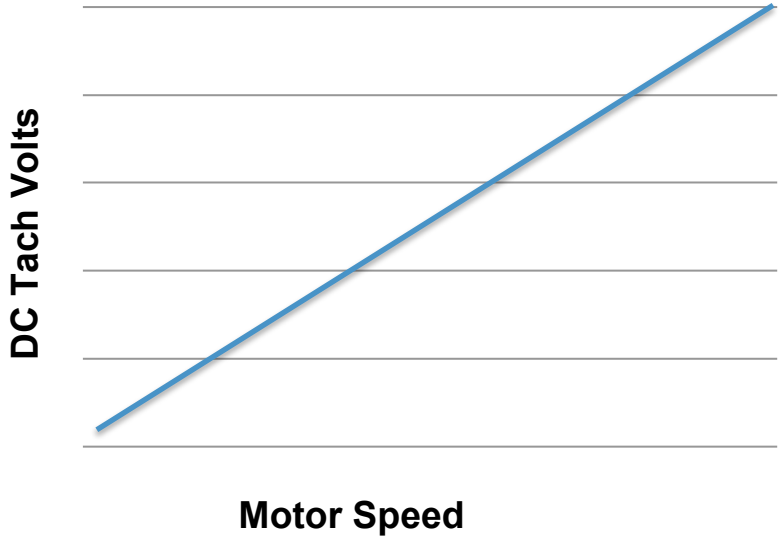


DC Tach Feedback

- DC tach volts are proportional to motor speed.
- Maximum voltage is +/-200VDC.

$$\text{Volts} = \frac{\text{V}}{1000} \text{ x Motor Speed}$$

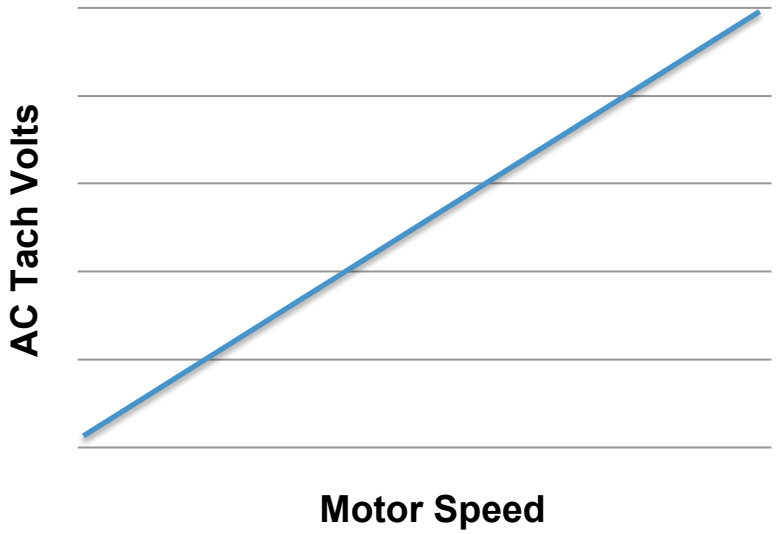
Example:
Tach rating = 50VDC/1000RPM
Motor speed = 1750RPM
Tach volts @ full speed = 1.75 x 50 = 88VDC



- Not quite as accurate as an encoder, typically 1 to 0.1%, depends on tach being used. 5PY 1%, APY/BC46 0.1%
- The feedback choice of yesteryear.
- Most expensive, requires mounting brackets and couplings that wear out and cause backlash.

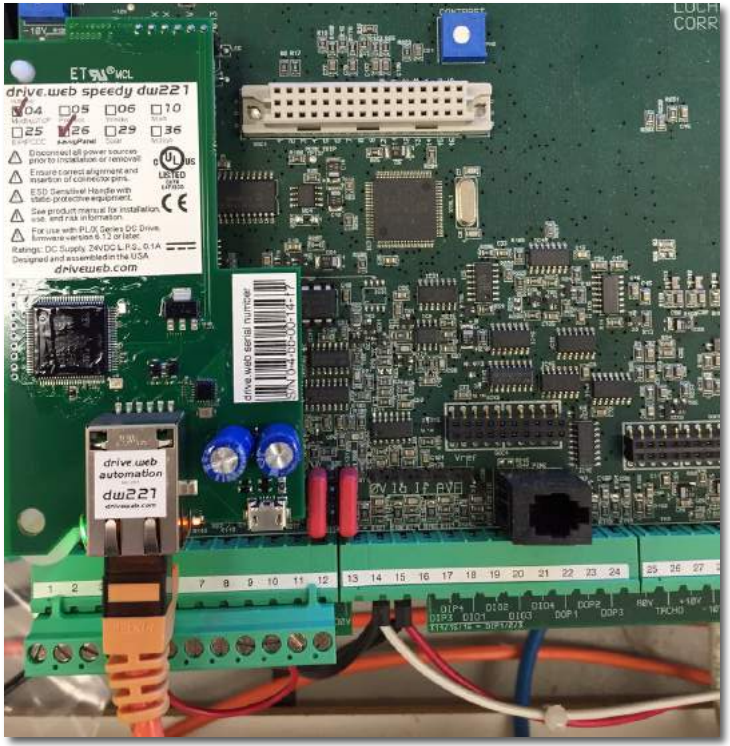
AC Tach Feedback

- Only non regen DC drives
- Will require an additional interface, Part #LA502447
- Used in the old days before DC drives had regulated fields, less expensive than a DC tachometer. Often used with Extruders.
- Provides about the same speed regulation as armature voltage feedback when the motor field is regulated. Speed regulation is approximately 2%.
- **DO NOT USE WITH A REGEN DRIVE!**



Ethernet and USB Interface
speedy – dw221

Bardac drives



DC Drives

You Need Assistance From Bardac?

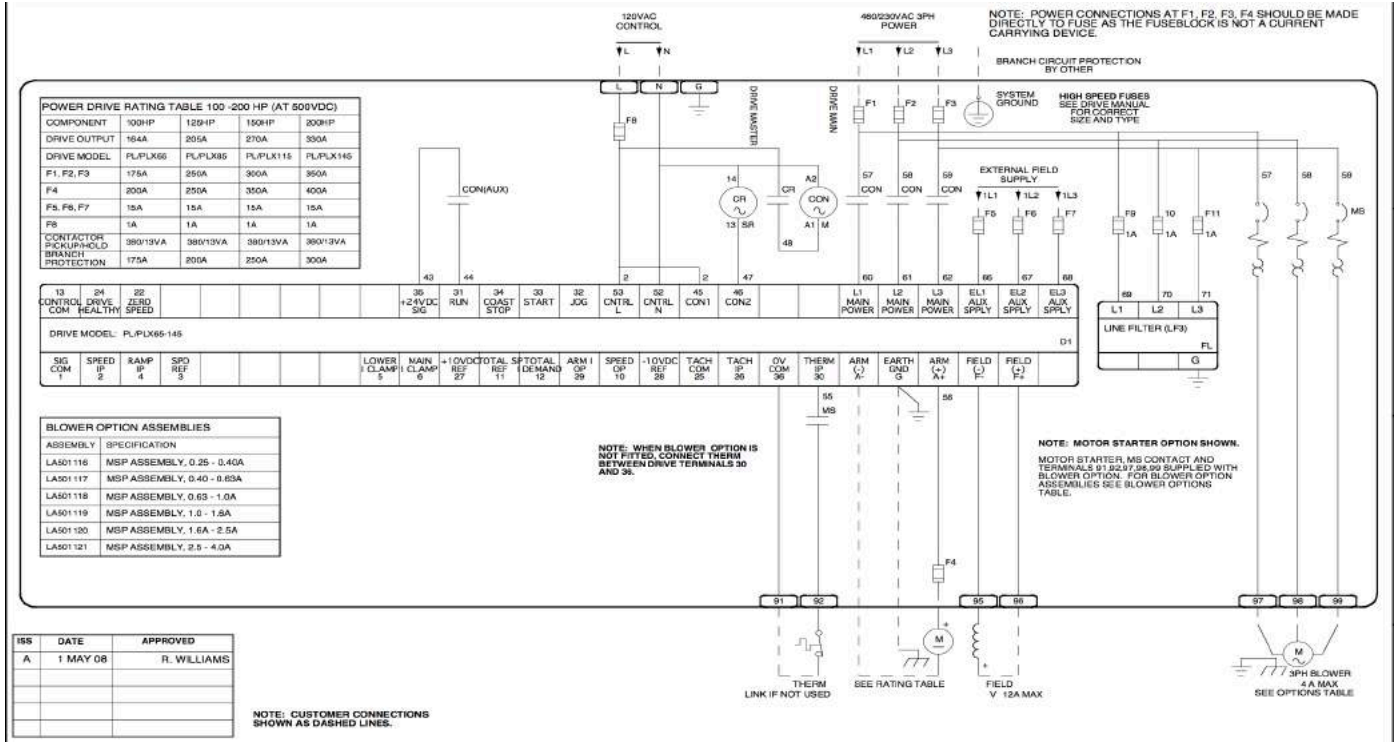
Helpful Information to have ready when talking with a Bardac applications engineer!

(1) Product Label

(2) Serial Label

(3) A drawing that shows how you have the drive connected up

Power drive schematic



POWER DRIVE RATING TABLE 100 -200 HP (AT 500VDC)				
COMPONENT	100HP	125HP	150HP	200HP
DRIVE OUTPUT	164A	205A	270A	330A
DRIVE MODEL	PL/PLX65	PL/PLX85	PL/PLX115	PL/PLX145
F1, F2, F3	175A	250A	300A	350A
F4	200A	250A	350A	400A
F5, F6, F7	15A	15A	15A	15A
F8	1A	1A	1A	1A
CONTACTOR PICKUP/HOLD	380/13VA	380/13VA	380/13VA	380/13VA
BRANCH PROTECTION	175A	200A	250A	300A

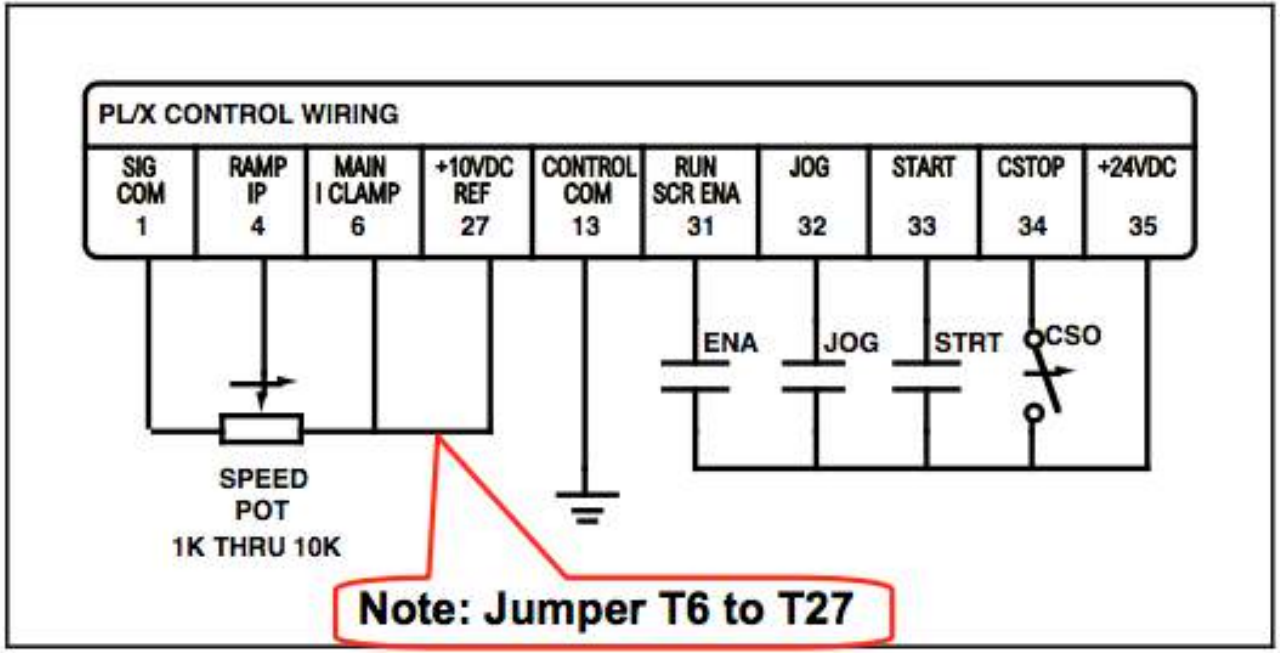
BLOWER OPTION ASSEMBLIES	
ASSEMBLY	SPECIFICATION
LA501116	MSP ASSEMBLY, 0.25 - 0.40A
LA501117	MSP ASSEMBLY, 0.40 - 0.63A
LA501118	MSP ASSEMBLY, 0.63 - 1.0A
LA501119	MSP ASSEMBLY, 1.0 - 1.6A
LA501120	MSP ASSEMBLY, 1.6A - 2.5A
LA501121	MSP ASSEMBLY, 2.5 - 4.0A

ISS	DATE	APPROVED
A	1 MAY 08	R. WILLIAMS

Drawing included with documentation package.

DC Drives

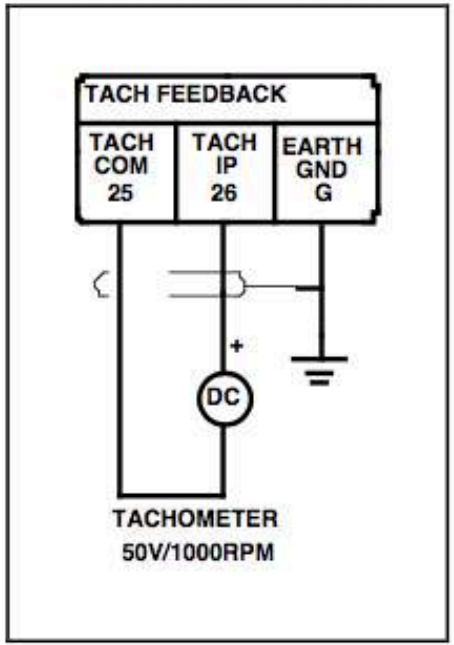
Control Wiring



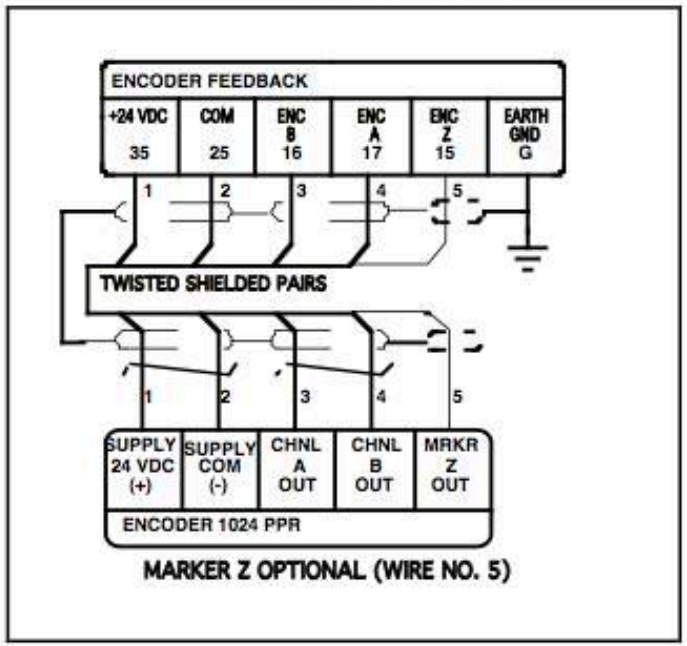
See Quick Start!

Encoder & Tach Connections

DC Tachometer



Encoder



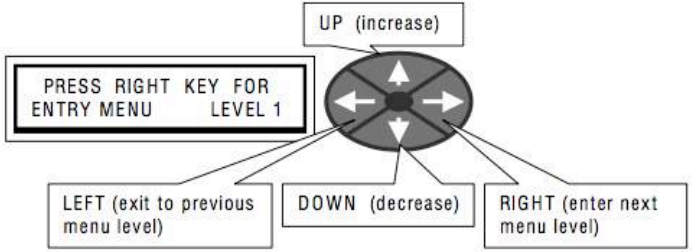
See Quick Start!

Keypad Operation

Bardac drives

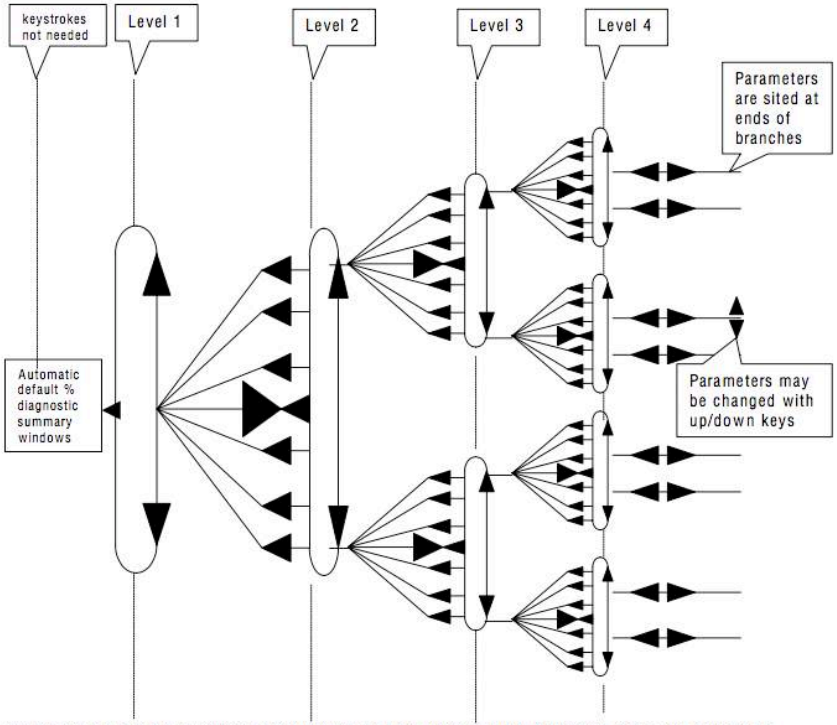
5.1 Key functions

The user display has been designed to make programming as simple as possible. 4 keys arranged as up/down and left/right are used to step through the tree structure in their nominated direction.



Notice that tapping the left key allows you to exit from any location back to the start point on the previous menu level. The selected menu is displayed on the upper line of characters. If you hold the left key down you will quickly arrive back at the default % diagnostic windows. The level number is displayed at the right hand end of the top line.

Remember to save!



As well as travelling around the tree structure the keys perform other functions. These are as follows.

Motor and Feedback Data

Bardac drives

A.Get the supply and motor nameplate data

Description	Typical	Actual	Units
Supply Voltage (**VL**)	480		VAC
Armature Volts (**VA**)	500		VDC
Armature Current (**IA**)	35		ADC
Base Speed (**BS**)	1750		RPM
Maximum Speed (**MS**)	2300		RPM
Field Volts (**VF**)	300		VDC
Field Current @ BS (**IFb**)	1.35		ADC
Field Current @ MS (**IFm**)	0.8		ADC
Feedback Device			
DC Tachometer (**TV**)	50		V/1000
Encoder (**PPR**)	1024		PPR
Supply Volts (**EV**)	5 - 24		VDC

See Quick Start!

Calibrate the drive to the motor

2. Calibrate the Drive to the Motor

At power up, the Diagnostic Summary Screens are displayed. By pressing the Left key at least 5 times, you will return you to these screens from any menu level.

5xL

SPD%	Iarm	Ifld	RJSC
0	0	0	0000

⇔

Sref	Ilim	−Ilim	mode
0	150	-150	STOP

When at the top level, the display toggles between the Diagnostic Summaries about every 5 seconds.

Press the keys in the sequence below to set the rated armature current from the nameplate data you recorded.

R,R,U,R,R - U/D

2)RATED ARM AMPS
35.0 AMPS — **IA**

Use the up and down keys to change the values.

Now, to move to the rated field current:

L,D,D,R - U/D

4)RATED FIELD AMPS
1.35 AMPS — **IFb**

Repeat these steps for the following:

L,D,R - U/D

5)BASE RATED RPM
1750 RPM — **BS**

L,D,R - U/D

6)DESIRED MAX RPM
1750 RPM — **BS**

L,9xD,R - U/D

18)RATED ARM VOLTS
500.0 VOLTS — **VA**

L,D,R - U/D

19)EL1/2/3 RATED AC
460.0 VOLTS — **VL**

Also check the following to ensure they have not been modified from the factory default settings:

L,D,R - U/D

20)MOTOR 1,2 SELECT
MOTOR 1

L,8xU,R - U/D

9)SPEED FBK TYPE
ARMATURE VOLTS

Then 4xL

Although the drive regulates field current by default, set the field voltage clamp as a percentage of AC supply volts.

FV % = (FV ÷ VL) x 100

R,R,7xD,R,D,R - U/D

100)FIELD VOLTS OP %
65.00 %

Then 4xL

See Quick Start!

Feedback Calibration

If you do not have a DC tachometer or encoder, skip this section and go to **Step 3**.

DC Tachometer Calibration

For a tachometer, initially calibrate the drive for the expected DC voltage at base speed.

TVb = (BS ÷ 1000) x TV

Caution:
TVb must not exceed 200 VDC.

R,R,U,R,6xD,R - U/D

```
8)ANALOG TACHO VOLTS
   87.50  VOLTS
```

Then 4xL

TVb

Encoder Calibration

Ensure quadrature is enabled and enter the PPR.

R,R,U,R,8xD,R,R - U/D

```
10)QUADRATURE ENABLE
      ENABLED
```

L,D,R - U/D

```
11)ENCODER LINES
      1024
```

Then 4xL

PPR

3. Save Parameters

To save your work thus far, from the Diagnostic Screens:

R,U,R

```
PARAMETER SAVE      2
UP KEY TO CONTINUE
```

U

```
PARAMETER SAVE      2
      SAVING
```

When done

```
PARAMETER SAVE      2
     FINISHED
```

Then 2xL

See Quick Start!

Check Drive Terminals

Bardac drives

4. Check Control Terminals

The next few checks are to ensure the drive contactor is sequenced properly prior to applying three phase power. The value under the letters **TRJSC** in the display indicate the actual Control Input (**CIP**) terminal status.

Letter	Terminal	Contact
Thermistor	30	THERM
Run	31	ENA
Jog	32	JOG
Start	33	STRT
Coast Stop	34	CSO

From the Diagnostic Screens, go to the CIP Diagnostic.

R,D,R,4xD,R,D,D,R

```
164)DOP 123TRJSC CIP
        10100000
```

Leaving the **CSO** contact of your control wiring open (a **0** under the **C**), close the other control contacts. Check to see if the digit under the appropriate letter changes as you cycle of the contact. Generally, **1** = **ON** while **0** = **OFF** (for the thermistor T, 0 = OK while 1 = Motor Overtemp).

Once satisfied with the operation of the **T**,**R**,**J**, and **S** control inputs, leave **R**,**J**, and **S OFF** and check the **C** control input for proper operation.

See Quick Start!

AUTO TUNE the Drive

5. Apply Main Three Phase Power

6. Autotune the PL/X

Prior to running the motor, the current loop of the drive must be tuned to the motor and cabling (**PIN**'s 93,94,& 95).

a) Ensure the drive is in a normal stop condition. The CIP's should match **TRJSC** below:

Still from Step 4 | 164)DOP 123TRJSC CIP 10101001 | **Then 4xL**

b) Enable the autotune mode.

R,R,6xD,R,7xD,R - U | 92)AUTOTUNE ENABLE ENABLED | **Then 4xL**

c) Start the drive by energizing the Start Input (T33).

R,D,R,4xD,R,D,D,R | 164)DOP 123TRJSC CIP 10101011 | **Then 4xL**

The contactor will close and an autotune will be performed (takes 10 - 60 seconds). When complete, the drive's contactor will open. Turn off the Start Input (T33).

Now, **SAVE PARAMETERS** as described in **Step 3**.

See Quick Start!

Rotational Checks

7. Motor Rotational Checks

Ideally, you would like to perform these running checks with the motor disconnected from the gear box and the machine.

As an additional precaution, restrict the available current to the drive by reducing the Current Limit to just enough current to turn the motor (usually 5 to 10%).

R,R,U,R,D,R – D

```
3)CURRENT LIMIT(%)
     5.00  %
```

Check operation of the speed potentiometer by monitoring the Ramp Input. Leave the reference at zero after checking for proper operation.

L,L,D,R,5xD,R

```
26)RAMP INPUT
     75.14  %
```

Then 4xL

Start the drive by energizing the Start Input (T33). Check the field voltage at the **F+** and **F-**. When the motor is cold, you will measure somewhat less than the rated field voltage (approximately 240 VDC for a 300 VDC rated field).

Confirm the field current matches the **IFb** nameplate data.

R,D,R,D,D,R,D,D,R

```
145)FLD CUR AMPS MON
     1.35  AMPS
```

Then 4xL

Increase the potentiometer setting until the motor is turning slowly. Check motor rotation. If backwards, stop, turn off **ALL** power to the drive, and swap the field leads (**F+, F-**). Recheck after changes.

Now, slowly bring the motor up to full speed while checking the voltage on the **A+** and **A-** terminals.

R,D,R,R,3xD,R

```
126)ARM VOLTS MON
     500.0  VOLTS
```

If you have neither a tachometer nor encoder, skip to **Step 9**. If using a tachometer or encoder, check to ensure the speed reference is positive (**+**).

3xU

```
123)TOTAL SPD REF MN
     26.50  %
```

Then, check the sign of the feedback, as follows:

Tachometer Feedback

6xD

```
129)TACHO VOLTS MON
    -23.19  VOLTS
```

Then 4xL

If positive (**+**), skip to **Step 8**. If negative (**-**), stop, power off the drive, then swap the tachometer leads on T25 and T26 and recheck.

Encoder Feedback

2xU

```
132)ENCODER RPM MON
     -464 RPM
```

Then 4xL

If positive (**+**), skip to **Step 8**. If negative (**-**), stop the drive and invert the encoder sign and recheck.

R,R,U,R,8xD,R,3xD,R – D

```
13)ENCODER SIGN
     INVERT
```

5xL

8. Switching Feedback Type

Now, stop the drive and select the appropriate feedback.

Tachometer Feedback

R,R,U,R,7xD,R – U

```
9)SPEED FBK TYPE
   ANALOG TACHO
```

Then 4xL

Encoder Feedback

R,R,U,R,7xD,R – 2xU

```
9)SPEED FBK TYPE
     ENCODER
```

Then 4xL

Again, start the drive and ensure maximum speed can be obtained and the armature voltage does not exceed the nameplate **VA**.

Bardac drives

See Quick Start!

DC Drives

Turn up current limit & SAVE!

Bardac drives

9. Increase the Current Limit to Rated Value

At this point, the Current Limit may be returned to 150%.

R,R,U,R,D,R – U

```
3)CURRENT LIMIT(%)
     150.00  %
```

Then 4xL

Now, **SAVE PARAMETERS** as described in **Step 3**.

See Quick Start!

10. Adjusting the Speed Calibration at Base Speed

Gradually, increase your potentiometer to the maximum position and then adjust the final speed of the motor.

Depending on the final feedback type, different parameters (**PIN**'s 16, 17,& 6) are used for speed calibration.

Do **NOT** exceed the base speed (**BS**) value while adjusting these parameters. These calibration parameters may be adjusted while the drive is running.

Major Menus, Key Parameters, Alarms, Application Blocks

- Major hardware components/termination points
- Drive keypad and screen
- Example:
  - Set accel time
  - Load in motor parameters
  - Auto tune
  - SAVE
- Alarms
- Major Application Blocks

AC Drives

E3 Series
General Purpose Drive

P2 Series
Vector Drive

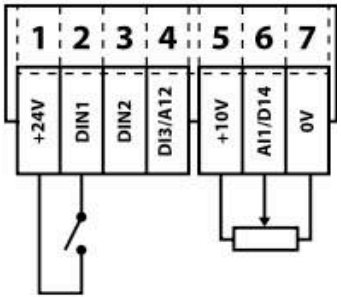
V3 Series
Eco Drive

Quick Start

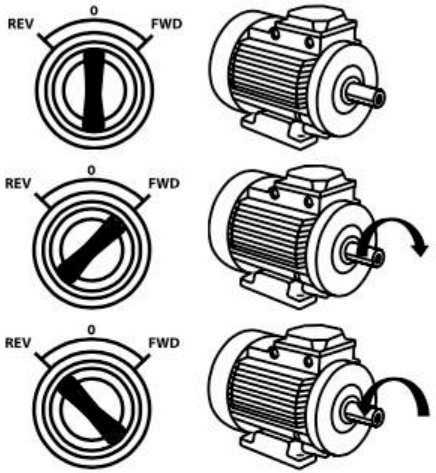
Similar for E3, P2, and V3 Drives

Quick Start – IP20 & IP66 Non Switched

- Connect a Start / Stop switch between control terminals 1 & 2
  - o Close the Switch to Start
  - o Open to Stop
- Connect a potentiometer (5k – 10kΩ) between terminals 5, 6 and 7 as shown
  - o Adjust the potentiometer to vary the speed from P-02 (0Hz default) to P-01 (50 / 60 Hz default)

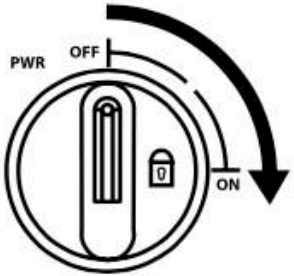


The OFF/REV/FWD will enable the output and control the direction of rotation of the motor.

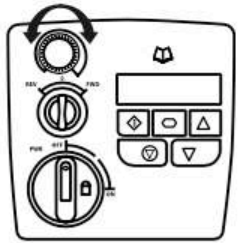


Quick Start – IP66 Switched

Switch the mains power on to the unit using the built in isolator switch on the front panel.



The potentiometer will control the motor shaft rotational speed.



Managing the Keypad

Bardac drives

Similar for E3, P2, and V3 Drives

5.1. Managing the Keypad

The drive is configured and its operation monitored via the keypad and display.

	NAVIGATE	Used to display real-time information, to access and exit parameter edit mode and to store parameter changes
	UP	Used to increase speed in real-time mode or to increase parameter values in parameter edit mode
	DOWN	Used to decrease speed in real-time mode or to decrease parameter values in parameter edit mode
	RESET / STOP	Used to reset a tripped drive. When in Keypad mode is used to Stop a running drive.
	START	When in keypad mode, used to Start a stopped drive.

Ethernet and USB Interface speedy – dw22X

Bardac drives

AC Drives

Drive Ventilation Requirements

An AC drive will generate 3% losses

Example: A 250HP AC drive, equivalent to 270kW

Losses = 8.1kW

savvy-SFD Tour

Bardac drives

drive.web