

DINVERTER

370 Watt Variable Speed Drive

For standard induction motors

User Manual



4.2 Power Connections

4.2.1 Fuses and Cabling

Cable of size 1.5mm^2 is recommended for use with the Dinverter. Screened cable (ie. armoured cable) will be needed if strict compliance with EMC Standards is required. In this case, the maximum length of cable to the motor will be less. Input cables should be protected by a 13 Ampere slow-blow fuse or similar.

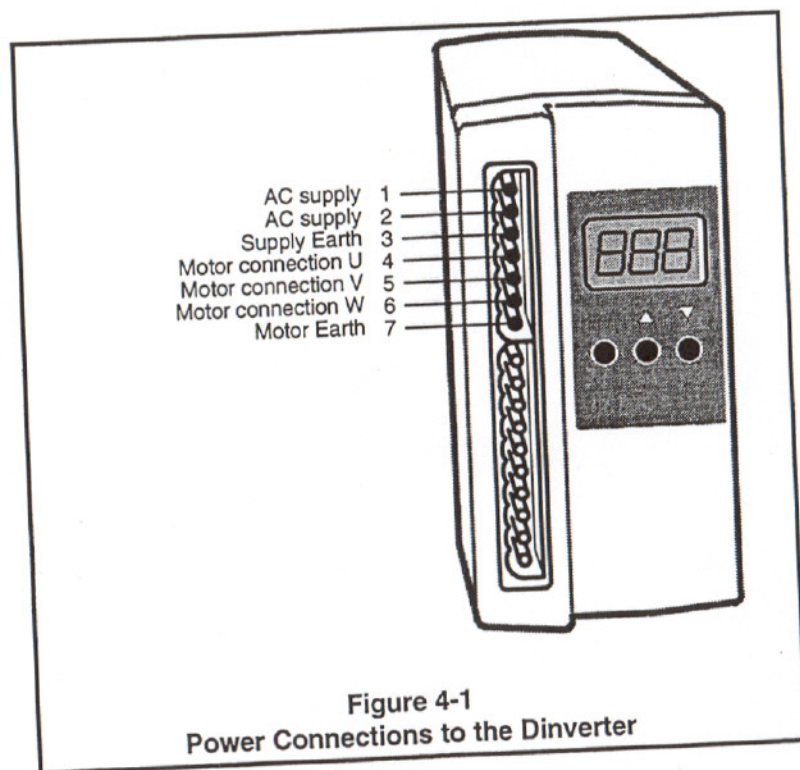


Table 4-1 Details of the Power Connections

Terminal No.	I/O	Function	Specification
1	I	AC Supply	210V to 240V AC $\pm 10\%$. Minimum Supply source impedance = 0.09 Ohms*
2	I	AC Supply	
3	I	Supply Earth	
4	O	Motor phase U	370W 2A rms output. Voltage nominally equal to the Supply level. Variable frequency
5	O	Motor phase V	
6	O	Motor phase W	
7	O	Motor Earth	

* At the Dinverter terminals.

Table 4-2 Dinverter Output Ratings

Motor rating kW(1)	Output		Input	
	FLC A rms	Overload 150% A rms	FLC A rms	Overload (150%) A rms (2)
0.37	2	3	4.6	6.9

Table 4-3 Dinverter Ratings

Displacement Factor (3)	Power Factor (4)	Maximum switch-on surge A peak (5)	Maximum I^2t of switch-on surge A^2s (5)
0.95	0.52	700	0.1

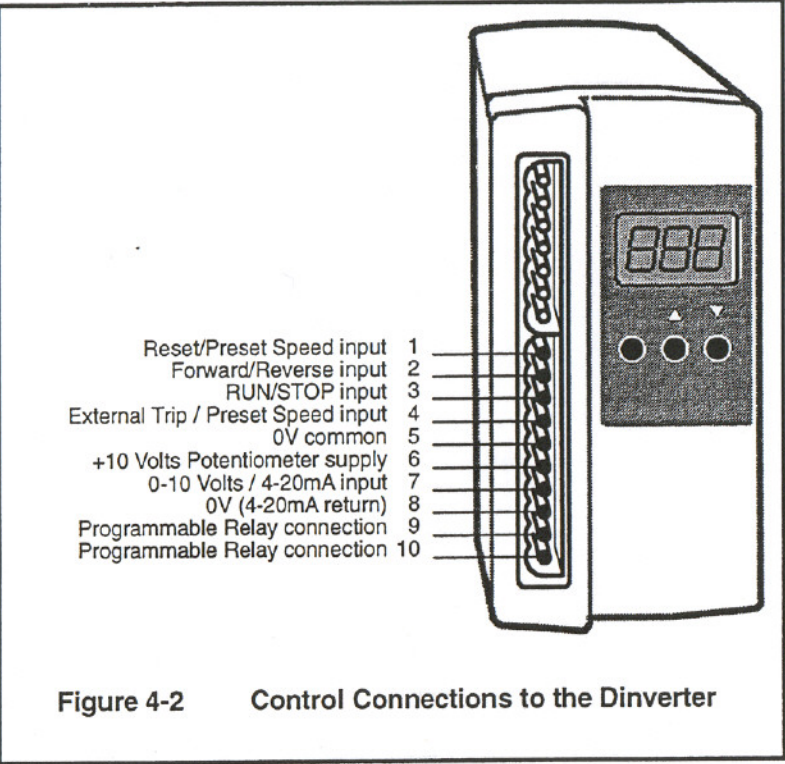


Figure 4-2 Control Connections to the Dinverter

Table 4-4 Details of the Control Connections

Terminal No.	I/O	Function	Specification
1	I	RESET/PRESET SPEED input	Momentary close to RESET or close to activate PRESET SPEED (see b10, b12)
2	I	FORWARD/ REVERSE	Close to runmotor in reverse direction
3	I	RUN/STOP	Close to RUN Open to STOP (Mode selected by b2, b7)
4	I	External TRIP/RESET SPEED input	Momentary open to TRIP or close to activate PRESET SPEEDS(see b10, b12)
5	I	0V common	
6	O	+10V Potentiometer supply	+10.4V $\pm 2\%$ at 5mA
7	I	0 to 10V 4 to 20mA input	Selectable by b3, b11
8	I	0V/4-20mA return	
9	O	Programmable Relay	Relay programmable by b5, b6 . Default as DRIVE HEALTHY relay. Contacts rated at 24V 7A DC or 110V 0.5A AC resistive
10	O		

5

Drive Configuration

5.1 Operating Procedures

Parameters are the means by which the operating characteristics of a system are controlled and monitored. The two principal kinds of parameter of a digital drive are the Operating Parameters and the Bit Parameters.

Operating Parameters have a real-value range, for example from 0 to 150%. Operating Parameters are analogous to control potentiometers.

Bit Parameters are used for selecting different control configurations and are *either/or* functions. Bit Parameters are analogous to control switches.

The response of the drive and the motor depends fundamentally on the set of drive parameters. These values are accessible through the keypad.

Operating and Bit Parameters that may be read are referred to as Read Parameters. Those that can be changed are referred to as Write Parameters. Some parameters are Read-Write Parameters. Read-write parameters can be adjusted in any sequence and changed as desired.

Operating Parameters can be adjusted while the motor is running.

NOTE Bit Parameter adjustment requires the motor to be stopped and the display to show rdY or a Trip condition.

In Keypad Mode, adjusting the parameters while the Dinverter is tripped will reset the drive.

No parameter can be adjusted to a value outside the operating range of the Dinverter. All parameters are limited to safe levels of inverter operation.

Parameters can be allowed to remain at their default values or at the settings made during final test or they can be adjusted in any sequence to suit specific applications. Default values are settings to which all parameters can be caused to return to at will, and are listed in *Parameter Quick Reference* in Chapter 6. The values set at the factory (as delivered values) may differ from default values for special customer requirements.

5.1.1 Adjusting Parameters via the Keypad

To select and read a Parameter

- 1 Press once the MODE key on the front panel of the Dinverter.
- 2 The display changes from the Present Indication to show for approximately 1 second a Parameter Number in the form **Pr1** or **b1**. The display then changes to show for 1 second the value set for the displayed parameter. The Parameter Number and the parameter Value continue to alternate for 8 seconds. At the end of this time, the display returns to showing the Present Indication.
- 3 To select a different Parameter from the one displayed, press:



The Parameter Number will increase or decrease. It is possible to scroll continuously through the Parameter Numbers by repeatedly pressing the key.

- 4 After the required Parameter Number has been selected, the display will show alternately the parameter Number and Parameter Value for 8 seconds.

To change a Parameter

NOTE The values of Bit Parameters can be changed only during either of the following conditions:

- The Dinverter has been stopped and the display is showing **rdY**
- The Dinverter has tripped and the display is flashing the Trip code

The values of Pr Parameters can be changed when the motor is running.

- 1 To stop the Dinverter, proceed as follows:

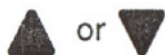
If the Dinverter is in Keypad Control mode (**b9** set at **0**), press:



to reduce the displayed value to zero.

If the Dinverter is in Terminal Control mode (**b9** set at **1**), open the **RUN/STOP** switch. Wait until the display shows **rdY**.

- 2 Select the parameter to be changed by following the procedure above for selecting and reading a parameter.
- 3 Press **MODE** once again. The display will show the Parameter Value constantly (without alternating with the Parameter Number).
- 4 Before 8 seconds elapse, press:



to increase or decrease the display reading. Pressing the key momentarily changes the value by plus or minus one least-significant digit. If the key is kept pressed, the displayed figure will increase or decrease rapidly. If a key is not pressed again within 8 seconds, the display reverts to the Present Indication. The last setting of the Parameter Value is stored.

If the Dinverter is driving a motor, the motor responds to changes in **Pr** Parameter Values as they are being made.

If a key is not pressed within 8 seconds, to change a parameter, it will be necessary to follow the procedure again for selecting a parameter.

Decimal Values

The display operates an automatic floating decimal point. According to the range of values of the parameter, the display inserts a decimal point as appropriate.

5.2 Configuration Examples

5.2.1 Safety

WARNING Safety Procedures must be properly observed

Ensure the following:

- The person in charge of the trial run is fully competent to perform or supervise mechanical and electrical installation.
- The motor rating is compatible with the inverter rating.
- The direction of rotation of the motor is correct.
- The motor is securely bolted down.
- The inverter is firmly attached in an upright position and is properly ventilated.

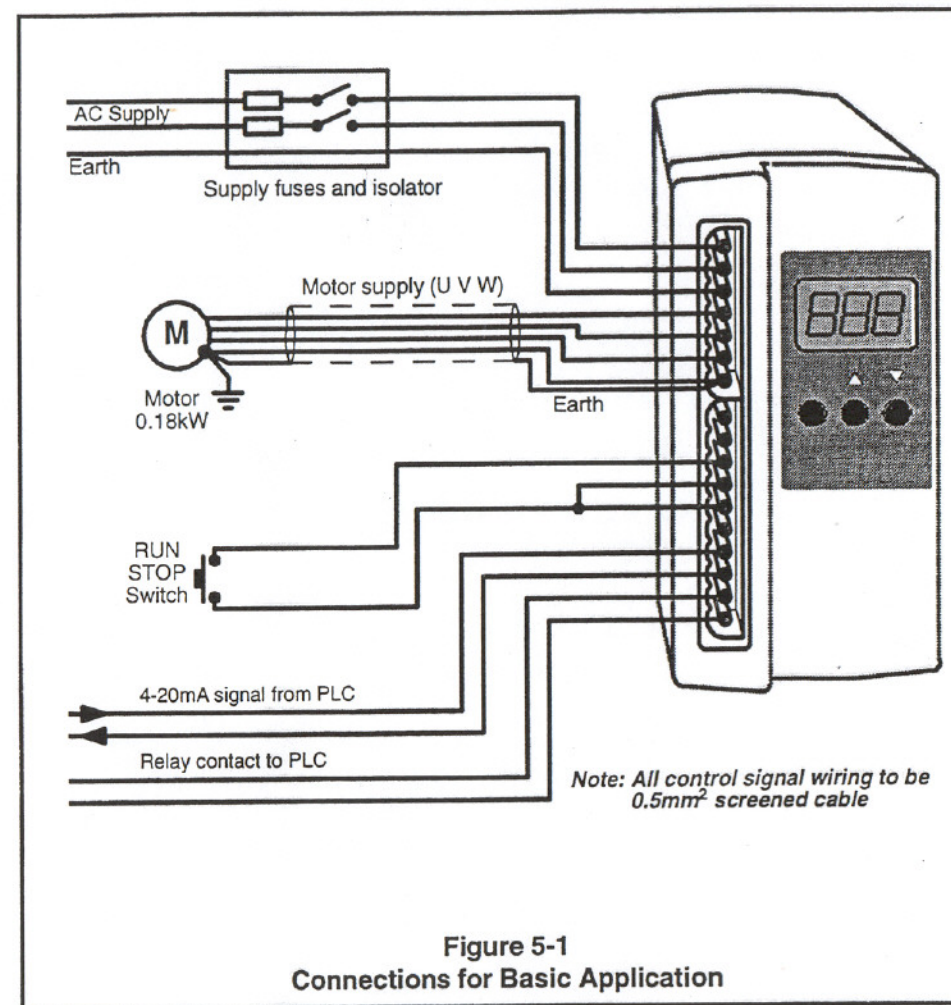
CAUTION Electrical supply connections must be earthed in accordance with local industrial safety regulations.

Protective hrc fuses or a circuit breaker of the correct rating must be installed in the supply. Refer to Chapter 4, Installation - Electrical.

NOTE For access to the Power Terminals and to the Control Terminals, refer to Chapter 4, Installation-Electrical.

5.2.2 Basic Application

It is required to drive a 0.18kW 1.0A induction motor up to 50Hz frequency. Basic control of speed is required using a 4-20mA reference from a nearby PLC. An emergency stop function using DC injection braking is to be included.

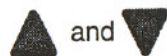


Connections

Typical connections are shown in Figure 5-1 above.

Commissioning

- 1 Power up the Dinverter (ensuring the RUN connection is not made)
- 2 Set **b2** at **1** for DC INJECTION BRAKING.
- 3 Set **b11** at **4.20**
Set **b3** at **1** to select Current Loop Reference
Set **Pr5 (MAXIMUM CONTINUOUS CURRENT)** at **50%** to provide some thermal protection for the motor.
- 4 Set up the required acceleration and deceleration profiles (**Pr2** and **Pr3**)
- 5 Set up minimum or maximum speed adjustment (**Pr0** and **Pr1**).
- 6 Close the **RUN** contact to start the motor.
- 7 The drive frequency will now be displayed. To display **PERCENTAGE LOAD** press simultaneously:



5.2.3 HVAC Application

It is required to drive a 0.37kW 2A motor at up to 70Hz frequency for an HVAC application. Acoustic noise is a prime consideration and an automatic re-start facility is required to re-start the drive in the event of a spurious Trip.

Three fan speeds are required (30, 50 and 70 Hz) and an indication of **At Speed** is also required.

Connections

Typical connections are shown in Figure 5-2.

Commissioning

Set the necessary parameters for **PRESET SPEED** selection and **AUTO RESET**.

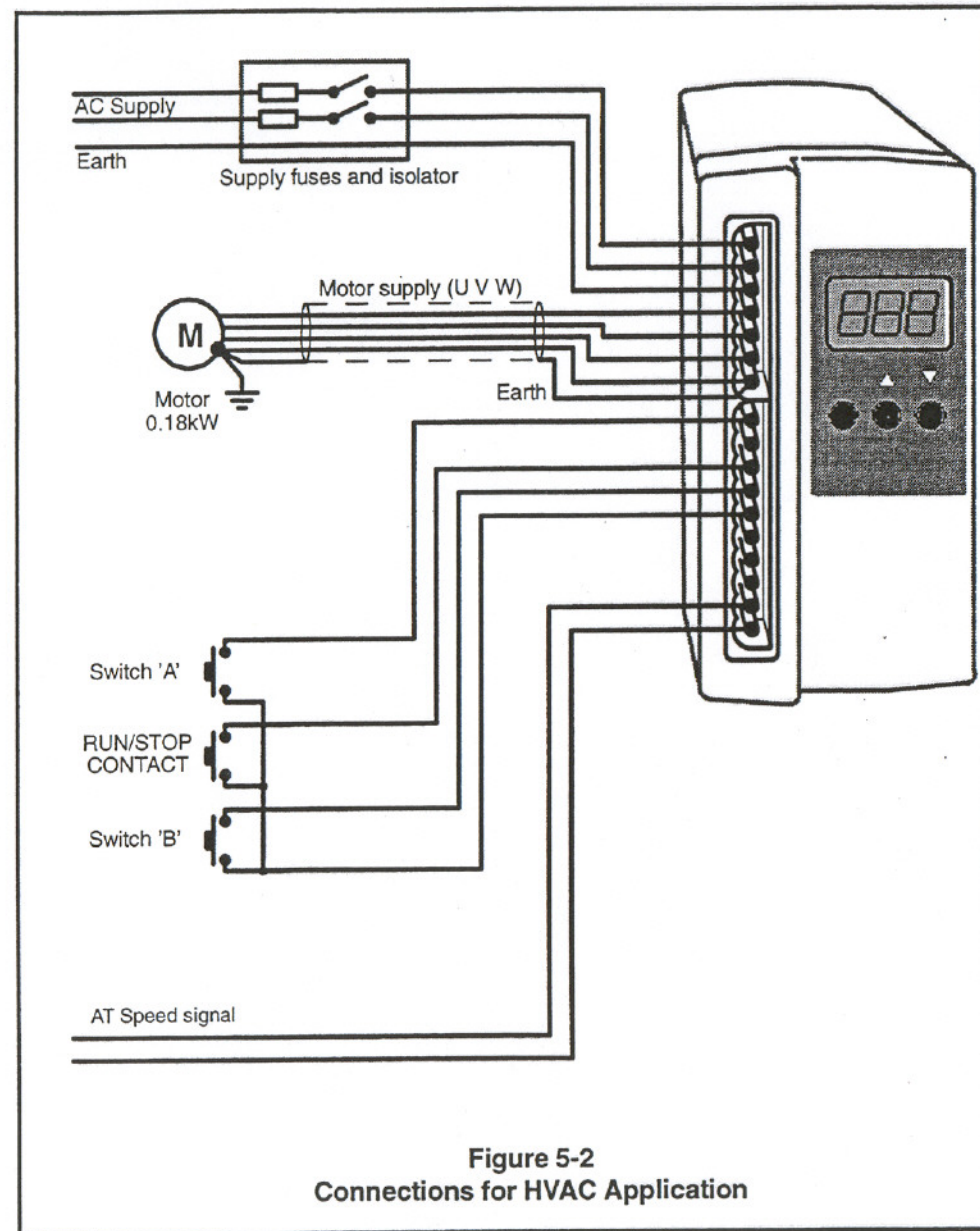


Figure 5-2
Connections for HVAC Application

5.3 Diagnostics and Fault Finding

Any Trip, internal or external, immediately stops the drive. The IGBT Smart Power bridge becomes inactive and the motor coasts to rest.

Internal protection Trips are always active and cannot be disabled.

An External Trip (**Et**) can be forced by the operator.

Display does not illuminate and the Dinverter does not run

Check the mains supply, supply fuses or circuit breaker. Replace supply fuses if blown or reclose the circuit breaker. If the supply fuses blow or the breaker trips again, contact the supplier of the Dinverter.

Motor does not start and the display shows rdY

When the Dinverter is in Keypad Mode, press:



or press the **START** pushbutton when the Dinverter is in Terminal Mode.

Check the control wiring and that external **STOP/RUN/TRIP** contacts and circuits are in order.

Motor does not start and the display shows 0

Check the wiring of the Speed Reference and that the correct mode has been selected. If Keypad mode is selected (**b9** set at **0**), press:



Check **PRESET SPEED** is not selected (**b10** and **b12** set at **1**) with a speed setting of **0**. Check **MAXIMUM FREQUENCY** parameter (**Pr1**) is not set at **0**.

A Trip Code is displayed

NOTE Thermal trip devices should not be continually tripped and reset.

OI Trip can be caused by shock load, cable or motor insulation faults, the length of cable to the motor being too great, or attempting to accelerate too large a motor.

OI and **OU** Trips may be caused by decelerating too quickly under the following conditions:

- When operating below motor base speed—**OI** trip
- When operating above motor base speed—**OU** trip.

Increase the value of **Pr3** and check that **b2** and **b7** are set for **RAMP STOP**.

If **PS** or **Err** are displayed, disconnect the Dinverter from the supply, wait 10 seconds, reconnect and re-start it. If the fault persists, contact the supplier of the Dinverter.

Motor fails to turn the load, and is noisy

The **BOOST** setting may be too high (**Pr6**). Check that the mechanical load is free to turn.

The Dinverter appears to be set at an unusable state

Set **b13** at **1** to reset all the parameters to default values.

Fault persists

If after performing any of the above checks the Dinverter still malfunctions, contact the supplier for assistance.

5.3.1 Trip Codes

cL Loss of 4-20mA current loop. The current has fallen to <3.5mA when **b11** = **4.20** or **20.4**.

When **b11** = **0.20** the CURRENT LOOP LOSS Trip is inactive.

Err** Hardware fault within the drive that occurs only at power-up. It is a lock-out condition with no reset facility. The hardware faults are as follows:

- 1 ASIC reading error
- 4 Processor error in serial interrupt
- 5 Keyboard fault
- 6 NOVRAM initialised
- 7 Current-sense circuitry has an excessively high positive offset at power up
- 8 Current-sense circuitry has an excessively high negative offset at power up.

Et External Trip, activated by removal of signal applied to Terminal 4

It Integrating Overload (**I x t**) Trip. The output current as defined by **Pr5** has reached the allowable time limit.

OI Instantaneous Overcurrent Trip. Excessive current flowing in the Smart Power IGBT inverter bridge caused by the following:

- Short circuit
- Low impedance earth fault
- Excessive shock-load

An OI Trip can also indicate an over-temperature within the IGBT inverter bridge.

OU DC bus overvoltage caused by the following:

- Mains supply over-voltage (even if momentary)
- High impedance earth fault
- Excessive regeneration due to a high rate of deceleration.

PS** Internal power supply fault.

to Time-out Trip that indicates the auto-reset function has failed to reset the drive after a third attempt to start with the same Trip fault.

UU The internal power supply voltage has fallen below the operating range. The Dinverter trips instantaneously.

****** The UU Trip can also be caused by a failure of internal components of the drive. These conditions require expert attention. Please consult the supplier of the drive.

5.2.7 Healthy Indications

rdY Motor stopped, Dinverter energised.

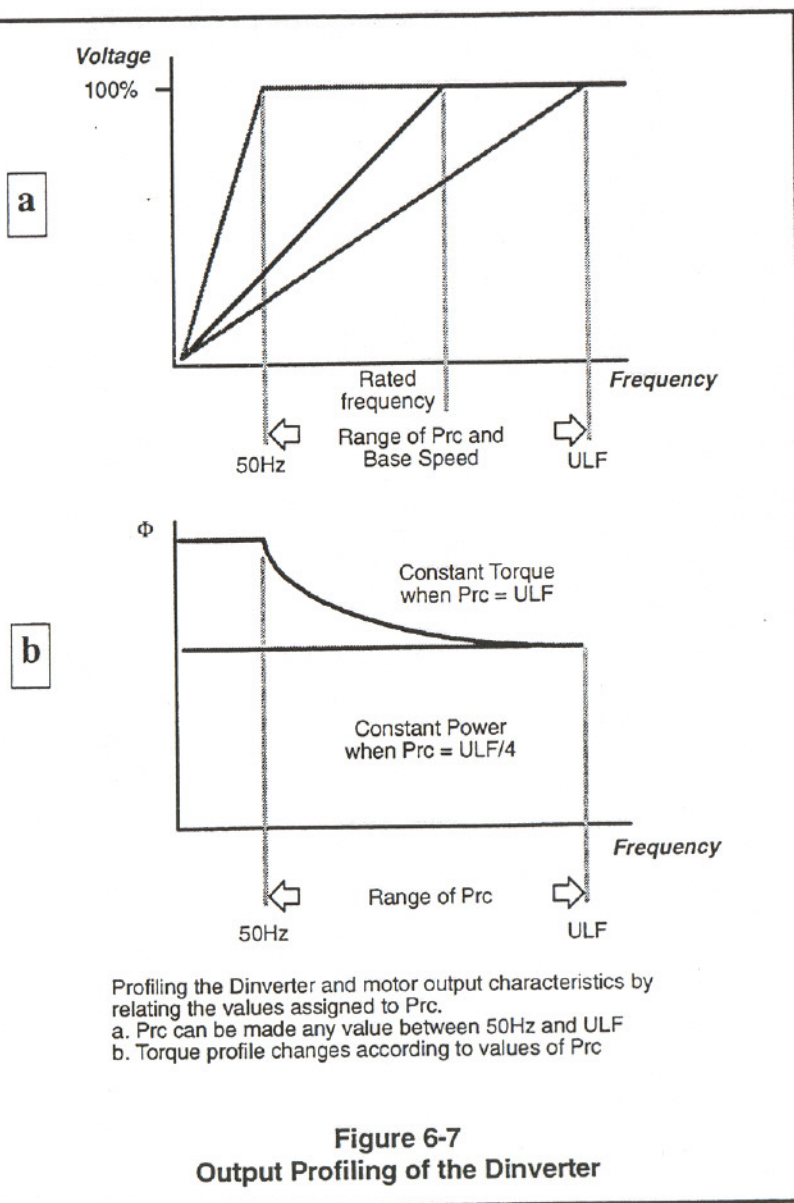
A number Motor speed (Hz) or load (%FLC) dependent on the setting of **b8** or a parameter value if accessed.

dcb DC braking active.

Inh Motor coasting to rest, IGBT bridge inhibited.

Flashing decimal point Dinverter is operating in the (**I x t**) region.

adjusted by parameter **Prc**. The maximum value of **Prc** is equal to the ULF. The minimum value is 50Hz.



6.3 Parameter Quick Reference

Table 6-6 Parameter Quick Reference Guide

Parameter	Function	Units	Min.	Max.	Default
Pr0	Minimum Speed / Preset Speed 2	Hz	0	Pr1	0.0
Pr1	MaximumSpeed / Preset Speed 3	Hz	Pr0	ULF	50.0
Pr2	Acceleration time [0 to ULF]	secs	0.2	600	5.0
Pr3	Deceleration time [ULF to 0]	secs	0.2	600	10.0
Pr4	not used				
Pr5	Maximum Continuous Current	% FLC	10.0	105	100
Pr6	Voltage (torque) Boost	% Supply Volts	0	25.5	9.8
Pr7	Preset Speed 1	Hz	0	ULF	0.0
Pr8	DC Braking Period	secs	0	16.0	1.0
Pr9	not used				
PrA	Last Trip				Et
Prb	Security Code	[0 = none]	100	255	0
b0	Auto-reset	[0 = disable, 1 = enable]			0
b1	Reset Bit	[0 = reset]	0	1	1
b2 b7	Braking [see below]		0	1	0 0

Parameter		Mode
b2	b7	
0	0	Standard ramp
0	1	Coast
1	0	Inject DC
1	1	High Level Ramp

Parameter	Function	Units	Min.	Max.	Default
b3	Select Reference [0 = Voltage, 1 = Current]				0
b4	Minimum Speed		0 = 0Hz	1 = Pr0	1
b5 b6	Relay Selector [see below]		0	1	1 1

Relay state	b5,b6			
	0,0	0,1	1,0	1,1
Energised	At Speed	Above Min. Speed	Running	Healthy
De-energised	Not At Speed	At Min. Speed or Stopped	Stopped	Tripped

Parameter	Function	Units	Min.	Max.	Default
b8	Select Display [0 = Display Frequency, 1 = Display Load]				0
b9	Select Mode [0 = Keypad Mode, 1 = Terminal Mode]				1
b10 b12	Select Control Terminal Functions [see below]				0 0
NOTE b10 and b12 allow Terminal 1 and Terminal 4 to be programmable Preset Speed Selection inputs					

Control Terminal	b10,b12				
	0,0	0,1	1,0	1,1	
1	Reset input	Reset input	Preset Speed 1	Preset Speed 1	Preset Speed 3
4	External Trip	Preset Speed 1	External Trip	Preset Speed 2	

Parameter	Function	Units	Values (Min. / Max)	Default
b11	Current Loop Speed Reference	mA	Ur 0.20 4.20 20.4	Ur
b13	Set Defaults [0 = no action, 1 = set defaults]			0
b14	PWM Switching Frequency	kHz	2.9 5.9 8.8 11.7	2.9
	Upper Limit of Frequency (ULF) [Max 240 at 2.9kHz] [Max 480 at 5.9 & 8.8kHz]	Hz	120 240 480 960	120
Prc	Maximum-voltage Frequency	Hz	50.0 ULF	50.0