

# Unidrive M400

Frequency inverters for manufacturing automation

## Quick Start Guide

Fast set-up and diagnosis  
with real-text display, plus  
integrated Machine Control  
Studio based on PLC



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## Original Instructions

For the purposes of compliance with the EU Machinery Directive 2006/42/EC, the English version of this manual is the Original Instructions. Manuals in other languages are Translations of the Original Instructions.

### Documentation

Manuals are available to download from the following locations: <http://www.drive-setup.com/ctdownloads>

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# 1 Safety information

## 1.1 Warnings, Cautions and Notes



A Warning contains information which is essential for avoiding a safety hazard.



A Caution contains information which is necessary for avoiding a risk of damage to the product or other equipment.

**NOTE** A **Note** contains information, which helps to ensure correct operation of the product.

## 1.2 Important safety information. Hazards. Competence of designers and installers

This guide applies to products which control electric motors either directly (drives) or indirectly (controllers, option modules and other auxiliary equipment and accessories). In all cases the hazards associated with powerful electrical drives are present, and all safety information relating to drives and associated equipment must be observed.

Specific warnings are given at the relevant places in this guide.

Drives and controllers are intended as components for professional incorporation into complete systems. If installed incorrectly they may present a safety hazard. The drive uses high voltages and currents, carries a high level of stored electrical energy, and is used to control equipment which can cause injury. Close attention is required to the electrical installation and the system design to avoid hazards either in normal operation or in the event of equipment malfunction. System design, installation, commissioning/start-up and maintenance must be carried out by personnel who have the necessary training and competence. They must read this safety information and this guide carefully.

## 1.3 Responsibility

It is the responsibility of the installer to ensure that the equipment is installed correctly with regard to all instructions given in this guide. They must give due consideration to the safety of the complete system, so as to avoid the risk of injury both in normal operation and in the event of a fault or of reasonably foreseeable misuse.

The manufacturer accepts no liability for any consequences resulting from inappropriate, negligent or incorrect installation of the equipment.

## 1.4 Compliance with regulations

The installer is responsible for complying with all relevant regulations, such as national wiring regulations, accident prevention regulations and electromagnetic compatibility (EMC) regulations. Particular attention must be given to the cross-sectional areas of conductors, the selection of fuses or other protection, and protective ground (earth) connections.

This guide contains instructions for achieving compliance with specific EMC standards.

All machinery to be supplied within the European Union in which this product is used must comply with the following directives:

2006/42/EC Safety of machinery.

2014/30/EU: Electromagnetic Compatibility.

## 1.5 Electrical hazards

The voltages used in the drive can cause severe electrical shock and/or burns, and could be lethal. Extreme care is necessary at all times when working with or adjacent to the drive. Hazardous voltage may be present in any of the following locations:

- AC and DC supply cables and connections
- Output cables and connections
- Many internal parts of the drive, and external option units

Unless otherwise indicated, control terminals are single insulated and must not be touched.

The supply must be disconnected by an approved electrical isolation device before gaining access to the electrical connections.

The STOP and Safe Torque Off functions of the drive do not isolate dangerous voltages from the output of the drive or from any external option unit.

The drive must be installed in accordance with the instructions given in this guide. Failure to observe the instructions could result in a fire hazard.

## 1.6 Stored electrical charge

The drive contains capacitors that remain charged to a potentially lethal voltage after the AC supply has been disconnected. If the drive has been energized, the AC supply must be isolated at least ten minutes before work may continue.

## 1.7 Mechanical hazards

Careful consideration must be given to the functions of the drive or controller which might result in a hazard, either through their intended behaviour or through incorrect operation due to a fault. In any application where a malfunction of the drive or its control system could lead to or allow damage, loss or injury, a risk analysis must be carried out, and where necessary, further measures taken to reduce the risk - for example, an over-speed protection device in case of failure of the speed control, or a fail-safe mechanical brake in case of loss of motor braking.

**With the sole exception of the Safe Torque Off function, none of the drive functions must be used to ensure safety of personnel, i.e. they must not be used for safety-related functions.**

The Safe Torque Off function may be used in a safety-related application. The system designer is responsible for ensuring that the complete system is safe and designed correctly according to the relevant safety standards.

The design of safety-related control systems must only be done by personnel with the required training and experience. The Safe Torque Off function will only ensure the safety of a machine if it is correctly incorporated into a complete safety system. The system must be subject to a risk assessment to confirm that the residual risk of an unsafe event is at an acceptable level for the application.

## 1.8 Access to equipment

Access must be restricted to authorized personnel only. Safety regulations which apply at the place of use must be complied with.

## 1.9 Environmental limits

Instructions in this guide regarding transport, storage, installation and use of the equipment must be complied with, including the specified environmental limits. This includes temperature, humidity, contamination, shock and vibration. Drives must not be subjected to excessive physical force.

## **1.10 Hazardous environments**

The equipment must not be installed in a hazardous environment (i.e. a potentially explosive environment).

## **1.11 Motor**

The safety of the motor under variable speed conditions must be ensured.

To avoid the risk of physical injury, do not exceed the maximum specified speed of the motor.

Low speeds may cause the motor to overheat because the cooling fan becomes less effective, causing a fire hazard. The motor should be installed with a protection thermistor. If necessary, an electric forced vent fan should be used.

The values of the motor parameters set in the drive affect the protection of the motor. The default values in the drive must not be relied upon. It is essential that the correct value is entered in the Motor Rated Current parameter.

## **1.12 Mechanical brake control**

Any brake control functions are provided to allow well co-ordinated operation of an external brake with the drive. While both hardware and software are designed to high standards of quality and robustness, they are not intended for use as safety functions, i.e. where a fault or failure would result in a risk of injury. In any application where the incorrect operation of the brake release mechanism could result in injury, independent protection devices of proven integrity must also be incorporated.

## **1.13 Adjusting parameters**

Some parameters have a profound effect on the operation of the drive. They must not be altered without careful consideration of the impact on the controlled system. Measures must be taken to prevent unwanted changes due to error or tampering.

## **1.14 Electromagnetic compatibility (EMC)**

Installation instructions for a range of EMC environments are provided in the relevant Power Installation Guide. If the installation is poorly designed or other equipment does not comply with suitable standards for EMC, the product might cause or suffer from disturbance due to electromagnetic interaction with other equipment. It is the responsibility of the installer to ensure that the equipment or system into which the product is incorporated complies with the relevant EMC legislation in the place of use.



## 2 Introduction

M400 minimizes machine downtime with its optional intuitive advanced LCD Keypad that offers real-text multi-language display for rapid set-up and superior diagnostics. Its onboard PLC with real-time tasking can be used for simple logic control using Machine Control Studio programming software (powered by CODESYS) to enhance drive application capability.

### 2.1 Operating modes

The drive is designed to operate in any of the following modes:

1. Open loop mode
  - Open loop vector mode
  - Fixed V/F mode (V/Hz)
  - Square V/F mode (V/Hz)
2. RFC - A
  - Without position feedback sensor

#### 2.1.1 Open loop mode

The drive applies power to the motor at frequencies varied by the user. The motor speed is a result of the output frequency of the drive and slip due to the mechanical load. The drive can improve the speed control of the motor by applying slip compensation. The performance at low speed depends on whether V/F mode or open loop vector mode is selected.

##### Open loop vector mode

The voltage applied to the motor is directly proportional to the frequency except at low speed where the drive uses motor parameters to apply the correct voltage to keep the flux constant under varying load conditions.

Typically 100 % torque is available down to 1 Hz for a 50 Hz motor.

##### Fixed V/F mode

The voltage applied to the motor is directly proportional to the frequency except at low speed where a voltage boost is provided which is set by the user. This mode can be used for multi-motor applications.

Typically 100 % torque is available down to 4 Hz for a 50 Hz motor.

##### Square V/F mode








The voltage applied to the motor is directly proportional to the square of the frequency except at low speed where a voltage boost is provided which is set by the user. This mode can be used for running fan or pump applications with quadratic load characteristics or for multi-motor applications. This mode is not suitable for applications requiring a high starting torque.

#### 2.1.2 RFC-A mode

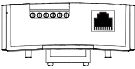


Rotor flux control provides closed loop control without the need for position feedback by using current, voltages and key motor parameters to estimate the motor speed. It can eliminate instability traditionally associated with open loop control such as operating large motors with light loads at low frequencies.

# 3 Options

Table 3-1 System Integration (SI) option module identification

| Type                       | Option module  | Color        | Name           | Further details                       |
|----------------------------|--|--------------|----------------|---------------------------------------|
| Fieldbus                   |   | Purple       | SI-PROFIBUS    | See relevant option module User Guide |
|                            |   | Medium Grey  | SI-DeviceNet   |                                       |
|                            |   | Light Grey   | SI-CANopen     |                                       |
|                            |   | Beige        | SI-Ethernet    |                                       |
|                            |   | Brown Red    | SI-EtherCAT    |                                       |
|                            |   | Yellow Green | SI-PROFINET V2 |                                       |
| Automation (I/O expansion) |  | Orange       | SI-I/O         |                                       |

**Table 3-2 Adaptor Interface (AI) option module identification**

| Type           | Option module   | Name                |
|----------------|---|---------------------|
| Communications |  | AI-485 Adaptor      |
|                |   | AI-485 24 V Adaptor |
| Backup         |  | AI-Backup Adaptor   |
| Backup         |  | AI-SMART Adaptor    |

## 4 Control connections

For information on the default control connections, refer to the back cover of this guide. The functionality of the control connections change depending on the setting of Pr **00.005**.

### 4.1 Control terminal configurations and wiring

| 00.005 |     | Drive Configuration   |  |  |  |   |        |    |  |
|--------|-----|---|--|--|--|---|--------|----|--|
| RW     | Txt |   |  |  |  |   | PT     | US |  |
| OL     | ⇕   | AV (0), AI (1), AV Preset (2),<br>AI Preset (3), Preset (4),<br>Keypad (5), Keypad Ref (6),<br>Electronic Pot (7),<br>Torque Control (8), Pid Control (9) |  |  |  | ⇒ | AV (0) |    |  |
| RFC-A  |     |   |  |  |  |   |        |    |  |

The setting of Pr **00.005** automatically sets the drive configuration.

| Value | Text           | Description   |
|-------|----------------|---|
| 0     | AV             | Analog input 1 (voltage) or Analog input 2 (voltage) selected by terminal (Local/Remote)                                    |
| 1     | AI             | Analog input 1 (current) or Analog input 2 (voltage) selected by terminal (Local/Remote)                                    |
| 2     | AV Preset      | Analog input 1 (voltage) or 3 presets selected by terminal  |
| 3     | AI Preset      | Analog input 1 (current) or 3 presets selected by terminal  |
| 4     | Preset         | Four presets selected by terminal   |
| 5     | Keypad         | Keypad reference  |
| 6     | Keypad Ref     | Keypad reference with terminal control  |
| 7     | Electronic Pot | Electronic Potentiometer  |
| 8     | Torque Control | Torque mode, Analog input 1 (current frequency reference) or Analog input 2 (voltage torque reference) selected by terminal |
| 9     | Pid Control    | PID mode, Analog input 1 (current feedback source) and Analog input 2 (voltage reference source)                            |

Action will only occur if the drive is inactive, and no User Actions are running. Otherwise, the parameter will return to its pre altered value on exit from edit mode. All parameters are saved if this parameter changes.

Figure 4-1 Pr 00.005 = AV

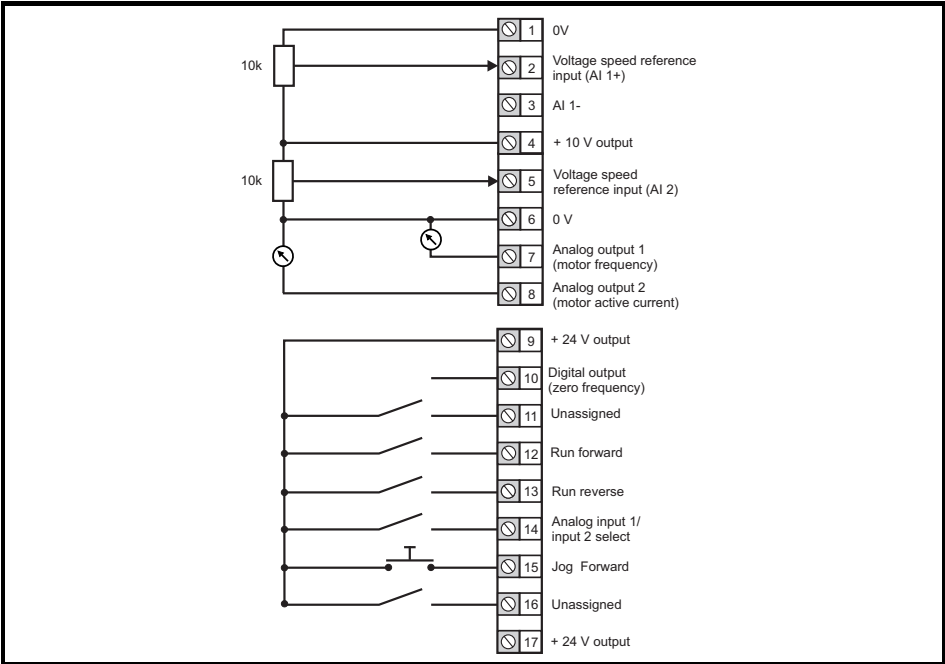


Figure 4-2 Pr 00.005 = AI

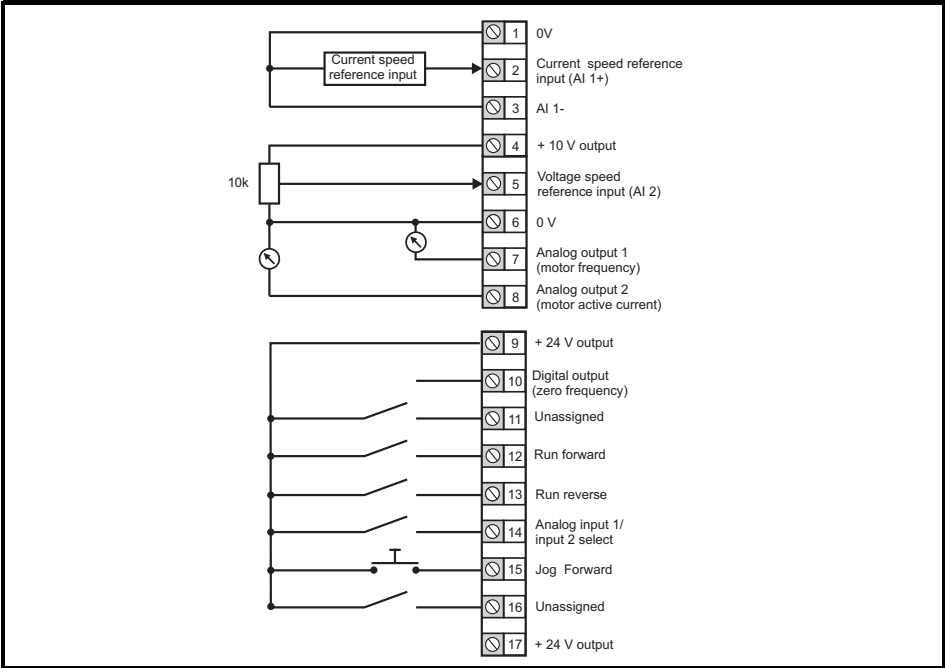


Figure 4-3 Pr 00.005 = AV Preset

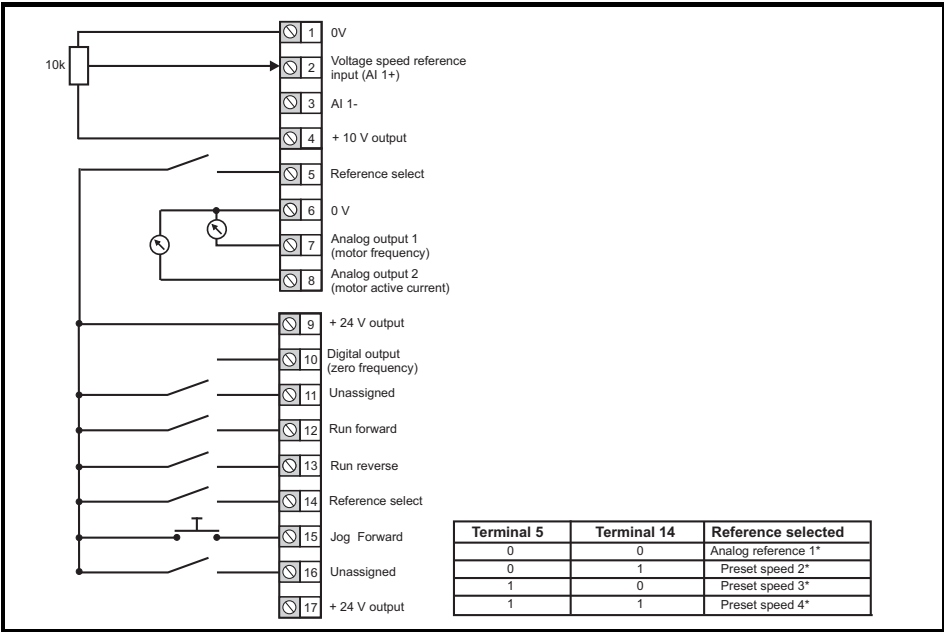
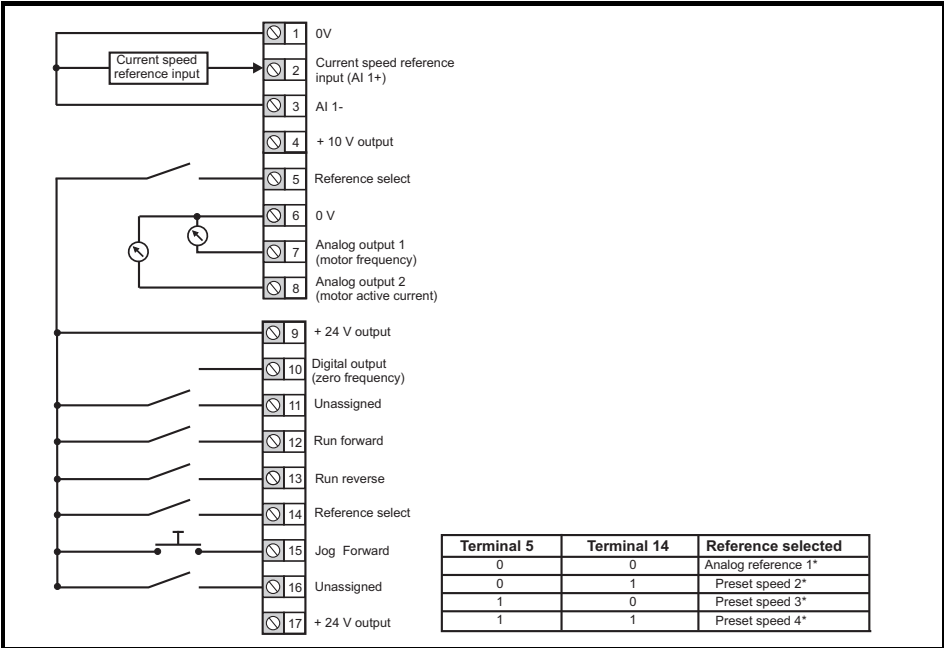
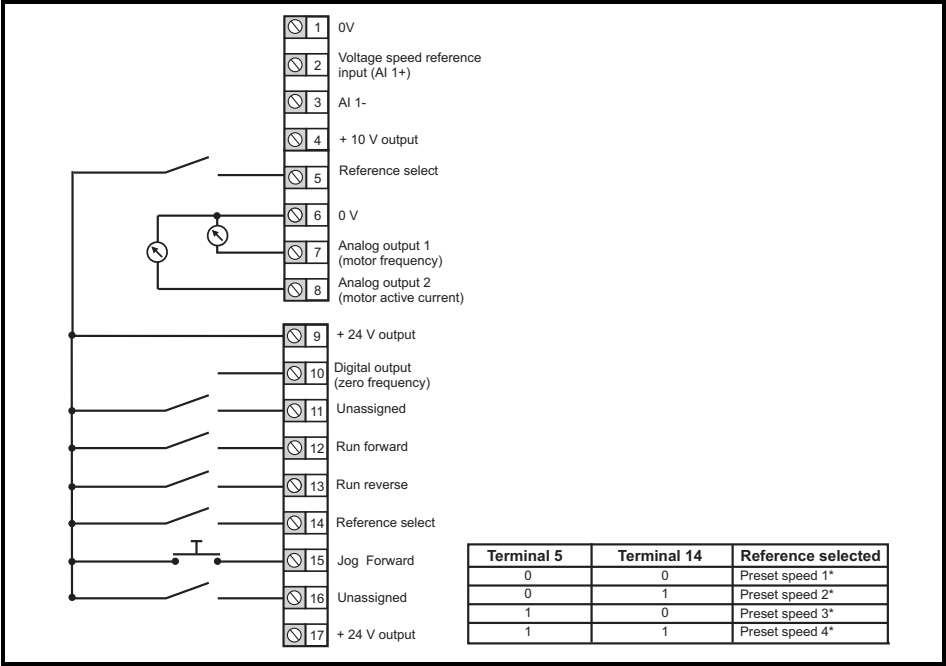


Figure 4-4 Pr 00.005 = AI Preset



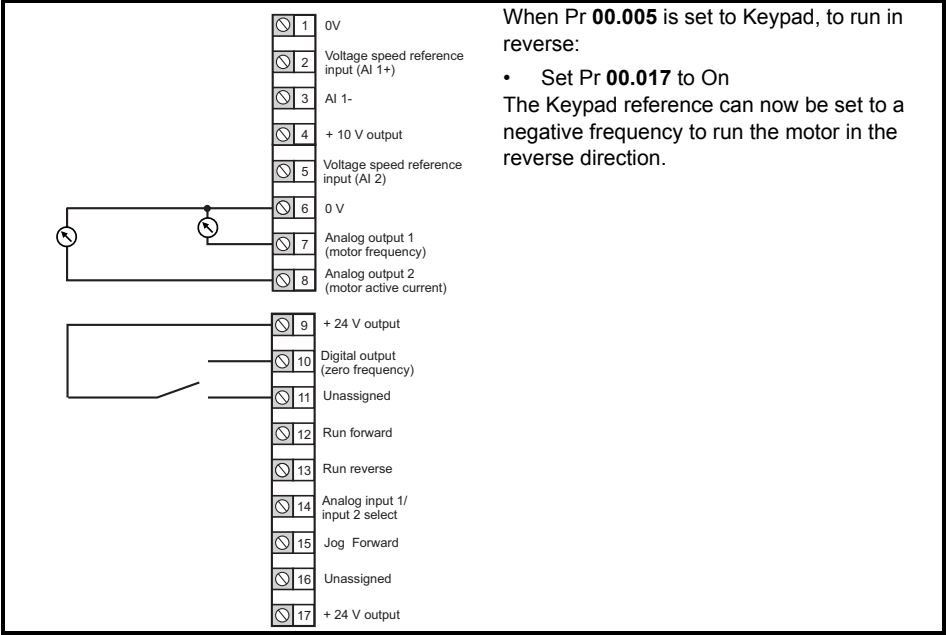
\* Refer to the *Control User Guide*.

Figure 4-5 Pr 00.005 = Preset

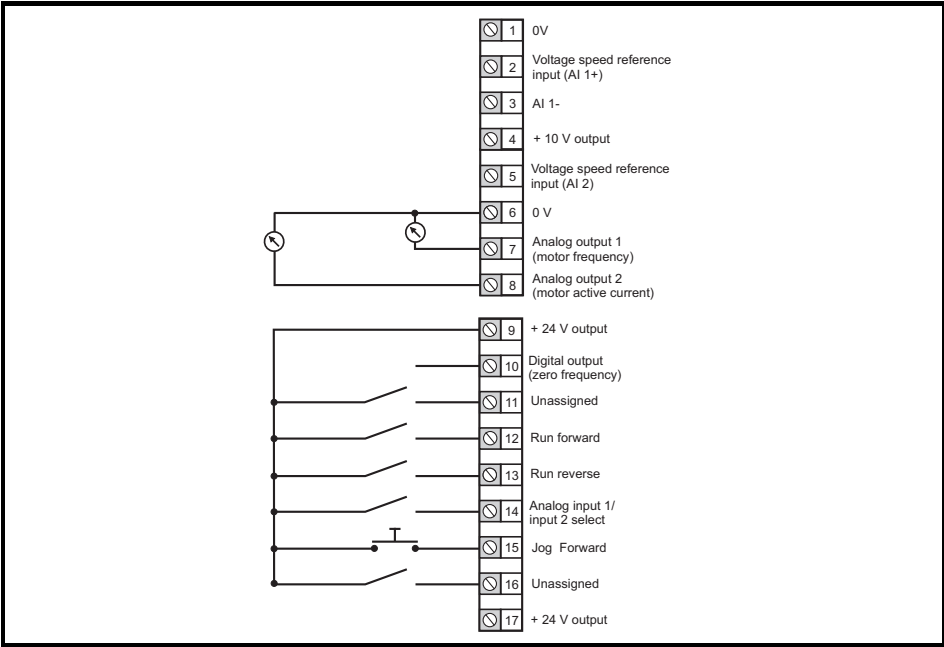


\* Refer to the *Control User Guide*.

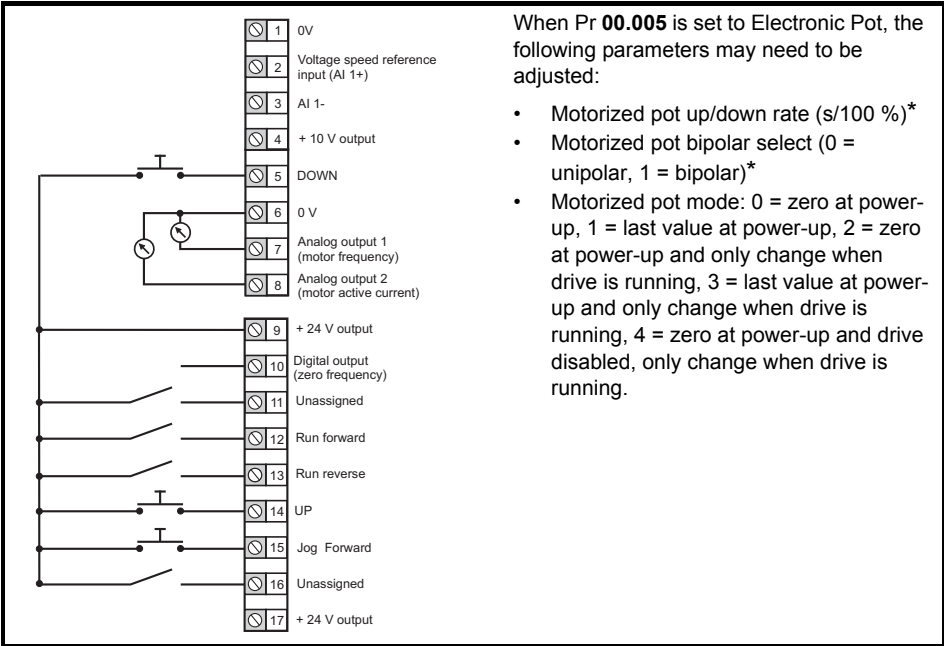
Figure 4-6 Pr 00.005 = Keypad



**Figure 4-7 Pr 00.005 = Keypad Ref**



**Figure 4-8 Pr 00.005 = Electronic Pot**



When Pr **00.005** is set to Electronic Pot, the following parameters may need to be adjusted:

- Motorized pot up/down rate (s/100 %)\*
- Motorized pot bipolar select (0 = unipolar, 1 = bipolar)\*
- Motorized pot mode: 0 = zero at power-up, 1 = last value at power-up, 2 = zero at power-up and only change when drive is running, 3 = last value at power-up and only change when drive is running, 4 = zero at power-up and drive disabled, only change when drive is running.

\* Refer to the *Control User Guide*.

Figure 4-9 Pr 00.005 = Torque Control

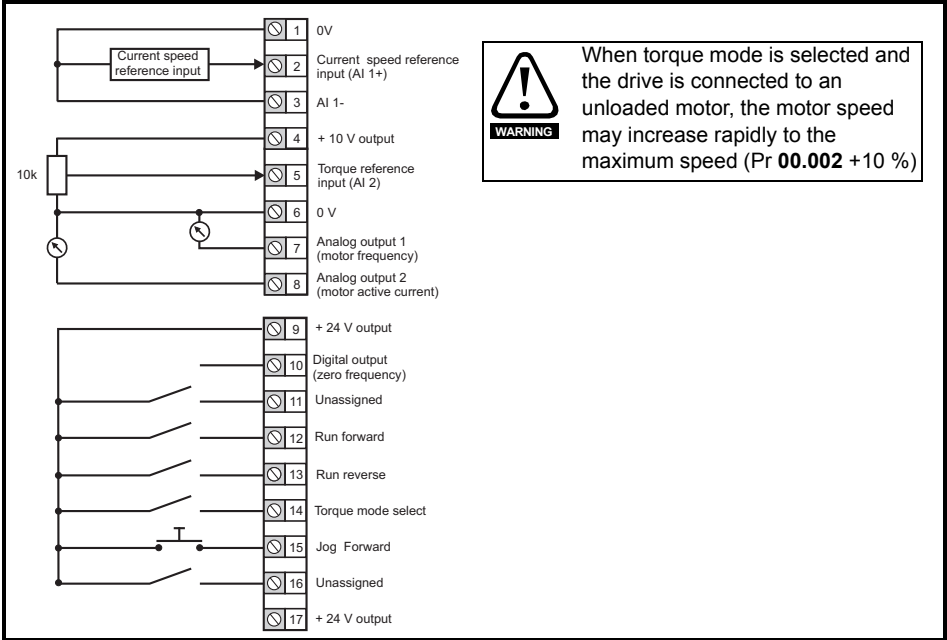
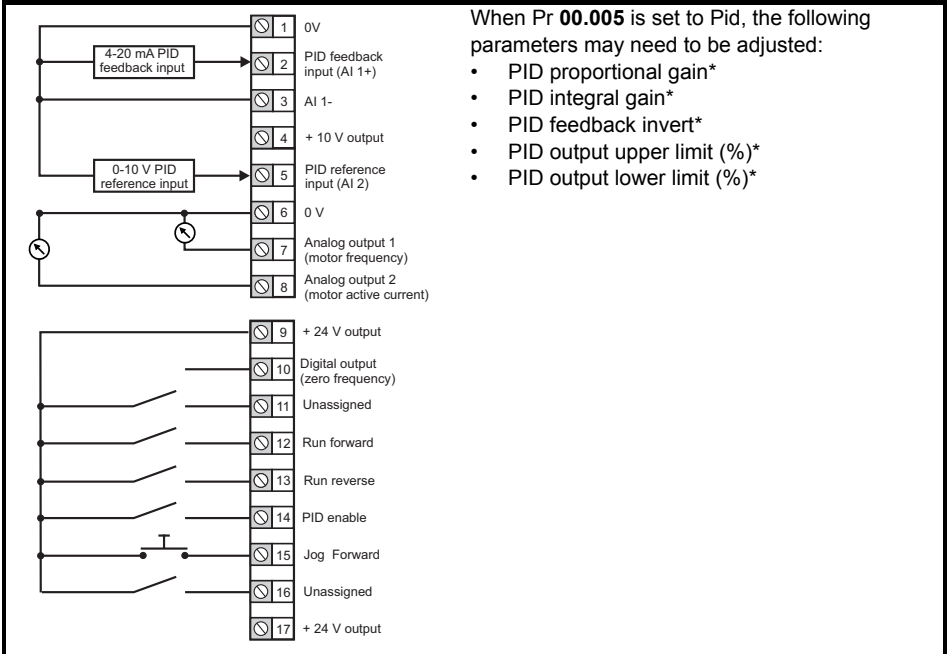


Figure 4-10 Pr 00.005 = PID Control



\* Refer to the *Control User Guide*.



## 4.2 Safe Torque Off (STO)


The Safe Torque Off function provides a means for preventing the drive from generating torque in the motor with a very high level of integrity. It is suitable for incorporation into a safety system for a machine. It is also suitable for use as a conventional drive enable input.

The safety function is active when either one or both STO inputs are in the logic-low state as specified in the control terminal specification. The function is defined according to EN 61800-5-2 and IEC 61800-5-2 as follows. (In these standards a drive offering safety-related functions is referred to as a PDS(SR)):


*'Power, that can cause rotation (or motion in the case of a linear motor), is not applied to the motor. The PDS(SR) will not provide energy to the motor which can generate torque (or force in the case of a linear motor).'*

This safety function corresponds to an uncontrolled stop in accordance with stop category 0 of IEC 60204-1. The Safe Torque Off function makes use of the special property of an inverter drive with an induction motor, which is that torque cannot be generated without the continuous correct active behavior of the inverter circuit. All credible faults in the inverter power circuit cause a loss of torque generation.


The Safe Torque Off function is fail-safe, so when the Safe Torque Off input is disconnected the drive will not operate the motor, even if a combination of components within the drive has failed. Most component failures are revealed by the drive failing to operate. Safe Torque Off is also independent of the drive firmware.



The design of safety-related control systems must only be done by personnel with the required training and experience. The Safe Torque Off function will only ensure the safety of a machine if it is correctly incorporated into a complete safety system. The system must be subject to a risk assessment to confirm that the residual risk of an unsafe event is at an acceptable level for the application.



Safe Torque Off does not provide electrical isolation. The supply to the drive must be disconnected by an approved isolation device before gaining access to power connections.



It is essential to observe the maximum permitted voltage of 5 V for a safe low (disabled) state of Safe Torque Off. The connections to the drive must be arranged so that voltage drops in the 0 V wiring cannot exceed this value under any loading condition. It is strongly recommended that the Safe Torque Off circuits be provided with a dedicated 0 V conductors which should be connected to terminals 32 and 36 at the drive.

Figure 4-11 Frame 1 to 4 STO connections

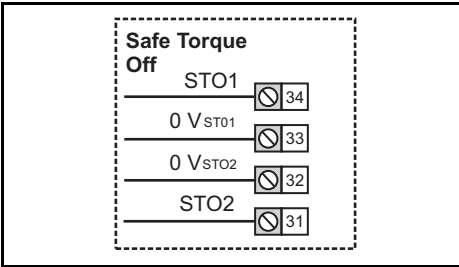
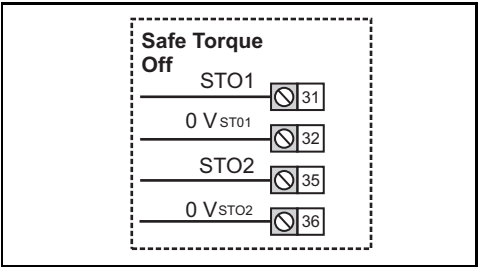


Figure 4-12 Frame 5 and above STO connections



**NOTE****Frame 1 to 4**

The 0 V terminals on the Safe Torque Off are isolated from each other and the 0 V common. On the size 2 110 V drives or when connecting single phase to a dual rated 200 V unit, the supply should be connected to L1 and L3.

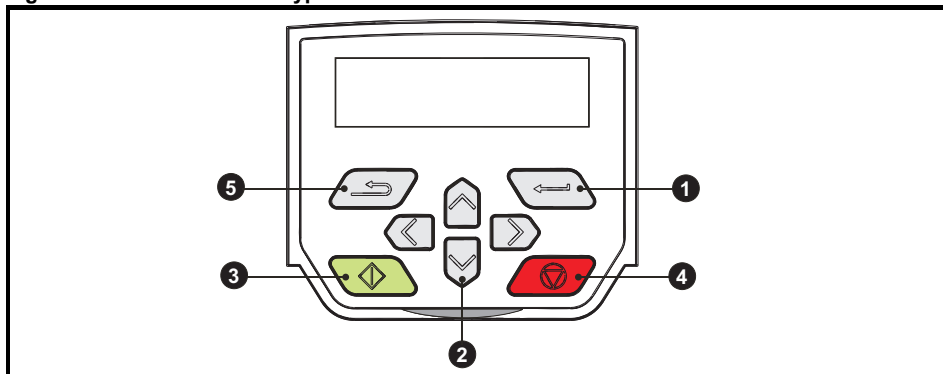
**NOTE****Frames 5 and above**

The 0 V terminals on the Safe Torque Off are not isolated from each other and the 0 V common.

## 5 Optional LCD keypad and display

The keypad and display provide information to the user regarding the operating status of the drive, alarms and trip codes, and provide the means for changing parameters, stopping and starting the drive, and the ability to perform a drive reset.

**Figure 5-1 Unidrive M400 keypad detail**



- (1) The *Enter* button is used to enter parameter view or edit mode, or to accept a parameter edit.
- (2) The *Navigation* buttons can be used to select individual parameters or to edit parameter values. In keypad mode, the 'Up' and 'Down' buttons are also used to increase or decrease the motor speed.
- (3) The *Start* button (green) is used to start the drive in keypad mode.
- (4) The *Stop / Reset* button (red) is used to stop and reset the drive in keypad mode. It can also be used to reset the drive in terminal mode.
- (5) The *Escape* button is used to exit from the parameter edit / view mode or disregard a parameter edit.

**NOTE**

The keypad is not supplied with the drive.

**NOTE**

It is possible to display alternative parameters on the multi line LCD display such as current magnitude. Refer to the *Control User Guide* for further information.

**Table 5-2 Status indications**

| Upper row string     | Description  | Drive output stage |
|----------------------|--|--------------------|
| <b>Inhibit</b>       | The drive is inhibited and cannot be run. The Safe Torque Off signal is not applied to Safe Torque Off terminals or is set to 0.       | Disabled           |
| <b>Ready</b>         | The drive is ready to run. The drive enable is active, but the drive inverter is not active because the final drive run is not active. | Disabled           |
| <b>Stop</b>          | The drive is stopped / holding zero frequency.   | Enabled            |
| <b>Run</b>           | The drive is active and running.   | Enabled            |
| <b>Supply Loss</b>   | Supply loss condition has been detected  | Enabled            |
| <b>Deceleration</b>  | The motor is being decelerated to zero frequency because the final drive run has been deactivated.                                     | Enabled            |
| <b>dc Injection</b>  | The drive is applying DC injection braking.  | Enabled            |
| <b>Trip</b>          | The drive has tripped and no longer controlling the motor. The trip code appears in the lower display.                                 | Disabled           |
| <b>Under Voltage</b> | The drive is in the under voltage state either in low voltage or high voltage mode.  | Disabled           |
| <b>Heat</b>          | The motor pre-heat function is active  | Enabled            |

## 5.1 Saving parameters


When changing a parameter in Menu 0, the new value is saved when pressing the Enter button



to return to parameter view mode from parameter edit mode.

If parameters have been changed in the advanced menus, then the change will not be saved automatically. A save function must be carried out.


### Procedure

1. Select 'Save parameters' in Pr **mm.000** (alternatively enter a value of 1001 in Pr **mm.000**)
2. Either:
  - Press the red  reset button
  - Carry out a drive reset through serial communications by setting Pr **10.038** to 100

## 5.2 Restoring parameter defaults

Restoring parameter defaults by this method saves the default values in the drives memory. *User security status* (00.010) and *User security code* (00.025) are not affected by this procedure).

### Procedure

1. Ensure the drive is not enabled, i.e. drive is in inhibit or under voltage state.
2. Select 'Reset 50 Hz Defs' or 'Reset 60 Hz Defs' in Pr **mm.000**. (alternatively, enter 1233 (50 Hz settings) or 1244 (60 Hz settings) in Pr **mm.000**).
3. Either:
  - Press the red  reset button
  - Carry out a drive reset through serial communications by setting Pr **10.038** to 100

## 6 Basic parameters (Menu 0)

Menu 0 is used to bring together various commonly used parameters for basic easy set up of the drive.

### 6.1 Menu 0: Basic parameters

| Parameter |                               | Range (⇅)   |       | Default (⇒)   |  | Type |     |    |    |    |    |
|-----------|-------------------------------|---|-------|---|--|------|-----|----|----|----|----|
|           |                               | OL  | RFC-A | OL  | RFC-A  |      |     |    |    |    |    |
| 00.001    | Minimum Speed                 | 0.00 to Pr 00.002 Hz  |       | 0.00 Hz   |  | RW   | Num |    |    |    | US |
| 00.002    | Maximum Speed                 | 0.00 to 550.00 Hz   |       | 50Hz default: 50.00 Hz<br>60Hz default: 60.00 Hz  |  | RW   | Num |    |    |    | US |
| 00.003    | Acceleration Rate 1           | 0.0 to 32000.0 s/100 Hz   |       | 5.0 s/100 Hz  |  | RW   | Num |    |    |    | US |
| 00.004    | Deceleration Rate 1           | 0.0 to 32000.0 s/100 Hz   |       | 10.0 s/100 Hz   |  | RW   | Num |    |    |    | US |
| 00.005    | Drive Configuration           | AV (0), AI (1), AV Preset (2),<br>AI Preset (3), Preset (4),<br>Keypad (5), Keypad Ref (6),<br>Electronic Pot (7),<br>Torque Control (8),<br>Pid Control (9)  |       | AV (0)  |  | RW   | Txt |    |    | PT | US |
| 00.006    | Motor Rated Current           | 0.00 to Drive Rating A  |       | Maximum Heavy Duty<br>Rating A  |  | RW   | Num |    | RA |    | US |
| 00.007    | Motor Rated Speed*            | 0.0 to 33000.0 rpm  |       | 50Hz<br>default:<br>1500.0 rpm<br>60Hz<br>default:<br>1800.0 rpm  | 50Hz<br>default:<br>1450.0 rpm<br>60Hz<br>default:<br>1750.0 rpm | RW   | Num |    |    |    | US |
| 00.008    | Motor Rated Voltage           | 0 to 765 V  |       | 200V drive: 230 V<br>400V drive 50 Hz: 400 V<br>400V drive 60 Hz: 460 V<br>575 V drive: 575 V<br>690 V drive: 690 V |  | RW   | Num |    | RA |    | US |
| 00.009    | Motor Rated Power<br>Factor** | 0.00 to 1.00  |       | 0.85  |  | RW   | Num |    | RA |    | US |
| 00.010    | User Security Status          | Level 1 (0), Level 2 (1),<br>All Menus (2), Status Only (3),<br>No Access (4)   |       | Level 1 (0)   |  | RW   | Num | ND |    | PT |    |
| 00.011    | Start/Stop Logic<br>Select    | 0 to 6  |       | 5   |  | RW   | Num |    |    |    | US |
| 00.012    | Input Logic Polarity          | Negative Logic (0) or<br>Positive Logic (1)   |       | Positive Logic (1)  |  | RW   | Txt |    |    |    | US |
| 00.015    | Jog Reference                 | 0.00 to 300.00 Hz   |       | 1.50 Hz   |  | RW   | Num |    |    |    | US |
| 00.016    | Analog Input 1 Mode           | 4-20 mA Stop (-6),<br>20-4 mA Stop (-5), 4-20 mA Low (-4),<br>20-4 mA Low (-3), 4-20 mA Hold (-2),<br>20-4 mA Hold (-1), 0-20 mA (0),<br>20-0 mA (1), 4-20 mA Trp (2),<br>20-4 mA Trp (3), 4-20 mA (4),<br>20-4 mA (5), Voltage (6) |       | Voltage (6)   |  | RW   | Txt |    |    |    | US |
| 00.017    | Bipolar Reference<br>Enable   | Off (0) or On (1)   |       | Off (0)   |  | RW   | Bit |    |    |    | US |
| 00.018    | Preset Reference 1            | 0.00 to Pr 00.002 Hz  |       | 0.00 Hz   |  | RW   | Num |    |    |    | US |
| 00.019    | Preset Reference 2            | 0.00 to Pr 00.002 Hz  |       | 0.00 Hz   |  | RW   | Num |    |    |    | US |
| 00.020    | Preset Reference 3            | 0.00 to Pr 00.002 Hz  |       | 0.00 Hz   |  | RW   | Num |    |    |    | US |
| 00.021    | Preset Reference 4            | 0.00 to Pr 00.002 Hz  |       | 0.00 Hz   |  | RW   | Num |    |    |    | US |
| 00.022    | Status Mode<br>Parameter 2    | 0.000 to 30.999   |       | 4.020   |  | RW   | Num |    |    | PT | US |
| 00.023    | Status Mode<br>Parameter 1    | 0.000 to 30.999   |       | 2.001   |  | RW   | Num |    |    | PT | US |

| Parameter |  | Range (⇅)  |  | Default (⇒)                      |        | Type |     |    |    |    |    |
|-----------|--|--|--|----------------------------------|--------|------|-----|----|----|----|----|
|           |  | OL   | RFC-A  | OL                               | RFC-A  |      |     |    |    |    |    |
| 00.024    | Customer Defined Scaling                         | 0.000 to 10.000  |  | 1.000                            |        | RW   | Num |    |    |    | US |
| 00.025    | User Security Code                               | 0 to 9999  |  | 0                                |        | RW   | Num | ND |    | PT | US |
| 00.027    | Power-up Keypad Control Mode Reference           | Reset (0), Last (1), Preset (2)  |  | Reset (0)                        |        | RW   | Txt |    |    |    | US |
| 00.028    | Ramp Mode Select                                 | Fast (0), Standard (1), Std boost (2), Fast boost (3)  |  | Standard (1)                     |        | RW   | Txt |    |    |    | US |
| 00.029    | Ramp Enable                                      |  | Off (0) or On (1)  |                                  | On (1) | RW   | Bit |    |    |    | US |
| 00.030    | Parameter Cloning                                | None (0), Read (1), Program (2), Auto (3), Boot (4)  |  | None (0)                         |        | RW   | Txt |    | NC |    | US |
| 00.031    | Stop Mode  | Coast (0), Ramp (1), Ramp dc I (2), dc I (3), Timed dc I (4), Disable (5)                                | Coast (0), Ramp (1), Ramp dc I (2), dc I (3), Timed dc I (4), Disable (5), No Ramp (6) | Ramp (1)                         |        | RW   | Txt |    |    |    | US |
| 00.032    | Dynamic V to F Select / Flux Optimization Select | 0 to 1   |  | 0                                |        | RW   | Num |    |    |    | US |
| 00.033    | Catch A Spinning Motor                           | Disable (0), Enable (1), Fwd Only (2), Rev Only (3)  |  | Disable (0)                      |        | RW   | Txt |    |    |    | US |
| 00.034    | Digital Input 5 Select                           | Input (0), Therm Short Cct (1), Thermistor (2), Therm No Trip (3)  |  | Input (0)                        |        | RW   | Txt |    |    |    | US |
| 00.035    | Digital Output 1 Control                         | 0 to 21  |  | 0                                |        | RW   | Num |    |    |    | US |
| 00.036    | Analog Output 1 Control                          | 0 to 14  |  | 0                                |        | RW   | Txt |    |    |    | US |
| 00.037    | Maximum Switching Frequency                      | 0.667 (0), 1 (1), 2 (2), 3 (3), 4 (4), 6 (5), 8 (6), 12 (7), 16 (8) kHz                                  | 2 (2), 3 (3), 4 (4), 6 (5), 8 (6), 12 (7), 16 (8) kHz                                  | 3 (3) kHz                        |        | RW   | Txt |    |    |    | US |
| 00.038    | Autotune   | 0 to 2   | 0 to 3   | 0                                |        | RW   | Num |    | NC |    | US |
| 00.039    | Motor Rated Frequency                            | 0.00 to 550.00 Hz  |  | 50Hz: 50.00 Hz<br>60Hz: 60.00 Hz |        | RW   | Num |    |    |    | US |
| 00.040    | Number of Motor Poles***                         | Auto (0) to 32 (16)  |  | Auto (0)                         |        | RW   | Num |    |    |    | US |
| 00.041    | Control Mode                                     | Ur S (0), Ur (1), Fixed (2), Ur Auto (3), Ur I (4), Square (5), Fixed Tapered (6)                        |  | Ur I (4)                         |        | RW   | Txt |    |    |    | US |
| 00.042    | Low Frequency Voltage Boost                      | 0.0 to 25.0 %  |  | 3.0 %                            |        | RW   | Num |    |    |    | US |
| 00.043    | Serial Baud Rate                                 | 600 (1), 1200 (2), 2400 (3), 4800 (4), 9600 (5), 19200 (6), 38400 (7), 57600 (8), 76800 (9), 115200 (10) |  | 19200 (6)                        |        | RW   | Txt |    |    |    | US |
| 00.044    | Serial Address                                   | 1 to 247   |  | 1                                |        | RW   | Num |    |    |    | US |
| 00.045    | Reset Serial Communications                      | Off (0) or On (1)  |  | Off (0)                          |        | RW   |     | ND | NC |    | US |
| 00.046    | Brake Controller Upper Current Threshold         | 0 to 200 %   |  | 50 %                             |        | RW   | Num |    |    |    | US |
| 00.047    | Brake Controller Lower Current Threshold         | 0 to 200 %   |  | 10 %                             |        | RW   | Num |    |    |    | US |

| Parameter |   | Range (⇅)  |   | Default (⇒)   |                          | Type |     |    |    |    |    |
|-----------|---|--|---|---------------|--------------------------|------|-----|----|----|----|----|
|           |   | OL   | RFC-A   | OL            | RFC-A                    |      |     |    |    |    |    |
| 00.048    | Brake Controller Brake Release Frequency            | 0.00 to 20.00 Hz                                     |   | 1.00 Hz       |                          | RW   | Num |    |    |    | US |
| 00.049    | Brake Controller Brake Apply Frequency              | 0.00 to 20.00 Hz                                     |   | 2.00 Hz       |                          | RW   | Num |    |    |    | US |
| 00.050    | Brake Controller Brake Delay                        | 0.0 to 25.0 s  |   | 1.0 s         |                          | RW   | Num |    |    |    | US |
| 00.051    | Brake Controller Post-brake Release Delay           | 0.0 to 25.0 s  |   | 1.0 s         |                          | RW   | Num |    |    |    | US |
| 00.053    | Brake Controller Initial Direction                  | Ref (0), Forward (1), Reverse (2)                    |   | Ref (0)       |                          | RW   | Txt |    |    |    | US |
| 00.054    | Brake Controller Brake Apply Through Zero Threshold | 0.00 to 25.00 Hz                                     |   | 1.00 Hz       |                          | RW   | Num |    |    |    | US |
| 00.055    | Brake Controller Enable                             | Disable (0), Relay (1), Digital IO (2), User (3)     |   | Disable (0)   |                          | RW   | Txt |    |    |    | US |
| 00.056    | Trip 0  | 0 to 255   |   |               |                          | RO   | Txt | ND | NC | PT | PS |
| 00.057    | Trip 1  | 0 to 255   |   |               |                          | RO   | Txt | ND | NC | PT | PS |
| 00.058    | Trip 2  | 0 to 255   |   |               |                          | RO   | Txt | ND | NC | PT | PS |
| 00.059    | OUP Enable  | Stop (0) or Run (1)                                  |   | Run (1)       |                          | RW   | Txt |    |    |    | US |
| 00.060    | OUP Status  | -2147483648 to 2147483647                            |   |               |                          | RO   | Num | ND | NC | PT |    |
| 00.065    | Frequency Controller Proportional Gain Kp1          |  | 0.000 to 200.000 s/rad                        |               | 0.100 s/rad              | RW   | Num |    |    |    | US |
| 00.066    | Frequency Controller Integral Gain Ki1              |  | 0.00 to 655.35 s <sup>2</sup> /rad            |               | 0.10 s <sup>2</sup> /rad | RW   | Num |    |    |    | US |
| 00.067    | Sensorless Mode Filter                              |  | 4 (0), 5 (1), 6 (2), 8 (3), 12 (4), 20 (5) ms |               | 4 (0) ms                 | RW   | Txt |    |    |    | US |
| 00.069    | Spin Start Boost                                    | 0.0 to 10.0  |   | 1.0           |                          | RW   | Num |    |    |    | US |
| 00.070    | PID1 Output   | ±100.00 %  |   |               |                          | RO   | Num | ND | NC | PT |    |
| 00.071    | PID1 Proportional Gain                              | 0.000 to 4.000                                       |   | 1.000         |                          | RW   | Num |    |    |    | US |
| 00.072    | PID1 Integral Gain                                  | 0.000 to 4.000                                       |   | 0.500         |                          | RW   | Num |    |    |    | US |
| 00.073    | PID1 Feedback Invert                                | Off (0) or On (1)                                    |   | Off (0)       |                          | RW   | Bit |    |    |    | US |
| 00.074    | PID1 Output Upper Limit                             | 0.00 to 100.00 %                                     |   | 100.00 %      |                          | RW   | Num |    |    |    | US |
| 00.075    | PID1 Output Lower Limit                             | ±100.00 %  |   | -100.00 %     |                          | RW   | Num |    |    |    | US |
| 00.076    | Action on Trip Detection                            | 0 to 31  |   | 0             |                          | RW   | Num | ND | NC | PT | US |
| 00.077    | Maximum Heavy Duty Current Rating                   | 0.00 to Drive HD Current Rating A                    |   |               |                          | RO   | Num | ND | NC | PT |    |
| 00.078    | Software Version                                    | 0 to 99.99.99.99                                     |   |               |                          | RO   | Num | ND | NC | PT |    |
| 00.079    | User Drive Mode                                     | Open loop (1), RFC A (2)                             |   | Open loop (1) | RFC-A (2)                | RW   | Txt | ND | NC | PT | US |
| 00.081    | Reference Selected                                  | -Pr 00.002 to Pr 00.002 or Pr 00.001 to Pr 00.002 Hz |   |               |                          | RO   | Num | ND | NC | PT |    |
| 00.082    | Pre-ramp Reference                                  | -Pr 00.002 to Pr 00.002 or Pr 00.001 to Pr 00.002 Hz |   |               |                          | RO   | Num | ND | NC | PT |    |
| 00.083    | Final Demand Reference                              | -Pr 00.002 to Pr 00.002 or Pr 00.001 to Pr 00.002 Hz |   |               |                          | RO   | Num | ND | NC | PT | FI |
| 00.084    | D.C. Bus Voltage                                    | 0 to 1190 V  |   |               |                          | RO   | Num | ND | NC | PT | FI |
| 00.085    | Output Frequency                                    | ±550.00 Hz   |   |               |                          | RO   | Num | ND | NC | PT | FI |

| Parameter     |                          | Range (⇧)                    |       | Default (⇨) |       | Type |     |    |    |    |    |
|---------------|--------------------------|------------------------------|-------|-------------|-------|------|-----|----|----|----|----|
|               |                          | OL                           | RFC-A | OL          | RFC-A |      |     |    |    |    |    |
| <b>00.086</b> | Output Voltage           | 0 to 930 V                   |       |             |       | RO   | Num | ND | NC | PT | FI |
| <b>00.087</b> | Motor Rpm                | ±33000.0 rpm                 |       |             |       | RO   | Num | ND | NC | PT | FI |
| <b>00.088</b> | Current Magnitude        | 0 to Drive Maximum Current A |       |             |       | RO   | Num | ND | NC | PT | FI |
| <b>00.089</b> | Torque Producing Current | ±Drive Maximum Current A     |       |             |       | RO   | Num | ND | NC | PT | FI |
| <b>00.090</b> | Digital I/O Read Word    | 000000000000 to 111111111111 |       |             |       | RO   | Bin | ND | NC | PT |    |
| <b>00.091</b> | Reference On             | Off (0) or On (1)            |       |             |       | RO   | Bit | ND | NC | PT |    |
| <b>00.092</b> | Reverse Select           | Off (0) or On (1)            |       |             |       | RO   | Bit | ND | NC | PT |    |
| <b>00.093</b> | Jog Select               | Off (0) or On (1)            |       |             |       | RO   | Bit | ND | NC | PT |    |
| <b>00.094</b> | Analog Input 1           | ±100.00 %                    |       |             |       | RO   | Num | ND | NC | PT | FI |
| <b>00.095</b> | Analog Input 2           | ±100.00 %                    |       |             |       | RO   | Num | ND | NC | PT | FI |

\* Setting Pr **00.007** to 0.0 will disable slip compensation.

\*\* Following a rotating autotune, Pr **00.009** is continuously written to by the drive, calculated from the value of *Stator Inductance* (Pr **05.025**). To manually enter a value into Pr **00.009**, Pr **05.025** will need to be set to 0. Refer to the description of Pr **05.010** in the *Parameter Reference Guide* for further details.

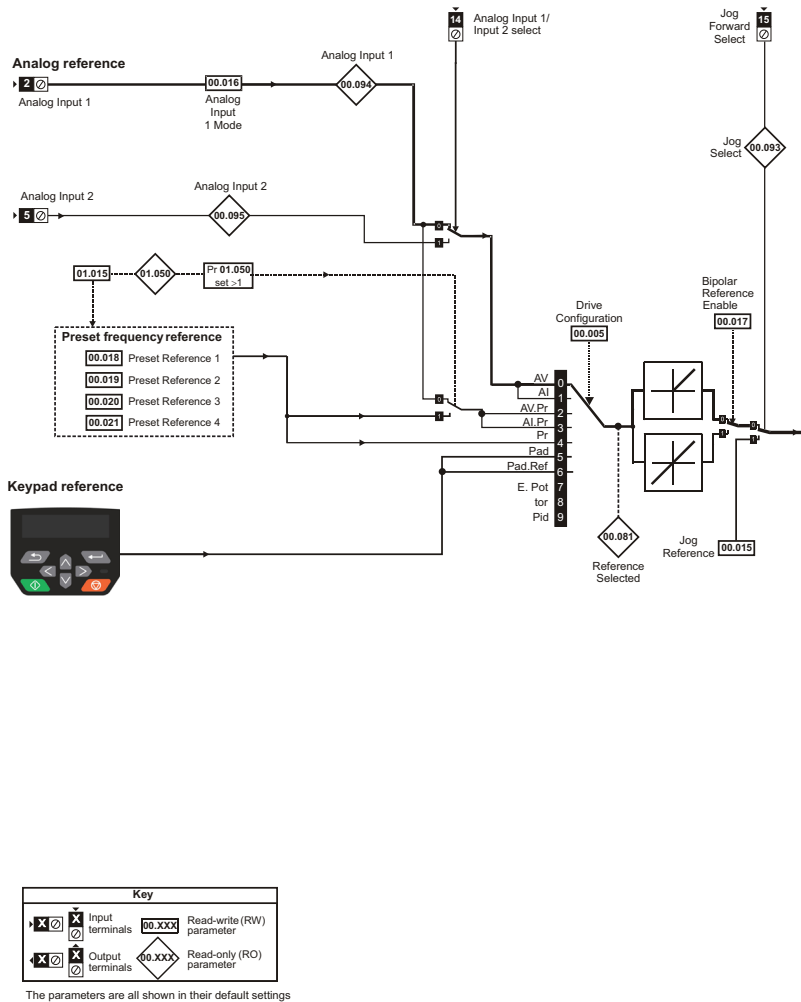
\*\*\* If this parameter is read via serial communications, it will show pole pairs.

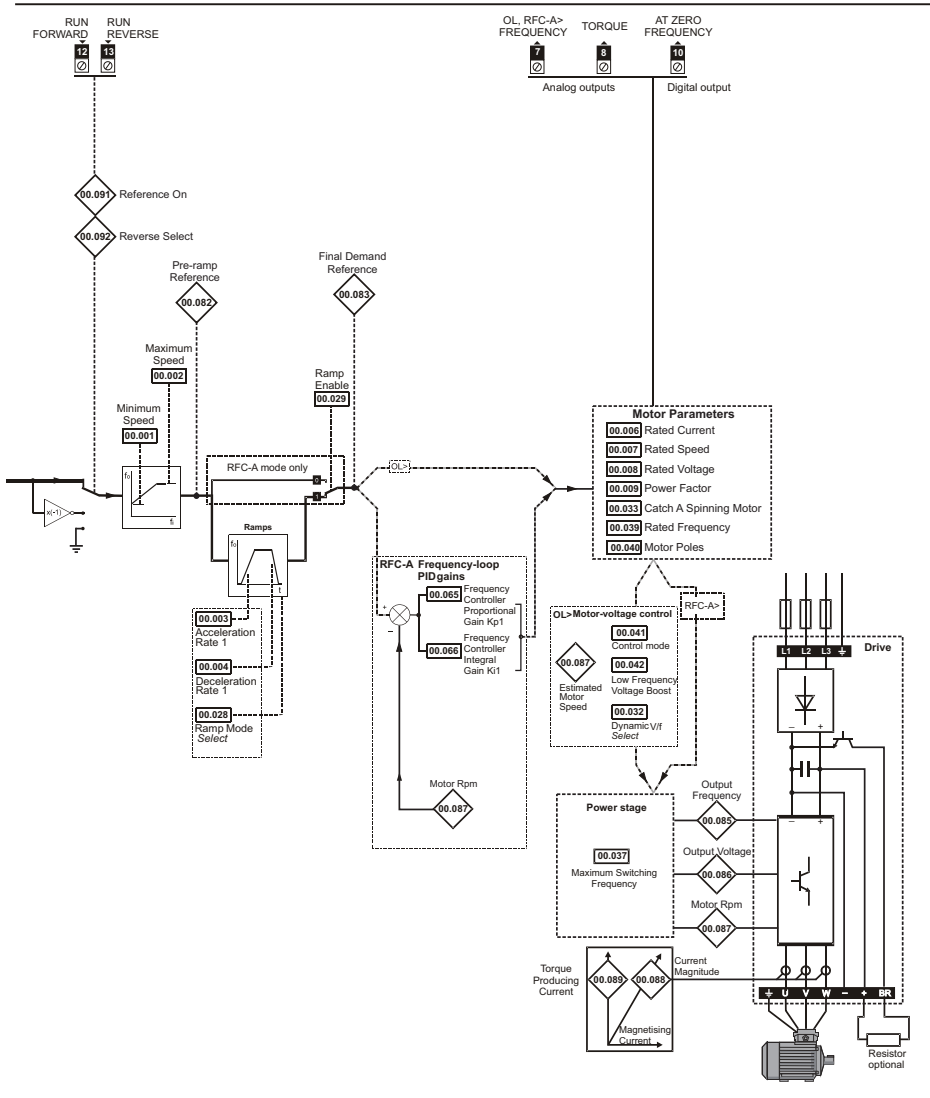
| RW | Read / Write     | RO | Read only  | Num | Number parameter    | Bit | Bit parameter    | Txt | Text string | Bin | Binary parameter | FI | Filtered    |
|----|------------------|----|------------|-----|---------------------|-----|------------------|-----|-------------|-----|------------------|----|-------------|
| ND | No default value | NC | Not copied | PT  | Protected parameter | RA  | Rating dependent | US  | User save   | PS  | Power-down save  | DE | Destination |





Figure 6-1 Menu 0 logic diagram





## 6.2 Unidrive M400 parameter descriptions

Key:

| RW | Read / Write     | RO | Read only  | Num | Number parameter    | Bit | Bit parameter    | Txt | Text string | Bin | Binary parameter | FI | Filtered    |
|----|------------------|----|------------|-----|---------------------|-----|------------------|-----|-------------|-----|------------------|----|-------------|
| ND | No default value | NC | Not copied | PT  | Protected parameter | RA  | Rating dependent | US  | User save   | PS  | Power-down save  | DE | Destination |

| 00.001 |   | Minimum Speed        |  |  |  |  |   |         |  |  |  |    |  |
|--------|---|----------------------|--|--|--|--|---|---------|--|--|--|----|--|
| RW     |   | Num                  |  |  |  |  |   |         |  |  |  | US |  |
| OL     | ↕ | 0.00 to Pr 00.002 Hz |  |  |  |  | ⇒ | 0.00 Hz |  |  |  |    |  |
| RFC-A  |   |                      |  |  |  |  |   |         |  |  |  |    |  |

Set Pr 00.001 at the required minimum output frequency of the drive for both directions of rotation. The drive speed reference is scaled between Pr 00.001 and Pr 00.002. Pr 00.001 is a nominal value; slip compensation may cause the actual frequency to be higher. When the drive is jogging, Pr 00.001 has no effect.

| 00.002 |   | Maximum Speed     |  |  |  |  |   |  |  |  |  |    |  |
|--------|---|-------------------|--|--|--|--|---|--|--|--|--|----|--|
| RW     |   | Num               |  |  |  |  |   |  |  |  |  | US |  |
| OL     | ↕ | 0.00 to 550.00 Hz |  |  |  |  | ⇒ | 50.0 Hz default: 50.00 Hz<br>60.0 Hz default: 60.00 Hz |  |  |  |    |  |
| RFC-A  |   |                   |  |  |  |  |   |  |  |  |  |    |  |

Set Pr 00.002 at the required maximum output frequency for both directions of rotation. The drive speed reference is scaled between Pr 00.001 and Pr 00.002. Pr 00.002 is a nominal value; slip compensation may cause the actual frequency to be higher. The drive has additional over-speed protection.

| 00.003 |   | Acceleration Rate 1     |  |  |  |  |   |              |  |  |  |    |  |
|--------|---|-------------------------|--|--|--|--|---|--------------|--|--|--|----|--|
| RW     |   | Num                     |  |  |  |  |   |              |  |  |  | US |  |
| OL     | ↕ | 0.0 to 32000.0 s/100 Hz |  |  |  |  | ⇒ | 5.0 s/100 Hz |  |  |  |    |  |
| RFC-A  |   |                         |  |  |  |  |   |              |  |  |  |    |  |

Set Pr 00.003 at the required rate of acceleration. Note that larger values produce lower acceleration. The rate applies in both directions of rotation.

| 00.004 |     | Deceleration Rate 1     |  |  |   |               |  |    |  |
|--------|-----|-------------------------|--|--|---|---------------|--|----|--|
| RW     | Num |                         |  |  |   |               |  | US |  |
| OL     | ↕   | 0.0 to 32000.0 s/100 Hz |  |  | ⇒ | 10.0 s/100 Hz |  |    |  |
| RFC-A  |     |                         |  |  |   |               |  |    |  |

Set Pr **00.004** at the required rate of deceleration. Note that larger values produce lower deceleration. The rate applies in both directions of rotation.

| 00.005 |     | Drive Configuration   |  |  |   |        |    |    |  |
|--------|-----|---|--|--|---|--------|----|----|--|
| RW     | Txt |   |  |  |   |        | PT | US |  |
| OL     | ↕   | AV (0), AI (1), AV Preset (2),<br>AI Preset (3), Preset (4),<br>Keypad (5), Keypad Ref (6),<br>Electronic Pot (7),<br>Torque Control (8), Pid Control (9) |  |  | ⇒ | AV (0) |    |    |  |

Use Pr **00.005** to select the required frequency/speed reference as follows:

| Value | Text           | Description   |
|-------|----------------|---|
| 0     | AV             | Analog Input 1 (voltage) or Analog Input 2 (voltage) selected by terminal (Local/Remote)                                    |
| 1     | AI             | Analog Input 1 (current) or Analog Input 2 (voltage) selected by terminal (Local/Remote)                                    |
| 2     | AV Preset      | Analog Input 1 (voltage) or 3 presets selected by terminal  |
| 3     | AI Preset      | Analog Input 1 (current) or 3 presets selected by terminal  |
| 4     | Preset         | Four presets selected by terminal   |
| 5     | Keypad         | Keypad reference  |
| 6     | Keypad Ref     | Keypad reference with terminal control  |
| 7     | Electronic Pot | Electronic Potentiometer  |
| 8     | Torque Control | Torque mode, Analog Input 1 (current frequency reference) or Analog Input 2 (voltage torque reference) selected by terminal |
| 9     | Pid Control    | PID mode, Analog Input 1 (current feedback source) and Analog Input 2 (voltage reference source)                            |

**NOTE** A change to Pr **00.005** is set by pressing the ENTER button on exit from parameter edit mode. The drive must be disabled, stopped or tripped for a change to take place. If Pr **00.005** is changed while the drive is running, when the ENTER button is pressed on exit from parameter edit mode, Pr **00.005** will change back to its previous value.

**NOTE** When the setting of Pr **00.005** is changed, the appropriate drive configuration parameters are set back to their default values.

| 00.006 |   | Motor Rated Current    |  |  |  |   |                             |    |  |    |  |
|--------|---|------------------------|--|--|--|---|-----------------------------|----|--|----|--|
| RW     |   | Num                    |  |  |  |   |                             | RA |  | US |  |
| OL     | ⇕ | 0.00 to Drive Rating A |  |  |  | ⇒ | Maximum Heavy Duty Rating A |    |  |    |  |
| RFC-A  |   |                        |  |  |  |   |                             |    |  |    |  |

The rated current parameter must be set to the maximum continuous current of the motor (taken from the name plate). The motor rated current is used in the following:

- Current limits
- Motor thermal overload protection
- Vector mode voltage control
- Slip compensation
- Dynamic V/F control

| 00.007 |   | Motor Rated Speed  |  |  |  |   |                           |  |  |    |  |
|--------|---|--------------------|--|--|--|---|---------------------------|--|--|----|--|
| RW     |   | Num                |  |  |  |   |                           |  |  | US |  |
| OL     | ⇕ | 0.0 to 33000.0 rpm |  |  |  | ⇒ | 50 Hz default: 1500.0 rpm |  |  |    |  |
| RFC-A  |   |                    |  |  |  |   | 60 Hz default: 1800.0 rpm |  |  |    |  |
|        |   |                    |  |  |  |   | 50 Hz default: 1450.0 rpm |  |  |    |  |
|        |   |                    |  |  |  |   | 60 Hz default: 1750.0rpm  |  |  |    |  |

Set to the rated speed of the motor (taken from the motor name plate). The motor rated speed is used to calculate the correct slip speed for the motor.

| 00.008 |   | Motor Rated Voltage |  |  |  |   |                          |    |  |    |  |
|--------|---|---------------------|--|--|--|---|--------------------------|----|--|----|--|
| RW     |   | Num                 |  |  |  |   |                          | RA |  | US |  |
| OL     | ⇕ | 0 to 765 V          |  |  |  | ⇒ | 200 V drive: 230 V       |    |  |    |  |
| RFC-A  |   |                     |  |  |  |   | 400 V drive 50 Hz: 400 V |    |  |    |  |
|        |   |                     |  |  |  |   | 400 V drive 60 Hz: 460 V |    |  |    |  |
|        |   |                     |  |  |  |   | 575 V drive: 575 V       |    |  |    |  |
|        |   |                     |  |  |  |   | 690 V drive: 690 V       |    |  |    |  |

The *Rated Voltage* (00.008) and the *Rated Frequency* (00.039) are used to define the voltage to frequency characteristic applied to the motor. The *Rated Frequency* (00.039) is also used in conjunction with the *Motor Rated Speed* (00.007) to calculate the rated slip for slip compensation.

| 00.009 |   | Motor Rated Power Factor |  |  |  |   |      |    |  |    |  |
|--------|---|--------------------------|--|--|--|---|------|----|--|----|--|
| RW     |   | Num                      |  |  |  |   |      | RA |  | US |  |
| OL     | ⇕ | 0.00 to 1.00             |  |  |  | ⇒ | 0.85 |    |  |    |  |
| RFC-A  |   |                          |  |  |  |   |      |    |  |    |  |

Enter the motor rated power factor  $\cos \varphi$  (taken from the motor name plate).

The drive can measure the motor rated power factor by performing a rotating autotune (see Autotune (Pr 00.038)).

| 00.010 |   | User Security Status  |  |  |  |    |             |    |    |  |
|--------|---|---|--|--|--|----|-------------|----|----|--|
| RW     |   | Num   |  |  |  | ND | NC          | PT | US |  |
| OL     | ⇕ | Level 1 (0), Level 2 (1),<br>All Menus (2), Status Only (3),<br>No Access (4) |  |  |  | ⇒  | Level 1 (0) |    |    |  |
| RFC-A  |   |   |  |  |  |    |             |    |    |  |

This parameter controls access via the drive keypad as follows:

| Value | Text        | Function   |
|-------|-------------|--|
| 0     | Level 1     | Access to first 10 parameters in Menu 0 only.  |
| 1     | Level 2     | Access to all parameters in Menu 0.  |
| 2     | All Menus   | Access to all menus.   |
| 3     | Status Only | The keypad remains in status mode and no parameters can be viewed or edited.   |
| 4     | No Access   | The keypad remains in status mode and no parameters can be viewed or edited. Drive parameters cannot be accessed via a comms/fieldbus interface in the drive or any option module. |

| 00.011 |   | Start/Stop Logic Select |  |  |  |   |   |  |    |  |
|--------|---|-------------------------|--|--|--|---|---|--|----|--|
| RW     |   | Num                     |  |  |  |   |   |  | US |  |
| OL     | ⇕ | 0 to 6                  |  |  |  | ⇒ | 5 |  |    |  |
| RFC-A  |   |                         |  |  |  |   |   |  |    |  |

This parameter changes the functions of the input terminals which are normally associated with the enabling, starting and stopping the drive.

| Pr 00.011 | Terminal 11       | Terminal 12       | Terminal 13       | Latching          |
|-----------|-------------------|-------------------|-------------------|-------------------|
| 0         | User programmable | Run Forward       | Run Reverse       | No                |
| 1         | /Stop             | Run Forward       | Run Reverse       | Yes               |
| 2         | User programmable | Run               | Forward/Reverse   | No                |
| 3         | /Stop             | Run               | Forward/Reverse   | Yes               |
| 4         | /Stop             | Run               | Jog Forward       | Yes               |
| 5         | User programmable | Run Forward       | Run Reverse       | No                |
| 6         | User programmable | User programmable | User programmable | User programmable |

Action will only occur if the drive is inactive. If the drive is active, the parameter will return to its pre-altered value on exit from edit mode.

| 00.012 |   | Input Logic Polarity                        |  |  |   |                    |  |    |  |
|--------|---|---|--|--|---|--------------------|--|----|--|
| RW     |   | Txt   |  |  |   |                    |  | US |  |
| OL     | ⇕ | Negative Logic (0) or<br>Positive Logic (1) |  |  | ⇒ | Positive Logic (1) |  |    |  |
| RFC-A  |   |   |  |  |   |                    |  |    |  |

Can be set to zero to change the logic for DI/O1-7 to negative logic, so that the state parameter is 0 if the digital I/O is high or 1 if the digital I/O is low.

| 00.015 |   | Jog Reference     |  |  |   |         |  |    |  |
|--------|---|-------------------|--|--|---|---------|--|----|--|
| RW     |   | Num               |  |  |   |         |  | US |  |
| OL     | ⇕ | 0.00 to 300.00 Hz |  |  | ⇒ | 1.50 Hz |  |    |  |
| RFC-A  |   |                   |  |  |   |         |  |    |  |

Defines the reference when jog is enabled.

| 00.016 |   | Analog Input 1 Mode  |  |  |   |             |  |    |  |
|--------|---|--|--|--|---|-------------|--|----|--|
| RW     |   | Txt  |  |  |   |             |  | US |  |
| OL     | ⇕ | 4-20 mA Stop (-6),<br>20-4 mA Stop (-5),<br>4-20 mA Low (-4), 20-4 mA Low (-3),<br>4-20 mA Hold (-2),<br>20-4 mA Hold (-1), 0-20 mA (0),<br>20-0 mA (1), 4-20 mA Trp (2),<br>20-4 mA Trp (3), 4-20 mA (4),<br>20-4 mA (5), Voltage (6) |  |  | ⇒ | Voltage (6) |  |    |  |
| RFC-A  |   |  |  |  |   |             |  |    |  |

Defines the mode of analog input 1.

The table below gives all the possible analog input modes.

| Value | Text         | Function   |
|-------|--------------|--|
| -6    | 4-20 mA Stop | Stop on loss   |
| -5    | 20-4 mA Stop | Stop on loss   |
| -4    | 4-20 mA Low  | 4-20 mA switching to equivalent of 4 mA input current on loss  |
| -3    | 20-4 mA Low  | 20-4 mA switching to equivalent of 20 mA input current on loss |
| -2    | 4-20 mA Hold | 4-20 mA hold at level before loss on loss                      |
| -1    | 20-4 mA Hold | 20-4 mA hold at level before loss on loss                      |
| 0     | 0-20 mA      | 0-20 mA  |
| 1     | 20-0 mA      | 20-0 mA  |
| 2     | 4-20 mA Trp  | 4-20 mA trip on loss   |
| 3     | 20-4 mA Trp  | 20-4 mA trip on loss   |
| 4     | 4-20 mA      | 4-20 mA no action on loss                                      |
| 5     | 20-4 mA      | 20-4 mA no action on loss                                      |
| 6     | Voltage      | Voltage  |

**NOTE** In 4-20 mA and 20-4 mA modes loss of input is detected if the current falls below 3 mA.

**NOTE** If both analog inputs (A1 and A2) are to be set-up as voltage inputs, and if the potentiometers are supplied from the drive's +10 V rail (terminal T4), they must have a resistance >4 k $\Omega$  each.

| 00.017 |                | Bipolar Reference Enable |  |  |               |         |  |    |  |
|--------|----------------|--------------------------|--|--|---------------|---------|--|----|--|
| RW     |                | Bit                      |  |  |               |         |  | US |  |
| OL     | $\updownarrow$ | Off (0) or On (1)        |  |  | $\Rightarrow$ | Off (0) |  |    |  |
| RFC-A  |                |                          |  |  |               |         |  |    |  |

Pr **00.017** determines whether the reference is uni-polar or bi-polar.

See *Minimum Speed* (00.001). Allows negative speed reference in keypad mode.

| 00.018 to 00.021 |                | Preset Reference 1 to 4    |  |  |               |         |  |    |  |
|------------------|----------------|----------------------------|--|--|---------------|---------|--|----|--|
| RW               |                | Num                        |  |  |               |         |  | US |  |
| OL               | $\updownarrow$ | 0.0 to Pr <b>00.002</b> Hz |  |  | $\Rightarrow$ | 0.00 Hz |  |    |  |
| RFC-A            |                |                            |  |  |               |         |  |    |  |

If the preset reference has been selected (see Pr **00.005**), the speed at which the motor runs is determined by these parameters.

See *Drive Configuration* (00.005).

| 00.022 |                | Status Mode Parameter 2 |  |  |               |       |  |    |    |
|--------|----------------|-------------------------|--|--|---------------|-------|--|----|----|
| RW     |                | Num                     |  |  |               |       |  | PT | US |
| OL     | $\updownarrow$ | 0.000 to 30.999         |  |  | $\Rightarrow$ | 4.020 |  |    |    |
| RFC-A  |                |                         |  |  |               |       |  |    |    |

This parameter and *Status Mode Parameter 1* (00.023) define which parameters are displayed in Status mode. The values can be alternated by pressing the Escape key, if the drive is running.

| 00.023 |                | Status Mode Parameter 1 |  |  |               |       |  |    |    |
|--------|----------------|-------------------------|--|--|---------------|-------|--|----|----|
| RW     |                | Num                     |  |  |               |       |  | PT | US |
| OL     | $\updownarrow$ | 0.000 to 30.999         |  |  | $\Rightarrow$ | 2.001 |  |    |    |
| RFC-A  |                |                         |  |  |               |       |  |    |    |

See *Status Mode Parameter 2* (00.022).



| 00.024 |   | Customer Defined Scaling |  |  |  |   |       |  |  |    |  |
|--------|---|--------------------------|--|--|--|---|-------|--|--|----|--|
| RW     |   | Num                      |  |  |  |   |       |  |  | US |  |
| OL     | ↕ | 0.000 to 10.000          |  |  |  | ⇒ | 1.000 |  |  |    |  |
| RFC-A  |   |                          |  |  |  |   |       |  |  |    |  |

This parameter defines the scaling applied to *Status Mode Parameter 1* (00.023). The scaling is only applied in the Status mode.

| 00.025 |   | User Security Code |  |  |  |    |    |    |    |  |  |
|--------|---|--------------------|--|--|--|----|----|----|----|--|--|
| RW     |   | Num                |  |  |  | ND | NC | PT | US |  |  |
| OL     | ↕ | 0-9999             |  |  |  | ⇒  | 0  |    |    |  |  |
| RFC-A  |   |                    |  |  |  |    |    |    |    |  |  |

If any number other than 0 is programmed into this parameter, user security can be applied so that no parameters except Pr **00.010** can be adjusted with the keypad. When this parameter is read via a keypad it appears as zero. Refer to the *Control User Guide* for further information.

| 00.027 |   | Power-up Keypad Control Mode Reference |  |  |  |    |           |    |    |  |  |
|--------|---|--|--|--|--|----|-----------|----|----|--|--|
| RW     |   | Txt                                    |  |  |  | ND | NC        | PT | US |  |  |
| OL     | ↕ | Reset (0), Last (1), Preset (2)        |  |  |  | ⇒  | Reset (0) |    |    |  |  |
| RFC-A  |   |  |  |  |  |    |           |    |    |  |  |

Defines which value of keypad control mode reference is displayed at power-up.

| Value | Text   | Description  |
|-------|--------|--|
| 0     | Reset  | Keypad reference is zero   |
| 1     | Last   | Keypad reference is the last used value                            |
| 2     | Preset | Keypad reference is copied from <i>Preset Reference 1</i> (00.018) |

| 00.028 |   | Ramp Mode Select   |  |  |  |   |              |  |  |    |  |
|--------|---|--|--|--|--|---|--------------|--|--|----|--|
| RW     |   | Txt  |  |  |  |   |              |  |  | US |  |
| OL     | ↕ | Fast (0), Standard (1),<br>Std boost (2), Fast boost (3) |  |  |  | ⇒ | Standard (1) |  |  |    |  |
| RFC-A  |   |  |  |  |  |   |              |  |  |    |  |

Defines the mode used by the ramp system.

- 0: Fast ramp
- 1: Standard ramp
- 2: Standard ramp with motor voltage boost
- 3: Fast ramp with motor voltage boost

Fast ramp is linear deceleration at programmed rate, normally used when a braking resistor is installed.

Standard ramp is controlled deceleration to prevent DC bus over-voltage trips, normally used when there is no braking resistor installed.

If a high motor voltage mode is selected, deceleration rates can be faster for a given inertia but motor temperatures will be higher.

| 00.029 |   |                   | Ramp Enable |  |  |  |   |        |  |    |  |  |
|--------|---|-------------------|-------------|--|--|--|---|--------|--|----|--|--|
| RW     |   | Bit               |             |  |  |  |   |        |  | US |  |  |
| OL     | ⇕ |                   |             |  |  |  | ⇒ |        |  |    |  |  |
| RFC-A  |   | Off (0) or On (1) |             |  |  |  |   | On (1) |  |    |  |  |

Setting Pr **00.029** to 0 allows the user to disable the ramps. This is generally used when the drive is required to closely follow a speed reference which already contains acceleration and deceleration ramps.

| 00.030 |   | Parameter Cloning                                      |  |  |  |   |          |  |     |
|--------|---|--|--|--|--|---|----------|--|-----|
| RW     |   | Txt  |  |  |  |   | NC       |  | US* |
| OL     | ⇅ | None (0), Read (1), Program (2),<br>Auto (3), Boot (4) |  |  |  | ⇒ | None (0) |  |     |
| RFC-A  |   |  |  |  |  |   |          |  |     |

\* Only a value of 3 or 4 in this parameter is saved.

If Pr **00.030** is equal to 1 or 2, this value is not transferred to the EEPROM or the drive. If Pr **00.030** is set to a 3 or 4 the value is transferred.

| Parameter string | Parameter value | Comment  |
|------------------|-----------------|--|
| None             | 0               | Inactive   |
| Read             | 1               | Read parameter set from the NV Media Card        |
| Program          | 2               | Programming a parameter set to the NV Media Card |
| Auto             | 3               | Auto save  |
| Boot             | 4               | Boot mode  |

For further information, please refer to Chapter 8 *Diagnostics* on page 52.

| 00.031 |   | Stop Mode   |  |  |   |          |  |    |  |
|--------|---|---|--|--|---|----------|--|----|--|
| RW     |   | Txt   |  |  |   |          |  | US |  |
| OL     | ⇕ | Coast (0), Ramp (1),<br>Ramp dc I (2), dc I (3),<br>Timed dc I (4), Disable (5)                 |  |  | ⇒ | Ramp (1) |  |    |  |
| RFC-A  |   | Coast (0), Ramp (1),<br>Ramp dc I (2), dc I (3),<br>Timed dc I (4), Disable (5),<br>No Ramp (6) |  |  |   |          |  |    |  |

Defines how the motor is controlled when the run signal is removed from the drive.

| Value | Text       | Description   |
|-------|------------|---|
| 0     | Coast      | Coast stop  |
| 1     | Ramp       | Ramp stop   |
| 2     | Ramp dc I  | Ramp stop + 1 second dc injection                   |
| 3     | dc I       | Injection braking stop with detection of zero speed |
| 4     | Timed dc I | Timed injection braking stop                        |
| 5     | Disable    | Disable   |
| 6     | No Ramp    | No ramp (RFC-A mode only)                           |

See the *Control User Guide* for further information.

| 00.032 |     | Dynamic V To F Select / Flux Optimisation Select |  |  |   |   |  |    |  |
|--------|-----|--|--|--|---|---|--|----|--|
| RW     | Num |  |  |  |   |   |  | US |  |
| OL     | ⇕   | 0 to 1   |  |  | ⇒ | 0 |  |    |  |
| RFC-A  |     |  |  |  |   |   |  |    |  |

#### Open loop:

Set to 1 to enable Dynamic V to F mode.

**0:** Fixed linear voltage to frequency ratio (constant torque - standard load)

**1:** Voltage to frequency ratio dependant on load current. This gives a higher motor efficiency.

#### RFC-A:

If this parameter is set to 1, the flux is reduced so that the magnetizing current is equal to the torque producing current, to optimize copper losses and reduce iron losses in the motor under low load conditions.

| 00.033 |     | Catch a Spinning Motor                                 |  |  |   |             |  |    |  |
|--------|-----|--|--|--|---|-------------|--|----|--|
| RW     | Txt |  |  |  |   |             |  | US |  |
| OL     | ⇕   | Disable (0), Enable (1),<br>Fwd Only (2), Rev Only (3) |  |  | ⇒ | Disable (0) |  |    |  |
| RFC-A  |     |  |  |  |   |             |  |    |  |

If the drive is to be configured in fixed boost mode (Pr **00.041** = Fd or SrE) with catch a spinning motor software enabled, an autotune (see Pr **00.038** on page 38) must be carried out to measure the motor's stator resistance beforehand. If a stator resistance is not measured, the drive may trip on Over Volts or OI ac while trying to catch a spinning motor.

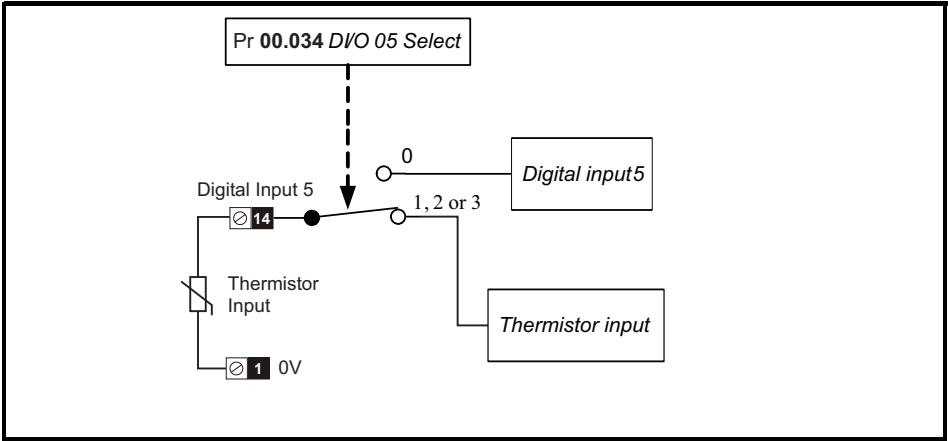
| Pr 00.033 | Text     | Function                         |
|-----------|----------|----------------------------------|
| 0         | Disable  | Disabled                         |
| 1         | Enable   | Detect all frequencies           |
| 2         | Fwd Only | Detect positive frequencies only |
| 3         | Rev Only | Detect negative frequencies only |

| 00.034 |     | Digital Input 5 Select  |  |  |   |           |  |    |  |
|--------|-----|---|--|--|---|-----------|--|----|--|
| RW     | Txt |   |  |  |   |           |  | US |  |
| OL     | ↕   | Input (0), Therm Short Cct (1), Thermistor (2), Therm No Trip (3) |  |  | ⇒ | Input (0) |  |    |  |
| RFC-A  |     |   |  |  |   |           |  |    |  |

This parameter selects the function of Digital Input 5 (terminal 14).

| Value | Text            | Function   |
|-------|-----------------|--|
| 0     | Input           | Digital input  |
| 1     | Therm Short Cct | Temperature measurement input with short circuit detection (Resistance <50 Ω)  |
| 2     | Thermistor      | Temperature measurement input without short circuit detection but with th trip |
| 3     | Therm No Trip   | Temperature measurement input with no trips                                    |

Figure 6-1 Thermistor input



| 00.035 |     | DO1 Control |  |  |   |   |  |    |  |
|--------|-----|-------------|--|--|---|---|--|----|--|
| RW     | Num |             |  |  |   |   |  | US |  |
| OL     | ↕   | 0-21        |  |  | ⇒ | 0 |  |    |  |
| RFC-A  |     |             |  |  |   |   |  |    |  |

Defines the behaviour of digital output 1 (terminal 10).

| Value | Description  |
|-------|--|
| 0     | User defined by Digital IO1 Source/Destination A                                 |
| 1     | Drive running signal   |
| 2     | Frequency arrived signal   |
| 3     | Frequency level detection signal   |
| 4     | Frequency level detection signal   |
| 5     | Overload detection signal  |
| 6     | Power off state  |
| 7     | External fault stop  |
| 8     | Frequency upper limit  |
| 9     | Frequency lower limit  |
| 10    | Drive running at zero frequency  |
| 14    | Drive Ready  |
| 15    | Drive OK   |
| 18    | Brake release  |
| 19    | Torque limiting (Valid while the torque is limited by torque limiting value 1/2) |
| 20    | Forward or reverse   |
| 21    | Motor 1 or 2   |

| 00.036 |   | Analog Output 1 Control |  |  |   |   |  |    |  |
|--------|---|-------------------------|--|--|---|---|--|----|--|
| RW     |   | Txt                     |  |  |   |   |  | US |  |
| OL     | ⇕ | 0 to 14                 |  |  | ⇒ | 0 |  |    |  |
| RFC-A  |   |                         |  |  |   |   |  |    |  |

Defines the functionality of Analog Output 1 (terminal 7).

| Value | Description                              |
|-------|--|
| 0     | User defined by Analog Output 1 Source A |
| 1     | Frequency output                         |
| 2     | Frequency reference                      |
| 3     | Motor speed                              |
| 4     | Current Magnitude                        |
| 6     | Torque output                            |
| 7     | Torque current output                    |
| 8     | Voltage output                           |
| 9     | DC bus voltage (0~800 V)                 |
| 10    | Analog Input 1                           |
| 11    | Analog Input 2                           |
| 12    | Power output (0~2 x Pe)                  |
| 13    | Torque limitation                        |
| 14    | Torque reference (0~300 %)               |

| 00.037 |   | Maximum Switching Frequency  |  |  |   |           |  |  |    |
|--------|---|--|--|--|---|-----------|--|--|----|
| RW     |   | Txt  |  |  |   |           |  |  | US |
| OL     | ⇕ | 0.667 (0), 1 (1), 2 (2), 3 (3), 4 (4),<br>6 (5), 8 (6), 12 (7), 16 (8) kHz |  |  | ⇒ | 3 (3) kHz |  |  |    |
| RFC-A  |   | 2 (2), 3 (3), 4 (4), 6 (5), 8 (6), 12 (7),<br>16 (8) kHz                   |  |  |   |           |  |  |    |

Defines the maximum switching frequency that can be used by the drive.

| Pr 00.037 | Text  | Description                |
|-----------|-------|----------------------------|
| 0         | 0.667 | 667 Hz switching frequency |
| 1         | 1     | 1 kHz switching frequency  |
| 2         | 2     | 2 kHz switching frequency  |
| 3         | 3     | 3 kHz switching frequency  |
| 4         | 4     | 4 kHz switching frequency  |
| 5         | 6     | 6 kHz switching frequency  |
| 6         | 8     | 8 kHz switching frequency  |
| 7         | 12    | 12 kHz switching frequency |
| 8         | 16    | 16 kHz switching frequency |

See the *Power Installation Guide* for drive derating data.

| 00.038 |   |        | Autotune |  |  |   |   |    |  |    |  |  |
|--------|---|--------|----------|--|--|---|---|----|--|----|--|--|
| RW     |   | Num    |          |  |  |   |   | NC |  | US |  |  |
| OL     | ⇕ | 0 to 2 |          |  |  | ⇒ | 0 |    |  |    |  |  |
| RFC-A  |   | 0 to 3 |          |  |  |   |   |    |  |    |  |  |

Defines the auto-tune test to be performed.

There are two autotune tests available in open loop mode, a stationary and a rotating test. A rotating autotune should be used whenever possible so the measured value of power factor of the motor is used by the drive.


Open Loop and RFC-A:

1.
- A stationary autotune can be used when the motor is loaded and it is not possible to remove the load from the motor shaft. To perform a Stationary autotune, set Pr **00.038** to 1,
2.
- A rotating autotune should only be used if the motor is unloaded. A rotating autotune first performs a stationary autotune, as above, then a rotating test is performed in which the motor is accelerated with currently selected ramps up to a frequency of *Rated Frequency* (00.039) x 2/3, and the frequency is maintained at that level for 4 seconds. To perform a Rotating autotune, set Pr **00.038** to 2.

RFC-A only:

3.
- This test measures the total inertia of the load and the motor. A series of progressively larger torque levels are applied to the motor to accelerate the motor up to 3/4 x *Motor Rated Speed* (Pr **00.007**) to determine the inertia from the acceleration/deceleration time.

Following the completion of an autotune test the drive will go into the inhibit state. The drive must be placed into a controlled disable condition before the drive can be made to run at the required reference. The drive can be put in to a controlled disable condition by removing the Safe Torque Off signal from terminals 31 and 35, setting the *Drive Enable* to Off (0) or disabling the drive via the *Control Word* and *Control Word Enable*



A rotating autotune will cause the motor to accelerate up to 2/3 base speed in the direction selected regardless of the reference provided. Once complete the motor will coast to a stop. The enable signal must be removed before the drive can be made to run at the required reference. The drive can be stopped at any time by removing the run signal or removing the drive enable.

| 00.039 |   | Motor Rated Frequency |  |  |  |   |                                    |  |  |    |  |
|--------|---|-----------------------|--|--|--|---|------------------------------------|--|--|----|--|
| RW     |   | Num                   |  |  |  |   |                                    |  |  | US |  |
| OL     | ⇕ | 0.00 to 550.00 Hz     |  |  |  | ⇒ | 50 Hz: 50.00 Hz<br>60 Hz: 60.00 Hz |  |  |    |  |
| RFC-A  |   |                       |  |  |  |   |                                    |  |  |    |  |

Enter the value from the rating plate of the motor. Defines the voltage to frequency ratio applied to the motor.

| 00.040 |   | Number Of Motor Poles |  |  |   |          |  |    |  |
|--------|---|-----------------------|--|--|---|----------|--|----|--|
| RW     |   | Num                   |  |  |   |          |  | US |  |
| OL     | ⇕ | Auto (0) to 32 (16)   |  |  | ⇒ | Auto (0) |  |    |  |
| RFC-A  |   |                       |  |  |   |          |  |    |  |

Set to the number of poles of the motor. The auto mode calculates the number of motor poles from the settings of Pr **00.007** and Pr **00.039**.

| 00.041 |   | Control Mode  |  |  |   |          |  |    |  |
|--------|---|---|--|--|---|----------|--|----|--|
| RW     |   | Txt   |  |  |   |          |  | US |  |
| OL     | ⇕ | Ur S (0), Ur (1), Fixed (2),<br>Ur Auto (3), Ur I (4), Square (5),<br>Fixed Tapered (6) |  |  | ⇒ | Ur I (4) |  |    |  |
| RFC-A  |   |   |  |  |   |          |  |    |  |

Defines the drive output mode, which can either be a voltage mode or a current mode.

| Value | Text          | Description   |
|-------|---------------|---|
| 0     | Ur S          | Stator resistance and voltage offset measured at each start         |
| 1     | Ur            | No measurements   |
| 2     | Fixed         | Fixed boost mode.   |
| 3     | Ur Auto       | Stator resistance and voltage offset measured at first drive enable |
| 4     | Ur I          | Stator resistance and voltage offset measured at each power-up      |
| 5     | Square        | Square law characteristic   |
| 6     | Fixed Tapered | Fixed boost with taper  |

**NOTE** The drive default setting is Ur I mode which means that the drive will carry out an autotune every time the drive is powered-up and enabled. If the load is not going to be stationary when the drive is powered-up and enabled, then one of the other modes should be selected. Not selecting another mode could result in poor motor performance or OI ac, Motor Too Hot or Over Volts trips.

| 00.042 |   | Low Frequency Voltage Boost |  |  |   |       |  |    |  |
|--------|---|-----------------------------|--|--|---|-------|--|----|--|
| RW     |   | Num                         |  |  |   |       |  | US |  |
| OL     | ⇕ | 0.0 to 25.0 %               |  |  | ⇒ | 3.0 % |  |    |  |
| RFC-A  |   |                             |  |  |   |       |  |    |  |

Determines the boost level when Pr **00.041** is set to Fixed, Square or Fixed Tapered modes.



| 00.043 |   | Serial Baud Rate   |  |  |  |   |           |  |    |  |
|--------|---|--|--|--|--|---|-----------|--|----|--|
| RW     |   | Txt  |  |  |  |   |           |  | US |  |
| OL     | ⇕ | 600 (1), 1200 (2),<br>2400 (3), 4800 (4), 9600 (5),<br>19200 (6), 38400 (7),<br>57600 (8), 76800 (9),<br>115200 (10) |  |  |  | ⇒ | 19200 (6) |  |    |  |
| RFC-A  |   |  |  |  |  |   |           |  |    |  |

Defines the serial baud rate of the drive

Changing the parameters does not immediately change the serial communications settings. See *Reset Serial Communications* (00.045) for more details.

| 00.044 |   | Serial Address |  |  |  |   |   |  |    |  |
|--------|---|----------------|--|--|--|---|---|--|----|--|
| RW     |   | Num            |  |  |  |   |   |  | US |  |
| OL     | ↕ | 1 to 247       |  |  |  | ⇒ | 1 |  |    |  |
| RFC-A  |   |                |  |  |  |   |   |  |    |  |

Used to define the unique address for the drive for the serial interface. The drive is always a slave address 0 is used to globally address all slaves, and so this address should not be set in this parameter.

Changing the parameters does not immediately change the serial communications settings. See *Reset Serial Communications* (00.045) for more details.

| 00.045 |   |                   | Reset Serial Communications |  |  |    |         |  |    |  |
|--------|---|-------------------|-----------------------------|--|--|----|---------|--|----|--|
| RW     |   | Bit               |                             |  |  | ND | NC      |  | US |  |
| OL     | ↕ | Off (0) or On (1) |                             |  |  | ⇒  | Off (0) |  |    |  |
| RFC-A  |   |                   |                             |  |  |    |         |  |    |  |

Set to On (1) to update communications set-up.

**NOTE** The display will briefly display On and return to Off on reset.

| 00.046 |   | Brake Controller Upper Current Threshold |  |  |  |   |      |  |    |  |
|--------|---|--|--|--|--|---|------|--|----|--|
| RW     |   | Num                                      |  |  |  |   |      |  | US |  |
| OL     | ↕ | 0 to 200 %                               |  |  |  | ⇒ | 50 % |  |    |  |
| RFC-A  |   |  |  |  |  |   |      |  |    |  |

Defines the upper current threshold for the brake. See Brake Controller Brake Release in *Parameter Reference Guide*.

| 00.047 |   | Brake Controller Lower Current Threshold |  |  |   |      |  |    |  |
|--------|---|--|--|--|---|------|--|----|--|
| RW     |   | Num                                      |  |  |   |      |  | US |  |
| OL     | ⇅ | 0 to 200 %                               |  |  | ⇒ | 10 % |  |    |  |
| RFC-A  |   |  |  |  |   |      |  |    |  |

Defines the lower current limit for the brake. See Brake Controller Brake Release in *Parameter Reference Guide*.

| 00.048 |   | Brake Controller Brake Release Frequency |  |  |   |         |  |    |  |
|--------|---|--|--|--|---|---------|--|----|--|
| RW     |   | Num                                      |  |  |   |         |  | US |  |
| OL     | ⇅ | 0.00 to 20.00 Hz                         |  |  | ⇒ | 1.00 Hz |  |    |  |
| RFC-A  |   |  |  |  |   |         |  |    |  |

Defines the Brake Release Frequency. See Brake Controller Brake Release in *Parameter Reference Guide*.

| 00.049 |   | Brake Controller Brake Apply Frequency |  |  |   |         |  |    |  |
|--------|---|--|--|--|---|---------|--|----|--|
| RW     |   | Num                                    |  |  |   |         |  | US |  |
| OL     | ⇅ | 0.00 to 20.00 Hz                       |  |  | ⇒ | 2.00 Hz |  |    |  |
| RFC-A  |   |  |  |  |   |         |  |    |  |

Defines the Brake Apply Frequency. See Brake Controller Brake Release in *Parameter Reference Guide*.

| 00.050 |   | Brake Controller Brake Delay |  |  |   |       |  |    |  |
|--------|---|------------------------------|--|--|---|-------|--|----|--|
| RW     |   | Num                          |  |  |   |       |  | US |  |
| OL     | ⇅ | 0.0 to 25.0 s                |  |  | ⇒ | 1.0 s |  |    |  |
| RFC-A  |   |                              |  |  |   |       |  |    |  |

Defines the pre-brake release delay. See Brake Controller Brake Release in *Parameter Reference Guide*.

| 00.051 |   | Brake Controller Post-brake Release Delay |  |  |   |       |  |    |  |
|--------|---|---|--|--|---|-------|--|----|--|
| RW     |   | Num                                       |  |  |   |       |  | US |  |
| OL     | ⇅ | 0.0 to 25.0 s                             |  |  | ⇒ | 1.0 s |  |    |  |
| RFC-A  |   |   |  |  |   |       |  |    |  |

Defines the post-brake release delay.

| 00.053 |     | Brake Controller Initial Direction |  |  |   |         |  |    |  |
|--------|-----|------------------------------------|--|--|---|---------|--|----|--|
| RW     | Txt |                                    |  |  |   |         |  | US |  |
| OL     | ⇕   | Ref (0), Forward (1), Reverse (2)  |  |  | ⇒ | Ref (0) |  |    |  |
| RFC-A  |     |                                    |  |  |   |         |  |    |  |

Defines the initial direction of the brake.

| Value | Text    |
|-------|---------|
| 0     | Ref     |
| 1     | Forward |
| 2     | Reverse |

See Brake Controller Brake Release in *Parameter Reference Guide*.

| 00.054 |     | Brake Controller Brake Apply Through Zero Threshold |  |  |   |         |  |    |  |
|--------|-----|---|--|--|---|---------|--|----|--|
| RW     | Num |   |  |  |   |         |  | US |  |
| OL     | ⇕   | 0.00 to 25.00 Hz                                    |  |  | ⇒ | 1.00 Hz |  |    |  |
| RFC-A  |     |   |  |  |   |         |  |    |  |

Defines if the brake is applied through zero threshold. See Brake Controller Brake Release in *Parameter Reference Guide*.

| 00.055 |     | Brake Controller Enable                             |  |  |   |             |  |    |  |
|--------|-----|---|--|--|---|-------------|--|----|--|
| RW     | Txt |   |  |  |   |             |  | US |  |
| OL     | ⇕   | Disable (0), Relay (1),<br>Digital IO (2), User (3) |  |  | ⇒ | Disable (0) |  |    |  |
| RFC-A  |     |   |  |  |   |             |  |    |  |

| Value | Text       |
|-------|------------|
| 0     | Disable    |
| 1     | Relay      |
| 2     | Digital IO |
| 3     | User       |

If *Brake Controller Enable* (00.055) = Disable, the brake controller is disabled.

If *Brake Controller Enable* (00.055) = Relay, the brake controller is enabled with I/O set up to control the brake via the relay output. Drive ok is re-routed to digital I/O.

If *Brake Controller Enable* (00.055) = Digital I/O, the brake controller is enabled with I/O set up to control the brake via digital I/O. Drive ok is routed to the relay output.

If *Brake Controller Enable* (00.055) = User, the brake controller is enabled, but no parameters are set up to select the brake output.

| 00.056 to 00.058 |     | Trip 0 to 2 |  |  |    |    |    |    |  |
|------------------|-----|-------------|--|--|----|----|----|----|--|
| RO               | Txt |             |  |  | ND | NC | PT | PS |  |
| OL               | ⇅   | 0 to 255    |  |  | ⇒  |    |    |    |  |
| RFC-A            |     |             |  |  |    |    |    |    |  |

These parameters show the last 3 trips.

| 00.059 |     | OUP Enable          |  |  |   |         |  |    |  |
|--------|-----|---------------------|--|--|---|---------|--|----|--|
| RW     | Txt |                     |  |  |   |         |  | US |  |
| OL     | ⇅   | Stop (0) or Run (1) |  |  | ⇒ | Run (1) |  |    |  |
| RFC-A  |     |                     |  |  |   |         |  |    |  |

Enables the onboard user program.

Onboard user programming provides a background task that loops continuously and a timed task that is executed each time at a defined rate. For further information refer to the *Control User Guide*.

| 00.060 |     | OUP Status                |  |  |    |    |    |  |  |
|--------|-----|---------------------------|--|--|----|----|----|--|--|
| RO     | Num |                           |  |  | ND | NC | PT |  |  |
| OL     | ⇅   | -2147483648 to 2147483647 |  |  | ⇒  |    |    |  |  |
| RFC-A  |     |                           |  |  |    |    |    |  |  |

This parameter indicates the status of the user program in the drive. For further information, refer to the *Control User Guide*.

| 00.065 |   | Frequency Controller Proportional Gain Kp1 |  |  |  |   |             |  |    |  |
|--------|---|--|--|--|--|---|-------------|--|----|--|
| RW     |   | Num  |  |  |  |   |             |  | US |  |
| OL     | ↕ |  |  |  |  | ⇒ |             |  |    |  |
| RFC-A  |   | 0.000 to 200.000 s/rad                     |  |  |  |   | 0.100 s/rad |  |    |  |

Defines the proportional gain for frequency controller 1.

#### RFC modes only.

The controller includes a feed forward proportional gain (Kp), a feed forward integral gain (Ki), and a differential feedback gain (Kd).

#### Proportional gain (Kp)

If Kp is non-zero and Ki is zero the controller will only have a proportional term, and there must be a frequency error to produce a torque reference. Therefore as the motor load increases there will be a difference between the reference and actual frequencies.

#### Integral gain (Ki)

The integral gain is provided to prevent frequency regulation. The error is accumulated over a period of time and used to produce the necessary torque reference without any frequency error. Increasing the integral gain reduces the time taken for the frequency to reach the correct level and increases the stiffness of the system, i.e. it reduces the positional displacement produced by applying a load torque to the motor.

| 00.066 |   | Frequency Controller Integral Gain Ki1 |  |  |  |   |                          |  |    |  |
|--------|---|--|--|--|--|---|--------------------------|--|----|--|
| RW     |   | Num                                    |  |  |  |   |                          |  | US |  |
| OL     | ↕ |  |  |  |  | ⇒ |                          |  |    |  |
| RFC-A  |   | 0.00 to 655.35 s <sup>2</sup> /rad     |  |  |  |   | 0.10 s <sup>2</sup> /rad |  |    |  |

Defines the integral gain for frequency controller 1. See *Frequency Controller Proportional Gain Kp1* (00.065).

| 00.067 |   | Sensorless Mode Filter                           |  |  |  |   |          |  |    |  |
|--------|---|--|--|--|--|---|----------|--|----|--|
| RW     |   | Txt  |  |  |  |   |          |  | US |  |
| OL     | ↕ |  |  |  |  | ⇒ |          |  |    |  |
| RFC-A  |   | 4 (0), 5 (1), 6 (2), 8 (3), 12 (4),<br>20 (5) ms |  |  |  |   | 4 (0) ms |  |    |  |

Defines the time constant for the filter applied to the output of the frequency estimator system.

| 00.069 |   |             | Spin Start Boost |  |  |   |     |  |    |  |
|--------|---|-------------|------------------|--|--|---|-----|--|----|--|
| RW     |   | Num         |                  |  |  |   |     |  | US |  |
| OL     | ⇅ | 0.0 to 10.0 |                  |  |  | ⇒ | 1.0 |  |    |  |
| RFC-A  |   |             |                  |  |  |   |     |  |    |  |

*Spin Start Boost* (00.069) is used by the algorithm that detects the frequency of a spinning motor when the drive is enabled and *Catch A Spinning Motor* (00.033)  $\geq 1$ . For smaller motors the default value of 1.0 is suitable, but for larger motors *Spin Start Boost* (00.069) may need to be increased. If *Spin Start Boost* (00.069) is too small the drive will detect zero speed whatever the frequency of the motor, and if *Spin Start Boost* (00.069) is too large the motor may accelerate away from standstill when the drive is enabled.

| 00.070 |   | PID1 Output |  |  |  |    |    |    |  |  |
|--------|---|-------------|--|--|--|----|----|----|--|--|
| RO     |   | Num         |  |  |  | ND | NC | PT |  |  |
| OL     | ↕ | ±100.00 %   |  |  |  | ⇒  |    |    |  |  |
| RFC-A  |   |             |  |  |  |    |    |    |  |  |

This parameter is the output of the PID controller. For further information, refer to the *Parameter Reference Guide*.

| 00.071 |   | PID1 Proportional Gain |  |  |  |   |       |  |    |  |
|--------|---|------------------------|--|--|--|---|-------|--|----|--|
| RW     |   | Num                    |  |  |  |   |       |  | US |  |
| OL     | ↕ | 0.000 to 4.000         |  |  |  | ⇒ | 1.000 |  |    |  |
| RFC-A  |   |                        |  |  |  |   |       |  |    |  |

Proportional gain applied to the PID error. For further information, refer to the *Parameter Reference Guide*.

| 00.072 |   | PID1 Integral Gain |  |  |   |       |  |    |  |
|--------|---|--------------------|--|--|---|-------|--|----|--|
| RW     |   | Num                |  |  |   |       |  | US |  |
| OL     | ↕ | 0.000 to 4.000     |  |  | ⇒ | 0.500 |  |    |  |
| RFC-A  |   |                    |  |  |   |       |  |    |  |

Integral gain applied to the PID error. For further information, refer to the *Parameter Reference Guide*.

| 00.073 |   | PID1 Feedback Invert |  |  |   |         |  |    |  |
|--------|---|----------------------|--|--|---|---------|--|----|--|
| RW     |   | Bit                  |  |  |   |         |  | US |  |
| OL     | ↕ | Off (0) or On (1)    |  |  | ⇒ | Off (0) |  |    |  |
| RFC-A  |   |                      |  |  |   |         |  |    |  |

This parameter allows the PID feedback source to be inverted. For further information, refer to the *Parameter Reference Guide*.

| 00.074 |   | PID1 Output Upper Limit |  |  |   |          |  |    |  |
|--------|---|-------------------------|--|--|---|----------|--|----|--|
| RW     |   | Num                     |  |  |   |          |  | US |  |
| OL     | ↕ | 0.00 to 100.00 %        |  |  | ⇒ | 100.00 % |  |    |  |
| RFC-A  |   |                         |  |  |   |          |  |    |  |

This parameter with *PID1 Output Lower Limit* (Pr **00.075**) allows the output to be limited to a range. For further information, refer to the *Parameter Reference Guide*.

| 00.075 |   | PID1 Output Lower Limit |  |  |   |           |  |    |  |
|--------|---|-------------------------|--|--|---|-----------|--|----|--|
| RW     |   | Num                     |  |  |   |           |  | US |  |
| OL     | ↕ | ±100.00 %               |  |  | ⇒ | -100.00 % |  |    |  |
| RFC-A  |   |                         |  |  |   |           |  |    |  |

See *PID1 Output Upper Limit* (Pr **00.074**).

| 00.076 |   | Action On Trip Detection |  |  |   |    |    |    |    |
|--------|---|--------------------------|--|--|---|----|----|----|----|
| RW     |   | Num                      |  |  |   | ND | NC | PT | US |
| OL     | ↕ | 0 - 31                   |  |  | ⇒ | 0  |    |    |    |
| RFC-A  |   |                          |  |  |   |    |    |    |    |

**Bit 0:** Stop on defined non-important trips

**Bit 1:** Disable braking resistor overload detection

**Bit 2:** Disable phase loss stop

**Bit 3:** Disable braking resistor temperature monitoring

**Bit 4:** Disable parameter freeze on trip. Refer to *Parameter Reference Guide*.

| 00.077 |   | Maximum Heavy Duty Rating         |  |  |   |    |    |    |  |
|--------|---|-----------------------------------|--|--|---|----|----|----|--|
| RO     |   | Num                               |  |  |   | ND | NC | PT |  |
| OL     | ⇕ | 0.00 to Drive HD Current Rating A |  |  | ⇒ |    |    |    |  |
| RFC-A  |   |                                   |  |  |   |    |    |    |  |

Displays the maximum heavy duty current rating of the drive.

| 00.078 |   | Software Version |  |  |   |    |    |    |  |
|--------|---|------------------|--|--|---|----|----|----|--|
| RO     |   | Num              |  |  |   | ND | NC | PT |  |
| OL     | ⇕ | 0 to 99.99.99.99 |  |  | ⇒ |    |    |    |  |
| RFC-A  |   |                  |  |  |   |    |    |    |  |

Displays the software version in the drive.

| 00.079 |   | User Drive Mode          |  |  |   |               |    |    |    |
|--------|---|--------------------------|--|--|---|---------------|----|----|----|
| RW     |   | Txt                      |  |  |   | ND            | NC | PT | US |
| OL     | ⇕ | Open loop (1), RFC A (2) |  |  | ⇒ | Open loop (1) |    |    |    |
| RFC-A  |   |                          |  |  |   | RFC-A (2)     |    |    |    |

Defines the mode of the drive.

| 00.081 |   | Reference Selected                                   |  |  |   |    |    |    |  |
|--------|---|--|--|--|---|----|----|----|--|
| RO     |   | Num  |  |  |   | ND | NC | PT |  |
| OL     | ⇕ | -Pr 00.002 to Pr 00.002 or Pr 00.001 to Pr 00.002 Hz |  |  | ⇒ |    |    |    |  |
| RFC-A  |   |  |  |  |   |    |    |    |  |

This is the basic reference selected from the available sources.

| 00.082 |   | Pre-ramp Reference                                   |  |  |   |    |    |    |  |
|--------|---|--|--|--|---|----|----|----|--|
| RO     |   | Num  |  |  |   | ND | NC | PT |  |
| OL     | ⇕ | -Pr 00.002 to Pr 00.002 or Pr 00.001 to Pr 00.002 Hz |  |  | ⇒ |    |    |    |  |
| RFC-A  |   |  |  |  |   |    |    |    |  |

The *Pre-ramp Reference* is the final output from the reference system that is fed into the ramp system.

| 00.083 |   | Final Demand Reference                               |  |  |  |    |    |    |    |  |
|--------|---|--|--|--|--|----|----|----|----|--|
| RO     |   | Num  |  |  |  | ND | NC | PT | FI |  |
| OL     | ⇅ | -Pr 00.002 to Pr 00.002 or Pr 00.001 to Pr 00.002 Hz |  |  |  | ⇒  |    |    |    |  |
| RFC-A  |   |  |  |  |  |    |    |    |    |  |

**Open loop mode:**

*Final Demand Reference* shows the fundamental drive output frequency from the *Post Ramp Reference* and the *Hard Frequency Reference*.

**RFC mode:**

*Final Demand Reference* shows the reference at the input to the frequency controller, which is the sum of the *Post Ramp Reference*, if the ramp output is not disabled and the hard frequency reference (if enabled). If the drive is disabled *Final Demand Reference* shows 0.00.

| 00.084 |   | D.C. Bus Voltage |  |  |  |    |    |    |    |  |
|--------|---|------------------|--|--|--|----|----|----|----|--|
| RO     |   | Num              |  |  |  | ND | NC | PT | FI |  |
| OL     | ⇅ | 0 to 1190 V      |  |  |  | ⇒  |    |    |    |  |
| RFC-A  |   |                  |  |  |  |    |    |    |    |  |

Voltage across the internal DC bus of the drive.

| 00.085 |   | Output Frequency |  |  |  |    |    |    |    |  |
|--------|---|------------------|--|--|--|----|----|----|----|--|
| RO     |   | Num              |  |  |  | ND | NC | PT | FI |  |
| OL     | ⇅ | ± 550.00 Hz      |  |  |  | ⇒  |    |    |    |  |
| RFC-A  |   |                  |  |  |  |    |    |    |    |  |

**Open loop mode:**

The *Output Frequency* is the sum of the *Post Ramp Reference* and the motor slip compensation frequency.

**RFC-A mode:**

The output frequency is not controlled directly, but the *Output Frequency* is a measurement of the frequency applied to the motor.

| 00.086 |   | Output Voltage |  |  |  |    |    |    |    |  |
|--------|---|----------------|--|--|--|----|----|----|----|--|
| RO     |   | Num            |  |  |  | ND | NC | PT | FI |  |
| OL     | ⇅ | 0 to 930 V     |  |  |  | ⇒  |    |    |    |  |
| RFC-A  |   |                |  |  |  |    |    |    |    |  |

The *Output Voltage* is the rms line to line voltage at the AC terminals of the drive.



| 00.087 |   | Motor Rpm    |  |  |  |    |    |    |    |  |  |
|--------|---|--------------|--|--|--|----|----|----|----|--|--|
| RO     |   | Num          |  |  |  | ND | NC | PT | FI |  |  |
| OL     | ⇕ | ±33000.0 rpm |  |  |  | ⇒  |    |    |    |  |  |
| RFC-A  |   |              |  |  |  |    |    |    |    |  |  |

*Motor Rpm* = 60 x Frequency / Pole pairs

where

Pole pairs = the numeric value of *Number Of Motor Poles* (Pr **00.040**) (i.e. 3 for a 6 pole motor)

The frequency used to derive the *Motor Rpm* is the *Final Demand Reference* (Pr **00.083**).

| 00.088 |   | Current Magnitude            |  |  |  |    |    |    |    |  |  |
|--------|---|------------------------------|--|--|--|----|----|----|----|--|--|
| RO     |   | Num                          |  |  |  | ND | NC | PT | FI |  |  |
| OL     | ⇕ | 0 to Drive Maximum Current A |  |  |  | ⇒  |    |    |    |  |  |
| RFC-A  |   |                              |  |  |  |    |    |    |    |  |  |

*Current Magnitude* is the instantaneous drive output current scaled so that it represents the r.m.s. phase current in Amps under steady state conditions.

| 00.089 |   | Torque Producing Current  |  |  |  |    |    |    |    |  |  |
|--------|---|---------------------------|--|--|--|----|----|----|----|--|--|
| RO     |   | Num                       |  |  |  | ND | NC | PT | FI |  |  |
| OL     | ⇕ | ± Drive Maximum Current A |  |  |  | ⇒  |    |    |    |  |  |
| RFC-A  |   |                           |  |  |  |    |    |    |    |  |  |

*Torque Producing Current* is the instantaneous level of torque producing current scaled so that it represents the r.m.s. level of torque producing current under steady state conditions.

| 00.090 |   | Digital I/O Read Word        |  |  |  |    |    |    |  |  |  |
|--------|---|------------------------------|--|--|--|----|----|----|--|--|--|
| RO     |   | Bin                          |  |  |  | ND | NC | PT |  |  |  |
| OL     | ⇕ | 000000000000 to 111111111111 |  |  |  | ⇒  |    |    |  |  |  |
| RFC-A  |   |                              |  |  |  |    |    |    |  |  |  |

*Digital I/O Read Word* reflects the state of digital inputs/outputs 1 to 5 and the relay.

| 00.091 |   | Reference On      |  |  |  |    |    |    |  |  |  |
|--------|---|-------------------|--|--|--|----|----|----|--|--|--|
| RO     |   | Bit               |  |  |  | ND | NC | PT |  |  |  |
| OL     | ⇕ | Off (0) or On (1) |  |  |  | ⇒  |    |    |  |  |  |
| RFC-A  |   |                   |  |  |  |    |    |    |  |  |  |

*Reference On*, which is controlled by the drive sequencer, indicates that the reference from the reference system is active.

| 00.092 |   | Reverse Select    |  |  |  |    |    |    |  |  |
|--------|---|-------------------|--|--|--|----|----|----|--|--|
| RO     |   | Bit               |  |  |  | ND | NC | PT |  |  |
| OL     | ⇕ | Off (0) or On (1) |  |  |  | ⇒  |    |    |  |  |
| RFC-A  |   |                   |  |  |  |    |    |    |  |  |

*Reverse Select*, which is controlled by the drive sequencer, is used to invert *Reference Selected* (Pr **00.081**) or the *Jog Reference* (Pr **00.015**).

| 00.093 |   | Jog Select        |  |  |  |    |    |    |  |  |
|--------|---|-------------------|--|--|--|----|----|----|--|--|
| RO     |   | Bit               |  |  |  | ND | NC | PT |  |  |
| OL     | ⇕ | Off (0) or On (1) |  |  |  | ⇒  |    |    |  |  |
| RFC-A  |   |                   |  |  |  |    |    |    |  |  |

*Jog Select*, which is controlled by the drive sequencer, is used to select the *Jog Reference* (Pr **00.015**).

| 00.094 |   | Analog Input 1 |  |  |  |    |    |    |    |  |
|--------|---|----------------|--|--|--|----|----|----|----|--|
| RO     |   | Num            |  |  |  | ND | NC | PT | FI |  |
| OL     | ⇕ | ±100.00 %      |  |  |  | ⇒  |    |    |    |  |
| RFC-A  |   |                |  |  |  |    |    |    |    |  |

This parameter displays the level of the analog signal present at analog input 1 (terminal 2).

| 00.095 |   | Analog Input 2 |  |  |  |    |    |    |    |  |
|--------|---|----------------|--|--|--|----|----|----|----|--|
| RO     |   | Num            |  |  |  | ND | NC | PT | FI |  |
| OL     | ⇕ | ±100.00 %      |  |  |  | ⇒  |    |    |    |  |
| RFC-A  |   |                |  |  |  |    |    |    |    |  |


This parameter displays the level of the analog signal present at analog input 2 (terminal 5).

## 7 Running the motor

This section takes a new user through all the essential steps to running a motor for the first time.

**Table 7-1 Open Loop and RFC-A**

| Action   | Detail  |  |
|--|---|--|
| Before power up  | Ensure: <ul style="list-style-type: none"> <li>The drive enable signal is not given, terminal 31 and 35 is open</li> <li>The run signal is not given, terminal 12/13 is open</li> <li>The motor is connected to the drive</li> <li>The motor connection is correct for the drive <math>\Delta</math> or Y</li> <li>The correct supply voltage is connected to the drive</li> </ul>  |  |
| Power up the drive                                     | The default setting is Open Loop vector mode. For RFC-A mode set Pr <b>00.079</b> to RFC-A, then press the stop/reset button to save the parameters. Ensure: The drive displays: Inhibit (enable terminals are open)  |  |
| Enter minimum and maximum speeds                       | Enter: <ul style="list-style-type: none"> <li>Minimum speed Pr <b>00.001</b> (Hz)</li> <li>Maximum speed Pr <b>00.002</b> (Hz)</li> </ul>   |  |
| Enter accel and decel rates                            | Enter: <ul style="list-style-type: none"> <li>Acceleration rate Pr <b>00.003</b> (s/100 Hz)</li> <li>Deceleration rate Pr <b>00.004</b> (s/100 Hz)</li> </ul>   |  |
| Enter motor nameplate details                          | <ol style="list-style-type: none"> <li>Motor rated current in Pr <b>00.006</b> (Amps)</li> <li>Motor rated speed in Pr <b>00.007</b> (rpm / min<sup>-1</sup>)</li> <li>Motor rated voltage in Pr <b>00.008</b> (Volts)</li> <li>Motor rated power factor in (cos <math>\phi</math>) Pr <b>00.009</b></li> </ol>   |  |
| <b>Ready to autotune</b>                               |   |  |
| Autotune   | The drive is able to perform either a stationary or a rotating autotune. The motor must be at a standstill before an autotune is enabled.<br>To perform an autotune: <ul style="list-style-type: none"> <li>Set Pr <b>00.038</b> = 1 for a stationary autotune or set Pr <b>00.038</b> = 2 for a rotating autotune</li> <li>Close the drive enable signal (apply +24 V to terminal 31 &amp; 35). The drive will display 'Ready'.</li> <li>Give a Run command (apply +24 V to terminal 12 - Run forward or terminal 13 - Run reverse). The lower display will flash 'Auto Tune' while the drive is performing the autotune.</li> <li>Wait for the drive to display 'Inhibit' and for the motor to come to a standstill.</li> <li>Remove the drive enable and run signal from the drive.</li> </ul> |  |
| Autotune complete                                      | When the autotune has been completed, Pr <b>00.038</b> will be set to 0   |  |
| Tuning of frequency controller gains (RFC-A mode only) | Depending on the application, the frequency controller gains (Pr <b>00.065</b> and Pr <b>00.066</b> ) may need to be adjusted.  |  |
| <b>Save parameters</b>                                 |   |  |
| Save parameters  | Select 'Save Parameters' in Pr <b>mm.000</b> (alternatively enter a value of 1001) and press the stop / Reset button to save parameters.  |  |

| Ready to run                    |   |   |
|---------------------------------|---|---|
| Run                             | The drive is now ready to run the motor. Close the Run Forward or Run Reverse terminals.  |  |
| Increasing and decreasing speed | Changing the selected analog frequency reference will increase and decrease the speed of the motor.   |   |
| Stopping                        | To stop the motor by following the selected deceleration rate, open either the run forward or run reverse terminal. If the enable terminal is opened while the motor is running, the drive output is immediately disabled and the motor will coast to a stop. |   |

## 8 Diagnostics



Users must not attempt to repair a drive if it is faulty, nor carry out fault diagnosis other than through the use of the diagnostic features described in this chapter.  
If a drive is faulty, it must be returned to the supplier of the drive for repair.

**Table 8-1 Trip indication**

| Trip code               | Condition   | Description   |
|-------------------------|---|---|
| <b>An Input 1 Loss</b>  | Analog input 1 current loss   | Current loss was detected in current mode on Analog input 1 (Terminal 2).   |
| <b>An Input 1 OI</b>    | Analog input 1 over-current   | Current input on analog input 1 exceeds 24 mA.  |
| <b>An Input 2 Loss</b>  | Analog input 2 current loss   | Current loss was detected in current mode on Analog input 2 (Terminal 5).   |
| <b>An Input 2 OI</b>    | Analog input 2 over-current   | Current input on analog input 2 exceeds 24 mA.  |
| <b>Autotune</b>         | Measured inertia has exceeded the parameter range   | The drive has tripped during a rotating autotune or mechanical load measurement test.   |
| <b>Autotune Stopped</b> | Autotune test stopped before completion   | The drive was prevented from completing an autotune test, because either the drive enable or the drive run signals were removed.  |
| <b>Brake R Too Hot</b>  | Braking resistor overload timed out ( $I^2t$ )  | Braking resistor overload has timed out.  |
| <b>Card Access</b>      | NV Media Card Write fail  | Unable to access the NV Media Card.   |
| <b>Card Boot</b>        | The Menu 0 parameter modification cannot be saved to the NV Media Card                                | The necessary boot file has not been created on the NV media card fitted to the drive to take the new parameter value. This occurs when <i>Parameter Cloning</i> (00.030) is changed to auto or boot mode, but the drive is not subsequently reset. |
| <b>Card Busy</b>        | NV Media Card cannot be accessed as it is being accessed by an option module                          | The <i>Card Busy</i> trip indicates that an attempt has been made to access a file on NV Media Card, but the NV Media Card is already being accessed by an option module. No data is transferred.   |
| <b>Card Compare</b>     | NV Media Card file/data is different to the one in the drive  | Trip is initiated if the parameters on the NV Media Card are different to the drive.  |
| <b>Card Data Exists</b> | NV Media Card data location already contains data   | Attempt has been made to store data on a NV Media Card in a data block which already contains data.   |
| <b>Card Drive Mode</b>  | NV Media Card parameter set not compatible with current drive mode                                    | The drive mode in the data block on the NV Media Card is different from the current drive mode.   |
| <b>Card Error</b>       | NV Media Card data structure error  | Attempt has been made to access the NV Media Card but an error has been detected in the data structure on the card. Resetting the trip will cause the drive to erase and create the correct folder structure.                                       |
| <b>Card Full</b>        | NV Media Card full  | There is not enough space left on the card.   |
| <b>Card No Data</b>     | NV Media Card data not found  | Attempt has been made to access non-existent file or block on the NV Media Card.  |
| <b>Card Option</b>      | NV Media Card trip; option modules installed are different between source drive and destination drive | The <i>Card Option</i> trip indicates that parameter data or default difference data is being transferred from the NV Media Card to the drive, but the option module category is different between the source and destination drives.               |
| <b>Card Product</b>     | NV Media Card data blocks are not compatible with the drive derivative                                | If Drive Derivative is different between the source and target drives. Refer to the <i>Control User Guide</i> .   |

| Trip code        | Condition  | Description   |          |        |   |                          |
|------------------|--|---|----------|--------|---|--------------------------|
| Card Rating      | NV Media Card Trip; The voltage and / or current rating of the source and destination drives are different | The current and / or voltage ratings are different between source and destination drives.   |          |        |   |                          |
| Card Read Only   | NV Media Card has the Read Only bit set  | Attempt has been made to modify a read-only NV Media Card or a read-only data block.  |          |        |   |                          |
| Card Slot        | NV Media Card trip; Option module file transfer has failed   | The Card Slot trip is initiated, if the transfer of an option module file to or from a module failed because the option module does not respond correctly.  |          |        |   |                          |
| Control Word     | Trip initiated from the <i>Control Word</i>  | Initiated by setting bit 12 on the control word when the control word is enabled. Refer to the <i>Parameter Reference Guide</i> .   |          |        |   |                          |
| Current Offset   | Current feedback offset error  | Current offset is too large to be trimmed.  |          |        |   |                          |
| Data Changing    | Drive parameters are being changed   | A user action or a file system write is active that is changing the drive parameters and the drive has been commanded to enable.  |          |        |   |                          |
| Derivative ID    | Derivative file error  | Contact the supplier of the drive.  |          |        |   |                          |
| Derivative Image | Derivative product image error   | Contact the supplier of the drive   |          |        |   |                          |
| Destination      | Two or more parameters are writing to the same destination parameter                                       | The <i>dest</i> trip indicates that destination output parameters of two or more logic functions (Menus 7 and 8) within the drive are writing to the same parameter.  |          |        |   |                          |
| Drive Config     | Drive configuration  | Contact the supplier of the drive.  |          |        |   |                          |
| EEPROM Fail      | Default parameters have been loaded  | <div>The cause of the trip can be identified from the sub trip number displayed after the trip string.<table><tr><th>Sub-trip</th><th>Reason</th></tr><tr><td>1</td><td><i>External Trip = 1</i></td></tr></table>Refer to the <i>Control User Guide</i>.</div> | Sub-trip | Reason | 1 | <i>External Trip = 1</i> |
| Sub-trip         | Reason   |   |          |        |   |                          |
| 1                | <i>External Trip = 1</i>   |   |          |        |   |                          |
| External Trip    | External trip is initiated   | <div>The cause of the trip can be identified from the sub trip number displayed after the trip string.<table><tr><th>Sub-trip</th><th>Reason</th></tr><tr><td>1</td><td><i>External Trip = 1</i></td></tr></table>Refer to the <i>Control User Guide</i>.</div> | Sub-trip | Reason | 1 | <i>External Trip = 1</i> |
| Sub-trip         | Reason   |   |          |        |   |                          |
| 1                | <i>External Trip = 1</i>   |   |          |        |   |                          |
| Fan Fail         | Fan fail   | Indicates the fan or fan circuitry has failed   |          |        |   |                          |
| File Changed     | File changed   | A file has been changed, power cycle to clear the trip  |          |        |   |                          |
| FW Incompatible  | Firmware Incompatibility   | The user firmware is incompatible with the power firmware.  |          |        |   |                          |
| HFxx trip        | Hardware faults  | Internal drive hardware fault (see the <i>Control User Guide</i> ).   |          |        |   |                          |
| Hot Rect/Brake   | Hot rectifier/brake  | Over-temperature detected on input rectifier or braking IGBT.   |          |        |   |                          |
| I cal. range     | Current calibration range  | Current calibration range error.  |          |        |   |                          |
| I/O Overload     | Digital output overload  | The total current drawn from the AI-Adaptor 24 V supply or from the digital output has exceeded the limit.  |          |        |   |                          |
| Keypad Mode      | Keypad has been removed when the drive is receiving the reference from the keypad                          | The <i>Keypad Mode</i> trip indicates that the drive is in keypad mode [ <i>Reference Selector</i> = 4 or 6] and the keypad has been removed or disconnected from the drive.<br>Refer to the <i>Control User Guide</i> .  |          |        |   |                          |

| Trip code               | Condition   | Description  |
|-------------------------|---|--|
| <b>Motor Too Hot</b>    | Output current overload timed out ( $I^2t$ )  | trip indicates a motor thermal overload based on the output current and motor thermal time constant. The drive will trip on <i>Motor Too Hot</i> when the accumulator gets to 100 %.<br>This can occur when: <ul style="list-style-type: none"> <li>• There is excessive mechanical load</li> <li>• Ensure the load is not jammed / sticking</li> <li>• Check the load on the motor has not changed</li> <li>• Ensure the motor rated current is not zero</li> </ul>   |
| <b>No power board</b>   | No power board  | No communication between the power and control boards.   |
| <b>Oht Brake</b>        | Braking IGBT over-temperature   | Braking IGBT over-temperature  |
| <b>Oht Control</b>      | Control stage over-temperature  | Control stage over-temperature   |
| <b>Oht dc bus</b>       | DC bus over temperature   | DC bus component over temperature based on a software thermal model.   |
| <b>Oht Inverter</b>     | Inverter over temperature based on thermal model  | IGBT junction over-temperature has been detected based on a software thermal model.  |
| <b>Oht Power</b>        | Power stage over temperature  | This trip indicates that a power stage over-temperature has been detected.   |
| <b>Oht Rectifier</b>    | Rectifier over temperature  | The <i>Oht Rectifier</i> trip indicates that a rectifier over-temperature has been detected.   |
| <b>Oi ac</b>            | Instantaneous output over current detected  | The instantaneous drive output current has exceeded the set limit.<br><b>Possible solutions:</b> <ul style="list-style-type: none"> <li>• Increase acceleration/deceleration rate</li> <li>• If seen during autotune reduce the voltage boost</li> <li>• Check for short circuit on the output cabling</li> <li>• Check integrity of the motor insulation using an insulation tester</li> <li>• Is the motor cable length within limits for the frame size</li> <li>• Reduce the values in the current loop gain parameters</li> </ul> |
| <b>Oi Brake</b>         | Braking IGBT over current detected: short circuit protection for the braking IGBT activated | Over current has been detected in braking IGBT or braking IGBT protection has been activated.<br><b>Possible cause:</b> <ul style="list-style-type: none"> <li>• Check brake resistor wiring</li> <li>• Check braking resistor value is greater than or equal to the minimum resistance value</li> <li>• Check braking resistor insulation</li> </ul>  |
| <b>Option Disable</b>   | Option module does not acknowledge during drive mode changeover                             | Option module did not acknowledge notifying the drive that communications with the drive has been stopped during the drive mode changeover within the allocated time.  |
| <b>Out Phase Loss</b>   | Output phase loss detected  | Phase loss has been detected at the drive output.  |
| <b>Output phase s/c</b> | Output phase short-circuit  | Over-current detected on drive output when enabled.  |
| <b>Over Speed</b>       | Motor frequency has exceeded the over frequency threshold                                   | Excessive motor speed (typically caused by mechanical load driving the motor).   |

| Trip code         | Condition   | Description   |
|-------------------|---|---|
| Over Volts        | DC bus voltage has exceeded the peak level or maximum continuous level for 15 seconds | The <i>Over Volts</i> trip indicates that the DC bus voltage has exceeded the maximum limit.<br>Possible solutions:<br><ul style="list-style-type: none"> <li>• Increase <i>Deceleration Rate 1</i> (Pr <b>00.004</b>)</li> <li>• Decrease the braking resistor value (staying above the minimum value).</li> <li>• Check nominal AC supply level.</li> <li>• Check for supply disturbances which could cause the DC bus to rise.</li> <li>• Check motor insulation using a insulation tester.</li> </ul> |
| Phase Loss        | Supply phase loss   | The drive has detected an input phase loss or large supply imbalance.   |
| Power Board HF    | Power board HF  | Power processor hardware fault.   |
| Power Comms       | Communication has been lost / errors detected between power and control               | No communications between power and control.  |
| Power Data        | Power system configuration data error   | Error in the configuration data stored in the power system.   |
| Power Down Save   | Power down save error   | Error has been detected in the power down save parameters saved in non-volatile memory.   |
| PSU               | Internal power supply fault   | One or more internal power supply rails are outside limits or overloaded.   |
| Resistance        | Measured resistance has exceeded the parameter range                                  | The measured stator resistance during an autotune test has exceeded the maximum possible value of <i>Stator Resistance</i> . Refer to the <i>Control User Guide</i> .   |
| Slot 1 Different  | Option module in option slot 1 has changed  | Option module in option slot 1 on the drive is a different type to that installed when parameters were last saved on the drive.   |
| Slot 1 Error      | Option module in option slot 1 has detected a fault                                   | Option module in option slot 1 on the drive has detected an error.  |
| Slot 1 HF         | Option module 1 hardware fault  | Option module in option slot 1 on the drive has indicated a hardware fault.   |
| Slot 1 Not Fitted | Option module in option slot 1 has been removed                                       | Option module in option slot 1 on the drive has been removed since the last power up.   |
| Slot 1 Watchdog   | Option module watchdog function service error   | Option module installed in Slot 1 has started the option watchdog function and then failed to service the watchdog correctly.   |
| Soft Start        | Soft start relay failed to close, soft start monitor failed                           | Soft start relay in the drive failed to close or the soft start monitoring circuit has failed.  |
| STO Error         | No Safe Torque Off board installed  | STO board not installed.  |
| Stored HF         | Hardware trip has occurred during last power down                                     | Hardware trip (HF01 –HF19) has occurred and the drive has been power cycled. Enter 1299 to <b>xx.000</b> to clear trip  |
| Sub-array RAM     | RAM allocation error  | The <i>Sub-array RAM</i> trip indicates that an option module derivative image has requested more parameter RAM than is allowed.  |
| Temp Feedback     | Internal thermistor has failed  | Internal thermistor has failed.   |
| Th Brake Res      | Brake resistor over temperature   | The <i>Th Brake Res</i> trip is initiated if the hardware based braking resistor thermal monitoring is connected and the resistor overheats.  |
| Th Short Circuit  | Motor thermistor short circuit  | The <i>Th Short Circuit</i> trip indicates that the motor thermistor connected to terminal 14 (digital input 5) on the control connections, is short circuit or low impedance (<50 Ω).  |



| Trip code             | Condition                                 | Description   |
|-----------------------|---|---|
| <b>Thermistor</b>     | Motor thermistor over-temperature         | The <i>Thermistor</i> trip indicates that the motor thermistor connected to terminal 14 (digital input 5) on the control connections has indicated a motor over temperature.            |
| <b>User OI ac</b>     | User OI ac                                | The <i>User OI ac</i> trip is initiated if the output current of the drive exceeds the trip level set by <i>User Over Current Trip Level</i> . Refer to the <i>Control User Guide</i> . |
| <b>User Prog Trip</b> | Trip generated by an onboard user program | This trip can be initiated from within an onboard user program  |
| <b>User Program</b>   | On board user program error               | An error has been detected in the onboard user program image.   |
| <b>User Save</b>      | User Save error / not completed           | The <i>User Save</i> trip indicates that an error has been detected in the user save parameters saved in non-volatile memory.   |
| <b>Watchdog</b>       | Control word watchdog has timed out       | The <i>Watchdog</i> trip indicates that the control word has been enabled and has timed out   |

## 8.1 Alarm indications

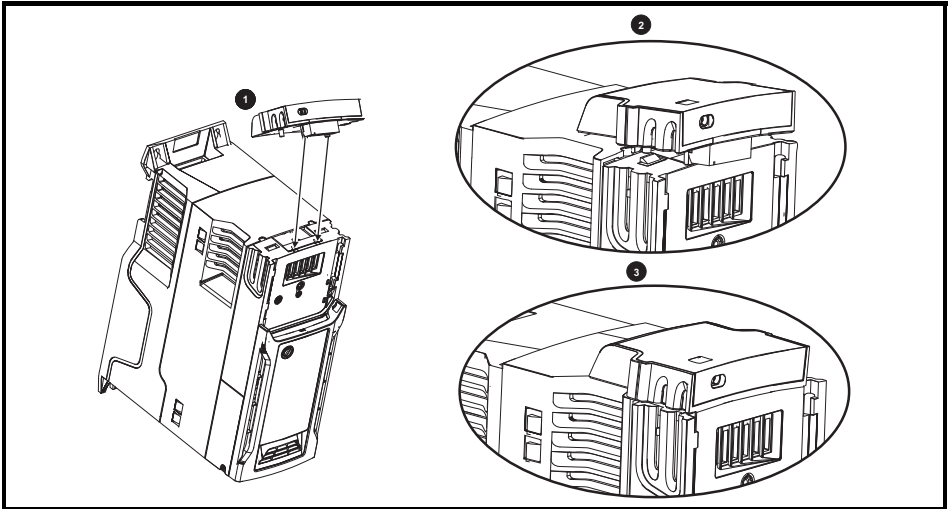
In any mode, an alarm is an indication given on the display by alternating the alarm string with the drive status string display. If an action is not taken to eliminate any alarm except "Auto Tune, Limit Switch or 24V Backup Lost" the drive may eventually trip. Alarms are not displayed when a parameter is being edited.

**Table 8-2 Alarm indications**

| Alarm string           | Description   |
|------------------------|---|
| <b>Brake Resistor</b>  | Brake resistor overload. <i>Braking Resistor Thermal Accumulator</i> in the drive has reached 75.0 % of the value at which the drive will trip. Refer to the <i>Power Installation Guide</i> .                                  |
| <b>Motor Overload</b>  | <i>Motor Protection Accumulator</i> in the drive has reached 75.0 % of the value at which the drive will trip and the load on the drive is >100 %, reduce motor current (load). Refer to the <i>Parameter Reference Guide</i> . |
| <b>Drive Overload</b>  | Drive over temperature. <i>Percentage Of Drive Thermal Trip Level</i> in the drive is greater than 90 %. Refer to the <i>Parameter Reference Guide</i> .  |
| <b>Auto Tune</b>       | The autotune procedure has been initialized and an autotune in progress.  |
| <b>Limit Switch</b>    | Limit switch active. Indicates that a limit switch is active and that is causing the motor to be stopped.   |
| <b>Low AC</b>          | Low voltage mode. See <i>Low AC Alarm</i> in the <i>Control User Guide</i> .  |
| <b>Current limit</b>   | Current limit active. See <i>Current Limit Active</i> in the <i>Control User Guide</i> .  |
| <b>24V Backup Lost</b> | 24V backup not present. See <i>24V Alarm Loss Enable</i> in the <i>Control User Guide</i> .   |

## 9 NV Media Card Operation

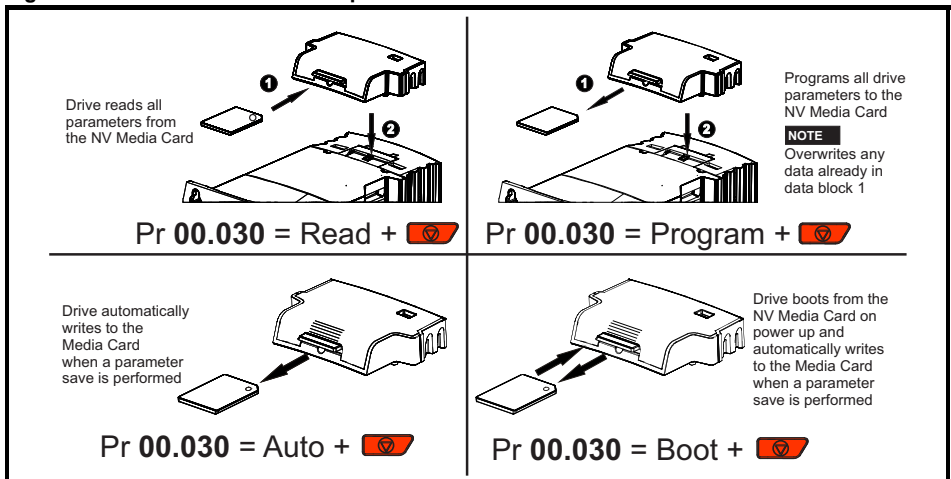
Figure 9-1 Installing the AI-Backup adaptor (SD Card)



1. Identify the two plastic fingers on the underside of the AI-Backup adaptor (1) - then insert the two fingers into the corresponding slots in the spring-loaded sliding cover on the top of the drive.
2. Hold the adaptor firmly and push the spring loaded protective cover towards the back of the drive to expose the connector block (2) below.

Press the adaptor downwards (3) until the adaptor connector locates into the drive connection below.

Figure 9-2 Basic NV Media Card operation



The whole card may be protected from writing or erasing by setting the read-only flag, refer to the *Control User Guide* for further information. The card should not be removed during data transfer, as the drive will produce a trip. If this occurs then either the transfer should be reattempted or in the case of a card to drive transfer, default parameters should be loaded.

**NOTE** The drive supports SD cards formatted with the FAT32 file system only.

# 10 Machine Control Studio

Machine Control Studio programming software powered by CODESYS

Machine Control Studio software provides a flexible and intuitive environment for programming Unidrive M's new automation and motion control features. This new software offers programming for the Unidrive M400's onboard PLC.

Machine Control Studio is powered by CODESYS, the leading open software for programmable machine control. The programming environment is fully EN/IEC 61131-3 compliant, meaning that it is familiar and therefore fast and easy to use for control engineers around the world.

The following EN/IEC 61131-3 programming languages are supported:

- Structured Text (ST)
- Function Block Diagram (FBD)
- Structured Function Chart (SFC)
- Ladder Diagram (LD)
- Instruction List (IL)

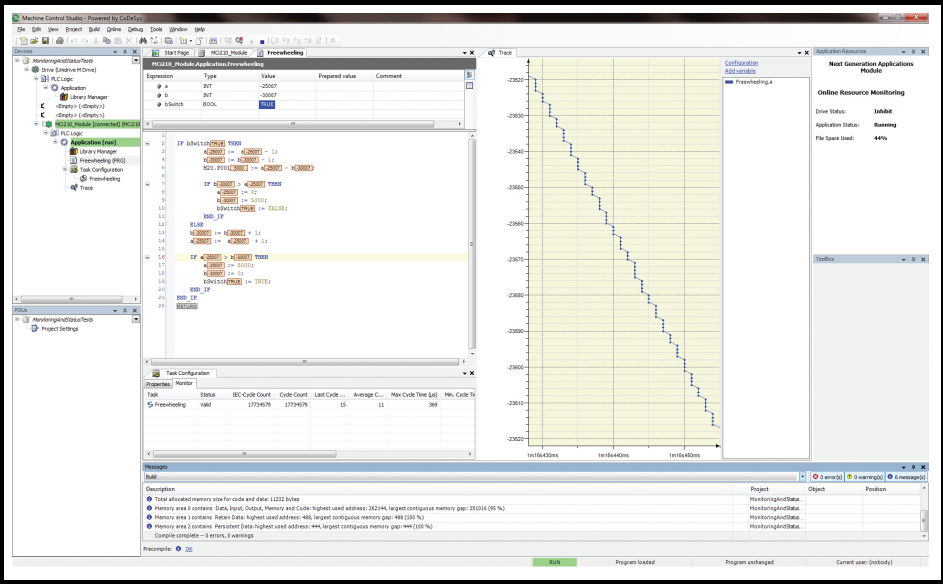
Also supported:

- Continuous Function Chart (CFC)

Onboard intelligence

- Programmable Logic Control (PLC) - memory: 12 kB
- 1 x Real-time task (16 ms), 1 x Background task

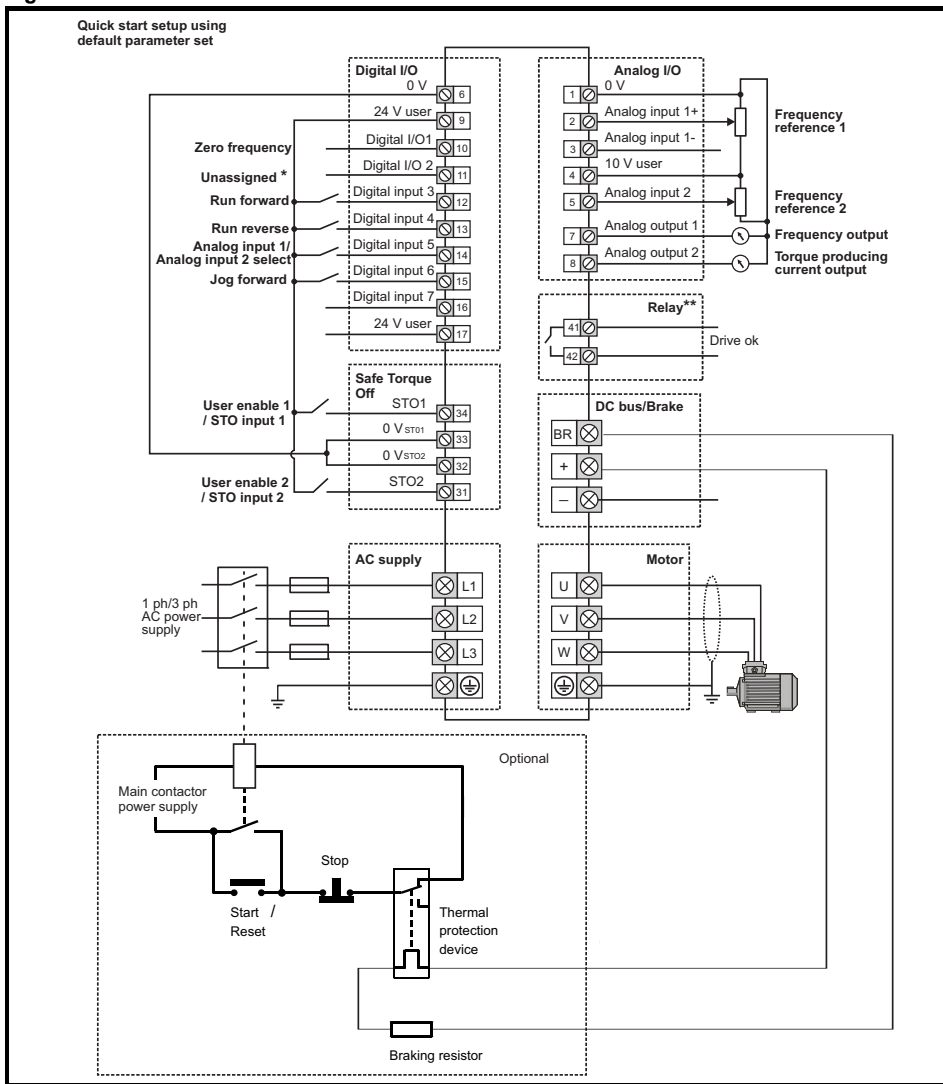
Intuitive IntelliSense functionality helps to write consistent and robust programming, speeding up software development. Programmers have access to a vibrant open-source community for function blocks. Machine Control Studio supports customers' own function block libraries, with on-line monitoring of program variables with user defined watch windows and help for on-line change of program, in line with current PLC practices.



Download Machine Control Studio from: [www.drive-setup.com](http://www.drive-setup.com).

# 11 Default control connections

Figure 11-1 Frame 1 to 4 connections



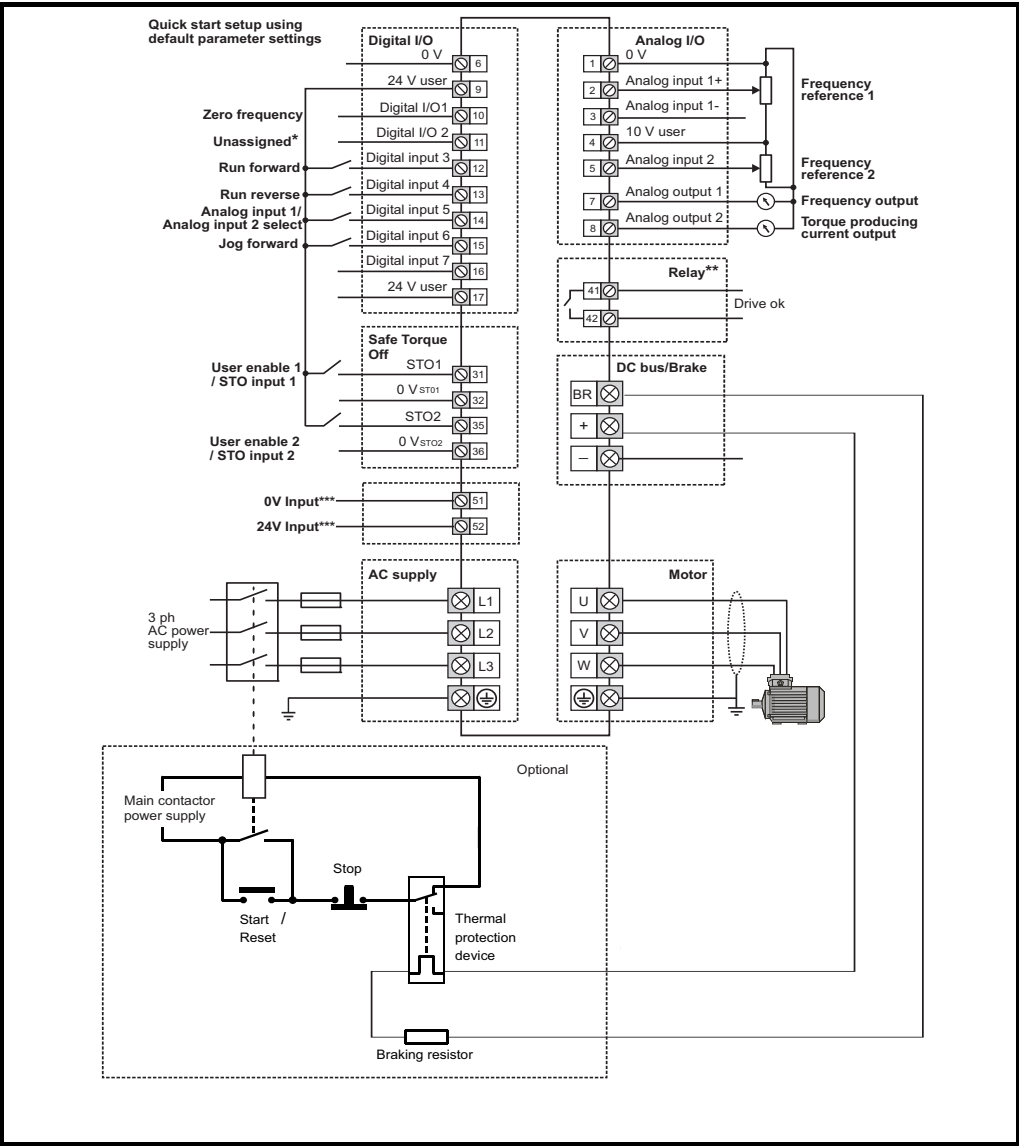
\* Unidrive M400 uses Safe Torque Off (drive enable) inputs and terminal 11 is unassigned.

\*\* 250 Vac maximum (UL class 1).

**NOTE** The 0 V terminals on the Safe Torque Off are isolated from each other and the 0 V common.  
On the size 2 110 V drives or when connecting single phase to a dual rated 200 V unit, the supply should be connected to L1 and L3.

**NOTE** For Frame 5 and above default control connections, see the back cover of this guide.

Figure 11-2 Frame 5 and above default control connections



\* Unidrive M400 uses Safe Torque Off (drive enable) inputs and terminal 11 is unassigned.  
\*\* 250 Vac maximum (UL class 1).  
\*\*\* Size 6 and larger only.

**NOTE** The 0 V terminals on the Safe Torque Off are not isolated from each other and the 0 V common.

