EMERSON
Industrial Automation

# *Control Quick Start Guide*

# *Unidrive M300*

**Enhance throughput with machine safety**

Part Number: 0478-0281-02
Issue: 2

## Original Instructions

For the purposes of compliance with the EU Machinery Directive 2006/42/EC

This guide is intended to provide basic information required in order to set-up a drive to run a motor. For more detailed installation information, please refer to the *Unidrive M300 User Guide* which is available to download from:

http://www.emersonindustrial.com/en-EN/controltechniques/downloads/userguidesandsoftware/Pages/downloads.aspx.

or

www.emersonindustrial.com/en-EN/leroy-somer-motors-drives/downloads/Pages/manuals.aspx.

## 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.

This guide does not include safety information. Incorrect installation or operation of the drive, could cause personnel injury or equipment damage. For essential safety information, please refer to the *Unidrive M300 User Guide* or the safety booklet supplied with the drive.

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Issue Number: 2

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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 Electrical safety - general warning

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

## 1.3 System design and safety of personnel

The drive is intended as a component for professional incorporation into complete equipment or a system. If installed incorrectly, the drive 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 experience. They must read this safety information and this Guide carefully.

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

**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.**

Careful consideration must be given to the functions of the drive which might result in a hazard, either through their intended behavior 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.

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.

## 1.4 Environmental limits

Instructions in this guide regarding transport, storage, installation and use of the drive must be complied with, including the specified environmental limits. Drives must not be subjected to excessive physical force.

## 1.5 Access

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

## 1.6 Fire protection

The drive enclosure is not classified as a fire enclosure. A separate fire enclosure must be provided. For further information, refer to the *Drive User Guide*.

## 1.7 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 instruction for achieving compliance with specific EMC standards.

Within the European Union, all machinery in which this product is used must comply with the following directives:

2006/42/EC: Safety of machinery.
2004/108/EC: Electromagnetic Compatibility.

## 1.8 Motor

Ensure the motor is installed in accordance with the manufacturer's recommendations. Ensure the motor shaft is not exposed.

Standard squirrel cage induction motors are designed for single speed operation. If it is intended to use the capability of the drive to run a motor at speeds above its designed maximum, it is strongly recommended that the manufacturer is consulted first.

Low speeds may cause the motor to overheat because the cooling fan becomes less effective. 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 should not be relied upon.

It is essential that the correct value is entered in Pr **00.006** motor rated current. This affects the thermal protection of the motor.

## 1.9 Mechanical brake control

The 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.

## 1.10 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.

## 1.11 Electrical installation

### 1.11.1 Electric shock risk

The voltages present in the following locations can cause severe electric shock and may be lethal:

- AC 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.

### 1.11.2 Stored 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.

# 2 Introduction

M300 helps machine builders maximise up-time and meet modern functional safety standards. Dual Safe Torque off (STO) inputs offer easy SIL3 conformity and reduce the need for external components, minimising overall machine dimensions and cost.

## 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)
   - Quadratic V/F mode (V/Hz)
2. RFC - A

### 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.

**Quadratic 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

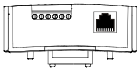
Sensorless mode provides closed loop control without the need for position feedback by using current, voltages and key operating motor parameters to estimate the motor speed. It can eliminate instability traditionally associated with open loop control such as operating large motors with light loads at 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 | |
| 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 |
| 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.Pr (2), AI.Pr (3), Preset (4), Pad (5), Pad.Ref (6), E.Pot (7), torque (8), Pid (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) 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.Pr | Analog input 1 (voltage) or 3 presets selected by terminal |
| 3 | AI.Pr | Analog input 1 (current) or 3 presets selected by terminal |
| 4 | Preset | Four presets selected by terminal |
| 5 | Pad | Keypad reference |
| 6 | Pad.Ref | Keypad reference with terminal control |
| 7 | E.Pot | Electronic Potentiometer |
| 8 | torque | Torque mode, Analog input 1 (current frequency reference) or Analog input 2 (voltage torque reference) selected by terminal |
| 9 | Pid | PID mode, Analog input 1 (current feedback source) and Analog input 2 (voltage reference source) |

Defaults are loaded before drive configuration changes are made.

Action will only occur if the drive is inactive, not in UU state 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 (50 and 60 Hz)**

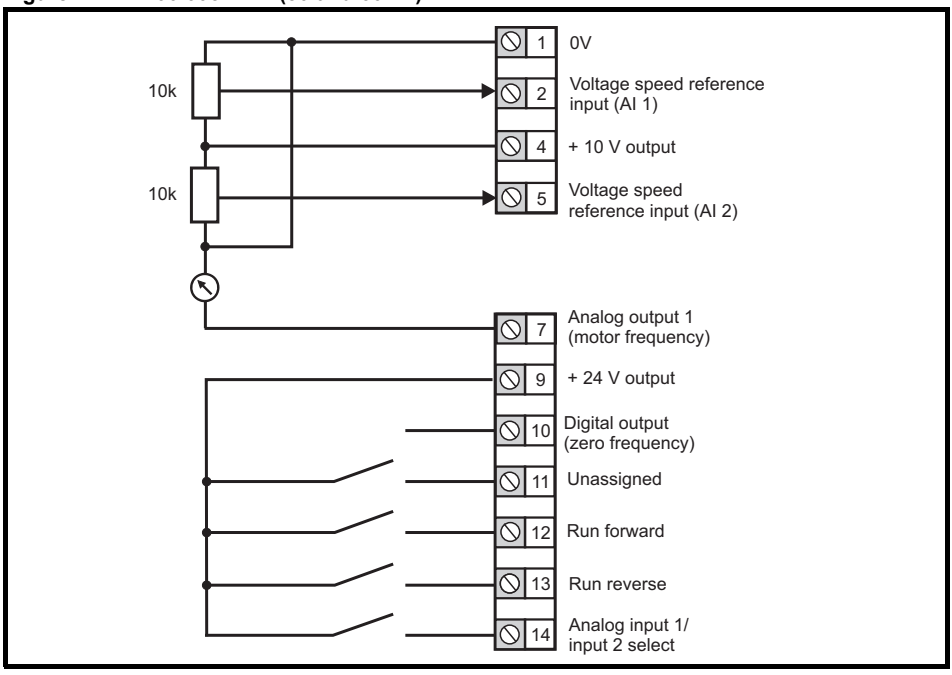



**Figure 4-2 Pr 00.005 = AI (50 and 60 Hz)**

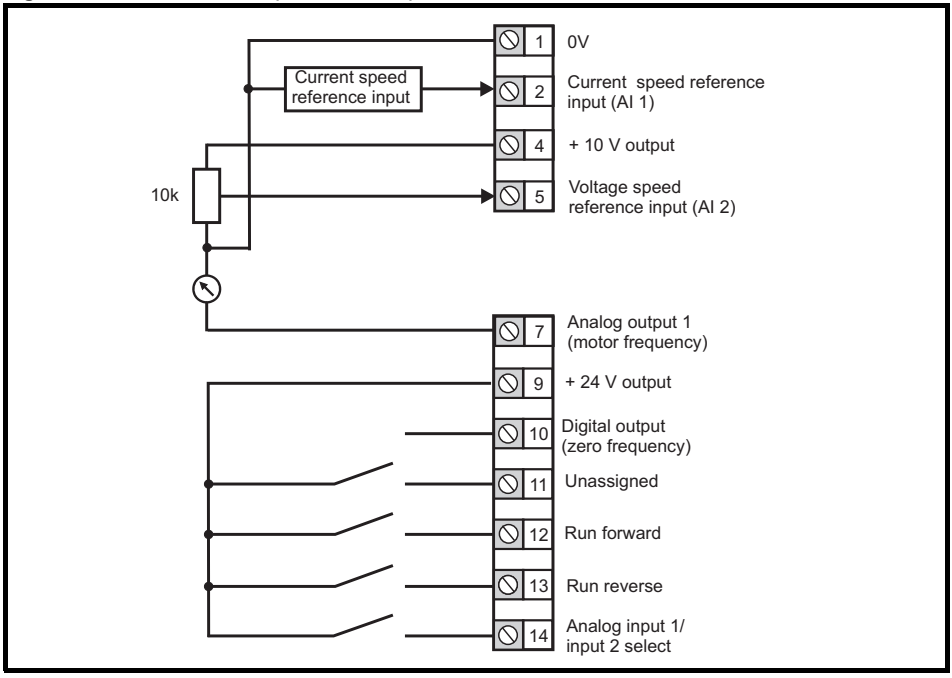
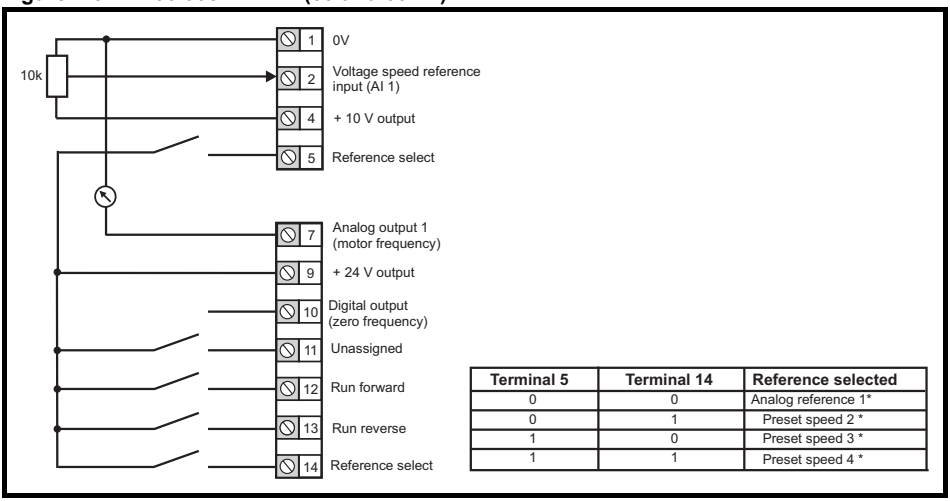


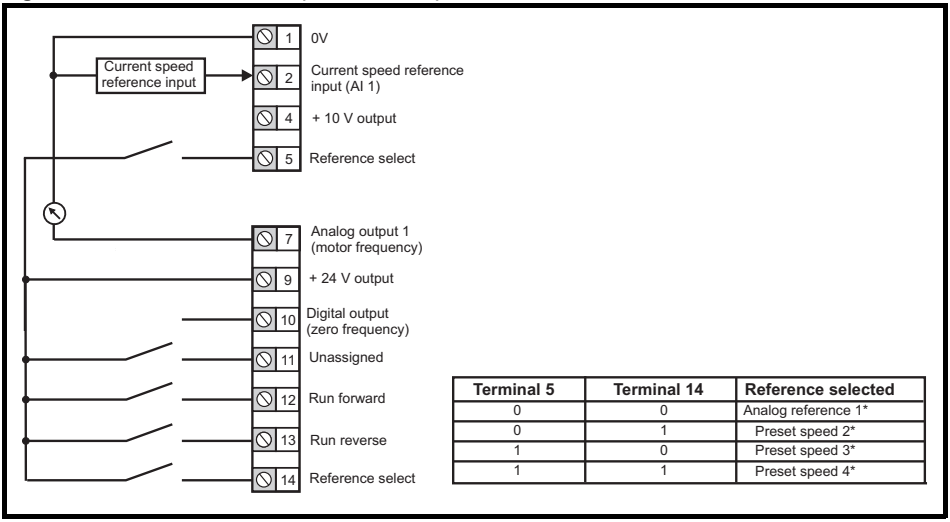
**Figure 4-3 Pr 00.005 = AV.Pr (50 and 60 Hz)**




| Terminal 5 | Terminal 14 | Reference selected |
|---|---|---|
| 0 | 0 | Analog reference 1* |
| 0 | 1 | Preset speed 2 * |
| 1 | 0 | Preset speed 3 * |
| 1 | 1 | Preset speed 4 * |

* Refer to the *Drive User Guide*.

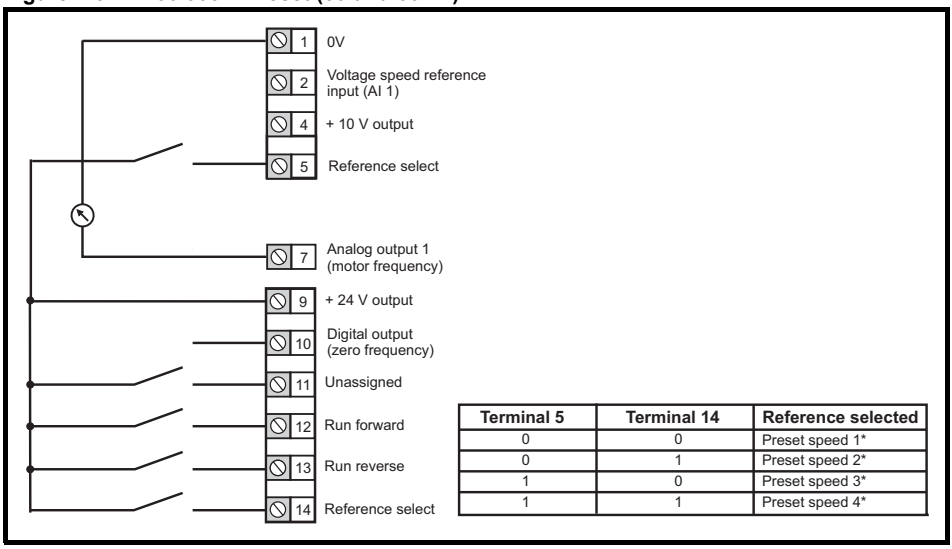
**Figure 4-4 Pr 00.005 = AI.Pr (50 and 60 Hz)**




| Terminal 5 | Terminal 14 | Reference selected |
|---|---|---|
| 0 | 0 | Analog reference 1* |
| 0 | 1 | Preset speed 2* |
| 1 | 0 | Preset speed 3* |
| 1 | 1 | Preset speed 4* |

* Refer to the *Drive User Guide*.

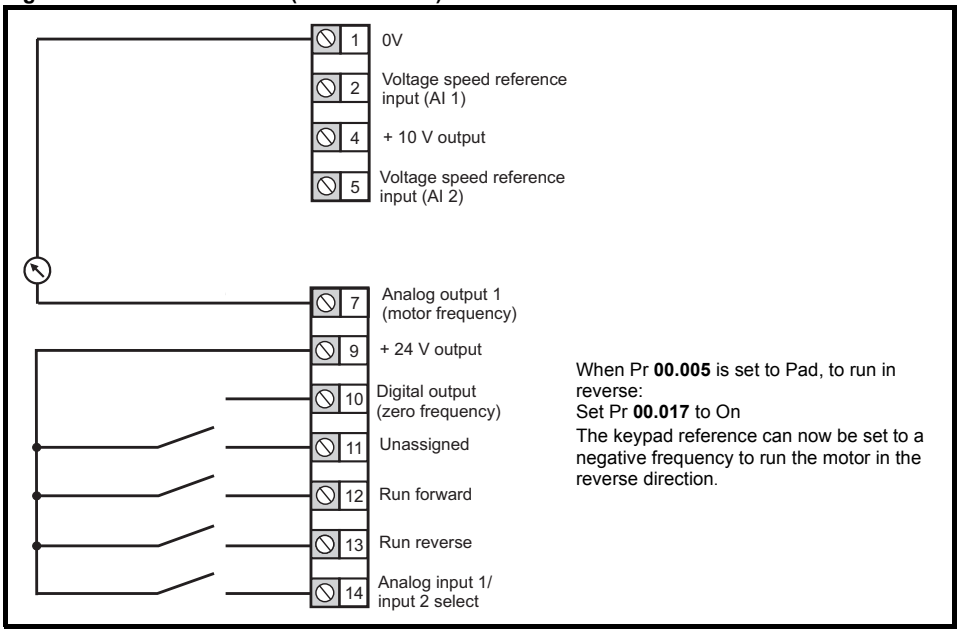
**Figure 4-5 Pr 00.005 = Preset (50 and 60 Hz)**




| Terminal 5 | Terminal 14 | Reference selected |
|---|---|---|
| 0 | 0 | Preset speed 1* |
| 0 | 1 | Preset speed 2* |
| 1 | 0 | Preset speed 3* |
| 1 | 1 | Preset speed 4* |

* Refer to the *Drive User Guide*.

**Figure 4-6 Pr 00.005 = Pad (50 Hz & 60 Hz)**




When Pr **00.005** is set to Pad, to run in reverse:
Set Pr **00.017** to On
The keypad reference can now be set to a negative frequency to run the motor in the reverse direction.

**Figure 4-7 Pr 00.005 = Pad.Ref (50 Hz & 60 Hz)**

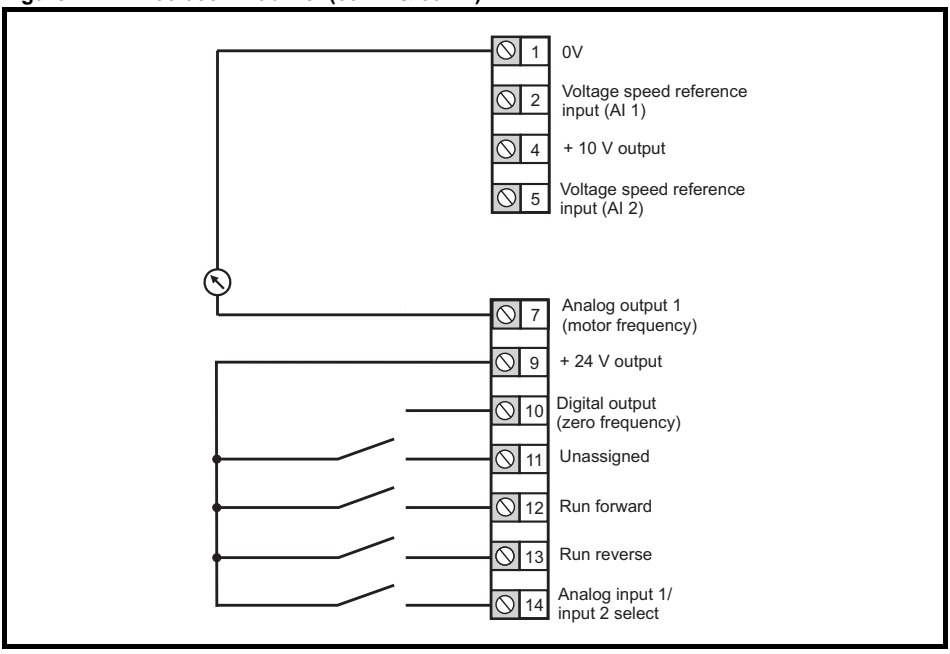



**Figure 4-8 Pr 00.005 = E.Pot (50 and 60 Hz)**

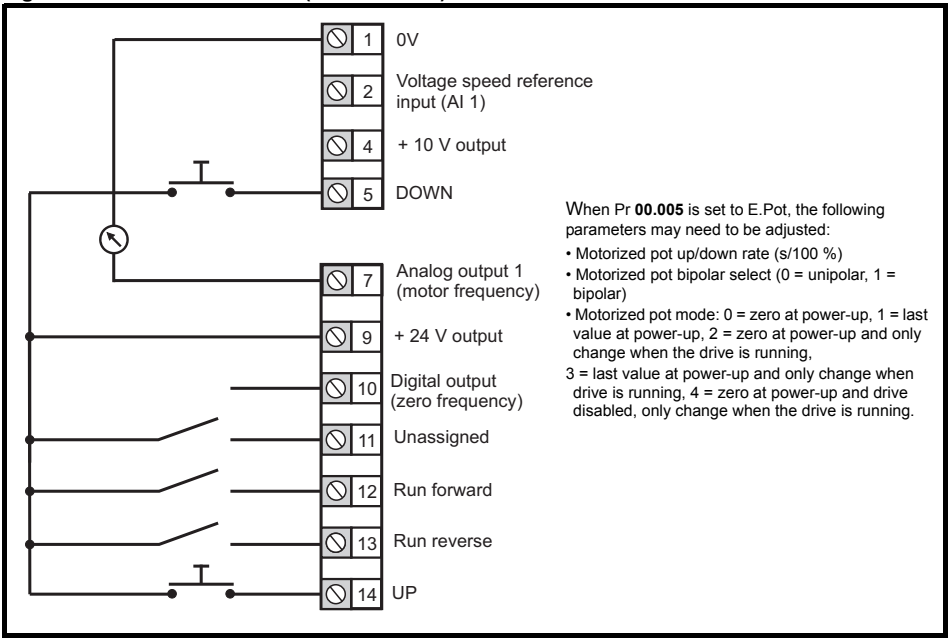
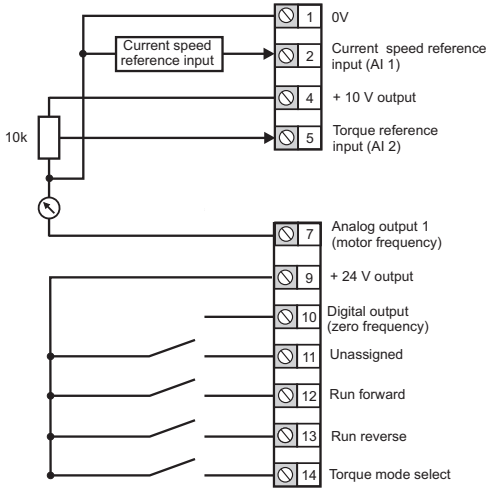


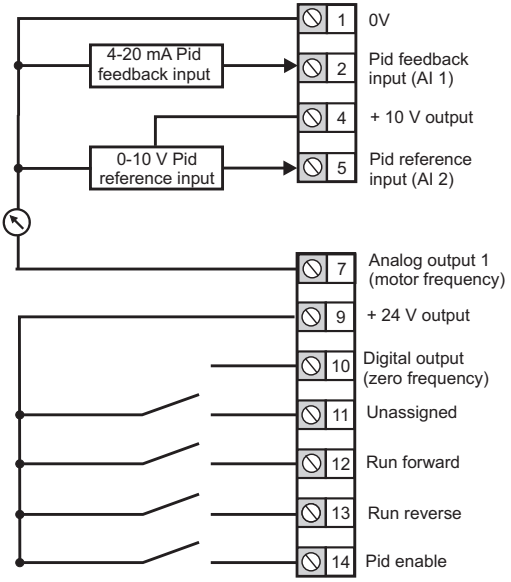
**Figure 4-9 Pr 00.005 = torque (50 and 60 Hz)**




**WARNING**

When torque mode is selected and the drive is connected to an unloaded motor, the motor speed may increase rapidly to the maximum speed (Pr **00.002** +10 %)

**Figure 4-10 Pr 00.005 = Pid (50 and 60 Hz)**




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

- PID proportional gain*
- PID integral gain*
- PID feedback invert*
- PID output upper limit (%)*
- PID output lower limit (%)*

* Refer to the *Drive 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.

**WARNING**

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.

**WARNING**

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.

**WARNING**

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 33 at the drive.

**Figure 4-11 Frame 1 to 4 STO connections**

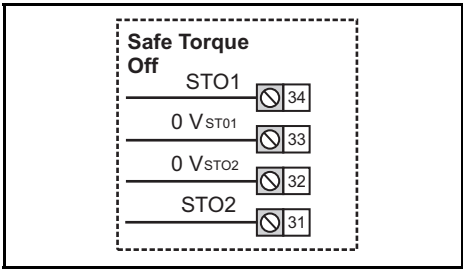
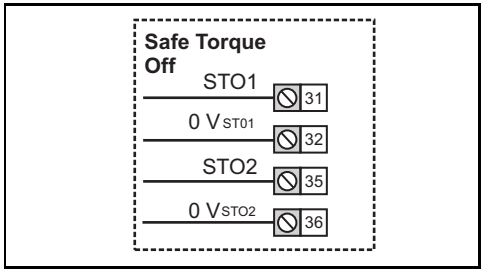



**Figure 4-12 Frame 5 and above STO connections**



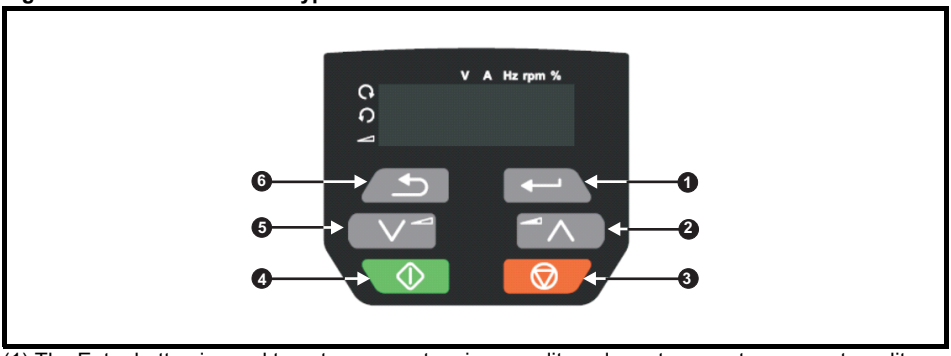
**NOTE** **Frame 1 to 4**
The 0 V terminals on the Safe Torque Off are isolated from each other and the 0 V common.

**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 Keypad and display

The keypad and display provide information to the user regarding the operating status of the drive 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 M300 keypad detail**




(1) The Enter button is used to enter parameter view or edit mode, or to accept a parameter edit.

(2, 5) The Navigation keys can be used to select individual parameters or to edit parameter values. In keypad mode, the 'Up' and 'Down' keys are also used to increase or decrease the motor speed.

(3) The Stop / Reset button is used to stop and reset the drive in keypad mode. It can also be used to reset the drive in terminal mode.

(4) The Start button is used to start the drive in keypad mode.

(6) The Escape button is used to exit from the parameter edit / view mode or disregard a parameter edit.

**Table 5-1 Status indications**

| String | Description | Drive output stage |
|---|---|---|
| **inh** | 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 |
| **rdy** | 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 |
| **Stop** | The drive is stopped / holding zero speed. | Enabled |
| **S.Loss** | Supply loss condition has been detected. | Enabled |
| **dc.inj** | The drive is applying DC injection braking. | Enabled |
| **Er** | The drive has tripped and no longer controlling the motor. The trip code appears in the display. | Disabled |
| **UV** | The drive is in the under voltage state either in low voltage or high voltage mode. | Disabled |

## 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'* 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

* If the drive is in the under voltage state (i.e. when the AI-Backup adaptor terminals are being supplied from a +24 Vdc supply) a value of 1001 must be entered into Pr **mm.000** to perform a save function.

## 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. terminal 11 is open or is OFF (0)
2. Select 'Def.50’ or 'Def.60' 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. All the parameters in Menu 0 appear in other menus in the drive (denoted by {…}). Menus 22 can be used to configure the parameters in Menu 0.

## 6.1 Menu 0: Basic parameters

| Parameter | | Range (⇳) | | Default (⇨) | | Type | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | OL | RFC-A | OL | RFC-A | | | | | | |
| **00.001** | Minimum Reference Clamp | ±VM_NEGATIVE_REF_CLAMP1 Hz | | 0.00 Hz | | RW | Num | | | | US |
| **00.002** | Maximum Reference Clamp | ±VM_POSITIVE_REF_CLAMP Hz | | 50 Hz default: 50.00 Hz<br>60 Hz default: 60.00 Hz | | RW | Num | | | | US |
| **00.003** | Acceleration Rate 1 | ±VM_ACCEL_RATE s/100 Hz | | 5.0 s/100 Hz | | RW | Num | | | | US |
| **00.004** | Deceleration Rate 1 | ±VM_ACCEL_RATE s/100 Hz | | 10.0 s/100 Hz | | RW | Num | | | | US |
| **00.005** | Drive Configuration | AV (0), AI (1), AV.Pr (2), AI.Pr (3), Preset (4), Pad (5), Pad.Ref (6), E.Pot (7), torque (8), Pid (9) | | AV (0) | | RW | Txt | | | PT | US |
| **00.006** | Motor Rated Current | 0.00 to VM_RATED_CURRENT A | | Maximum Heavy Duty Rating A | | RW | Num | | RA | | US |
| **00.007** | Motor Rated Speed | 0.0 to 80000.0 rpm | | 50 Hz default: 1500.0 rpm<br>60 Hz default: 1800.0 rpm | 50 Hz default: 1450.0 rpm<br>60 Hz default: 1750.0 rpm | RW | Num | | | | US |
| **00.008** | Motor Rated Voltage | 0 to VM_AC_VOLTAGE_SET V | | 110 V drive: 230 V<br>200 V drive: 230 V<br>400 V drive 50 Hz: 400 V<br>400 V drive 60 Hz: 460 V | | RW | Num | | RA | | US |
| **00.009** | Motor Rated Power Factor | 0.00 to 1.00 | | 0.85 | | RW | Num | | RA | | US |
| **00.010** | User Security Status | LEVEL.0 (0), ALL (1), r.only.0 (2), r.only.A (3), Status (4), no.acc(5) | | LEVEL.0 (0) | | RW | Num | ND | NC | PT | |
| **00.015** | Jog Reference | 0.00 to 300.00 Hz | | 1.50 Hz | | RW | Num | | | | US |
| **00.016** | Analog Input 1 Mode | 4-20.S (-6), 20-4.S (-5), 4-20.L (-4), 20-4.L (-3), 4-20.H (-2), 20-4.H (-1), 0-20 (0), 20-0 (1), 4-20.tr (2), 20-4.tr (3), 4-20 (4), 20-4 (5), Volt (6) | | Volt (6) | | RW | Txt | | | | US |
| **00.017** | Bipolar Reference Enable | Off (0) or On (1) | | Off (0) | | RW | Bit | | | | US |
| **00.018** | Preset Reference 1 | ±VM_SPEED_FREQ_REF Hz | | 0.00 Hz | | RW | Num | | | | US |
| **00.025** | User Security Code | 0 to 9999 | | 0 | | RW | Num | ND | NC | 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), Std (1), Std.bst (2), Fst.bst (3) | | Std (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), Prog (2), Auto (3), boot (4) | | None (0) | | RW | Txt | | NC | | US |
| **00.031** | Stop Mode | CoASt (0), rP (1), rP.dc I (2), dc I (3), td.dc I (4), dis (5) | CoASt (0), rP (1), rP.dc I (2), dc I (3), td.dc I (4), dis (5), No.rP (6) | rp (1) | | RW | Txt | | | | US |

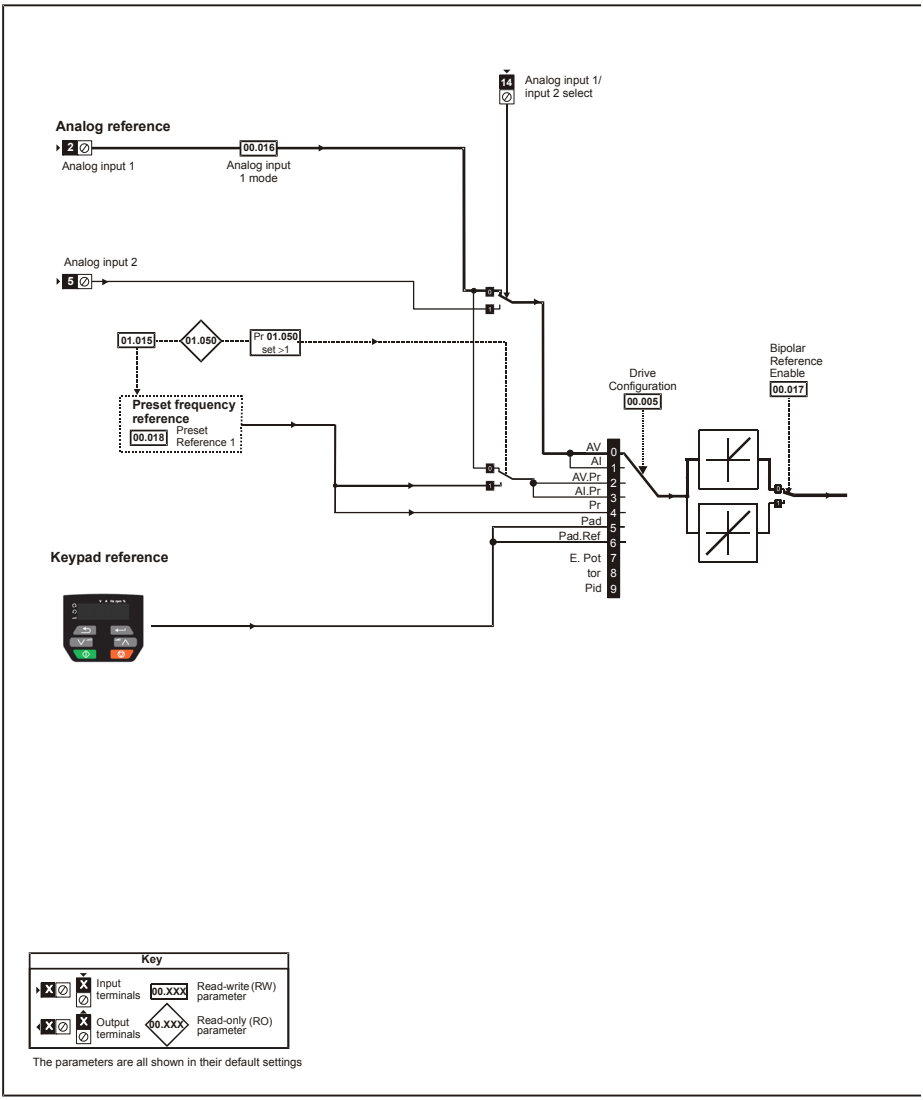
| Parameter | | Range (⇳) | | Default (⇨) | | Type | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | OL | RFC-A | OL | RFC-A | | | | | | |
| **00.032** | Dynamic V to F Select / Flux Optimization Select | 0 to 1 | | 0 | | RW | Num | | | | US |
| **00.033** | Catch A Spinning Motor | dis (0), Enable (1), Fr.Only (2), Rv.Only (3) | | dis (0) | | RW | Txt | | | | US |
| **00.034** | Digital Input 5 Mode | Input (0), th.Sct (1), th (2), th.Notr (3), Fr (4) | | 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 VM_SPEED_FREQ_REF_UNIPOLAR Hz | | 50 Hz: 50.00 Hz<br>60 Hz: 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), Fd (2), Ur.Auto (3), Ur.I (4), SrE (5), Fd.tap (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 | 300 (0), 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 |
| **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), For (1), Rev (2) | | Ref (0) | | RW | Txt | | | | US |
| **00.054** | Brake Controller Brake Apply Through Zero Threshold | 0.00 to 25.00 Hz | | 0.00 Hz | | RW | Num | | | | US |
| **00.055** | Brake Controller Enable | dis (0), Relay (1), dig IO (2), User (3) | | dis (0) | | RW | Txt | | | | US |
| **00.065** | Frequency Controller Proportional Gain Kp1 | | 0.000 to 200.000 s/rad | | 0.100 s/rad | RW | Num | | | | US |

| Parameter | | Range (⇳) | | Default (⇨) | | Type | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | OL | RFC-A | OL | RFC-A | | | | | | |
| **00.066** | Frequency Controller Integral Gain Ki1 | | 0.00 to 655.35 $s^2$/rad | | 0.10 $s^2$/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 |
| **00.076** | Action on Trip Detection | 0 to 31 | | 0 | | RW | Num | ND | NC | PT | US |
| **00.077** | Maximum Heavy Duty Current Rating | 0.00 to 9999.99 A | | | | RO | Num | ND | NC | PT | |
| **00.078** | Software Version | 0 to 999999 | | | | RO | Num | ND | NC | PT | |
| **00.079** | User Drive Mode | OPEn.LP (1), RFC-A (2) | | OPEn.LP (1) | RFC-A (2) | RW | Txt | ND | NC | PT | US |

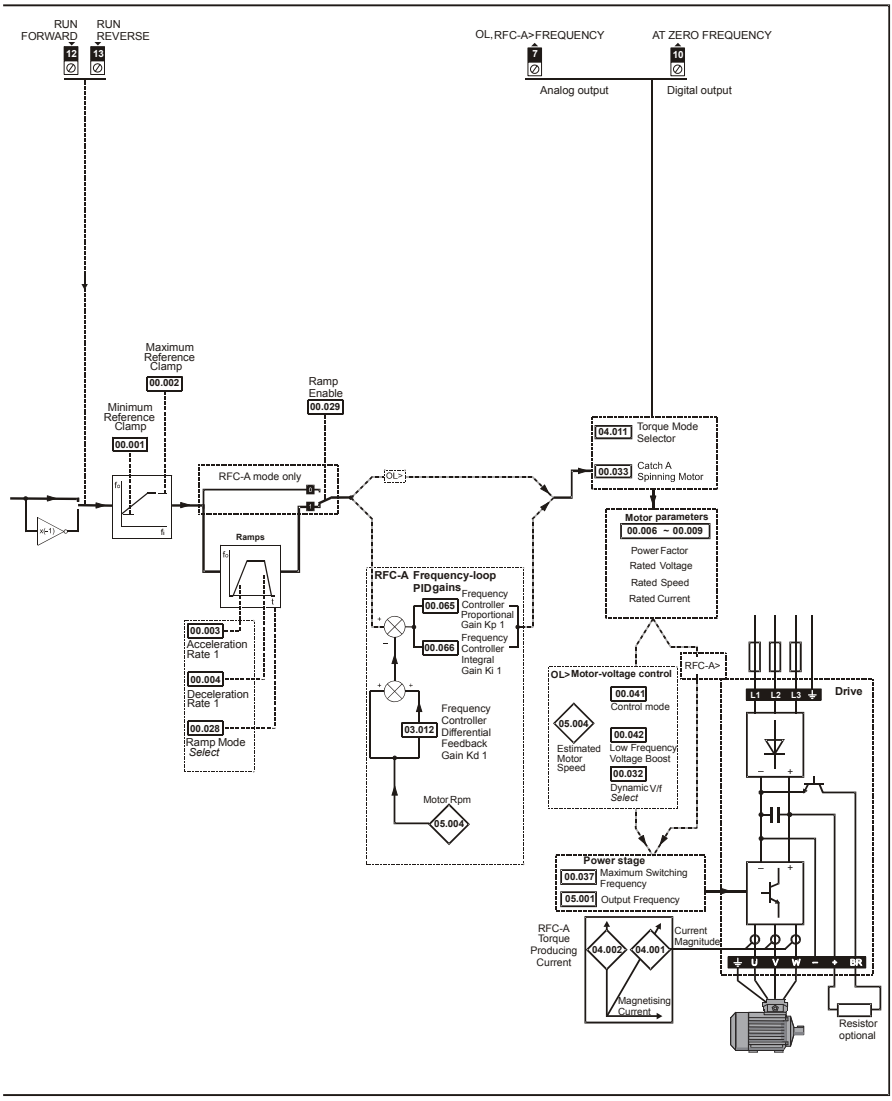
* If this parameter is read via serial communications, it will show pole pairs.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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**




The parameters are all shown in their default settings


RUN FORWARD
12
RUN REVERSE
13
OL,RFC-A>FREQUENCY
7
Analog output
AT ZERO FREQUENCY
10
Digital output
Maximum Reference Clamp
00.002
Minimum Reference Clamp
00.001
Ramp Enable
00.029
RFC-A mode only
Ramps
00.003
Acceleration Rate 1
00.004
Deceleration Rate 1
00.028
Ramp Mode Select
RFC-A Frequency-loop PIDgains
00.065
Frequency Controller Proportional Gain Kp 1
00.066
Frequency Controller Integral Gain Ki 1
03.012
Frequency Controller Differential Feedback Gain Kd 1
Motor Rpm
05.004
04.011
Torque Mode Selector
00.033
Catch A Spinning Motor
Motor parameters
00.006 ~ 00.009
Power Factor
Rated Voltage
Rated Speed
Rated Current
OL> Motor-voltage control
00.041
Control mode
05.004
Estimated Motor Speed
00.042
Low Frequency Voltage Boost
00.032
Dynamic V/f Select
RFC-A>
Drive
L1 L2 L3
Power stage
00.037
Maximum Switching Frequency
05.001
Output Frequency
RFC-A Torque Producing Current
04.002
04.001
Current Magnitude
Magnetising Current
U V W BR
Resistor optional

## 6.2 Unidrive M300 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 {01.007}** | | **Minimum Reference Clamp** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| RW | | Num | | | | | | US | |
| **OL** / **RFC-A** | ⇳ | ±VM_NEGATIVE_REF_CLAMP1 Hz | ⇨ | 0.00 Hz | | | | | |

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 {01.006}** | | **Maximum Reference Clamp** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| RW | | Num | | | | | | US | |
| **OL** / **RFC-A** | ⇳ | ±VM_POSITIVE_REF_CLAMP Hz | ⇨ | 50.0 Hz default: 50.00 Hz<br>60.0 Hz default: 60.00 Hz | | | | | |

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 {02.011}** | | **Acceleration Rate 1** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| RW | | Num | | | | | | US | |
| **OL** / **RFC-A** | ⇳ | ±VM_ACCEL_RATE s/100 Hz | ⇨ | 5.0 s/100 Hz | | | | | |

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 {02.021} | | Deceleration Rate 1 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RW | | Num | | | | | | | US | |
| OL<br>RFC-A | ⇳ | ±VM_ACCEL_RATE s/100 Hz | | | ⇨ | 10.0 s/100 Hz | | | | |

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 {11.034} | | Drive Configuration | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RW | | Txt | | | | | | PT | US | |
| OL | ⇳ | AV (0), AI (1), AV.Pr (2), AI.Pr (3), Preset (4), Pad (5), Pad.Ref (6), E.Pot (7), torque (8), Pid (9) | | | ⇨ | AV (0)* | | | | |

* With Unidrive M201, the default is Pad (5).

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

| Value | Text | Description |
|---|---|---|
| 0 | AV | Analog input 1 (voltage) 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.Pr | Analog input 1 (voltage) or 3 presets selected by terminal |
| 3 | AI.Pr | Analog input 1 (current) or 3 presets selected by terminal |
| 4 | Preset | Four presets selected by terminal |
| 5 | Pad | Keypad reference |
| 6 | Pad.Ref | Keypad reference with terminal control |
| 7 | E.Pot | Electronic Potentiometer |
| 8 | torque | Torque mode, Analog input 1 (current frequency reference) or Analog input 2 (voltage torque reference) selected by terminal |
| 9 | Pid | 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 MODE key 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 MODE key 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 {05.007} | | Motor Rated Current | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RW | | Num | | | | | RA | | US | |
| OL | ⇳ | 0.00 to VM_RATED_CURRENT 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 (see *Enable Slip Compensation)*
- Dynamic V/F control

| 00.007 {05.008} | | Motor Rated Speed | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RW | | Num | | | | | | | US | |
| OL | ⇳ | 0.0 to 80000.0 rpm | | | | ⇨ | 50 Hz default: 1500.0 rpm<br>60 Hz default: 1800.0 rpm | | | |
| RFC-A | | | | | | | 50 Hz default: 1450.0 rpm<br>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 {05.009} | | Motor Rated Voltage | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RW | | Num | | | | | RA | | US | |
| OL | ⇳ | 0 to VM_AC_VOLTAGE_SET V | | | | ⇨ | 110 V drive: 230 V<br>200 V drive: 230 V<br>400 V drive 50 Hz: 400 V<br>400 V drive 60 Hz: 460 V | | | |
| RFC-A | | | | | | | | | | |

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 {05.010} | | 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 φ (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 {11.044} | | User Security Status | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RW | | Num | | | | ND | NC | PT | US | |
| OL<br>RFC-A | ⇳ | LEVEL.0 (0), ALL (1), r.only.0 (2), r.only.A (3), Status (4), no.Acc (5) | | | ⇨ | LEVEL.0 (0) | | | | |

This parameter controls access via the drive keypad as follows:

| Value | Text | Function |
|---|---|---|
| 0 | Menu 0 (LEVEL.0) | All writable parameters are available to be edited but only parameters in Menu 0 are visible. |
| 1 | All Menus (ALL) | All writable parameters are visible and available to be edited. |
| 2 | Read-only Menu 0 (r.only.0) | All parameters are read-only. Access is limited to Menu 0 parameters only. |
| 3 | Read-only (r.only.A) | All parameters are read-only however all menus and parameters are visible. |
| 4 | Status Only (Status) | The keypad remains in status mode and no parameters can be viewed or edited. |
| 5 | No Access (no.Acc) | 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. |

| 00.015 {01.005} | | Jog Reference | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RW | | Num | | | | | | | US | |
| OL<br>RFC-A | ⇳ | 0.00 to 300.00 Hz | | | ⇨ | 1.50 Hz | | | | |

Defines the reference when jog is enabled.

| 00.016 {07.007} | | Analog Input 1 Mode | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RW | | Txt | | | | | | | US | |
| OL | ⇳ | 4-20.S (-6), 20-4.S (-5), 4-20.L (-4), 20-4.L (-3), 4-20.H (-2), 20-4.H (-1), 0-20 (0), 20-0 (1), 4-20.tr (2), 20-4.tr (3), 4-20 (4), 20-4 (5), Volt (6) | ⇨ | Volt (6) | | | | | |

Defines the mode of analog input 1.

The table below gives all the possible analog input modes.

| Value | Text | Function |
|---|---|---|
| -6 | 4-20.S | Stop on loss |
| -5 | 20-4.S | Stop on loss |
| -4 | 4-20.L | 4-20 mA switching to equivalent of 4 mA input current on loss |
| -3 | 20-4.L | 20-4 mA switching to equivalent of 20 mA input current on loss |
| -2 | 4-20.H | 4-20 mA hold at level before loss on loss |
| -1 | 20-4.H | 20-4 mA hold at level before loss on loss |
| 0 | 0-20 | 0-20 mA |
| 1 | 20-0 | 20-0 mA |
| 2 | 4-20.tr | 4-20 mA trip on loss |
| 3 | 20-4.tr | 20-4 mA trip on loss |
| 4 | 4-20 | 4-20 mA no action on loss |
| 5 | 20-4 | 20-4 mA no action on loss |
| 6 | Volt | 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 T3), they must have a resistance >4 kΩ each.

| 00.017 {01.010} | | Bipolar Reference Enable | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RW | | Bit | | | | | | | US | |
| OL<br>RFC-A | ⇳ | Off (0) or On (1) | | | ⇨ | Off (0) | | | | |

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

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

| 00.018 {01.021} | | Preset Reference 1 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RW | | Num | | | | | | | US | |
| OL / RFC-A | ⇳ | ±VM_SPEED_FREQ_REF Hz | | | ⇨ | 0.00 Hz | | | | |

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).

| 00.025 {11.030} | | User Security Code | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RW | | Num | | | | ND | NC | PT | US | |
| OL / RFC-A | ⇳ | 0-9999 | | | ⇨ | 0 | | | | |

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 *Drive User Guide* for further information.

| 00.027 {01.051} | | Power-up Keypad Control Mode Reference | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RW | | Txt | | | | ND | NC | PT | US | |
| OL / RFC-A | ⇳ | Reset (0), Last (1), Preset (2) | | | ⇨ | Reset (0) | | | | |

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 *Preset Reference 1* (00.018) |

| 00.028 {02.004} | | Ramp Mode Select | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RW | | Txt | | | | | | | US | |
| OL / RFC-A | ⇳ | Fast (0), Std (1), Std.bst (2), Fst.bst (3) | | | ⇨ | Std (1) | | | | |

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 {02.002} | | 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 {11.042} | | Parameter Cloning | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| RW | | Txt | | | | | NC | US* | |
| OL | ⇳ | None (0), Read (1), Program (2), 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 9 *NV Media Card Operation* on page 46.

| 00.031 {06.001} | | Stop Mode | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RW | | Txt | | | | | | | US | |
| OL | ⇳ | CoASt (0), rP (1), rP.dc I (2), dc I (3), td.dc I (4), dis (5) | | | ⇨ | rP (1) | | | | |
| RFC-A | | CoASt (0), rP (1), rP.dc I (2), dc I (3), td.dc I (4), dis (5), No.rP (6) | | | | | | | | |

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

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

See the *Drive User Guide* for further information.

| 00.032 {05.013} | | Dynamic V To F Select / Flux Optimisation Select | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RW | | Num | | | | | | | US | |
| OL | ⇳ | 0 to 1 | | | ⇨ | 0 | | | | |
| RFC-A | | | | | | | | | | |

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.

| 00.033 {06.009} | | Catch a Spinning Motor | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RW | | Txt | | | | | | | US | |
| OL | ⇳ | dis (0), Enable (1), Fr.Only (2), Rv.Only (3) | | | ⇨ | dis (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 32) must be carried out to measure the motor's stator resistance beforehand. If a stator resistance is not measured, the drive may trip on 0 V or OI.AC while trying to catch a spinning motor.

| Pr 00.033 | Text | Function |
|---|---|---|
| 0 | Dis | Disabled |
| 1 | Enable | Detect all frequencies |
| 2 | Fr.Only | Detect positive frequencies only |
| 3 | Rv.Only | Detect negative frequencies only |

| 00.034 {08.035} | | Digital Input 5 Mode | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RW | | Txt | | | | | | | US | |
| OL<br>RFC-A | ⇳ | Input (0), th.Sct (1), th (2), th.Notr (3), Fr (4) | | | ⇨ | Input (0) | | | | |

This parameter selects the function of Digital Input 5.

| Value | Text | Function |
|---|---|---|
| 0 | Input (0) | Digital input |
| 1 | th.Sct (1) | Temperature measurement input with short circuit detection (Resistance <50 Ω ) |
| 2 | th (2) | Temperature measurement input without short circuit detection but with th trip |
| 3 | th.Notr (3) | Temperature measurement input with no trips |
| 4 | Fr (4) | Frequency input |

| 00.035 {08.091} | | DO1 Control (terminal 10) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RW | | Num | | | | | | | US | |
| OL<br>RFC-A | ⇳ | 0-21 | | | ⇨ | 0 | | | | |

Defines the behaviour of digital output 1.

| Value | Description |
|---|---|
| 0 | User defined by Digital IO1 Source/Destination A, Digital IO2 Source/Destination A, *Relay 1 Output Source A,* or Relay 2 Output Source A. |
| 1 | Drive running signal (RUN) |
| 2 | Frequency arrived signal (FAR) |
| 3 | Frequency level detection signal (FDT1) |
| 4 | Frequency level detection signal (FDT2) |
| 5 | Overload detection signal (OL) |
| 6 | Power off state (LU) |
| 7 | External fault stop (EXT) |
| 8 | Frequency upper limit (FHL) |
| 9 | Frequency lower limit (FLL) |
| 10 | Drive running at zero frequency |
| 14 | Drive (RDY) |
| 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 {07.055} | | Analog Output 1 Control | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RW | | Txt | | | | | | | US | |
| OL | ⇳ | 0 to 14 | | | ⇨ | 0 | | | | |
| RFC-A | | | | | | | | | | |

Defines the functionality of Analog Output 1.

| 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 {05.018} | | Maximum Switching Frequency | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RW | | Txt | | | | | | | US | |
| OL | ⇳ | 0.667 (0), 1 (1), 2 (2), 3 (3), 4 (4), 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), 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 *Drive User Guide* for drive derating data.

| 00.038 {05.012} | | 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 mechanical characteristic of the motor and load by rotating the motor. This test should only be used provided all the basic control parameters have been set-up correctly. The test measures the motor and load inertia, which can be used in automatic set-up of the frequency controller gains and in producing a torque feed-forward term. It also measures the load compensation parameters to cancel resonance effects.

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, 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 {05.006} | | Motor Rated Frequency | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RW | | Num | | | | | | | US | |
| OL | ⇳ | 0.00 to VM_SPEED_FREQ_REF_ UNIPOLAR 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 {05.011} | | 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 {05.014} | | Control Mode | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RW | | Txt | | | | | | | US | |
| OL | ⇳ | Ur.S (0), Ur (1), Fd (2), Ur.Auto (3), Ur.I (4), SrE (5), Fd.tap (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 | Fd | 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 | SrE | Square law characteristic |
| 6 | Fd.tap (6) | 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, It.AC or 0 V trips.

| 00.042 {05.015} | | Low Frequency Voltage Boost | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RW | | Num | | | | | | | US | |
| OL | ⇳ | 0.0 to 25.0 % | | | ⇨ | 3 % | | | | |
| RFC-A | | | | | | | | | | |

Determines the boost level when Pr **00.041** is set to Fd, SrE or Fd.tap modes.

| 00.043 {11.025} | | Serial Baud Rate | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RW | | Txt | | | | | | | US | |
| OL<br>RFC-A | ⇳ | 300 (0), 600 (1), 1200 (2), 2400 (3), 4800 (4), 9600 (5), 19200 (6), 38400 (7), 57600 (8), 76800 (9), 115200 (10) | | | | ⇨ | 19200 (6) | | | |

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 {11.023} | | Serial Address | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RW | | Num | | | | | | | US | |
| OL<br>RFC-A | ⇳ | 1 to 247 | | | | ⇨ | 1 | | | |

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 {11.020} | | Reset Serial Communications | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RW | | Bit | | | | ND | NC | | US | |
| OL<br>RFC-A | ⇳ | Off (0) or On (1) | | | | ⇨ | Off (0) | | | |

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

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

| 00.046 {12.042} | | Brake Controller Upper Current Threshold | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RW | | Num | | | | | | | US | |
| OL<br>RFC-A | ⇳ | 0 to 200 % | | | ⇨ | 50 % | | | | |

Defines the upper current threshold for the brake. See Brake Controller Brake Release in *Drive User Guide*.

| 00.047 {12.043} | | Brake Controller Lower Current Threshold | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RW | | Num | | | | | | | US | |
| OL<br>RFC-A | ⇳ | 0 to 200 % | | | ⇨ | 10 % | | | | |

Defines the lower current limit for the brake. See Brake Controller Brake Release in *Drive User Guide*.

| 00.048 {12.044} | | Brake Controller Brake Release Frequency | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RW | | Num | | | | | | | US | |
| OL<br>RFC-A | ⇳ | 0.00 to 20.00 Hz | | | ⇨ | 1.00 Hz | | | | |

Defines the Brake Release Frequency. See Brake Controller Brake Release in *Drive User Guide*.

| 00.049 {12.045} | | Brake Controller Brake Apply Frequency | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RW | | Num | | | | | | | US | |
| OL<br>RFC-A | ⇳ | 0.00 to 20.00 Hz | | | ⇨ | 2.00 Hz | | | | |

Defines the Brake Apply Frequency. See Brake Controller Brake Release in *Drive User Guide*.

| 00.050 {12.046} | | Brake Controller Brake Delay | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RW | | Num | | | | | | | US | |
| OL<br>RFC-A | ⇳ | 0.0 to 25.0 s | | | ⇨ | 1.0 s | | | | |

Defines the pre-brake release delay. See Brake Controller Brake Release in *Drive User Guide*.

| 00.051 {12.047} | | Brake Controller Post-brake Release Delay | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RW | | Num | | | | | | | US | |
| OL<br>RFC-A | ⇳ | 0.0 to 25.0 s | | | ⇨ | 1.0 s | | | | |

Defines the post-brake release delay.

| 00.053 {12.047} | | Brake Controller Initial Direction | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RW | | Txt | | | | | | | US | |
| OL<br>RFC-A | ⇳ | Ref (0), For (1), Rev (2) | | | ⇨ | Ref (0) | | | | |

Defines the initial direction of the brake.

| Value | Text |
|---|---|
| 0 | reF |
| 1 | For |
| 2 | Rev |

See Brake Controller Brake Release in *Drive User Guide*.

| 00.054 {12.051} | | Brake Controller Brake Apply Through Zero Threshold | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RW | | Num | | | | | | | US | |
| OL<br>RFC-A | ⇳ | 0.00 to 25.00 Hz | | | ⇨ | 0.00 Hz | | | | |

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

| 00.055 {12.041} | | Brake Controller Enable | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RW | | Txt | | | | | | | US | |
| OL<br>RFC-A | ⇳ | dis (0), Relay (1), dig IO (2), User (3) | | | ⇨ | dis (0) | | | | |

| Value | Text |
|---|---|
| 0 | Dis |
| 1 | Relay |
| 2 | dig IO |
| 3 | USEr |

If *Brake Controller Enable* (00.055) = 0, the brake controller is disabled.

If *Brake Controller Enable* (00.055) = 1, 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) = 2, 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) = 3, the brake controller is enabled, but no parameters are set up to select the brake output.

| 00.065 {03.010} | | 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.

**Differential gain (Kd)**

The differential gain is provided in the feedback of the frequency controller to give additional damping.

| 00.066 {03.011} | | Frequency Controller Integral Gain Ki1 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| RW | | Num | | | | | | US | |
| OL | ⇳ | | | | ⇨ | | | | |
| RFC-A | | 0.00 to 655.35 $s^2$/rad | | | | 0.10 $s^2$/rad | | | |

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

| 00.067 {03.079} | | Sensorless Mode Filter | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RW | | Txt | | | | | | | US | |
| OL | ⇳ | | | | ⇨ | | | | | |
| RFC-A | | 4 (0), 5 (1), 6 (2), 8 (3), 12 (4), 20 (5) ms | | | | 4 (0) ms | | | | |

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

| 00.069 {05.040} | | 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) ≥ 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.

| 00.076 {10.037} | | 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 *Drive User Guide.*

| 00.077 {11.032} | | Maximum Heavy Duty Rating | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RO | | Num | | | | ND | NC | PT | | |
| OL | ⇳ | 0.00 to 9999.99 A | | | ⇨ | | | | | |
| RFC-A | | | | | | | | | | |

Displays the maximum heavy duty current rating of the drive.

| 00.078 {11.029} | | Software Version | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RO | | Num | | | | ND | NC | PT | | |
| OL<br>RFC-A | ⇳ | 0 to 999999 | | | | ⇨ | | | | |

Displays the software version in the drive.

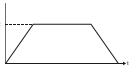
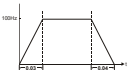
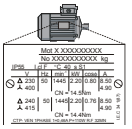
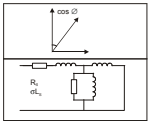
| 00.079 {11.031} | | User Drive Mode | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RW | | Txt | | | | ND | NC | PT | US | |
| OL<br>RFC-A | ⇳ | OPEn.LP (1), RFC-A (2) | | | | ⇨ | OPEn.LP (1)<br>RFC-A (2) | | | |

Defines the mode of the drive.

# 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:<br>• The drive enable signal is not given, terminal 31 and 34 (frame 1 to 4) or terminals 31 and 35 (frames 5 to 9) are open<br>• The run signal is not given, terminal 12/13 is open<br>• The motor is connected to the drive<br>• The motor connection is correct for the drive Δ or Y<br>• The correct supply voltage is connected to the drive | |
| Power up the drive | The default setting is Open Loop vector mode. For RFC-A mode set Pr **00.079** to RFC-A, then press the stop/reset button to save the parameters.<br>Ensure: The drive displays: Inhibit |  |
| Enter minimum and maximum speeds | Enter:<br>• Minimum speed Pr **00.001** (Hz)<br>• Maximum speed Pr **00.002** (Hz) |  |
| Enter accel and decel rates | Enter:<br>• Acceleration rate Pr **00.003** (s/100 Hz)<br>• Deceleration rate Pr **00.004** (s/100 Hz) |  |
| Enter motor nameplate details | Enter:<br>• Motor rated current in Pr **00.006** (A)<br>• Motor rated speed in Pr **00.007** (rpm)<br>• Motor rated voltage in Pr **00.008** (V)<br>• Motor rated power factor in Pr **00.009**<br>• If the motor is not a standard 50/60 Hz motor, set Pr **00.039** accordingly |  |
| **Ready to autotune** | | |
| 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:<br>• Set Pr **00.038** = 1 for a stationary autotune or set Pr **00.038** = 2 for a rotating autotune<br>• Close the drive enable signal (apply +24 V to STO inputs). The drive will display 'Ready'.<br>• Close the run signal (apply +24 V to terminal 12 or 13). The lower display will flash 'Auto Tune' while the drive is performing the autotune.<br>• Wait for the drive to display 'Inhibit' and for the motor to come to a standstill.<br>• Remove the drive enable and run signal from the drive. |  |
| Autotune complete | When the autotune has been completed, Pr **00.038** will be set to 0 | |
| Tuning of frequency controller gains (RFC-A mode only) | Depending on the application, the frequency controller gains (Pr **00.065** and Pr **00.066**) may need to be adjusted. | |
| **Save parameters** | | |
| Save parameters | Select 'SAVE' in Pr **mm.000** (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. | |
| Increasing and decreasing speed | Turning the speed potentiometer will increase and decrease the speed of the motor. | |
| Stopping | To stop the motor under ramp control, open either the run forward or run reverse terminal. If the enable terminal is opened while the motor is running, 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 indications**

| Trip code | Condition | Description |
|---|---|---|
| **C.Acc** | NV Media Card Write fail | Unable to access the NV Media Card. |
| **C.bt** | 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 *Parameter Cloning* (00.030) is changed to auto or boot mode, but the drive is not subsequently reset. |
| **C.by** | NV Media Card cannot be accessed as it is being accessed by an option module | 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. |
| **C.cPr** | NV Media Card file/data is different to the one in the drive | A *C.cPr* trip is initiated if the parameters on the NV Media Card are different to the drive. |
| **C.d.E** | 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. |
| **C.dAt** | NV Media Card data not found | Attempt has been made to access non-existent file or block on the NV Media Card. |
| **C.Err** | 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. |
| **C.FuL** | NV Media Card full | There is not enough space left on the card. |
| **C.OPt** | NV Media Card trip; option modules installed are different between source drive and destination drive | The 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. |
| **C.Pr** | 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 *Drive User Guide*. |
| **C.rdo** | 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. |
| **C.rtg** | 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. |
| **C.SI** | NV Media Card trip; Option module file transfer has failed | The *C.SI* 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. |
| **C.tyP** | 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. |
| **cL.A1** | Analog input 1 current loss | Current loss was detected in current mode on Analog input 1 (Terminal 2). |
| **CL.bt** | Trip initiated from the *Control Word* | Initiated by setting bit 12 on the control word when the control word is enabled. Refer to *Drive User Guide* |
| **Cur.c** | Current calibration range | Current calibration range error. |
| **Cur.O** | Current feedback offset error | Current offset is too large to be trimmed. |
| **d.Ch** | 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. |
| **dEr.E** | Derivative file error | Contact the supplier of the drive. |
| **dEr.I** | Derivative product image error | Contact the supplier of the drive |

<table>
<tr><th>Trip code</th><th>Condition</th><th>Description</th></tr>
<tr><td>dESt</td><td>Two or more parameters are writing to the same destination parameter</td><td>The dESt 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.</td></tr>
<tr><td>dr.CF</td><td>Drive configuration</td><td>Contact the supplier of the drive.</td></tr>
<tr><td>EEF</td><td>Default parameters have been loaded</td><td>The EEF trip indicates that default parameters have been loaded. The exact cause/reason of the trip can be identified from the sub-trip number (see Drive User Guide).</td></tr>
<tr><td>Et</td><td>An External trip is initiated</td><td>The cause of the trip can be identified from the sub trip number displayed after the trip string.<br><table><tr><th>Sub-trip</th><th>Reason</th></tr><tr><td>1</td><td>External Trip = 1</td></tr></table>Refer to Drive User Guide.</td></tr>
<tr><td>FAN.F</td><td>Fan fail</td><td>Indicates the fan or fan circuitry has failed</td></tr>
<tr><td>Fi.Ch</td><td>File changed</td><td>A file has been changed, power cycle to clear the trip</td></tr>
<tr><td>FI.In</td><td>Firmware Incompatibility</td><td>The user firmware is incompatible with the power firmware.</td></tr>
<tr><td>HFxx trip</td><td>Hardware faults</td><td>Internal drive hardware fault (see Drive User Guide).</td></tr>
<tr><td>It.Ac</td><td>Output current overload timed out ($I^2t$)</td><td>The It.Ac trip indicates a motor thermal overload based on the output current and motor thermal time constant. The drive will trip on It.Ac when the accumulator gets to 100 %.<br>This can occur when:<br>• There is excessive mechanical load<br>• Ensure the load is not jammed / sticking<br>• Check the load on the motor has not changed<br>• Ensure the motor rated current is not zero</td></tr>
<tr><td>It.br</td><td>Braking resistor overload timed out ($I^2t$)</td><td>Braking resistor overload has timed out. This can be caused by excessive braking resistor energy.</td></tr>
<tr><td>no.PS</td><td>No power board</td><td>No communication between the power and control boards.</td></tr>
<tr><td>O.Ld1</td><td>Digital output overload</td><td>The total current drawn from 24 V user supply or from the digital output has exceeded the limit.</td></tr>
<tr><td>O.SPd</td><td>Motor frequency has exceeded the over frequency threshold</td><td>Excessive motor speed (typically caused by mechanical load driving the motor).</td></tr>
<tr><td>Oh.br</td><td>Braking IGBT over-temperature</td><td>Braking IGBT over-temperature. Detected by thermal model</td></tr>
<tr><td>Oh.dc</td><td>DC bus over temperature</td><td>DC bus component over temperature based on a software thermal model.</td></tr>
<tr><td>Oht.C</td><td>Control stage over-temperature</td><td>Control stage over-temperature detected.</td></tr>
<tr><td>Oht.I</td><td>Inverter over temperature based on thermal model</td><td>IGBT junction over-temperature has been detected based on a software thermal model.</td></tr>
<tr><td>Oht.P</td><td>Power stage over temperature</td><td>This trip indicates that a power stage over-temperature has been detected.</td></tr>
<tr><td>Oht.r</td><td>Rectifier over temperature</td><td>The Oht.r trip indicates that a rectifier over-temperature has been detected.</td></tr>
<tr><td>OI.A1</td><td>Analog input 1 over-current</td><td>Current input on analog input 1 exceeds 24 mA.</td></tr>
<tr><td>OI.AC</td><td>Instantaneous output over current detected</td><td>The instantaneous drive output current has exceeded.The set limit.<br>Possible solutions:<br>• Increase acceleration/deceleration rate<br>• If seen during autotune reduce the voltage boost<br>• Check for short circuit on the output cabling<br>• Check integrity of the motor insulation using an insulation tester<br>• Is the motor cable length within limits for the frame size<br>• Reduce the values in the current loop gain parameters</td></tr>
</table>

| Trip code | Condition | Description |
|---|---|---|
| **OI.br** | 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>Possible cause:<br>• Check brake resistor wiring<br>• Check braking resistor value is greater than or equal to the minimum resistance value<br>• Check braking resistor insulation |
| **OI.SC** | Output phase short-circuit | Over-current detected on drive output when enabled. |
| **OPt.d** | 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. |
| **Out.P** | Output phase loss detected | Phase loss has been detected at the drive output. |
| **OV** | DC bus voltage has exceeded the peak level or maximum continuous level for 15 seconds | The *OV* trip indicates that the DC bus voltage has exceeded the maximum limit.<br>Possible solutions:<br>• Increase *Deceleration Rate 1* (Pr **00.004**)<br>• Decrease the braking resistor value (staying above the minimum value)<br>• Check nominal AC supply level<br>• Check for supply disturbances which could cause the DC bus to rise<br>• Check motor insulation using a insulation tester |
| **P.dAt** | Power system configuration data error | Contact the supplier of the drive. |
| **Pb.bt** | Power board is in bootloader mode | Power board is in bootloader mode |
| **Pb.Er** | Communication has been lost / errors detected between power control | Communications loss between power and control. |
| **Pb.HF** | Power board HF | Power processor hardware fault - contact the supplier of the drive |
| **Pd.S** | Power down save error | Error has been detected in the power down save parameters saved in non-volatile memory. |
| **PH.Lo** | Supply phase loss | The drive has detected an input phase loss or large supply imbalance. |
| **PSU** | Internal power supply fault | One or more internal power supply rails are outside limits or overloaded. |
| **r.ALL** | RAM allocation error | Option module derivative image has requested more parameter RAM than is allowed. |
| **r.b.ht** | Hot rectifier/brake | Over-temperature detected on input rectifier or braking IGBT. |
| **rS** | Measured resistance has exceeded the parameter range | The measured stator resistance during an autotune test has exceeded the maximum possible value of *Stator Resistance*. Refer to the *Drive User Guide*. |
| **SCL** | Control word watchdog has timed out | The control word has been enabled and has timed out |
| **SL.dF** | Option module in option slot 1 has changed | Option slot 1 on the drive is a different type to that installed when parameters were last saved on the drive. |
| **SL.Er** | Option module in option slot 1 has detected a fault | Option module in option slot 1 on the drive has detected an error. |
| **SL.HF** | Option module 1 hardware fault | Option slot 1 on the drive has indicated a hardware fault. |
| **SL.nF** | Option module in option slot 1 has been removed | The option module in option slot 1 on the drive has been removed since the last power up. |
| **SL.tO** | Option module watchdog function service error | The option module installed in Slot 1 has started the option watchdog function and then failed to service the watchdog correctly. |

<table>
<tr><th>Trip code</th><th>Condition</th><th>Description</th></tr>
<tr><td>So.St</td><td>Soft start relay failed to close, soft start monitor failed</td><td>Soft start relay in the drive failed to close or the soft start monitoring circuit has failed.</td></tr>
<tr><td>St.HF</td><td>Hardware trip has occurred during last power down</td><td>Hardware trip (HF01 –HF19) has occurred and the drive has been power cycled. Enter 1299 to xx.000 to clear trip</td></tr>
<tr><td>Sto</td><td>No Safe Torque Off board installed</td><td>Safe Torque Off board not installed.</td></tr>
<tr><td>th</td><td>Motor thermistor over-temperature</td><td>The motor thermistor connected to terminal 14 (digital input 5) on the control connections has indicated a motor over temperature.</td></tr>
<tr><td>th.br</td><td>Brake resistor over temperature</td><td>The th.br trip is initiated if the hardware based braking resistor thermal monitoring is connected and the resistor overheats.</td></tr>
<tr><td>tH.Fb</td><td>Internal thermistor has failed</td><td>Internal thermistor has failed.</td></tr>
<tr><td>thS</td><td>Motor thermistor short circuit</td><td>The motor thermistor connected to terminal 14 (digital input 5) on the control connections, is short circuit or low impedance (<50 Ω).</td></tr>
<tr><td>tun.S</td><td>Autotune test stopped before completion</td><td>The drive was prevented from completing an autotune test, because either the drive enable or the drive run signals were removed.</td></tr>
<tr><td>tunE.1</td><td>Autotune 1</td><td>The drive has tripped during a rotating autotune. The cause of the trip can be identified from the sub-trip number.<br><table><tr><th>Sub-trip</th><th>Reason</th></tr><tr><td>1</td><td>Reserved</td></tr><tr><td>2</td><td>The motor did not reach the required speed during rotating auto-tune or mechanical load measurement.</td></tr></table>Refer to the Drive User Guide.</td></tr>
<tr><td>tunE.3</td><td>Autotune 3</td><td>RFC-A mode only.<br>The drive has tripped during a rotating auto-tune or mechanical load measurement. The cause of the trip can be identified from the associated sub-trip number.<table><tr><th>Sub-trip</th><th>Reason</th></tr><tr><td>1</td><td>Measured inertia has exceeded the parameter range during a mechanical load measurement.</td></tr><tr><td>2</td><td>Reserved</td></tr><tr><td>3</td><td>The commutation signals changed in the wrong direction during a rotating autotune.</td></tr></table>Refer to the Drive User Guide.</td></tr>
<tr><td>U.OI</td><td>User OI ac</td><td>The U.OI trip is initiated if the output current of the drive exceeds the trip level set by User Over Current Trip Level. Refer to the Drive User Guide.</td></tr>
<tr><td>U.S</td><td>User Save error / not completed</td><td>The U.S trip indicates that an error has been detected in the user save parameters saved in non-volatile memory.</td></tr>
<tr><td>US.24</td><td>User 24 V supply is not present on the adaptor interface terminals (1,2)</td><td>A US.24 trip is initiated if the User Supply Select is set to 1 and no user 24 V supply is present on the user 24 V input on the AI-Backup adaptor. Refer to the Drive User Guide.</td></tr>
</table>

## 8.1 Alarm indications

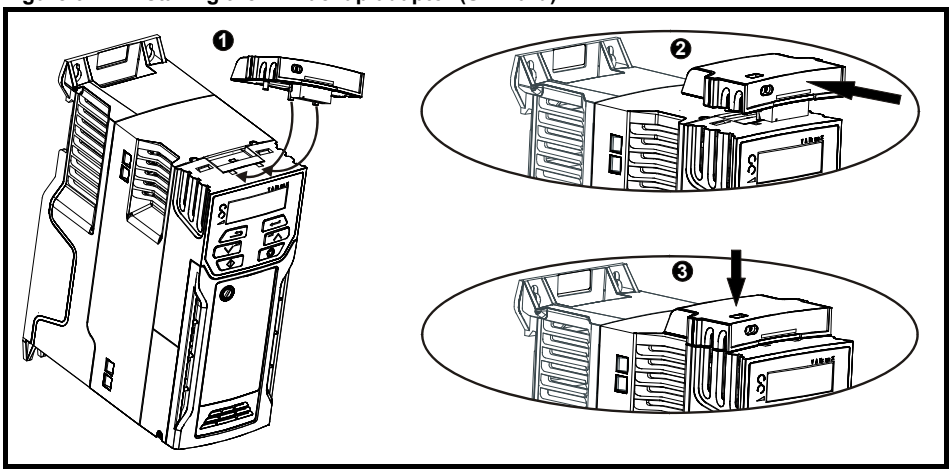
In any mode, an alarm is an indication given on the display by alternating the alarm string with the drive status string display. If an action is not taken to eliminate any alarm except "tuning and LS" the drive may eventually trip. Alarms are not displayed when a parameter is being edited.

**Table 8-2 Alarm indications**

| Alarm string | Description |
|---|---|
| **br.res** | Brake resistor overload. *Braking Resistor Thermal Accumulator* in the drive has reached 75.0 % of the value at which the drive will trip.Refer to the *Drive User Guide* |
| **OV.Ld** | *Motor Protection Accumulator* 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 *Drive User Guide* |
| **d.OV.Ld** | Drive over temperature. *Percentage Of Drive Thermal Trip Level* in the drive is greater than 90 %. Refer to the *Drive User Guide* |
| **tuning** | The autotune procedure has been initialized and an autotune in progress. |
| **LS** | Limit switch active. Indicates that a limit switch is active and that is causing the motor to be stopped. |
| **Lo.AC** | Low voltage mode. See *Low AC Alarm* in *Drive User Guide.* |
| **I.AC.Lt** | Current limit active. See *Current Limit Active* in *Drive User Guide.* |

# 9 NV Media Card Operation

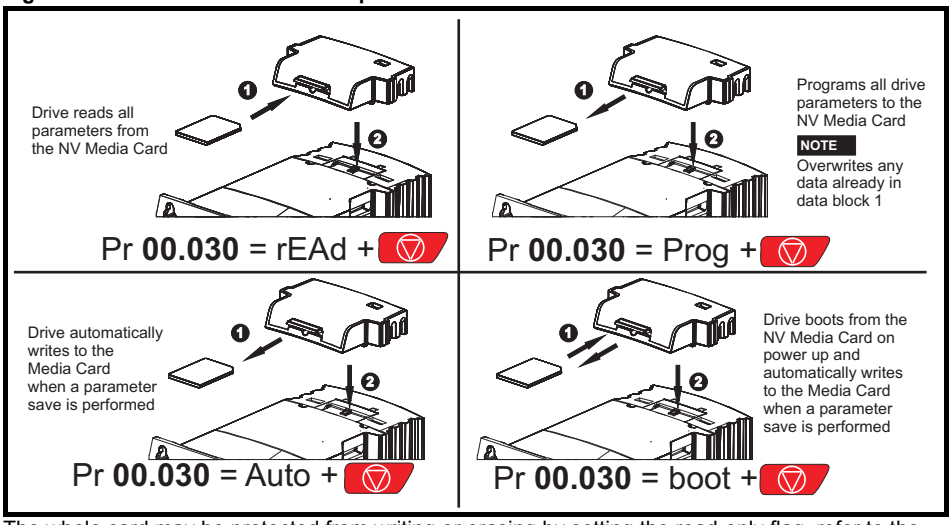
**Figure 9-1 Installing the AI-Backup adaptor (SD Card)**



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.

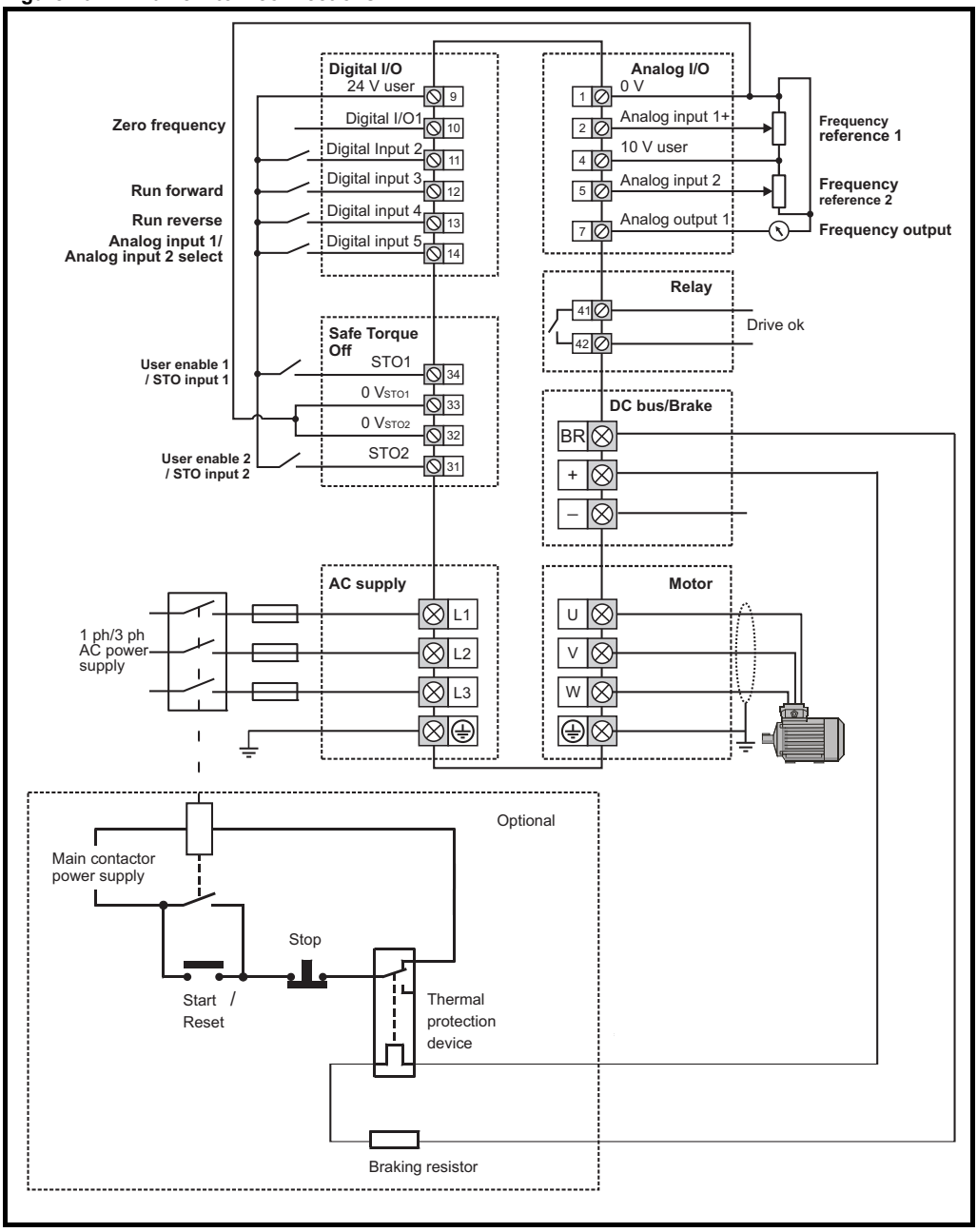
**Figure 9-2 Basic NV Media Card operation**




The whole card may be protected from writing or erasing by setting the read-only flag, refer to the *Drive 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.

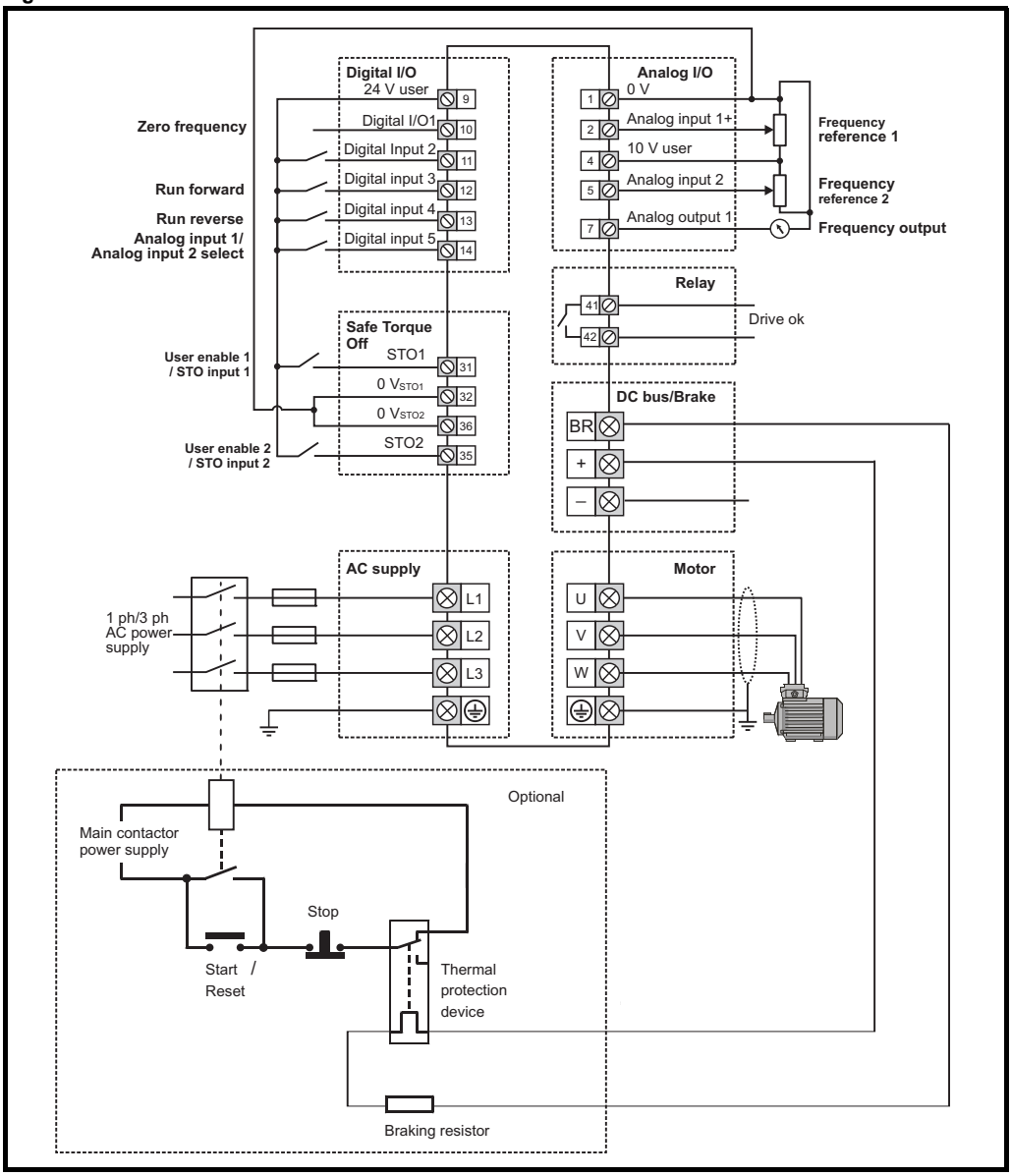
# 10 Default control connections

**Figure 10-1 Frame 1 to 4 connections**




**NOTE** The 0 V terminals on the Safe Torque Off are isolated from each other and the 0 V common.

**Figure 10-2 Frame 5 to 9 connections**




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